



9. ULUSLARARASI FEN BİLİMLER VE İNOVASYON KONGRESİ

16-17 MART 2024
ŞANLIURFA

KONGRE KİTABI

EDİTÖRLER:

Prof. Dr. Manole COJOCARU

Assist. Prof. Dr. Ahmet ILICA

Dr. Hassan ZARIOUH



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CONGRESS ID

CONGRESS TITLE

9. INTERNATIONAL SCIENCES AND INNOVATION CONGRESS

DATE AND PLACE

16-17 MARCH 2024, ŞANLIURFA/TURKEY ONLINE PRESENTATIONS

ORGANIZATION

ISARC INTERNATIONAL SCIENCE AND ART RESEARCH CENTER

GENERAL COORDINATOR

Yasemin AĞAOĞLU

COORDINATOR

Gamze KÖYMEN

EDITOR

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9. INTERNATIONAL SCIENCES AND INNOVATION

CONGRESS

16-17 MARCH 2024

ŞANLIURFA

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PARTICIPATING COUNTRIES

**ALGERIA/AZERBAIJAN/CONGO/INDIA/INDONESIA/IRAN/MALAYSIA/MOROCCO/NIGERIA/PAKISTAN/
TUNISIA /UKRAINE**

TOTAL NUMBER OF INTERNATIONAL PAPER: 32

PAPER FROM TURKEY: 26

zoom



ÖNEMLİ, DİKKATLE OKUYUNUZ LÜTFEN

- ❖ Kongremizde Yazım Kurallarına uygun gönderilmiş ve bilim kurulundan geçen bildirimler için online (video konferans sistemi üzerinden) sunum imkanı sağlanmıştır.
- ❖ Online sunum yapabilmek için <https://zoom.us/join> sitesi üzerinden giriş yaparak “Meeting ID or Personal Link Name” yerine ID numarasını girerek oturuma katılabilirsiniz.
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- ❖ Her oturumdaki sunucular, sunum saatinden 5 dk öncesinde oturuma bağlanmış olmaları gerekmektedir.
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- ❖ Moderatör – oturumdaki sunum ve bilimsel tartışma (soru-cevap) kısmından sorumludur.

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- ◆ Kongre programında yer ve saat değişikliği gibi talepler dikkate alınmayacaktır

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- ❖ The Zoom application is free and no need to create an account.
- ❖ The Zoom application can be used without registration.
- ❖ The application works on tablets, phones and PCs.
- ❖ The participant must be connected to the session 5 minutes before the presentation time.
- ❖ All congress participants can connect live and listen to all sessions.
- ❖ Moderator is responsible for the presentation and scientific discussion (question-answer) section of the session.

POINTS TO TAKE INTO CONSIDERATION - TECHNICAL INFORMATION

- ◆ Make sure your computer has a microphone and is working.
- ◆ You should be able to use screen sharing feature in Zoom.
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ÖNEMLİ NOT: SUNUMLARINIZI HEM TÜRKÇE HEM İNGİLİZCE HAZIRLAMANIZI RİCA EDERİZ

16.03.2024

SATURDAY / 10:30-12:00

SESSION-1 HALL-1

MODERATOR: Prof. Dr. Aybaba HANÇERLİOĞULLARI

Algeria/Azerbaijan/Congo/India/Indonesia/Iran/Malaysia/Morocco/Nigeria/Pakistan/Tunisia /Ukraine

AUTHORS	AFFILIATION	TOPIC TITLE
Hüseyin GEZER Assoc. Prof. Dr. Kemal Fürkan SÖKMEN Resc. Assist. Muhammed Emin TOPAL Assoc. Prof. Dr. Birol ŞAHİN	Bursa Technical University Recep Tayyip Erdoğan University	Güneş Enerjisi Destekli Trijenerasyon Sistemin Termodinamik Analizi: Gıda Üretim Tesisi Örneği
Civil Eng. Merve ARSLAN KAPUCU Assoc. Prof. Dr. Latif Onur UĞUR	Düzce University	Estimation Of Exterior Thermal Insulation Costs Of Multi-Storey Reinforced Concrete Buildings: A Model Example
Farah MAHER Salah HAJISMAIL	Ankara Yildirim Beyazit University	Assessment Of Natural Lighting Levels In The Studio Classroom Of The Architectural Department At Aybu Using The Dialux Tool
Rafa Othman Hussein ELSHARA Ramadan Ahmed Ali AGOUB Prof. Dr. Aybaba HANÇERLİOĞULLARI	Kastamonu University	An Approach Based On Particle Swarm Optimization For Parameter Estimation Of PV Solar Cells And Modules
Abdulmonem AHMED Prof. Dr. Aybaba HANÇERLİOĞULLARI	Kastamonu University	Generating Arabic Words From Roots
Ramadan Ahmed Ali AGOUB Rafa Othman Hussein ELSHARA Prof. Dr. Aybaba HANÇERLİOĞULLARI	Kastamonu University	Maximum Power Point Tracking Based On Fuzzy Logic And Particle Swarm Optimization For Solar Photovoltaic Systems
GUERBOUB Lynda SOUFI Ouahiba OULDSAADI Linda	Université de Bejaia, Algeria	Exploring Bioactive Compounds In Olive Pomace: Implications For Human Health
Ahmet Cumhur ÖZTÜRK Assist. Prof. Dr. Fatih SOYGAZİ	Aydin Adnan Menderes University	Detecting Communities In Social Networks Using Graph Mining

16.03.2024

SATURDAY / 10:30-12:00

SESSION-1 HALL-2

MODERATOR: Prof. Dr. Mehmet ALKAN

Algeria/Azerbaijan/Congo/India/Indonesia/Iran/Malaysia/Morocco/Nigeria/Pakistan/Tunisia /Ukraine

AUTHORS	AFFILIATION	TOPIC TITLE
Funda DEMİR Batıkan Erdem DEMİR	Karabuk University	Optimization Of PID Parameters In Double FED Induction Motor Speed Control Using Whale Optimization Algorithm
Ömer Emre UÇAKKUŞ Adalet ZEREN,Sinan FİDAN Mustafa Özgür BORA,Satılmış ÜRGÜN Reyhan CEYLAN,Elanur OZUN Tamer SINMAZÇELİK	Kocaeli University Ulus Metal San. ve Tic. A.Ş.	Characterization Of Surface Morphology Changes In Cold Work Tool Steel 1.2379 From Repetitive CO ₂ Laser Line Operations
Ömer Emre UÇAKKUŞ Adalet ZEREN,Sinan FİDAN Mustafa Özgür BORA,Satılmış ÜRGÜN Reyhan CEYLAN,Elanur OZUN Tamer SINMAZÇELİK	Kocaeli University Ulus Metal San. ve Tic. A.Ş.	Investigating The Effects Of CO ₂ Laser Processing Parameters On 1.2379 Cold Work Tool Steel Surfaces
Hassan ZARİOUH	Mohammed I University, Morocco	Integrating Information And Communication Technology Into Education
Ercan AVCIOĞLU Prof. Dr. Mehmet ALKAN	Yıldız Technical University	Creating Urban Transformation Data Model For Risky Areas: A Case Study Of Beykoz Cubuklu Neighbourhood
Selin GÜNGÖR Ramazan BAYINDIR	Gazi University	An Approach based on the Deep Learning and Ant Colony Optimization Algorithm for Fake News Detection

16.03.2024

SATURDAY / 11:00-12:30

SESSION-2 HALL-3

MODERATOR: Assist. Prof. Dr. Yavuzkan PAKSOY

Algeria/Azerbaijan/Congo/India/Indonesia/Iran/Malaysia/Morocco/Nigeria/Pakistan/Tunisia /Ukraine

AUTHORS	AFFILIATION	TOPIC TITLE
Assoc. Prof. Dr. Derya KARATAŞ YENİ Assist. Prof. Dr. Yavuzkan PAKSOY Vet. Duygu ARSLAN	Necmettin Erbakan University Alfa Vet Veteriner Hekim Muayenehanesi	Cannibalism Abnormal Behavior And Infection Risks In Parrots
Assist. Prof. Dr. Yavuzkan PAKSOY Lect. Ali Ekber ÜN Prof. Dr. Nazan KOLUMAN	Necmettin Erbakan University Ankara Yıldırım Beyazıt University Cukurova University	Imitation Behavior In Horses
Dr. Kenan ÇELİK Kader ERÇİK Mehmet ÇİÇEK Murat KAYA	GAP International Agricultural Research And Training Center Alata Garden Cultures Research Institute	Determination of the Performance of Some Local Strawberry Varieties in Diyarbakır Ecology
Mehmet BOZAN Mehmet Can ULUÇEŞME Arda EYVAZ, Onur CEYLAN Ferda SEVİNÇ, Münir AKTAŞ Sezayi ÖZÜBEK	Fırat University Selçuk University	Diyarbakır Yöresinde Koyunlarda Babesia Ovis'in Elisa Yöntemiyle Serolojik Olarak Prevalansının Belirlenmesi
Aynur DEMİR	Istanbul University-Cerrahpaşa	Feline Infectious Peritonitis: Ophthalmic Presentations Manifestations And Treatment Options

16.03.2024

SATURDAY / 11:00-12:30

SESSION-2 HALL -4

MODERATOR: Assist. Prof. Dr. Ahmet ILICA

Algeria/Azerbaijan/Congo/India/Indonesia/Iran/Malaysia/Morocco/Nigeria/Pakistan/Tunisia /Ukraine

AUTHORS	AFFILIATION	TOPIC TITLE
Assist. Prof. Dr. Ahmet ILICA	Kutahya Dumlupinar University	Variable Frequency Drives In Photovoltaic Energy FED Electric Submersible Water Pumps
Assist. Prof. Dr. Ahmet ILICA	Kutahya Dumlupinar University	Bidirectional Isolated DC-DC Converters In Electric Vehicle Systems
Resc. Assist. Muhammed TELÇEKEN Bünyamin BİNGÖL Devrim AKGÜN Sezgin KAÇAR	Sakarya University Sakarya University of Applied Sciences	Object Detection With YOLOv9 Algorithm In Aerial Imaging Applications
Resc. Assist. Muhammed TELÇEKEN Bünyamin BİNGÖL Furkan Taha BADEMCI Devrim AKGÜN Sezgin KAÇAR	Sakarya University Sakarya University of Applied Sciences	Analysis Of Pedestrian And Vehicle Traffic With Artificial Intelligence
Gamze SOYTURK Onder KIZILKAN	Isparta University of Applied Sciences	Study On Helium Brayton Cycle For Waste Heat Recovery In A Cement Plant
Gamze SOYTURK Onder KIZILKAN	Isparta University of Applied Sciences	Closed Brayton Cycle Applications Using Solar Dish Collector: A Comparative Evaluation For Air, Helium And Nitrogen
Emine KOÇ SÖGÜTCÜ	Sivas Cumhuriyet University	On Prime Ideals And Multiplicative Generalization Derivations In Ideals
Emine KOÇ SÖGÜTCÜ	Sivas Cumhuriyet University	Multiplicative Generalization Derivations In Prime Ideals

16.03.2024

SATURDAY / 11:00-12:30

SESSION-2 HALL -5
MODERATOR: Major Gheorghe GIURGIU

Algeria/Azerbaijan/Congo/India/Indonesia/Iran/Malaysia/Morocco/Nigeria/Pakistan/Tunisia /Ukraine

AUTHORS	AFFILIATION	TOPIC TITLE
Dr. Zehra Nur KULUÖZTÜRK	Bitlis Eren University	Investigation Of Simulation Parameters Affecting The Calculation Of Full Energy Peak Efficiency With The Fluka Code
Major Gheorghe GIURGIU Prof. dr. Manole COJOCARU	Deniplant-Aide Sante Medical Center, Titu Maiorescu University, Romania	Natural Modulation Of The Microbiota In Patients With Atopic Dermatitis
Durga Devi SUPPIAH Wan Mohd Ashri Wan DAUD Mohd Rafie JOHAN	Universiti Malaya, Malaysian	Synergistic effect of Incorporation method on Fe-Co based Catalyst for CO ₂ Valorization
P. H. NAJAFGULIYEVA	II Department of Surgical Diseases of AMU	Update On The Management Of Upper Gastroduodenal Bleeding In The Postkovid Period
Shalala ISMAYILOVA Galina BAKHSHALIYEVA Amina MAMMADOVA	Azerbaijan Medical University	Relationship Between Fibroblast Growth Factor-23 And Vascular Calcification In Hemodialysis Patients
Narmin EYVAZOVA Nurlan ALIZADE Galina BAKHSHALIYEVA Shalala ISMAYILOVA	Azerbaijan Medical University	Multifactorial Pathogenesis Of Calciphylaxis

16.03.2024

SATURDAY / 11:30-13:00

SESSION-3 HALL -6
MODERATOR: Assoc. Prof., Dr. S. RADHIKA

Algeria/Azerbaijan/Congo/India/Indonesia/Iran/Malaysia/Morocco/Nigeria/Pakistan/Tunisia /Ukraine

AUTHORS	AFFILIATION	TOPIC TITLE
Navila Bunga SAFIRA Olga VALENTINA Lailah Nur AZIZAH Eva Zulmi MEILAWATI Muhammad Sultan MUBAROK	State Islamic University K.H Abdurrahman Wahid Pekalongan Indonesia	Meaning, Objectives And Functions Of Monetary Policy
Nouha HAOUDI Mohammed KARA, Jamila BAHOU, Lahcen HSSAINI, Razouk RACHID	Sidi Mohamed Ben Abdellah University, Morocco	Evaluation of Fruit Growth on a Biferous Fig tree: Monitoring of Morphometric Parameters
Joy CHATTERJEE, Associate Professor, Rajiv Kumar DWIVEDI, Dr. Anil VASHISHT	Amity University	A Study On Factors Affecting Consumers' Choices Of Over The-Counter Medications
Shahid ADEE, Kinza ZAINAB, Fazal-UR-REHMAN, Muhammad AZEEM, Umaira BILAL	Government College University Faisalabad	Tallow Laurel (<i>Litsea Glutinosa</i>) As Noval Bio-Material For Eco-Friendly Coloration Of Cotton
Ashika K., Assist. Prof., Dr. R. SUBHASHINI, Assoc. Prof., Dr. S. RADHIKA	RMK Engineering College, India	Water Purification By Gold Nanoparticles
M . Banu SHREE, Assist. Prof., Dr. R. SUBHASHINI, Assoc. Prof., Dr. S. RADHIKA	RMK Engineering College, India	Hydroponic Plant Growth System - Analysis
Mohd Rashid Yusof HAMID Boon Hoong ONG	Universiti Malaya, Malaysia	Influence Of Precursor Selection On Surface Wettability Tuning In ZNO Thin Films
Inna KOVAL, Ragif RAKHMANTOV, Olena LYKHOLAT, Tetyana LYKHOLAT, Maksim KVITKO, Yuriy LYKHOLAT	University of Customs and Finance, Oles Honchar Dnipro National University, Kryvyi Rih State Pedagogical University, Ukraine	Comparative Characteristic Of Introduced Representatives Of The Genus <i>Rosa L.</i> In The Ukrainian Steppe Zone

16.03.2024

SATURDAY / 11:30-13:00

SESSION-3 HALL-7

MODERATOR: R. THIRUCHELVI

Algeria/Azerbaijan/Congo/India/Indonesia/Iran/Malaysia/Morocco/Nigeria/Pakistan/Tunisia /Ukraine

AUTHORS	AFFILIATION	TOPIC TITLE
OKUNADE, Racheal Funke, OLAOYE, Gbadebo OLAKOJO, Samuel Adelowo	Agriculture, University Nigeria	Performance Of Soybean Under Different Phosphorus Concentration And Soybean Population In South Western Nigeria
Ali FARAJZADEH Mahtab DELFANI	Razi University, Iran	The Iterative Approximating Of Multivalued Nonexpansive Mappings In Metric Spaces
Maria Taj MUHAMMAD Nasir Uddin KHAN	University of Karachi, Pakistan	Clean And Green Environment By Using Natural Surfactants With Better Surfactant Properties Than Synthetic Ones
Aicha SOUID Mehrez GAMMOUDI Safa MELKI M'hamed EL CAFSI	University of Tunis of Manar, Tunisia	Insights into Gastrotrichs fauna from Bizerte, Tunisia coastlines
R. THIRUCHELVI	Vels Institute,B. Tech Biotechnology, India	Bifunctional Cancer Cell-Based Vaccine Concomitantly Drives Direct Tumor Killing And Antitumor Immunity
Siwar HACHANA Boutheina Ben ABDALLAH M'hamed EL CAFSI	University of Tunis of Manar, Tunisia	Study Of Oxidative Stress Biomarkers Caused By Fungicide:Mylobutanil On Nile Tilapia (<i>Oreochromis Niloticus</i>) Gills
Remya Babu R. Shiburaj SUGATHAN	University of Kerala, India	Studies On Antimicrobial And Anti-Biofilm Potential Of Selected Medicinal Plants Against <i>Proteus mirabilis</i>
Missoum RADJAI	University of Medea, Algeria	First-Principles Calculations To Investigate Structural, Elastic, Optical And Electronic Properties Of NaCaBr ₃ Compound Using DFT Framework

16.03.2024

SATURDAY / 11:30-13:00

SESSION-3 HALL-8

MODERATOR: Dr. Ahmad Farhad TALEBI

Algeria/Azerbaijan/Congo/India/Indonesia/Iran/Malaysia/Morocco/Nigeria/Pakistan/Tunisia /Ukraine

AUTHORS	AFFILIATION	TOPIC TITLE
Elhadj RAOUACHE,Amel BENFRADJ,Abdelhamid MKAHAL, Fares KHALFALLAH	University Djelfa, University of bordj bou arreridj, University of M'sila, Algeria	Numerical Simulation of Rotary Friction Welding of Similar Materials
Asma FAIZ, Fawad ALI Wali Khan MASHWANI	Kohat University, Pakistan	Power Graphs Of Gyrogroups Determined By Their Generalized Spectra
S. S. OMOPARIOLA E. O. OLUSONA	The Federal Polytechnic, Ilaro Nigeria	Comparative Study Of Properties Of Concrete Made With Pit Sand And Granite Dust
Kasra ZAREI Dr. Ahmad Farhad TALEBI	Semnan University, Iran	Performance Assessment Of Solar PV-Driven Hybrid RO Desalination System: The Future Of Energy Efficient Desalination
Ehsan RASOULINEZHAD	University of Tehran, Iran	Emission Taxation And Sustainability In The Selected CIS Countries
Ali FARAJZADEH	Razi university, Iran	On Quasi-Equilibrium Problem And Its Application
Ananda aprilia Aulia SYAHNA, Laelatul FAUZIAH	State Islamic University K.H Abdurrahman Wahid Pekalongan, Indonesia	Behavior Student To Feminism Woman Disability In A Hadith Perspective At Uin Kh Abdurrahman Wahid Pekalongan
Sabrina Rosa DEWI Fariska Amalia PUTRI Muhammad Sultan MUBAROK	State Islamic University K.H Abdurrahman Wahid Pekalongan, Indonesia	Management Ethics And Economic Ethics (Monopoly & Oligopoly)
Don-De Dieu Pacifique BAKALA Armel MBON	Université Marien NGOUABI, Congo	The Concepts of 'Fire and Fury' in Mary Shelley's Frankenstein

PHOTO GALERY

The screenshot displays a Zoom meeting interface. At the top, a green banner reads "4 Zehra Nur KULUÖZTÜRK-SESSION... ekranını görüntüleyorsunuz". The main content area shows a presentation slide titled "Simulating Tools and Parameters" with a sub-heading "Description of the geometry:". The slide text states: "FLUKA can handle even very complex geometries, using an improved version of the well-known Combinatorial Geometry (CG) package." Below this, it says "The CG used by Fluka is based on two important concepts: bodies and regions." A 3D schematic of a Na(I) detector is shown. The bottom of the slide reads "Schematic representation of Na(I) detector considered in simulation" and "8. INTERNATIONAL SCIENCES AND INNOVATION CONGRESS 16-17 MARCH 2024 - SANKIYARA".

The right side of the interface shows a gallery of participants. Visible names include: H 5 Gheorghe Giurgiu, ISARC Yasemin AĞAOĞLU, Amina Mammadova, Durga Devi, Narmin Eyvazova, and Nurlan Alizadeh. A "Giriş yapın" (Sign in) button is visible in the top right.

The bottom of the interface features a toolbar with icons for "Sesi aç", "Videoyu Başlat", "Katılımcılar", "Sohbet", "Ekranı paylaş", "Kaydet", "Alt Yazıları Göster", "Ara Odalar", "Reaksiyonlar", "Uygulamalar", "Beyaz Tahtalar", and "Odadan Çık".

Below the main interface, another presentation slide titled "Examples" is shown. It contains two examples:

- $R = \left\{ \begin{pmatrix} a & b \\ 0 & c \end{pmatrix} \mid a, b, c \in \mathbb{Z} \right\}$ halka, $d: R \rightarrow R$,
 $d \begin{pmatrix} a & b \\ 0 & c \end{pmatrix} = \begin{pmatrix} 0 & -2b + a - c \\ 0 & 0 \end{pmatrix}$ olarak tanımlansın. d, R nin bir türevidir.
- R bir halka ve $a \in R$ olsun. $\forall x \in R$ için $I_a(x) = [a, x] = ax - xa$ tanımlı dönüşüm R nin bir türevidir. Bu dönüşüme özel olarak a tarafından belirlenmiş iç türev adı verilir.

The bottom of this slide shows the name "Emine KOÇ SÖĞÜTÇÜ" and the date "16.03.2024".

The right side of this section shows a gallery of participants with names: S2 H4 Ahmet ILICA, ISARC Yasemin AĞAOĞLU, Emine KOÇ SÖĞÜTÇÜ, Furkan Taha Bademci, and Furkan Taha Bademci.

Giriş yapın

ATLARDA TAKLİT DAVRANIŞI

Taklit Davranışının Yelıştiricilięe Olumsuz Etkileri

- Atlar, komsu tavlada bulunan dięer atları taklit ederek onların kötü davranışlarını örneklebilirler. Tahla kemirme, kendi etrafında dönme, aşırı kışıneme, yem sarafinde kayaya tırmanma, insanları ısırma ve duvara tekme atma bu anormal davranışlara örneklebilir.
- İnsanlarla kötü ilişki içerisinde olan atlar, dięer atları kötü yönde etkileyebilir.
- Otlanırken üstünlük kurmak isteyen atlar, dięer atlara zarar verebilir ve bu davranış sürü üyeleri tarafından taklit edilebilir.
- Hırcınlık, yelıştiricilikte kötü bir davranıştır ve genellikle dięer atların mizacını etkiler.

Duygu ARSLAN, s-2, h-3

ISARC Yasemin AęAOęLU

MEHMET BOZA...

MEHMET BOZAN H-3

Dr. Kenan ęELİK/...

Session-2, Hall-3, Aynur DEMİR

Dr. Kenan ęELİK/GAPUTAEM

Funda Demir ekranını görüntüleyorsunuz Seçenekleri Görüntüle Giriş yapın Görüntüle

• SONUÇLAR

- Optimizasyon algoritması performans karşılaştırmaları, aşırma (overshoot), kararlılık süresi (settling time) ve yükselme süresi (rise time) değerlerine göre hız (v) grafiğine dayanarak Table 4'te sunulmuştur. Hız (v) tepkisinde minimum aşırma değeri PID'de meydana gelmektedir.
- En büyük aşırma WOA'da gözlemlenmektedir. En düşük ve en yüksek aşırma değerleri arasında yaklaşık iki kat fark bulunmaktadır. Kararlılık süresi açısından en iyi sonuç WOA'dan elde edilmektedir.
- En uzun kararlılık süresi ise PID'de gözlemlenmektedir. En kısa ve en uzun kararlılık süreleri arasındaki fark %91'dir. Yükselme süresi açısından en iyi sonuç WOA'dan elde edilmektedir.
- En uzun yükselme süresi ise PID'de gözlemlenmektedir. En kısa ve en uzun yükselme süreleri arasındaki fark %35'tir.

Funda Demir

ISARC Yasemin AęAOęLU

Hall-2 Reyhan C...

OMER EMİRE UęAKK...

Selin Güngör

Ercan AVCIOęLU

Selin Güngör

Zariouh Hassan, session ...

Sesi aç Videoyu Baęlat Katılımcılar Sohbet Ekran paylaş Kaydet Alt Yazılan Göster Ara Odalar Reaksiyonlar Uygulamalar Beşiz Tahtalar Odadan Çık

Giriş yapın

The screenshot displays a Zoom meeting interface. On the left, a presentation slide is visible, titled "ISARC 9. INTERNATIONAL SCIENCES AND INNOVATION CONGRESS" and "AN APPROACH BASED ON PARTICLE SWARM OPTIMIZATION FOR PARAMETER ESTIMATION OF PV SOLAR CELLS AND MODULES" by Rafa Othman Hussein ELSHARA. The slide features a background image of solar panels and the ISARC logo. Below the slide, a chat window shows a message from Rafa: "Hello everyone, my name is RAFA ELSHARA and I am a PhD student at Kasimov University. My research focuses on... I am excited to be here today and look forward to learning from and engaging with all of you." On the right, a gallery view shows 12 participants. The participant "Rafa" is highlighted with a yellow border. Other participants include Ahmet cumhur oztürk, ISARC Yaseemin AGAO..., Hall 1 - Hüseyin..., Hall 1 - Hüseyin Gezer, Hall 1 - Farah M..., Hall1 Merve AR..., Hall 1- Farah Maher, Hall1 Merve ARSLAN..., SALAH HAJI ISMAIL, Ramadan Agoub, Abdulmonem Ahmed, Fatih Soygazi, and SALAH HAJI ISMAIL.

INTERNATIONAL SCIENCE AND ART RESEARCH CENTER

REF: AKADEMİK TEŞVİK

22.03.2024

İLGİLİ MAKAMA

9. ULUSLARARASI FEN BİLİMLERİ VE İNOVASYON KONGRESİ 16-17 MARCH 2024 tarihleri arasında ŞANLIURFA/TÜRKİYE 'de ve online olarak 12 farklı ülkeden (Türkiye:26 ve diğer Ülkeler:32; Toplam:58) akademisyen/araştırmacıların katılımı ile gerçekleşmiştir. Kongre, 16 Ocak 2020 Akademik Teşvik Ödeneği Yönetmeliğine getirilen ‘‘ Tebliğlerin sunulduğu yurt içinde veya yurtdışındaki etkinliğin uluslararası olarak nitelendirilebilmesi için Türkiye dışından en az 5 ülkeden farklı tebliğ sunan konuşmacının katılım sağlaması ve tebliğlerin yarımından fazlasının Türkiye dışından katılımcılar tarafından sunulması esastır. ‘‘ değişikliğine uygun düzenlenmiştir.Bilgilerinize arz edilir.

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GÜNEŞ ENERJİSİ DESTEKLİ TRİJENERASYON SİSTEMİN TERMODİNAMİK ANALİZİ: GIDA ÜRETİM TESİSİ ÖRNEĞİ

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ÖZET

Elektrik, ısı veya soğutma gibi her bir çıktının ayrı ayrı üretildiği geleneksel güç üretim sistemleri ile kıyaslandığında trijenerasyon güç üretim sistemlerinden daha yüksek verim elde edilmektedir. Trijenerasyon sistemler, verimli çıktılardan ayrı ayrı üretildiği geleneksel yöntemlere göre hem üretim maliyeti açısından hem de enerji verimliliği açısından daha avantajlıdır. Bu bilgiler ışığında çalışmanın temel amacı güneş enerjisi destekli trijenerasyon enerji üretim sisteminin bir gıda üretim tesisine uygulanması ve termodinamik açıdan incelemesi olarak belirlenmiştir. Tasarlanan trijenerasyon sistem, güneş enerjisi destekli gaz türbini çevrimi, rankine çevrimi, organik rankine çevrimi ve buhar sıkıştırırmalı soğutma çevriminden oluşmaktadır. Güneş enerjisi kullanımı ile gaz türbininin ihtiyaç duyduğu yakıt miktarı azaltılarak hem daha ekonomik hem de daha çevre dostu bir sistem olması hedeflenmiştir. Tasarlanan trijenerasyon sistem ile bir gıda üretim tesisinin temel ihtiyaçları olan elektrik, sıcak su ve soğutma ihtiyacı aynı anda karşılanmaktadır. Yapılan analizler sonucunda sistemde net 6944,12 kW elektrik üretimi gerçekleştiği, güneş enerjisi destekli gaz türbini çevrimi veriminin %28 ve tüm sistemin veriminin %37 olduğu sonucuna ulaşılmıştır.

Anahtar Kelimeler: Termodinamik, enerji, trijenerasyon, güneş enerjisi.

1. Giriş

Sentez gaz, ısıtma, elektrik ve soğutma gibi verimli çıktılardan üçünün aynı anda elde edildiği sistemlere trijenerasyon sistemler adı verilmektedir (Bamisile vd., 2021; Ahmadi vd., 2014; Khalid vd., 2015; Ozlu ve Dincer, 2015; Takleh ve Zare, 2021; Petrillo vd., 2021; Jafary vd., 2021). Günümüzde, bilim dünyası tek verimli çıktının elde edildiği geleneksel enerji üretim

sistemleri yerine daha verimli sistemler olan kojenerasyon, trijenerasyon veya multijenerasyon sistemleri tercih etmektedir. Literatürdeki çalışmalar incelendiğinde, Ramos vd., (2022) yapmış oldukları çalışmada, ev ortamında organik Rankine çevrimi (ORC) motoruna dayalı bir güneş enerjisi kombine ısı ve güç (CHP) sisteminin potansiyeli araştırılmaktadır. Boşaltılmış tüplü kolektör dizisini ve ORC motorunu birleştiren sistem konfigürasyonunun, 60 m²'lik bir kolektör dizisinden 3,605 kWh/yıl elektrik çıkışı sağlayan, elektrik önceliklendirmesi için en uygun olduğu bulundu. Ayrıca sistem, yıllık ortalama hane talebinin 6 katından fazlasına eşdeğer olan 13,175 kWh/yıl evsel sıcak su ihtiyacını karşılamaktadır. Wang vd. (2011), yapmış oldukları çalışmada Organik Rankine çevrimini (ORC) geleneksel buhar sıkıştırma çevrimiyle birleştirmişlerdir. Bu konsept dayalı olarak nominal 5 kW soğutma kapasiteli bir prototip sistem geliştirilmiş ve laboratuvar koşullarında test edilmiştir. Sistem tasarım noktasının dışında test edilmiş olmasına rağmen, 0,48'lik ölçülen ısıyla etkinleştirilen COP'de 4,4 kW soğutma üreterek iyi performans göstermiştir.

Bu çalışmada bir gıda üretim tesisinin elektrik, ısı ve soğutma ihtiyacının karşılanması amacıyla bir trijenerasyon sistem tasarlanmıştır. Tasarlanan sistem, güneş enerjisi destekli gaz türbini, rankine çevrimi, organik rankine çevrimi ve buhar sıkıştırımlı soğutma çevriminden oluşmaktadır. Trijenerasyon sistemler, elektrik, sıcak su, hidrojen gibi çıktılarını ayrı ayrı ürettiği sistemlere göre maliyet ve verim açısından daha avantajlı sistemlerdir (Çalapkulu, 2020).

Bu bilgiler göz önünde bulundurularak çalışmanın amacı güneş enerjisi destekli trijenerasyon enerji üretim sisteminin bir gıda üretim tesisine uygulanması ve termodinamik açıdan incelenmesi olarak belirlenmiştir. Tasarlanan trijenerasyon sistem, güneş enerjisi destekli gaz türbini çevrimi, rankine çevrimi, organik rankine çevrimi ve buhar sıkıştırımlı soğutma çevriminden oluşmaktadır. Güneş enerjisi kullanımı ile gaz türbininin ihtiyaç duyduğu yakıt miktarı azaltılarak hem daha ekonomik hem de daha çevre dostu bir sistem olması hedeflenmiştir. Tasarlanan trijenerasyon sistem ile bir gıda üretim tesisinin temel ihtiyaçları olan elektrik, sıcak su ve soğutma ihtiyacı aynı anda karşılanmaktadır.

2. Materyal ve Metot

2.1. Kütle Dengesi

Kütlenin korunumu ilkesi aşağıdaki gibidir:

$$\sum \dot{m}_g = \sum \dot{m}_c \quad (1)$$

Burada \dot{m}_g birim zamanda sisteme giren kütle ve \dot{m}_c birim zamanda sistemden çıkan küttedir.

2.2. Enerji Dengesi

Termodinamiğin I. yasası esas alınarak enerji denklemi aşağıdaki gibi yazılabilir.

$$\sum \dot{E}_g = \sum \dot{E}_ç \quad (2)$$

Burada \dot{E}_g birim zamanda sisteme giren enerji ve $\dot{E}_ç$ birim zamanda sistemden çıkan enerjidir.

2.3. Sistemin Tanımlanması

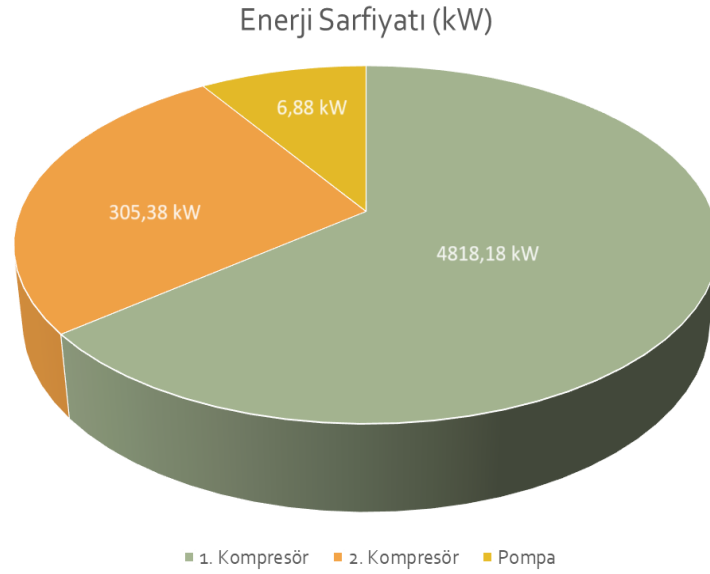
Bu çalışmada, gıda üretim tesisinin elektrik, sıcak su ve soğutma ihtiyacının karşılanması amacıyla Şekil 1’de gösterilen trijenerasyon sistem tasarlanmıştır. Tasarlanan trijenerasyon sistem, güneş enerjisi destekli gaz türbini çevrimi, rankine çevrimi, organik rankine çevrimi ve buhar sıkıştırırmalı soğutma çevriminden oluşmaktadır.



Şekil 1. Gıda üretim tesisine uygulanan trijenerasyon sistemin şematik gösterimi

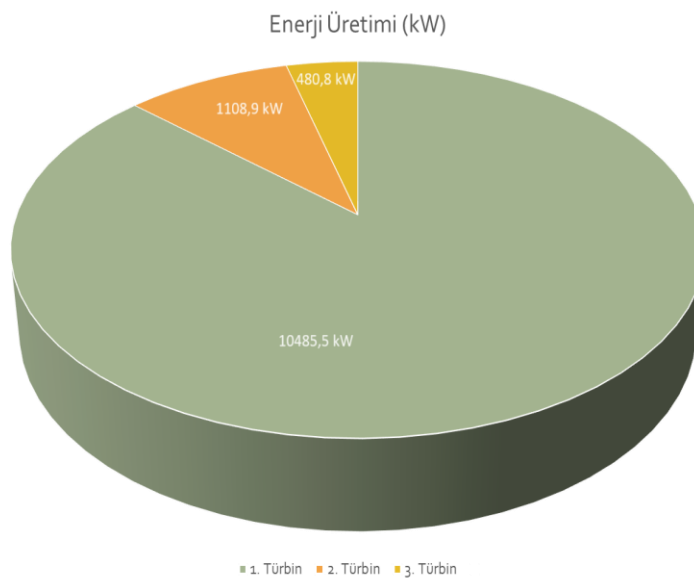
3. Sonular ve Tartışma

Trijenerasyon bir sistemin gıda üretim tesisine uygulanması sonucunda her bir bileşende gerçekleşen enerji, sarfiyatı, enerji üretimi ve atılan ısı değerleri bu bölümde verilmiştir.



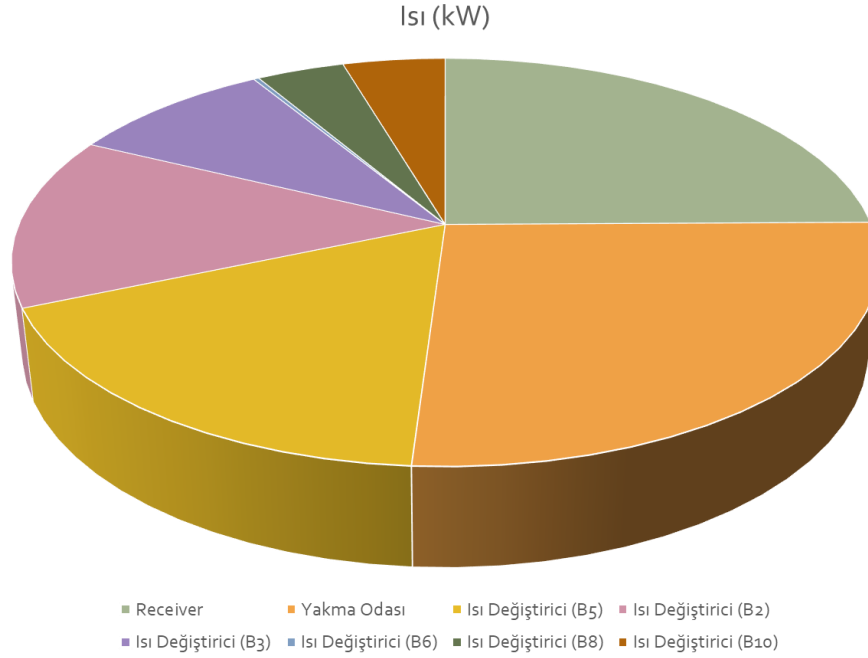
Şekil 2. Sistemdeki bileşenlerin enerji sarfiyatı

Sistemde, iş akışkanlarının basınçlandırılması ve çevrimin tamamlanması için kullanılan iki adet kompresör ve bir adet pompa bulunmaktadır. Termodinamiğin 1. Kanunu kapsamında gerçekleştirilen analizler sonucunda 1. kompresörde 4818,18 kW, 2. kompresörde 305,38 kW ve pompada 6,88 kW enerji sarfiyatı olduğu görülmüştür.



Şekil 3. Sistemdeki bileşenlerin enerji üretimi

Sistemde, gıda üretim tesisinin enerji ihtiyacı ile kompresörlerin ve buhar sıkıştırma soğutma sisteminin çalışması için gerekli enerjinin karşılandığı üç adet türbin bulunmaktadır. 1. türbinde 10485,5 kW, 2. türbinde 1108,9 kW ve 3. türbinde 480,8 kW enerji üretimi gerçekleşmektedir.



Şekil 3. Sistemdeki bileşenlerin ısı değerleri

Yapılan analizler sonucunda sistemin net enerji üretiminin 6570 kW olduğu, gaz türbini çevrimi veriminin %28 ve tüm sistemin veriminin %37,7 olduğu bulunmuştur.

4. Sonuçlar

Bu çalışmada gıda üretim tesisi uygulamaları için geliştirilen bir trijenerasyon sistemin termodinamik ilkeleri doğrultusunda enerji analizleri yapılmış ve her bir bileşenin ve sistemin toplam verimlilikleri hesaplanmıştır. Bu çalışma sonucunda;

- Gıda üretim tesisi için kurulabilecek trijenerasyon sisteminin termodinamik performans parametreleri ortaya çıkarılmıştır.
- Gıda üretim tesisinde kullanılabilecek bir sistem tanıtılmıştır.
- Yapılan analizler sonucunda sistemde net 6570,16 kW elektrik üretimi gerçekleştiği, güneş enerjisi destekli gaz türbini çevrimi veriminin %28 ve tüm sistemin veriminin %37,7 olduğu sonucuna ulaşılmıştır.

- Bu çalışmanın devamında her bir bileşende entropi oluşumunu incelemek için termodinamik analizler yapılacaktır. Ayrıca sistemin termoeconomik analizleri yapılarak maliyet ve sistemin amortisman süresi incelenecektir.

KAYNAKÇA

- Ahmadi, P., Rosen, M. A., & Dincer, I. (2011). Greenhouse gas emission and exergo-environmental analyses of a trigeneration energy system. *International Journal of Greenhouse Gas Control*, 5(6), 1540-1549. <https://doi.org/10.1016/j.ijggc.2011.08.011>.
- Çakmak, T., & Kiliç, M. (2007). *Uludağ Üniversitesi Mühendislik-Mimarlık Fakültesi Dergisi*. Cilt, 12.
- Çengel, Y. A. (2015). *Termodinamik: mühendislik yaklaşımıyla*. Palme Yayıncılık.
- Dincer, I., & Acar, C. (2015). Review and evaluation of hydrogen production methods for better sustainability. *International Journal of Hydrogen Energy*, 40(34), 11094-11111. <https://doi.org/10.1016/j.ijhydene.2014.12.035>.
- Dincer, I., & Rosen, M. A. (2005). Thermodynamic aspects of renewables and sustainable development. *Renewable and Sustainable Energy Reviews*, 9(2), 169-189. <https://doi.org/10.1016/j.rser.2004.02.002>.
- Owusu, P. A., & Asumadu-Sarkodie, S. (2016). A review of renewable energy sources, sustainability issues and climate change mitigation. *Cogent Engineering*, 3(1), 1167990. <https://doi.org/10.1080/23311916.2016.1167990>.
- Qi, W., & Li, G. (2020). Residential carbon emission embedded in China's inter-provincial population migration. *Energy Policy*, 136, 111065. <https://doi.org/10.1016/j.enpol.2019.111065>.
- Ramos, A., & Rouboa, A. (2022). Life cycle thinking of plasma gasification as a waste-to-energy tool: Review on environmental, economic and social aspects. *Renewable and Sustainable Energy Reviews*, 153, 111762. <https://doi.org/10.1016/j.rser.2021.111762>.
- Sadık, A. T. A., AKSOY, M., ŞAHİN, R., & KAHRAMAN, A. (2022). Jeotermal ısı kaynaklı Organik Rankine Çevriminde kuru ve izantropik akışkanların çevresel etkilerinin ve termodinamik performanslarının karşılaştırılması. *Gümüşhane Üniversitesi Fen Bilimleri Dergisi*, 12(3), 726-743.
- Sayed, E. T., Wilberforce, T., Elsaid, K., Rabaia, M. K. H., Abdelkareem, M. A., Chae, K.-J., & Olabi, A. G. (2021). A critical review on environmental impacts of renewable energy systems and mitigation strategies: Wind, hydro, biomass and geothermal. *Science of The Total Environment*, 766, 144505. <https://doi.org/10.1016/j.scitotenv.2020.144505>.
- Sharma, S., Agarwal, S., & Jain, A. (2021). Significance of Hydrogen as Economic and Environmentally Friendly Fuel. *Energies*, 14(21), 7389. <https://doi.org/10.3390/en14217389>.
- Wang, H., Peterson, R., Harada, K., Miller, E., Ingram-Goble, R., Fisher, L., ... & Ward, C. (2011). Performance of a combined organic Rankine cycle and vapor compression cycle for heat activated cooling. *Energy*, 36(1), 447-458. <https://doi.org/10.1016/j.energy.2010.10.020>

ÇOK KATLI BETONARME YAPILARIN DIŞ CEPHE ISI YALITIM MALİYETLERİNİN TAHMİNİ: BİR MODEL ÖRNEĞİ

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ÖZET

Isı, etkileşim halinde olan farklı sıcaklıklara sahip ortamlarda sıcaklığın yüksek olduğu ortamdan düşük olduğu ortama doğru geçiş yapma eğilimi göstermektedir. Yapılarda; ısı geçişini önlemek ve konforlu yaşam alanı sağlamak amacıyla ısı yalıtım imalatı yapılmaktadır. Çalışmada; ısı yalıtımı ve uygulama detayları, yapı maliyeti ve çalışmada kullanılacak hesaplama yöntemleri ile ilgili bilgiler verilmiştir. Çalışmada kullanılan 3 adet çok katlı betonarme projelere, farklı kalınlıklardaki XPS, EPS ve taş yünü dış cephe ısı yalıtım malzemelerinin uygulandığı varsayılarak dış cephe ısı yalıtım maliyetleri 2024 yılı Şubat ayı piyasa fiyatlarına göre birim fiyat yöntemi ve regresyon analizi yöntemi ile hesaplanmıştır. Çalışma kapsamında, çok katlı betonarme yapılarda uygulanan farklı dış cephe ısı yalıtım sistemlerinin maliyeti ne ölçüde etkileyeceği araştırılmıştır. Çalışmada amaç; çok katlı betonarme projelerde farklı ısı yalıtım sistemlerinin uygulanması durumunda; dış cephe ısı yalıtım sisteminin maliyetini tespit etmek için regresyon analizi ile bir model oluşturmak ve yapılması planlanan başka çok katlı betonarme projelerde bu modele dayanarak maliyetin önceden belirlenmesini sağlamak olacaktır.

Anahtar Kelimeler: Maliyet, Dış Cephe Isı Yalıtımı, Birim Fiyat, Regresyon Analizi

ESTIMATION OF EXTERIOR THERMAL INSULATION COSTS OF MULTI-STOREY REINFORCED CONCRETE BUILDINGS: A MODEL EXAMPLE

ABSTRACT

In environments with different interacting temperatures, heat tends to transfer from the environment where the temperature is higher to the environment where the temperature is lower. In buildings; Thermal insulation is manufactured in order to prevent heat transfer and provide a comfortable living space. In the study; Information about thermal insulation and application details, construction cost and calculation methods to be used in the study is given. Assuming that XPS, EPS and rock wool exterior thermal insulation materials of different thicknesses were applied to the 3 multi-storey reinforced concrete projects used in the study, exterior thermal insulation costs were calculated using the unit price method and regression

analysis method according to market prices in February 2024. Within the scope of the study, it was investigated to what extent different exterior thermal insulation systems applied in multi-storey reinforced concrete structures would affect the cost. The aim of the study is; In case of application of different thermal insulation systems in multi-storey reinforced concrete projects; The aim will be to create a model with regression analysis to determine the cost of the exterior thermal insulation system and to determine the cost in advance based on this model in other planned multi-storey reinforced concrete projects.

Keywords: Cost, Exterior Thermal Insulation, Unit Price, Regression Analysis

1.GİRİŞ

Dış cephe ısı yalıtım imalatı için kullanılacak pek çok ısı yalıtım malzemesi ve sistemi mevcuttur. Bu çeşitli malzemeler ve sistemler arasında tercih yaparken kullanım amacı, kullanım yeri ve maliyet parametrelerini göz önünde bulundurulmalı, en uygun malzeme kullanılmalıdır. Doğru karar verilmiş ısı yalıtım malzemesi ve sistemi, yapı içinde konforlu bir yaşam alanı, yakıt ve enerji kullanımında azalma, hava kirliliğinde azalma, yapı işletme, bakım, onarım maliyetlerinde azalma, yapı kullanım ömründe artış sağlamaktadır. Yalıtım, hem yapıyı hem de yapının kullanıcılarını dış etkenlerden korumaya yönelik önlemler içermektedir. Malzemenin yanlış seçilmesi ya da yanlış uygulanması yalıtım sisteminden beklenen verimin alınmasına engel olmaktadır.

Yapı maliyeti; yapının oluşturulması sırasında harcanan tüm mal ve hizmetlerin maddi karşılığı olarak tanımlanmaktadır. İnşaat sektörü; birçok sektörü etkileyen ve birçok sektörden etkilenen, karmaşıklık ve belirsizlik içeren bir sektör olması sebebiyle kıt kaynakların en verimli şekilde kullanılması çok önem arz etmekte ve bu doğrultuda maliyetin doğru hesaplanması gerekli olmaktadır. Yapı maliyeti tahmininde, bütçe çerçevesinde gerçeğe yakın harcamaların yapılması, yapının istenilen kalitede ve en ekonomik şekilde tasarlanması, planlanması ve üretilmesi önem arz etmektedir. Bu çalışma doğrultusunda yapının dış cephe ısı yalıtım maliyeti birim fiyat yöntemi ve regresyon analizi yöntemi ile hesaplanmış, her iki yöntemden elde edilen maliyetler karşılaştırılmış ve dış cephe ısı yalıtım maliyetinin yapı maliyeti içerisindeki oranı incelenmiştir.

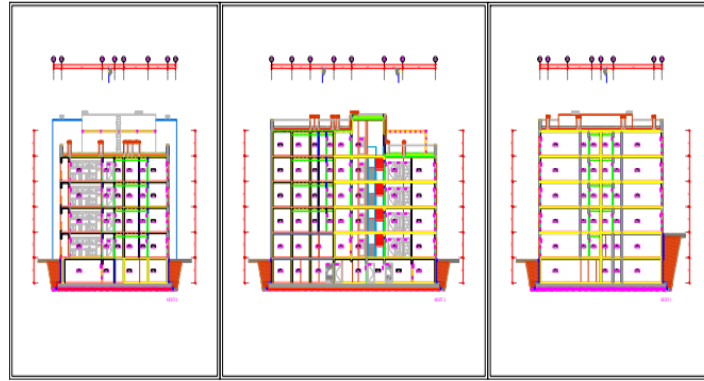
Birim fiyat yönteminde inşaat maliyetleri, imalatların miktarı ile her bir imalat için belirlenen fiyatların çarpımıyla elde edilir. Birim fiyat yöntemi; yapı maliyeti hesaplama yöntemleri arasında, bütün dünyada gerçeğe en yakın sonuç veren maliyet hesaplama yöntemi olarak kabul görmekte ve kullanılmaktadır. [1] Bir inşaatta imalatların miktarları değişmeyeceğine

göre; inşaatın maliyetini ileriye dönük olarak hesaplamak da mümkündür. [2] Bu çalışmada mevcut yapıların imalat miktarları hesaplanarak 2024 yılı Şubat ayı piyasa fiyatlarına göre maliyet hesabı yapılmıştır. Birim fiyat yönetimi imalat miktarına dayalı olan hesap yöntemidir.

Regresyon analizi, maliyeti etkileyen yapıya özgü faktörler ile maliyet arasındaki ilişkinin istatistiksel olarak belirlenmesini ve maliyet hesabının yapılmasını sağlamaktadır. Regresyon analizi, bir bağımlı değişken ve iki ya da daha fazla bağımsız değişken arasındaki ilişkiyi analiz etmek için kullanılan metottur ve bağımlı değişkenin bağımsız değişkenlerin etkisiyle nasıl değiştiğini açıklamaya çalışmaktadır.

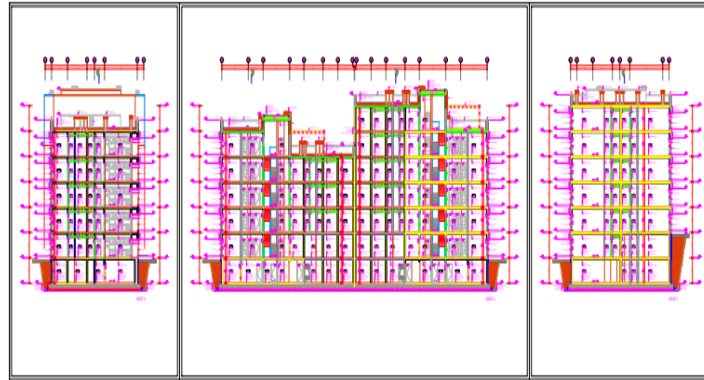
1.1.Çalışmada Kullanılan Projelerin Detayları

Çalışmada örnek olarak kullanılan 1. proje 2 bodrum kat+ zemin kat+ 3 normal kat olan toplamda 6 katlı 13 bağımsız bölümden oluşan çok katlı betonarme konut projesidir.



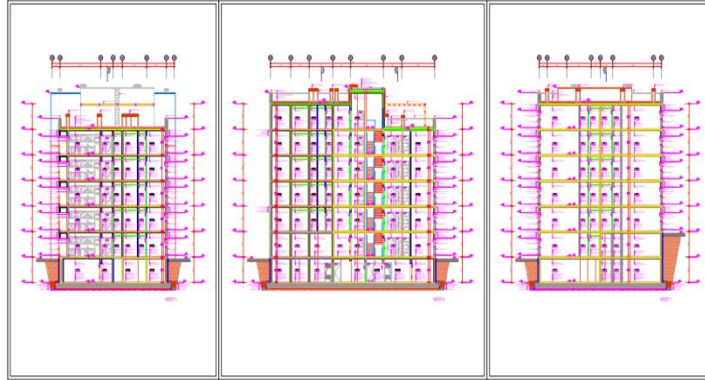
Şekil 2.1. Proje 1 kesitleri

Çalışmada örnek olarak kullanılan 2. proje 2 bodrum kat+ zemin kat+ 3 normal kat olan toplamda 6 katlı 28 bağımsız bölümden oluşan çok katlı betonarme konut projesidir.



Şekil 2.2. Proje 2 kesitleri

Çalışmada örnek olarak kullanılan 3. proje 2 bodrum kat+ zemin kat+ 4 normal kat olan toplamda 7 katlı 16 bağımsız bölümden oluşan çok katlı betonarme konut projesidir.



Şekil 2.3. Proje 3 kesitleri

2.ARAŞTIRMA VE BULGULAR

Çalışmada kullanılmak üzere, 3 adet benzer nitelikteki çok katlı betonarme proje esas alınmıştır. Standartlarına, projelerine, mahal listelerine uygun olarak projelerin 2024 yılı Şubat ayı piyasa fiyatlarına göre birim fiyat yöntemi ile yapı maliyeti hesaplanmış, daha sonra farklı kalınlıklardaki XPS, EPS ve taş yünü dış cephe ısı yalıtım malzemelerinin projelere uygulandığı varsayılarak dış cephe ısı yalıtım sistemlerinin maliyet hesapları birim fiyat yöntemi ile yapılmıştır. Ayrıyeten regresyon analizinde veri seti olarak kullanılmak üzere; 59 adet benzer nitelikte çok katlı betonarme projelere, farklı kalınlıklardaki XPS, EPS ve taş yünü dış cephe ısı yalıtım malzemelerinin uygulandığı varsayılarak dış cephe ısı yalıtım maliyetleri 2024 yılı Şubat ayı piyasa fiyatlarına göre hesaplanmıştır. Çalışmada örnek olarak kullanılan 3 adet projenin verileri regresyon analizi sonucu oluşturulan denklemlerde yerine koyularak projelerin regresyon analizi yöntemi ile dış cephe ısı yalıtım maliyetleri hesaplanmıştır. Dış cephe ısı yalıtım sistemlerinin maliyetinin hesaplanması için kullanılan birim fiyat ve regresyon analizi yöntemleri sonucu elde edilen maliyetler karşılaştırılarak değerlendirmelerde bulunulmuştur. Çalışma kapsamında, çok katlı betonarme yapılarda uygulanan farklı dış cephe ısı yalıtım sistemlerinin maliyeti ne ölçüde etkileyeceği araştırılmıştır.

3.BİRİM FİYAT YÖNTEMİ İLE MALİYET HESABI

Seçilen üç adet benzer nitelikteki çok katlı betonarme konut projelerinin yalıtımsız durumda toplam maliyetinin incelemesi, farklı yalıtım sistemleri uygulanması durumunda ısı yalıtım sistemlerinin ve yapı maliyetlerinin incelemesi, farklı ısı yalıtım sistemlerinin yapılarıdaki

toplam maliyetinin içerisindeki oranı incelemesi yapılmıştır. Maliyetler hesaplanırken; arsa ve proje bedelleri, fizibilite ve jeoloji etütleri, altyapı gibi maliyetler dâhil edilmemiştir.

Birim fiyat yöntemi ile yapılan hesaplamalar sonucunda;

1. projede; ısı yalıtımsız durumda yapı maliyeti 20.400.037,08 TL olarak elde edilmiştir. Dış cephe ısı yalıtımlı durumlarda yapı maliyeti en düşük 21.722.754,11 TL ile 3 cm EPS dış cephe ısı yalıtım sistemi kullanılması durumunda, en yüksek 22.402.892,01 TL ile 10 cm taş yünü dış cephe ısı yalıtım sistemi kullanılması durumunda elde edilmiştir. 3 cm EPS uygulanması durumunda dış cephe ısı yalıtım sistemi maliyetinin yapı maliyeti içerisindeki oranı % 6,09, 10 cm taş yünü uygulanması durumunda dış cephe ısı yalıtım sistemi maliyetinin yapı maliyeti içerisindeki oranı %8,94 olmaktadır. En düşük dış cephe ısı yalıtım maliyeti 3 cm EPS uygulanması durumunda 1.322.717,03 TL, en yüksek dış cephe ısı yalıtım maliyeti 10 cm taş yünü uygulanması durumunda 2.002.854,93 TL olmaktadır.

2. projede; ısı yalıtımsız durumda yapı maliyeti 44.299.915,65 TL olarak elde edilmiştir. Dış cephe ısı yalıtımlı durumlarda yapı maliyeti en düşük 46.607.846,51TL ile 3 cm EPS dış cephe ısı yalıtım sistemi kullanılması durumunda, en yüksek 47.747.416,59 TL ile 10 cm taş yünü dış cephe ısı yalıtım sistemi kullanılması durumunda elde edilmiştir. 3 cm EPS uygulanması durumunda dış cephe ısı yalıtım sistemi maliyetinin yapı maliyeti içerisindeki oranı % 4,95, 10 cm taş yünü uygulanması durumunda dış cephe ısı yalıtım sistemi maliyetinin yapı maliyeti içerisindeki oranı %7,22 olmaktadır. En düşük dış cephe ısı yalıtım maliyeti 3 cm EPS uygulanması durumunda 2.307.930,86 TL, en yüksek dış cephe ısı yalıtım maliyeti 10 cm taş yünü uygulanması durumunda 3.447.500,94 TL olmaktadır.

3. projede; ısı yalıtımsız durumda yapı maliyeti 24.569.861,26 TL olarak elde edilmiştir. Dış cephe ısı yalıtımlı durumlarda yapı maliyeti en düşük 25.857.849,28TL ile 3 cm EPS dış cephe ısı yalıtım sistemi kullanılması durumunda, en yüksek 26.470.574,08 TL ile 10 cm taş yünü dış cephe ısı yalıtım sistemi kullanılması durumunda elde edilmiştir. 3 cm EPS uygulanması durumunda dış cephe ısı yalıtım sistemi maliyetinin yapı maliyeti içerisindeki oranı % 4,98, 10 cm taş yünü uygulanması durumunda dış cephe ısı yalıtım sistemi maliyetinin yapı maliyeti içerisindeki oranı %7,18 olmaktadır. En düşük dış cephe ısı yalıtım maliyeti 3 cm EPS uygulanması durumunda 1.287.988,02TL, en yüksek dış cephe ısı yalıtım maliyeti 10 cm taş yünü uygulanması durumunda 1.900.712,82TL olmaktadır.

Kullanılan Isı Yalıtım Türüne Göre Yapı Birim Fiyat Yöntemi Maliyet Analizi	PROJE 1			PROJE 2			PROJE 3		
	Dış Cephe Isı Yalıtım Maliyeti (TL)	Toplam Yapı Maliyeti (TL)	Dış Cephe Yalıtım Maliyeti i Yüzdesi (%)	Dış Cephe Isı Yalıtım Maliyeti (TL)	Toplam Yapı Maliyeti (TL)	Dış Cephe Yalıtım Maliyeti Yüzdesi (%)	Dış Cephe Isı Yalıtım Maliyeti (TL)	Toplam Yapı Maliyeti (TL)	Dış Cephe Yalıtım Maliyeti Yüzdesi (%)
Dış Cephe Isı Yalıtımsız Yapı Maliyeti	0	20.400.037,08	0	0	24.569.861,26	0	0	24.569.861,26	0
3 cm EPS Dış Cephe Isı Yalıtım Sistemi Maliyeti	1.322.717,03	21.722.754,11	6,09	1.287.988,02	25.857.849,28	4,98	1.287.988,02	25.857.849,28	4,98
4 cm EPS Dış Cephe Isı Yalıtım Sistemi Maliyeti	1.376.117,97	21.776.155,05	6,32	1.336.096,03	25.905.957,29	5,16	1.336.096,03	25.905.957,29	5,16
5 cm EPS Dış Cephe Isı Yalıtım Sistemi Maliyeti	1.422.799,67	21.822.836,75	6,52	1.378.150,79	25.948.012,05	5,31	1.378.150,79	25.948.012,05	5,31
6 cm EPS Dış Cephe Isı Yalıtım Sistemi Maliyeti	1.491.270,54	21.891.307,62	6,81	1.439.835,04	26.009.696,30	5,54	1.439.835,04	26.009.696,30	5,54
7 cm EPS Dış Cephe Isı Yalıtım Sistemi Maliyeti	1.565.753,97	21.965.791,05	7,13	1.506.935,91	26.076.797,17	5,78	1.506.935,91	26.076.797,17	5,78
3 cm XPS Dış Cephe Isı Yalıtım Sistemi Maliyeti	1.389.195,33	21.789.232,41	6,38	1.347.877,20	25.917.738,46	5,20	1.347.877,20	25.917.738,46	5,20
4 cm XPS Dış Cephe Isı Yalıtım Sistemi Maliyeti	1.500.256,53	21.900.293,61	6,85	1.447.930,37	26.017.791,63	5,57	1.447.930,37	26.017.791,63	5,57
5 cm XPS Dış Cephe Isı Yalıtım Sistemi Maliyeti	1.616.954,29	22.016.991,37	7,34	1.553.061,42	26.122.922,68	5,95	1.553.061,42	26.122.922,68	5,95
6 cm XPS Dış Cephe Isı Yalıtım Sistemi Maliyeti	1.709.304,00	22.109.341,08	7,73	1.636.257,72	26.206.118,98	6,24	1.636.257,72	26.206.118,98	6,24
7 cm XPS Dış Cephe Isı Yalıtım Sistemi Maliyeti	1.806.494,28	22.206.531,36	8,13	1.723.814,81	26.293.676,07	6,56	1.723.814,81	26.293.676,07	6,56
8 cm XPS Dış Cephe Isı Yalıtım Sistemi Maliyeti	1.981.520,43	22.381.557,51	8,85	1.881.492,93	26.451.354,19	7,11	1.881.492,93	26.451.354,19	7,11
3 cm Taş Yünü Dış Cephe Isı Yalıtım Sistemi Maliyeti	1.444.819,61	21.844.856,69	6,61	1.397.988,18	25.967.849,44	5,38	1.397.988,18	25.967.849,44	5,38
4 cm Taş Yünü Dış Cephe Isı Yalıtım Sistemi Maliyeti	1.550.680,28	21.950.717,36	7,06	1.493.356,28	26.063.217,54	5,73	1.493.356,28	26.063.217,54	5,73
5 cm Taş Yünü Dış Cephe Isı Yalıtım Sistemi Maliyeti	1.650.628,83	22.050.665,91	7,49	1.583.398,25	26.153.259,51	6,05	1.583.398,25	26.153.259,51	6,05
6 cm Taş Yünü Dış Cephe Isı Yalıtım Sistemi Maliyeti	1.655.644,23	22.055.681,31	7,51	1.587.916,54	26.157.777,80	6,07	1.587.916,54	26.157.777,80	6,07
7 cm Taş Yünü Dış Cephe Isı Yalıtım Sistemi Maliyeti	1.741.467,63	22.141.504,71	7,87	1.665.233,39	26.235.094,65	6,35	1.665.233,39	26.235.094,65	6,35
8 cm Taş Yünü Dış Cephe Isı Yalıtım Sistemi Maliyeti	1.805.798,13	22.205.835,21	8,13	1.723.187,66	26.293.048,92	6,55	1.723.187,66	26.293.048,92	6,55
9 cm Taş Yünü Dış Cephe Isı Yalıtım Sistemi Maliyeti	1.969.768,53	22.369.805,61	8,81	1.870.905,84	26.440.767,10	7,08	1.870.905,84	26.440.767,10	7,08
10 cm Taş Yünü Dış Cephe Isı Yalıtım Sistemi Maliyeti	2.002.854,93	22.402.892,01	8,94	1.900.712,82	26.470.574,08	7,18	1.900.712,82	26.470.574,08	7,18

Çizelge 3.1. Birim fiyat yöntemi ile ısı yalıtım maliyeti hesabı ve yapı maliyeti içindeki oranı

4.REGRESYON ANALİZİ YÖNTEMİ İLE MALİYET HESABI

Bu çalışmada; 59 adet benzer nitelikteki çok katlı betonarme projelere farklı dış cephe ısı yalıtım sistemleri uygulandığı varsayılarak dış cephe ısı yalıtım maliyetleri 2024 yılı Ocak ayı piyasa fiyatlarına göre hesaplanmış ve projelere özgü verilerden yararlanarak veri seti olarak kullanılmış ve regresyon analizi yapılmıştır. Regresyon analizi yapmak için SPSS programı kullanılmıştır. Regresyon analizi için kullanılan veriler; ısı yalıtımı maliyeti bağımlı değişken, cephe yüksekliği (m), cephe alanı (m²), cephe boşluk alanı (m²) bağımsız değişken olarak kullanılmıştır. Regresyon analizi ile elde edilen sonuçlara göre tez çalışmasında kullanılan örnek projelerin farklı dış cephe ısı yalıtım sistemleri maliyeti elde edilmiştir. Bu elde edilen örnek projelere ait dış cephe ısı yalıtımı maliyetleri, birim fiyat yöntemi ile hesaplanan dış cephe ısı yalıtım maliyetleri ile karşılaştırılarak hata oranı incelenmiştir.

Çizelge 4.1. Tezde Kullanılan Projelerin Özellikleri

TEZDE KULLANILAN YAPININ ÖZELLİKLERİ	PROJE 1	PROJE 2	PROJE 3
Cephe yüksekliği (m)	18	16	19
Cephe alanı (m ²)	1820,65	2914,52	1657,63
Cephe boşluk alanı (m ²)	416,65	562,12	392,79

4.1.Regresyon Analizi ile 3 cm EPS Dış Cephe Isı Yalıtım Sistemi Maliyeti

3 cm EPS dış cephe ısı yalıtım sistemi maliyeti regresyon analizi yöntemi ile elde edilmiştir. Regresyon denklemi aşağıdaki gibi kurulmuş olup çalışmada kullanılan projelere ait veriler denklemde yerine koyularak 3 cm EPS dış cephe ısı yalıtım sisteminin maliyeti hesaplanmıştır. Regresyon analizine göre 3 cm EPS dış cephe ısı yalıtım sisteminin maliyeti 1. projede 1.345.546,55 TL, 2. projede 1.827.795,59 TL, 3. projede 1.250.750,00 TL olarak bulunmuştur.

3 cm EPS dış cephe ısı yalıtım maliyeti (TL)= -31862,203x Cephe yüksekliği (m) +257,463x Cephe boşluk alanı (m²) + 348,37x Cephe alanı (m²) +1177534,406 Hata! Başvuru kaynağı bulunamadı.

4.2.Regresyon Analizi ile 4 cm EPS Dış Cephe Isı Yalıtım Sistemi Maliyeti

4 cm EPS dış cephe ısı yalıtım sistemi maliyeti regresyon analizi yöntemi ile elde edilmiştir.

Regresyon denklemi aşağıdaki gibi kurulmuş olup çalışmada kullanılan projelere ait veriler denklemde yerine koyularak 4 cm EPS dış cephe ısı yalıtım sisteminin maliyeti hesaplanmıştır. Regresyon analizine göre 4 cm EPS dış cephe ısı yalıtım sisteminin maliyeti 1. projede 1.386.631,30 TL, 2. projede 1.883.605,16 TL, 3. projede 1.288.940,26 TL olarak bulunmuştur.

4 cm EPS dış cephe ısı yalıtım maliyeti (TL) = -32835,094x Cephe yüksekliği (m) + 265,324x Cephe boşluk alanı (m²) + 359,007x Cephe alanı (m²) + 1213489,655 **Hata! Başvuru kaynağı bulunamadı.**

4.3.Regresyon Analizi ile 5 cm EPS Dış Cephe Isı Yalıtım Sistemi Maliyeti

5 cm EPS dış cephe ısı yalıtım sistemi maliyeti regresyon analizi yöntemi ile elde edilmiştir. Regresyon denklemi aşağıdaki gibi kurulmuş olup çalışmada kullanılan projelere ait veriler denklemde yerine koyularak 5 cm EPS dış cephe ısı yalıtım sisteminin maliyeti hesaplanmıştır. Regresyon analizine göre 5 cm EPS dış cephe ısı yalıtım sisteminin maliyeti 1. projede 1.430.306,13 TL, 2. projede 1.942.933,52 TL, 3. projede 1.329.538,08 TL olarak bulunmuştur.

5 cm EPS dış cephe ısı yalıtım maliyeti (TL) = -33869,27x Cephe yüksekliği (m) + 273,681x Cephe boşluk alanı (m²) + 370,315x Cephe alanı (m²) + 1251709,801 **Hata! Başvuru kaynağı bulunamadı.**

4.4.Regresyon Analizi ile 6 cm EPS Dış Cephe Isı Yalıtım Sistemi Maliyeti

6 cm EPS dış cephe ısı yalıtım sistemi maliyeti regresyon analizi yöntemi ile elde edilmiştir. Regresyon denklemi aşağıdaki gibi kurulmuş olup çalışmada kullanılan projelere ait veriler denklemde yerine koyularak 6 cm EPS dış cephe ısı yalıtım sisteminin maliyeti hesaplanmıştır. Regresyon analizine göre 6 cm EPS dış cephe ısı yalıtım sisteminin maliyeti 1. projede 1.488.923,52 TL, 2. projede 2.022.559,23 TL, 3. projede 1.384.025,78 TL olarak bulunmuştur.

6 cm EPS dış cephe ısı yalıtım maliyeti (TL) = -35257,355x Cephe yüksekliği (m) + 284,897x Cephe boşluk alanı (m²) + 385,491x Cephe alanı (m²) + 1303009,383 **Hata! Başvuru kaynağı bulunamadı.**

4.5.Regresyon Analizi ile 7 cm EPS Dış Cephe Isı Yalıtım Sistemi Maliyeti

7 cm EPS dış cephe ısı yalıtım sistemi maliyeti regresyon analizi yöntemi ile elde edilmiştir. Regresyon denklemi aşağıdaki gibi kurulmuş olup çalışmada kullanılan projelere ait veriler

denklemdede yerine koyularak 7 cm EPS dış cephe ısı yalıtım sisteminin maliyeti hesaplanmıştır. Regresyon analizine göre 7 cm EPS dış cephe ısı yalıtım sisteminin maliyeti 1. projede 1.508.605,50 TL, 2. projede 2.038.526,35 TL, 3. projede 1.405.289,60 TL olarak bulunmuştur.

7 cm EPS dış cephe ısı yalıtım maliyeti (TL)= -33751,76x Cephe yüksekliği (m) +298,024x Cephe boşluk alanı (m²) +383,102x Cephe alanı (m²) +1294470,822 Hata! Başvuru kaynağı bulunamadı.

4.6.Regresyon Analizi ile 3 cm XPS Dış Cephe Isı Yalıtım Sistemi Maliyeti

3 cm XPS dış cephe ısı yalıtım sistemi maliyeti regresyon analizi yöntemi ile elde edilmiştir. Regresyon denklemi aşağıdaki gibi kurulmuş olup çalışmada kullanılan projelere ait veriler denklemdede yerine koyularak 3 cm XPS dış cephe ısı yalıtım sisteminin maliyeti hesaplanmıştır. Regresyon analizine göre 3 cm XPS dış cephe ısı yalıtım sisteminin maliyeti 1. projede 1.355.588,21 TL, 2. projede 1.841.436,31 TL, 3. projede 1.260.084,20 TL olarak bulunmuştur.

3 cm XPS dış cephe ısı yalıtım maliyeti (TL)= -32099,98x Cephe yüksekliği (m) +259,384x Cephe boşluk alanı (m²) +350,97x Cephe alanı (m²) + 1186321,976 Hata! Başvuru kaynağı bulunamadı.

4.7.Regresyon Analizi ile 4 cm XPS Dış Cephe Isı Yalıtım Sistemi Maliyeti

4 cm XPS dış cephe ısı yalıtım sistemi maliyeti regresyon analizi yöntemi ile elde edilmiştir. Regresyon denklemi aşağıdaki gibi kurulmuş olup çalışmada kullanılan projelere ait veriler denklemdede yerine koyularak 4 cm XPS dış cephe ısı yalıtım sisteminin maliyeti hesaplanmıştır. Regresyon analizine göre 4 cm XPS dış cephe ısı yalıtım sisteminin maliyeti 1. projede 1.408.129,65 TL, 2. projede 1.912.808,60 TL, 3. projede 1.308.924,01 TL olarak bulunmuştur.

4 cm XPS dış cephe ısı yalıtım maliyeti (TL)= -33344,165x Cephe yüksekliği (m) +269,438x Cephe boşluk alanı (m²) + 364,573x Cephe alanı (m²) +1232303,448 Hata! Başvuru kaynağı bulunamadı.

4.8.Regresyon Analizi ile 5 cm XPS Dış Cephe Isı Yalıtım Sistemi Maliyeti

5 cm XPS dış cephe ısı yalıtım sistemi maliyeti regresyon analizi yöntemi ile elde edilmiştir.

Regresyon denklemi aşağıdaki gibi kurulmuş olup çalışmada kullanılan projelere ait veriler denklemde yerine koyularak 5 cm XPS dış cephe ısı yalıtım sisteminin maliyeti hesaplanmıştır. Regresyon analizine göre 5 cm XPS dış cephe ısı yalıtım sisteminin maliyeti 1. projede 1.476.818,68 TL, 2. projede 2.006.116,01 TL, 3. projede 1.372.773,75 TL olarak bulunmuştur.

5 cm XPS dış cephe ısı yalıtım maliyeti (TL)= -34970,71x Cephe yüksekliği (m) +282,581x Cephe boşluk alanı (m²) +382,357 x Cephe alanı (m²) +1292415,811 Hata! Başvuru kaynağı bulunamadı.

4.9. Regresyon Analizi ile 6 cm XPS Dış Cephe Isı Yalıtım Sistemi Maliyeti

6 cm XPS dış cephe ısı yalıtım sistemi maliyeti regresyon analizi yöntemi ile elde edilmiştir. Regresyon denklemi aşağıdaki gibi kurulmuş olup çalışmada kullanılan projelere ait veriler denklemde yerine koyularak 6 cm XPS dış cephe ısı yalıtım sisteminin maliyeti hesaplanmıştır. Regresyon analizine göre 6 cm XPS dış cephe ısı yalıtım sisteminin maliyeti 1. projede 1.579.554,43 TL, 2. projede 2.145.672,75 TL, 3. projede 1.468.271,54 TL olarak bulunmuştur.

6 cm XPS dış cephe ısı yalıtım maliyeti (TL)= -37403,455x Cephe yüksekliği (m) +302,239x Cephe boşluk alanı (m²) +408,956x Cephe alanı (m²) + 1382322,998 Hata! Başvuru kaynağı bulunamadı.

4.10.Regresyon Analizi ile 7 cm XPS Dış Cephe Isı Yalıtım Sistemi Maliyeti

7 cm XPS dış cephe ısı yalıtım sistemi maliyeti regresyon analizi yöntemi ile elde edilmiştir. Regresyon denklemi aşağıdaki gibi kurulmuş olup çalışmada kullanılan projelere ait veriler denklemde yerine koyularak 7 cm XPS dış cephe ısı yalıtım sisteminin maliyeti hesaplanmıştır. Regresyon analizine göre 7 cm XPS dış cephe ısı yalıtım sisteminin maliyeti 1. projede 1.607.510,70 TL, 2. projede 2.183.648,59 TL, 3. projede 1.494.258,25TL olarak bulunmuştur.

7 cm XPS dış cephe ısı yalıtım maliyeti (TL)= -38065,463 x Cephe yüksekliği (m) +307,588x Cephe boşluk alanı (m²) + 416,194x Cephe alanı (m²) +1406788,892 Hata! Başvuru kaynağı bulunamadı.

4.11.Regresyon Analizi ile 8 cm XPS Dış Cephe Isı Yalıtım Sistemi Maliyeti

8 cm XPS dış cephe ısı yalıtım sistemi maliyeti regresyon analizi yöntemi ile elde edilmiştir. Regresyon denklemi aşağıdaki gibi kurulmuş olup çalışmada kullanılan projelere ait veriler

denklemdede yerine koyularak 8 cm XPS dış cephe ısı yalıtım sisteminin maliyeti hesaplanmıştır. Regresyon analizine göre 8 cm XPS dış cephe ısı yalıtım sisteminin maliyeti 1. projede 1.675.821,05 TL, 2. projede 2.275.680,94 TL, 3. projede 1.558.279,47 TL olarak bulunmuştur.

8 cm XPS dış cephe ısı yalıtım maliyeti (TL) = -39085,972x Cephe yüksekliği (m) + 324,781x Cephe boşluk alanı (m²) + 433,728 x Cephe alanı (m²) + 1454381,664 Hata! Başvuru kaynağı bulunamadı.

4.12.Regresyon Analizi ile 3 cm Taş Yünü Dış Cephe Isı Yalıtım Sistemi Maliyeti

3 cm taş yünü dış cephe ısı yalıtım sistemi maliyeti regresyon analizi yöntemi ile elde edilmiştir. Regresyon denklemi aşağıdaki gibi kurulmuş olup çalışmada kullanılan projelere ait veriler denklemdede yerine koyularak 3 cm taş yünü dış cephe ısı yalıtım sisteminin maliyeti hesaplanmıştır. Regresyon analizine göre 3 cm taş yünü dış cephe ısı yalıtım sisteminin maliyeti 1. projede 1.441.657,72 TL, 2. projede 1.958.353,56 TL, 3. projede 1.340.089,93 TL olarak bulunmuştur.

3 cm taş yünü dış cephe ısı yalıtım maliyeti (TL) = -34138,074 x Cephe yüksekliği (m) + 275,853x Cephe boşluk alanı (m²) + 373,254x Cephe alanı (m²) + 1261644,006 Hata! Başvuru kaynağı bulunamadı.

4.13.Regresyon Analizi ile 4 cm Taş Yünü Dış Cephe Isı Yalıtım Sistemi Maliyeti

4 cm taş yünü dış cephe ısı yalıtım sistemi maliyeti regresyon analizi yöntemi ile elde edilmiştir. Regresyon denklemi aşağıdaki gibi kurulmuş olup çalışmada kullanılan projelere ait veriler denklemdede yerine koyularak 4 cm taş yünü dış cephe ısı yalıtım sisteminin maliyeti hesaplanmıştır. Regresyon analizine göre 4 cm taş yünü dış cephe ısı yalıtım sisteminin maliyeti 1. projede 1.488.923,52 TL, 2. projede 2.022.559,23 TL, 3. projede 1.384.025,78 TL olarak bulunmuştur.

4 cm taş yünü dış cephe ısı yalıtım maliyeti (TL) = -35257,355x Cephe yüksekliği (m) + 284,897x Cephe boşluk alanı (m²) + 385,491 x Cephe alanı (m²) + 1303009,383 Hata! Başvuru kaynağı bulunamadı.

4.14.Regresyon Analizi ile 5 cm Taş Yünü Dış Cephe Isı Yalıtım Sistemi Maliyeti

5 cm taş yünü dış cephe ısı yalıtım sistemi maliyeti regresyon analizi yöntemi ile elde edilmiştir.

Regresyon denklemi aşağıdaki gibi kurulmuş olup çalışmada kullanılan projelere ait veriler denklemde yerine koyularak 5 cm taş yünü dış cephe ısı yalıtım sisteminin maliyeti hesaplanmıştır. Regresyon analizine göre 5 cm taş yünü dış cephe ısı yalıtım sisteminin maliyeti 1. projede 1.532.900,63 TL, 2. projede 2.082.298,00 TL, 3. projede 1.424.904,61 TL olarak bulunmuştur.

5 cm taş yünü dış cephe ısı yalıtım maliyeti (TL) = -36298,712x Cephe yüksekliği (m) + 293,312x Cephe boşluk alanı (m²) + 396,877x Cephe alanı (m²) + 1341494,893 Hata! Başvuru kaynağı bulunamadı.

4.15.Regresyon Analizi ile 6 cm Taş Yünü Dış Cephe Isı Yalıtım Sistemi Maliyeti

6 cm taş yünü dış cephe ısı yalıtım sistemi maliyeti regresyon analizi yöntemi ile elde edilmiştir. Regresyon denklemi aşağıdaki gibi kurulmuş olup çalışmada kullanılan projelere ait veriler denklemde yerine koyularak 6 cm taş yünü dış cephe ısı yalıtım sisteminin maliyeti hesaplanmıştır. Regresyon analizine göre 6 cm taş yünü dış cephe ısı yalıtım sisteminin maliyeti 1. projede 1.579.554,43 TL, 2. projede 2.145.672,75 TL, 3. projede 1.468.271,54 TL olarak bulunmuştur.

6 cm taş yünü dış cephe ısı yalıtım maliyeti (TL) = -37403,455x Cephe yüksekliği (m) + 302,239x Cephe boşluk alanı (m²) + 408,956x Cephe alanı (m²) + 1382322,998 Hata! Başvuru kaynağı bulunamadı.

4.16.Regresyon Analizi ile 7 cm Taş Yünü Dış Cephe Isı Yalıtım Sistemi Maliyeti

7 cm taş yünü dış cephe ısı yalıtım sistemi maliyeti regresyon analizi yöntemi ile elde edilmiştir. Regresyon denklemi aşağıdaki gibi kurulmuş olup çalışmada kullanılan projelere ait veriler denklemde yerine koyularak 7 cm taş yünü dış cephe ısı yalıtım sisteminin maliyeti hesaplanmıştır. Regresyon analizine göre 7 cm taş yünü dış cephe ısı yalıtım sisteminin maliyeti 1. projede 1.614.655,62 TL, 2. projede 2.193.354,38 TL, 3. projede 1.500.899,78 TL olarak bulunmuştur.

7 cm taş yünü dış cephe ısı yalıtım maliyeti (TL) = -38234,643 x Cephe yüksekliği (m) + 308,955x Cephe boşluk alanı (m²) + 418,044 x Cephe alanı (m²) + 1413041,287 Hata! Başvuru kaynağı bulunamadı.

4.17.Regresyon Analizi ile 8 cm Taş Yünü Dış Cephe Isı Yalıtım Sistemi Maliyeti

8 cm taş yünü dış cephe ısı yalıtım sistemi maliyeti regresyon analizi yöntemi ile elde edilmiştir. Regresyon denklemi aşağıdaki gibi kurulmuş olup çalışmada kullanılan projelere ait veriler denklemde yerine koyularak 8 cm taş yünü dış cephe ısı yalıtım sisteminin maliyeti hesaplanmıştır. Regresyon analizine göre 8 cm taş yünü dış cephe ısı yalıtım sisteminin maliyeti 1. projede 1.648.355,12 TL, 2. projede 2.239.131,89 TL, 3. projede 1.532.225,08 TL olarak bulunmuştur.

8 cm taş yünü dış cephe ısı yalıtım maliyeti (TL) = -39032,644 x Cephe yüksekliği (m) + 315,403x Cephe boşluk alanı (m²) + 426,769xCephe alanı (m²) + 1442533,074 Hata! Başvuru kaynağı bulunamadı.

4.18.Regresyon Analizi ile 9 cm Taş Yünü Dış Cephe Isı Yalıtım Sistemi Maliyeti

9 cm taş yünü dış cephe ısı yalıtım sistemi maliyeti regresyon analizi yöntemi ile elde edilmiştir. Regresyon denklemi aşağıdaki gibi kurulmuş olup çalışmada kullanılan projelere ait veriler denklemde yerine koyularak 9 cm taş yünü dış cephe ısı yalıtım sisteminin maliyeti hesaplanmıştır. Regresyon analizine göre 9 cm taş yünü dış cephe ısı yalıtım sisteminin maliyeti 1. projede 1.689.756,04 TL, 2. projede 2.295.371,13 TL, 3. projede 1.570.709,22 TL olarak bulunmuştur.

9 cm taş yünü dış cephe ısı yalıtım maliyeti (TL) = -40012,999x Cephe yüksekliği (m) + 323,325x Cephe boşluk alanı (m²) + 437,488xCephe alanı (m²) + 1478764,137 Hata! Başvuru kaynağı bulunamadı.

4.19.Regresyon Analizi ile 10 cm Taş Yünü Dış Cephe Isı Yalıtım Sistemi Maliyeti

10 cm taş yünü dış cephe ısı yalıtım sistemi maliyeti regresyon analizi yöntemi ile elde edilmiştir. Regresyon denklemi aşağıdaki gibi kurulmuş olup çalışmada kullanılan projelere ait veriler denklemde yerine koyularak 10 cm taş yünü dış cephe ısı yalıtım sisteminin maliyeti hesaplanmıştır. Regresyon analizine göre 10 cm taş yünü dış cephe ısı yalıtım sisteminin maliyeti 1. projede 1.768.953,49 TL, 2. projede 2.385.450,99 TL, 3. projede 1.647.880,06 TL olarak bulunmuştur.

10 cm taş yünü dış cephe ısı yalıtım maliyeti (TL) = -40576,774 x Cephe yüksekliği (m)

+327,474xCephe boşluk alanı (m²)+ 445,854xCephe alanı (m²)+ 1551149,29 **Hata! Başvuru kaynağı bulunamadı.**

Regresyon analizi yöntemi ile yapılan hesaplamalar sonucunda;

1. projede, en düşük hata oranı %0,16 ile 6 cm EPS dış cephe yalıtım sistemi uygulanması durumunda, en yüksek hata oranı %15,43 ile 8 cm XPS dış cephe yalıtım sistemi uygulanması durumunda elde edilmiştir.

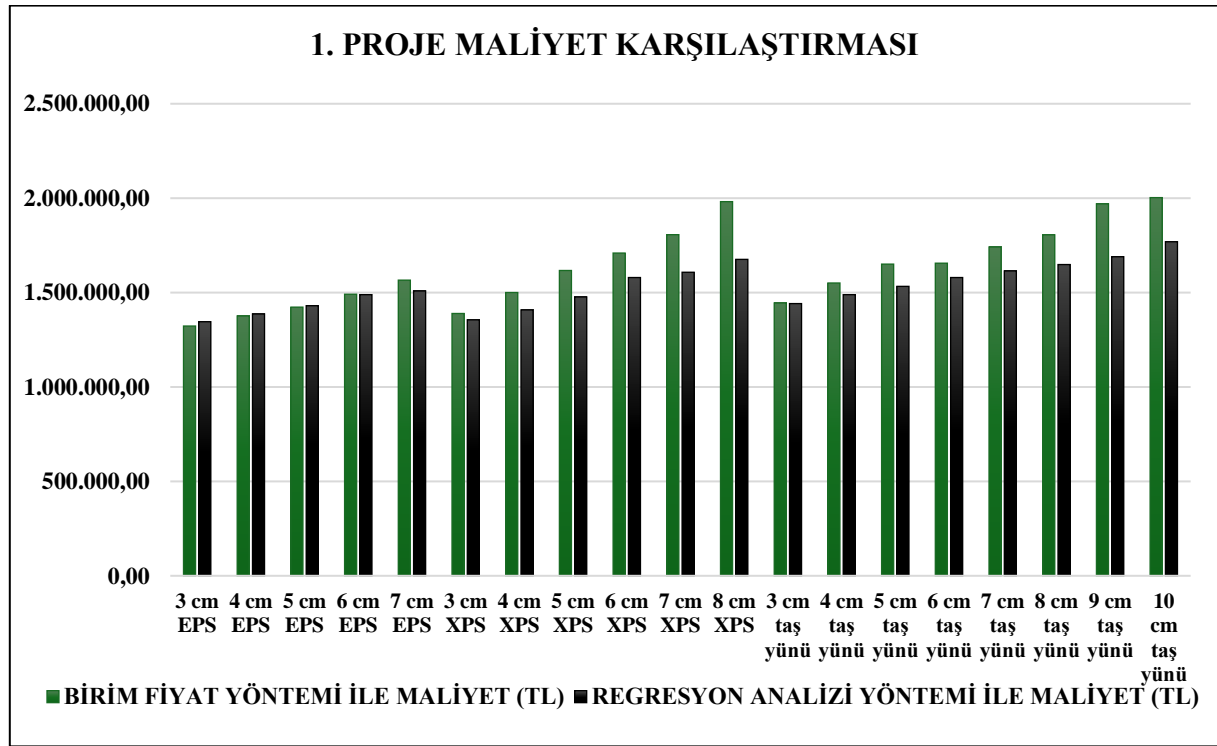
2. projede, en düşük hata oranı %19,42 ile 3 cm EPS dış cephe yalıtım sistemi uygulanması durumunda, en yüksek hata oranı %32,15 ile 8 cm XPS dış cephe yalıtım sistemi uygulanması durumunda elde edilmiştir.

3. projede, en düşük hata oranı %7,29 ile 3 cm taş yünü dış cephe yalıtım sistemi uygulanması durumunda, en yüksek hata oranı %20,14 ile 8 cm XPS dış cephe yalıtım sistemi uygulanması durumunda elde edilmiştir.

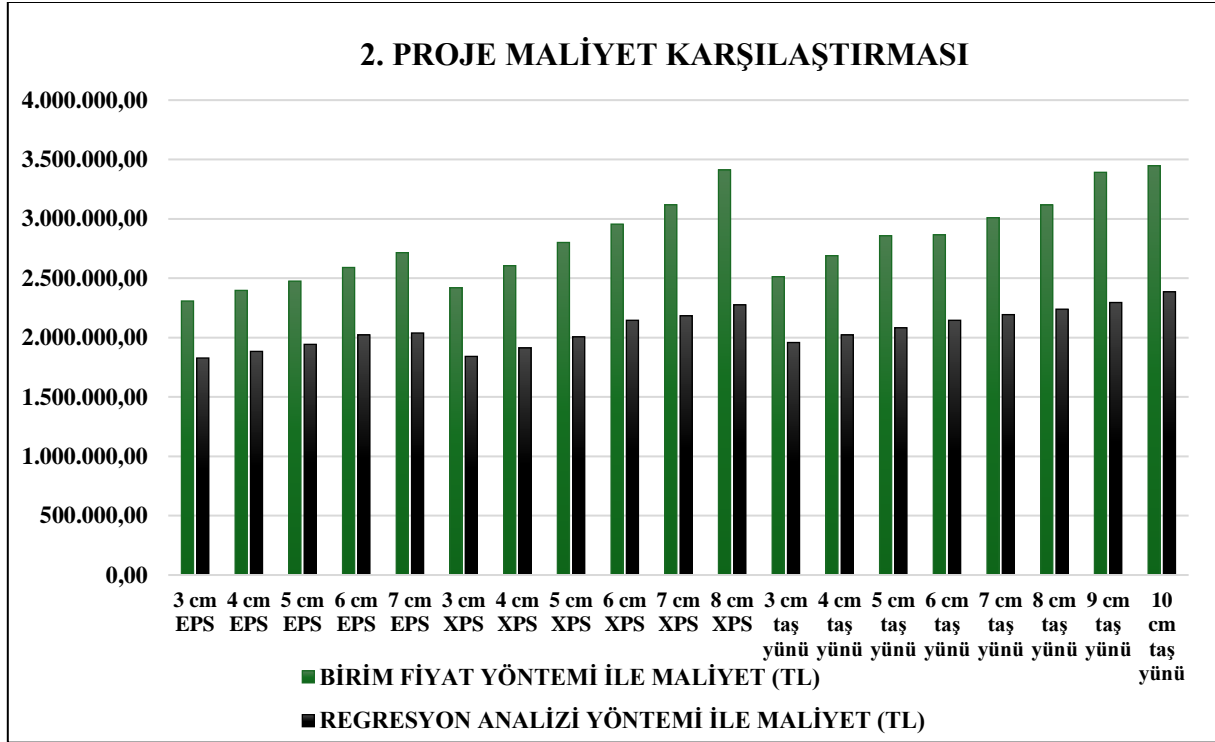
Çizelge 4.2. Isı Yalıtım Sistemi Türüne Göre Birim Fiyat Yöntemi Maliyeti, Regresyon Analizi Yöntemi Maliyeti ve Hata Oranları

Test No	Isı Yalıtım Sistemine Göre Regresyon Analizi İle Yapı Maliyeti	PROJE 1			PROJE 2			PROJE 3			Ortalama Hata Oranı (%)
		Birim Fiyat Yöntemi ile Maliyet (TL)	Regresyon Analizi Yöntemi ile Maliyet (TL)	Hata Oranı (%)	Birim Fiyat Yöntemi ile Maliyet (TL)	Regresyon Analizi Yöntemi ile Maliyet (TL)	Hata Oranı (%)	Birim Fiyat Yöntemi ile Maliyet (TL)	Regresyon Analizi Yöntemi ile Maliyet (TL)	Hata Oranı (%)	
1	3 cm EPS Dış Cephe Isı Yalıtım Sistemi Maliyeti	1.322.717,03	1.345.546,55	1,73	2.307.930,86	1.827.795,59	20,80	1.287.988,02	1.250.750,00	2,89	8,47
2	4 cm EPS Dış Cephe Isı Yalıtım Sistemi Maliyeti	1.376.117,97	1.386.631,30	0,76	2.397.404,06	1.883.605,16	21,43	1.336.096,03	1.288.940,26	3,53	8,57
3	5 cm EPS Dış Cephe Isı Yalıtım Sistemi Maliyeti	1.422.799,67	1.430.306,13	0,53	2.475.619,18	1.942.933,52	21,52	1.378.150,79	1.329.538,08	3,53	8,53
4	6 cm EPS Dış Cephe Isı Yalıtım Sistemi Maliyeti	1.491.270,54	1.488.923,52	0,16	2.590.342,02	2.022.559,23	21,92	1.439.835,04	1.384.025,78	3,88	8,65
5	7 cm EPS Dış Cephe Isı Yalıtım Sistemi Maliyeti	1.565.753,97	1.508.605,50	3,65	2.715.138,90	2.038.526,35	24,92	1.506.935,91	1.405.289,60	6,75	11,77
6	3 cm XPS Dış Cephe Isı Yalıtım Sistemi Maliyeti	1.389.195,33	1.355.588,21	2,42	2.419.315,15	1.841.436,31	23,89	1.347.877,20	1.260.084,20	6,51	10,94
7	4 cm XPS Dış Cephe Isı Yalıtım Sistemi Maliyeti	1.500.256,53	1.408.129,65	6,14	2.605.398,04	1.912.808,60	26,58	1.447.930,37	1.308.924,01	9,60	14,11
8	5 cm XPS Dış Cephe Isı Yalıtım Sistemi Maliyeti	1.616.954,29	1.476.818,68	8,67	2.800.924,97	2.006.116,01	28,38	1.553.061,42	1.372.773,75	11,61	16,22
9	6 cm XPS Dış Cephe Isı Yalıtım Sistemi Maliyeti	1.709.304,00	1.579.554,43	7,59	2.955.656,77	2.145.672,75	27,40	1.636.257,72	1.468.271,54	10,27	15,09

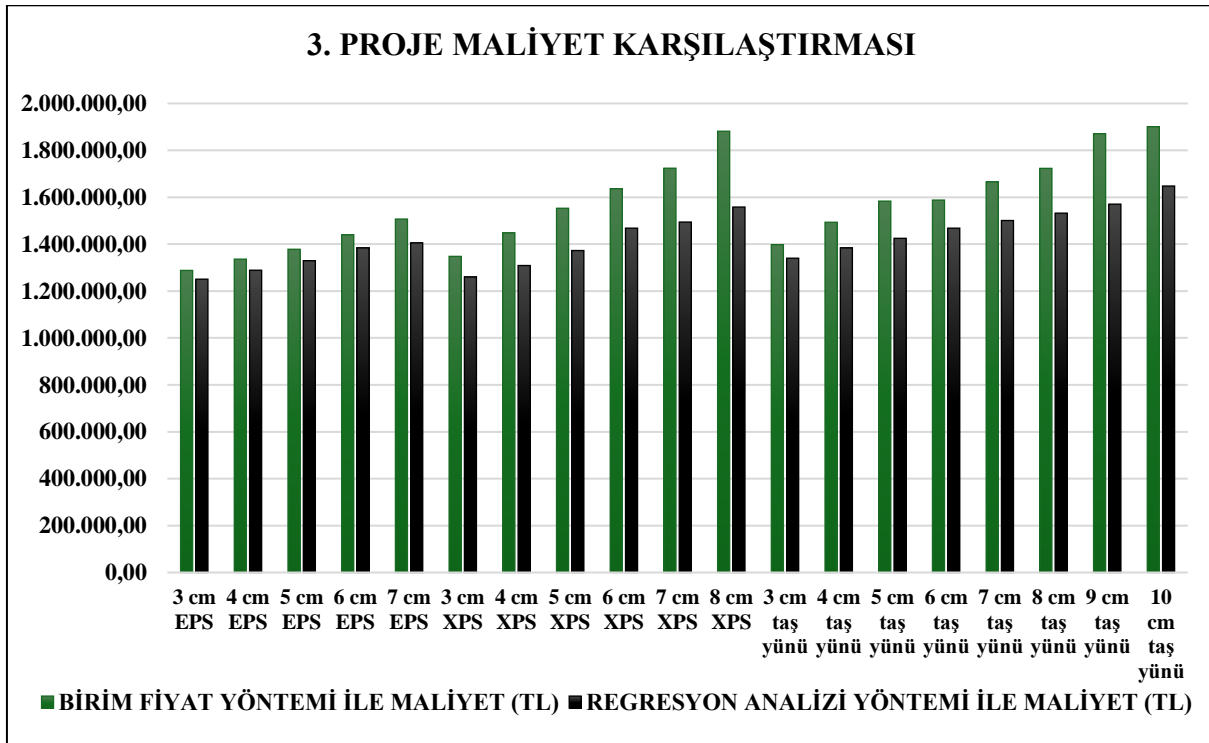
10	7 cm XPS Dış Cephe Isı Yalıtım Sistemi Maliyeti	1.806.494,28	1.607.510,70	11,01	3.118.498,95	2.183.648,59	29,98	1.723.814,81	1.494.258,25	13,32	18,10
11	8 cm XPS Dış Cephe Isı Yalıtım Sistemi Maliyeti	1.981.520,43	1.675.821,05	15,43	3.411.755,01	2.275.680,94	33,30	1.881.492,93	1.558.279,47	17,18	21,97
12	3 cm Taş Yünü Dış Cephe Isı Yalıtım Sistemi Maliyeti	1.444.819,61	1.441.657,72	0,22	2.512.513,56	1.958.353,56	22,06	1.397.988,18	1.340.089,93	4,14	8,81
13	4 cm Taş Yünü Dış Cephe Isı Yalıtım Sistemi Maliyeti	1.550.680,28	1.488.923,52	3,98	2.689.882,96	2.022.559,23	24,81	1.493.356,28	1.384.025,78	7,32	12,04
14	5 cm Taş Yünü Dış Cephe Isı Yalıtım Sistemi Maliyeti	1.650.628,83	1.532.900,63	7,13	2.857.346,61	2.082.298,00	27,12	1.583.398,25	1.424.904,61	10,01	14,75
15	6 cm Taş Yünü Dış Cephe Isı Yalıtım Sistemi Maliyeti	1.655.644,23	1.579.554,43	4,60	2.865.749,91	2.145.672,75	25,13	1.587.916,54	1.468.271,54	7,53	12,42
16	7 cm Taş Yünü Dış Cephe Isı Yalıtım Sistemi Maliyeti	1.741.467,63	1.614.655,62	7,28	3.009.546,89	2.193.354,38	27,12	1.665.233,39	1.500.899,78	9,87	14,76
17	8 cm Taş Yünü Dış Cephe Isı Yalıtım Sistemi Maliyeti	1.805.798,13	1.648.355,12	8,72	3.117.332,55	2.239.131,89	28,17	1.723.187,66	1.532.225,08	11,08	15,99
18	9 cm Taş Yünü Dış Cephe Isı Yalıtım Sistemi Maliyeti	1.969.768,53	1.689.756,04	14,22	3.392.064,72	2.295.371,13	32,33	1.870.905,84	1.570.709,22	16,05	20,87
19	10 cm Taş Yünü Dış Cephe Isı Yalıtım Sistemi Maliyeti	2.002.854,93	1.768.953,49	11,68	3.447.500,94	2.385.450,99	30,81	1.900.712,82	1.647.880,06	13,30	18,60



Şekil 4.1. Proje 1 birim fiyat ve regresyon analizi yöntemleri ile maliyet karşılaştırması



Şekil 4.2. Proje 2 birim fiyat ve regresyon analizi yöntemleri ile maliyet karşılaştırması



Şekil 4.3. Proje 3 birim fiyat ve regresyon analizi yöntemleri ile maliyet karşılaştırması

5.SONUÇ

Çalışmada örnek olarak kullanılan 3 adet çok katlı betonarme konut projelerine farklı ısı yalıtım sistemleri uygulandığı varsayılarak dış cephe ısı yalıtım maliyetleri regresyon analizi yöntemi ve birim fiyat yöntemi ile hesaplanması sonucunda her üç proje için de en düşük dış cephe ısı yalıtım maliyeti 3 cm EPS ısı yalıtım sisteminde, en yüksek dış cephe ısı yalıtım maliyeti 10 cm taş yünü ısı yalıtım sisteminde elde edilmiştir.

1. projede; dış cephe ısı yalıtımı 3 cm EPS uygulanması durumunda maliyeti birim fiyat yöntemine göre 1.322.717,03 TL regresyon analizi yöntemine göre 1.345.546,55 TL olmaktadır. Bu durumda hata oranı %1,73 olmaktadır. Dış cephe ısı yalıtımı 10 cm taş yünü uygulanması durumunda maliyeti birim fiyat yöntemine göre 2.002.854,93 TL, regresyon analizi yöntemine göre 1.768.953,49 TL olmaktadır. Bu durumda hata oranı %11,68 olmaktadır.

2. projede; dış cephe ısı yalıtımı 3 cm EPS uygulanması durumunda maliyeti birim fiyat yöntemine göre 2.307.930,86 TL regresyon analizi yöntemine göre 1.827.795,59 TL olmaktadır. Bu durumda hata oranı %20,80 olmaktadır. Dış cephe ısı yalıtımı 10 cm taş yünü uygulanması durumunda maliyeti birim fiyat yöntemine göre 3.447.500,94 TL, regresyon analizi yöntemine göre 2.385.450,99 TL olmaktadır. Bu durumda hata oranı %30,81 olmaktadır.

3. projede; dış cephe ısı yalıtımı 3 cm EPS uygulanması durumunda maliyeti birim fiyat yöntemine göre 1.287.988,02 TL regresyon analizi yöntemine göre 1.250.750,00 TL olmaktadır. Bu durumda hata oranı %2,89 olmaktadır. Dış cephe ısı yalıtımı 10 cm taş yünü uygulanması durumunda maliyeti birim fiyat yöntemine göre 1.900.712,82 TL, regresyon analizi yöntemine göre 1.647.880,06TL olmaktadır. Bu durumda hata oranı %13,30 olmaktadır.

Birim fiyat yöntemine göre 1. projede; 3 cm EPS dış cephe ısı yalıtım sistemi uygulanması durumunda dış cephe ısı yalıtım sistemi maliyetinin yapı maliyeti içerisindeki oranı % 6,09, 10 cm taş yünü uygulanması durumunda dış cephe ısı yalıtım sistemi maliyetinin yapı maliyeti içerisindeki oranı %8,94 olmaktadır.

Birim fiyat yöntemine göre 2. projede; 3 cm EPS dış cephe ısı yalıtım sistemi uygulanması durumunda dış cephe ısı yalıtım sistemi maliyetinin yapı maliyeti içerisindeki oranı % 4,95, 10 cm taş yünü uygulanması durumunda dış cephe ısı yalıtım sistemi maliyetinin yapı maliyeti içerisindeki oranı %7,22 olmaktadır.

Birim fiyat yöntemine göre 3. projede; 3 cm EPS dış cephe ısı yalıtım sistemi uygulanması durumunda dış cephe ısı yalıtım sistemi maliyetinin yapı maliyeti içerisindeki oranı % 4,98, 10 cm taş yünü uygulanması durumunda dış cephe ısı yalıtım sistemi maliyetinin yapı maliyeti içerisindeki oranı %7,18 olmaktadır.

Regresyon analizi yönteminde 1. projede, en düşük hata oranı %0,16 ile 6 cm EPS dış cephe yalıtım sistemi uygulanması durumunda, en yüksek hata oranı %15,43 ile 8 cm XPS dış cephe yalıtım sistemi uygulanması durumunda elde edilmiştir. 2. projede, en düşük hata oranı %19,42 ile 3 cm EPS dış cephe yalıtım sistemi uygulanması durumunda, en yüksek hata oranı %32,15 ile 8 cm XPS dış cephe yalıtım sistemi uygulanması durumunda elde edilmiştir. 3. projede, en düşük hata oranı %7,29 ile 3 cm taş yünü dış cephe yalıtım sistemi uygulanması durumunda, en yüksek hata oranı %20,14 ile 8 cm XPS dış cephe yalıtım sistemi uygulanması durumunda elde edilmiştir.

Regresyon analizinde hesaplanan R^2 değerinin 0,721 olması yani 1'e yakın bir değerde olması yapılan modellemenin gerçeğe yakın olduğunu göstermektedir. Regresyon analizinde kullanılacak veri sayısının çok daha fazla olması ve farklı projelerde farklı ısı yalıtım sistemleri kullanarak hesaplanan maliyetlerin test edilmesi daha verimli ve daha doğru sonuçlar elde etmek için imkân sağlayacaktır.

Çalışmada, çok katlı betonarme projelerde farklı dış cephe ısı yalıtım uygulamalarının maliyetini elde etmek için regresyon analizi ile bir model oluşturulmuştur. Bu doğrultuda yapılması planlanan başka çok katlı betonarme projelerde bu modele dayanarak dış cephe ısı yalıtım maliyetini tahmin etmekte fayda sağlayacaktır.

KAYNAKÇA

1. Latif Onur Uğur, Umut Naci Baykan, Yapı Maliyetinin Fonksiyonel Eleman Yöntemi ile Tahmini, E-Journal Of New World Sciences Academy, Volume: 4, Number: 4, Article Number: 1A0043, 2009.

Latif Onur Uğur, Yapı Maliyetinin Yapay Sinir Ağı ile Analizi, Gazi Üniversitesi Fen Bilimleri Enstitüsü Doktora Tezi, 2007, Ankara.

AYBÜ MİMARLIK BÖLÜMÜ STÜDYO SINIFINDAKİ DOĞAL AYDINLATMA DÜZEYLERİNİN DIALUX ARACI KULLANILARAK DEĞERLENDİRİLMESİ

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ÖZET

Doğal Doğal ışık, iç ortamların atmosferini ve işlevselliğini şekillendirmede önemli bir rol oynar. Bu çalışma, üniversite eğitim ortamlarındaki mimari sınıflarında doğal ışığın etkilerini tartışır. Mimarlık ve gerçek hayatta bulunan binalar üzerindeki araştırmalardan yola çıkarak, çalışma, Ankara Yıldırım Bayezit Üniversitesi (AYBU) Mimarlık Fakültesi'ndeki mimari sınıflarının kullanıcıları için rahatlık seviyelerini ne kadar başarıyla elde ettiğini tartışır. Uygulanan yöntem, binayı modellemek için Dialux aracını kullanmak ve yılın farklı günlerinde bir simülasyon çalıştırarak aydınlatma ve aydınlatma seviyelerini elde etmek ve bunları tasarım standartlarıyla karşılaştırmaktır. Sonuçlar, doğal aydınlatma düzeylerinin sağlıklı bir eğitim-öğretim faaliyeti yürütmek için yeterli olmadığını göstermektedir. Bunun nedeni, binanın fakülte olarak tasarlanmaması, başlangıçta laboratuvar binası olarak kullanılması, daha sonra üniversite binası olarak kullanılması olabilir. mimarlık fakültesi. Ayrıca makale, stratejik olarak yerleştirilmiş pencereler ve yenilikçi aydınlatma teknikleri gibi mimari müdahaleler yoluyla doğal ışık kullanımını ve kullanıcı konforunu artıran stratejileri araştırıyor. Tasarımcılar, doğal ışığın iç mekan üzerindeki çok yönlü etkisini anlayarak, kullanıcı deneyiminin kalitesini artıran daha sağlıklı, daha sürdürülebilir ve estetik açıdan hoş ortamlar yaratabilirler.

Anahtar Kelimeler: Doğal Aydınlatma, Eğitim Sınıfı, Dialux

ASSESSMENT OF NATURAL LIGHTING LEVELS IN THE STUDIO CLASSROOM OF THE ARCHITECTURAL DEPARTMENT AT AYBU USING THE DIALUX TOOL

ABSTRACT

Natural light plays a crucial role in shaping the ambiance and functionality of interior spaces. This paper discusses the effects of natural light on architectural classrooms in university educational settings. Drawing on research from architecture and real-life buildings, the paper discusses the extent to which natural light achieves the comfort levels of users within the

architectural classrooms of the faculty of Architecture building in AYBU. The method implemented is using the Dialux tool to model the building and run a simulation in different days of the year, to obtain the levels of lighting and illumination and compare it with the design standards. The results show that the natural lighting levels are not adequate for conducting healthy education activities, which might be due to the fact the building itself was not designed as a faculty, it was initially a laboratory building, transformed later to be used as the architecture faculty. Additionally, the paper explores strategies that increase the use of natural light and user comfort through architectural interventions, such as strategically placed windows, as well as innovative lighting techniques. By understanding the multifaceted impact of natural light on interior space, designers can create healthier, more sustainable, and aesthetically pleasing environments that improve the quality of users' experience.

Keywords: Daylight, Educational Classroom, Dialux

1. INTRODUCTION

The amount of natural light and its spread during different times of the day and the year are important factors in evaluating the efficiency of the interior spaces of different buildings. Its effects go beyond just lighting, as it affects the mood, productivity, and general well-being of users (Mahmoud, 2023). The welfare, happiness, and good mood directly affect a person's physical and mental health. Architects, designers, and researchers have long recognized the importance of harnessing natural light to enhance the aesthetics and performance of buildings.

Adequate lighting is indispensable to countless human endeavors and greatly affects the quality of the indoor environment, especially in workplaces. The European standard EN 12464-1 is adopted internationally for lighting workplace regulations. It presents a detailed description of the necessary illumination (both natural and artificial) for various activities such as industrial, offices, public assembly, and educational places (European standard, EN 12464-1, 2002).

Light is electromagnetic radiation within the wavelength range of 380 nm to 770 nm, stimulating the human visual system and enabling the perception of vision. On the other hand, optical radiation encompasses a broader range of electromagnetic radiation from 1 nm to 1 mm, impacting various aspects of human physiology beyond vision (Boyce, 2022).

Light, as the visible part of the electromagnetic spectrum, possesses distinctive properties that enable its transmission through space. While light rays can travel limitless distances, they can also undergo interactions with objects, leading to reflection, transmission, or absorption. The sun is the source of natural lighting while artificial lighting is produced by electrical lighting devices (Gago, 2015).

Lighting in educational places is essential to provide a well-lit environment that is conducive to comfortable and efficient task execution by students and faculty (Ashrafian, 2019). The atmosphere inside an educational building has a significant impact on the satisfaction and effectiveness of its occupants by achieving physical and psychological comfort for both teachers and learners, as lighting plays a pivotal role in this regard. A wisely designed interior environment gives educational buildings a spacious and inviting feel, enhancing vitality, receptivity to information, and overall satisfaction.

In this paper, we explore the extent to which natural light can be used in the design of classroom interiors in university buildings. By examining the case study of (Ankara Yildirim Beyazit (AYBU) building of the Faculty of Architecture and Fine Arts, we aim to provide a comprehensive understanding of how natural light shapes the environment and contributes to creating healthier and more attractive spaces. The current study is of the building and studio classrooms of the Department of Architecture to evaluate the efficiency of natural lighting, Especially that this building was not initially designed as faculty building, it was modified later and used for education purposes of Architectural department. Through this analysis, we hope to provide insights that can inform the design and optimization of indoor environments to maximize the benefits of natural light for users according to the EN 12464-1 standard adopted by Türkiye.

2. LITERATURE REVIEW

The optimization of window configuration plays a pivotal role in enhancing both visual and thermal comfort within built environments. This improvement is achieved through the mitigation of glare, effective distribution of natural light, and the regulation of solar energy influx. To improve students' performance and reduce energy consumption, (Ashrafian, 2019) focuses on the case study of a school in Eskisehir (Türkiye) by evaluating the effect of natural lighting on the building design. It investigates the influence of varying transparency ratios (Window-to-Wall Ratio, WWR) and different combinations of windows in two cardinal orientations (west

and east) on both occupants' comfort levels and the energy requirements of a classroom setting. The simulation results using Dialux show a reduction of 15% in artificial lighting and an improvement in comfort by using a glazing ratio of 50%.

The architectural design processes undertaken by students within the Studio Room necessitate a prolonged duration of engagement. Hence, it is imperative to have a studio environment that accommodates these activities comfortably. Among the essential considerations for such comfort is lighting, as design drawing tasks necessitate adequate illumination to facilitate optimal execution. A simulation is carried out in (Pujiyanti, 2022) using Dialux to evaluate the lighting levels in the studio of the Department of Architecture at UNISA. The results showed that lighting needs improvements and additions to artificial lighting to meet the approved architectural standards.

(Mandala, 2019) presents an architectural study of studios at Catholic University (Indonesia) using both student questionnaires and simulations using Dialux. Factors such as lighting techniques, lighting levels, color temperature, room reflectance, and daylight contribution stand out as the most influential determinants in shaping the quality of a studio environment. Although the lighting level is below standard, participants consistently rate the quality of lighting within the studio space positively.

An analysis of the current status of the lighting quality at ETSIAE University (Spain) is conducted in (Zamarreño-Suárez, 2020) using measured data and Dialux simulations. Based on the findings obtained from the sampled classrooms, it is evident that the average illumination levels over desks can be substantially enhanced through the implementation of LED technology. The ultimate goal of the study is to meet the European standard for illumination in classrooms (i.e. 500 lux), from the initial situation with much lower illumination values.

Daylight serves as a critical component not only for energy conservation but also for enhancing the overall quality of life. Moreover, there is a growing emphasis on acknowledging and leveraging naturally provided energy sources as an initial stride toward achieving optimal energy efficiency and diminishing reliance on fossil fuels. (Omar, 2018) Analysis of the indoor daylight conditions and the energy performance of the library within the Faculty of Architecture, Design, and Built Environment at Beirut Arab University. The investigation encompasses an analysis of

various architectural elements, including spatial depth, window dimensions, external obstruction angles, and glazing visible transmittance.

Dialux tool is also used for the evaluation of lighting performance in the hall of the Faculty of Engineering, State University of Gorontalo (Pratiwi, 2021). Engineering design interventions can effectively optimize the direction of light towards designated points of interest while concurrently mitigating glare. However, further engineering refinements are requisite to fully address the prevailing challenges.

The surveyed architecture studios of the University Tun Hussein Onn Malaysia (UTHM) fell short of meeting the illuminance levels outlined in various standards (Adnan, 2021). Results are collected using the Dialux tool and a conducted survey among architecture students who were using the studios. The outcome of this study can be considered for future architectural studio lighting design to improve the students' learning experience.

Natural lighting plays a crucial role in the energy dynamics of buildings, as insufficient natural light often leads to heightened electricity consumption for artificial lighting. From this perspective, it is evident that the arrangement of lighting fixtures should take into account daylighting illuminance levels to realize energy-efficient lighting (Nurrohman, 2021). The studio classrooms at the Department of Architecture, Universitas Trisakti, require sufficient illumination for the students to be able for hand/ digital drawing. This study is performed in the design stage of next-built studios.

(Yüksek, 2015) conducts an assessment of daylighting performances of classrooms in Kırklareli University (Türkiye) using the Velux Daylight Visualizer simulation program. Research has demonstrated that daylight illuminance levels within such environments exhibit directional variation. Accordingly, architectural considerations such as building orientation, fenestration patterns on building facades, and the incorporation of shading elements should be meticulously designed by proficient experts in the field of natural lighting to optimize these conditions.

In (Alkan, 2016), presents a study of the visual and thermal performances of buildings in Istanbul which have been transformed into Architecture schools. Because of the special requirement of studios and having in mind the green building strategy, architecture schools should satisfy several kinds of performances including lighting, ventilation, and heating.

Therefore, efficient energy utilization is vital not only for environmental conservation but also for minimizing Turkey's energy expenditures.

3. STUDY AREA AND METHOD

3.1. Natural Lighting (Daylight)

The illuminance is a crucial parameter in lighting design, reflecting the light flux per unit area incident on a specific space. By understanding the relationship between illuminance, space characteristics, and human behavior, designers can create lighting environments that align with the needs of occupants. The advancements in lighting technology contribute to the continuous improvement of lighting design practices and the overall well-being of individuals in built environments (Mahmoud, 2023). Architectural lighting design is an important discipline within the broader field of lighting design, characterized by its specific focus on the integration of lighting with architectural elements. Architectural lighting design places a greater emphasis on visual enhancement by optimizing the utilization and distribution of light within the environment (Osibona, 2021). Skillful lighting design can highlight architectural details and create a sense of hierarchy within a space. By strategically illuminating different elements, such as columns, arches, or facades, lighting can accentuate the unique features of a building and draw attention to its design. The quality of lighting is determined by a combination of factors, including illuminance, uniformity, correlated color temperature, color rendering index, perceived brightness, and sufficiency (Aslanoğlu, 2023).

Natural lighting (daylighting) can be classified into direct and indirect. Direct natural light is derived from the sun and is commonly referred to as white light encompassing a broad range of frequency components within the visible spectrum. While direct lighting occurs when the sun is above the horizon, and its rays directly reach the ground without being scattered, indirect light refers to the sunlight that has undergone reflection or refraction processes, altering its color composition (Dogan, 2019). In architectural design, understanding the path of direct sunlight is crucial for optimizing building designs to harness or mitigate its effects, such as controlling solar heat gain or providing natural lighting. On the other hand, the softer and more uniform nature of diffuse daylight has unique implications for visual perception. Diffuse light reduces harsh contrasts, minimizes glare, and creates a more comfortable environment for human activities.

Architects often strive to harness diffuse daylight to provide uniform illumination in interior spaces and create visually pleasing atmospheres.

While electric lighting has revolutionized indoor spaces, it falls short of replicating the holistic benefits of natural light. Artificial lighting often lacks the dynamic qualities of sunlight, leading to a static and monotonous indoor environment. Maximizing the use of daylight in architectural design instead of artificial lighting has significant benefits on mood disorders and overall improvement in mental health, in addition to reducing the expenditure of electrical energy that leads to material losses and general pollution. Daylighting has been an ancient aspect of architectural design, harmonizing the built environment with the natural rhythms of the sun.

3.2. Case Study

The research is conducted within the campus of AYBU, situated in the Esnboğa District of Ankara City. Specifically, the study focused on four studio rooms located within the D-block/ floor 3 of the Faculty of Architecture and Fine Arts as presented in Fig 1. Studios 1 and 2 have three openings on the east side, while, studios 3 and 4 have three openings on the west side.



Fig1. Plan of studio rooms

3.3. Method: Dialux Tool

Employing a quantitative approach, the research utilized simulation methodology to investigate pertinent phenomena. Data analysis was executed through descriptive statistical techniques, aimed at portraying and elucidating the collected data without attempting to draw overarching conclusions or generalizations. The outcomes of the simulation were presented through tabular

and graphical formats, and detailed subsequently. Furthermore, the assessment of lighting performance was facilitated by the utilization of Dialux Evo 12.0 simulation software.

Dialux software serves as a comprehensive tool for simulating natural and artificial lighting levels, analyzing annual energy consumption stemming from electric lighting, assessing energy savings derived from daylight utilization, and gauging building energy efficiency (<https://www.dialux.com/en-GB/dialux>). Notably, Dialux facilitates indoor lighting analysis in conjunction with daylighting considerations. Additionally, the software is capable of computing daylight illumination across diverse sky conditions, including overcast, average, and clear skies. Moreover, Dialux offers an extensive array of catalogs encompassing commercial electric lighting products, daylight control systems, and other pertinent items. Through the utilization of Dialux software, substantial reductions in energy consumption have been achieved by simulating interior and exterior lighting designs, thereby underscored by various simulation iterations (Ahmad, 2020).

The Dialux_Evo 12.0 simulation was carried out in the climatic conditions of Ankara on 21 March, 21 June, 21 September, and 21 December Fig 2. Meanwhile, the simulation is carried out in a sufficient lecture period, starting at 08.00 to 16.00 with clear sky conditions and latitude $11^{\circ} 55' 39''$ E longitude $15^{\circ} 51' 32''$ N.

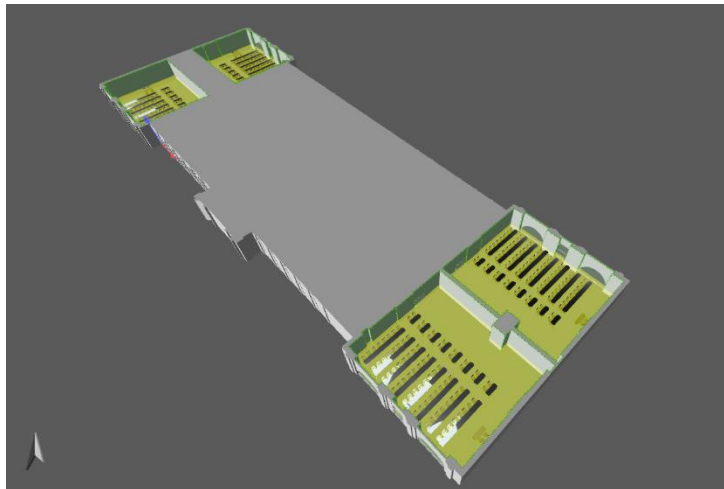


Fig 2. 3D model of studio rooms in dialux on 21.3.2023 at 5:00 p.m.

4. SIMULATION RESULTS AND DISCUSSION

The plan of the building is available in AutoCAD in the Engineering Affairs office of AYBU. It is first imported to Dialux, and a 3D model is then presented for analysis. After providing the Dialux with available data on the building location and simulation time (Year, Month, Day, Hours), simulations are executed.

Four scenarios are simulated, one for every studio room. The results of measurements using the software Dialux Evo. According to the European standards (European Standard, EN 12464-1, 2002) adopted by Turkey for indoor lighting, the lighting of educational classrooms should be higher than 500 lux. The rooms under investigation are studio rooms for the architecture Department, so the aforementioned standard must be raised to be equal to 750 as Art rooms in art schools mentioned in the standard. For that, the minimum lux (mini-lux) is taken to be 750 Lux.

4.1. Scenario 1: Studio Room 1

Table 1. presents the simulation results collected for scenario 1 (Room 1) using Dialux Evo according to the input information.

The simulation is carried out on four different dates for the year 2023, with three months between two consecutive dates. For the results to be reflective of reality, the dates of the summer solstice (21 June) and winter solstice (21 December) were chosen from among those dates.

the summer solstice is the day with the longest period of daylight and the shortest night of the year when the Sun is at its highest position in the sky. The winter solstice is the day with the shortest period of daylight and longest night of the year, and when the Sun is at its lowest daily maximum elevation.

The simulations present results for hours 8, 9, 10, 11, 12, 13, 14, 15, 16, and 17:00. However, for other times, students need artificial lighting in the studio.

Table 1: Results of architectural Studio Room 1

Date /hour	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00
21.03.2023	714	1331	1319	817	221	177	159	154	160	159
21.06.2023	1789	1961	1711	1053	296	183	162	155	156	154
21.09.2023	956	1390	1249	661	207	172	156	155	164	144
21.12.2023	0	184	401	233	156	138	125	114	78	31.9

In the results of Table 1, We noticed that the natural lighting is enough for illumination of room 1 from 8:00 to 11:00 on the simulated dates except for the date 21 December. The location of the room gives a maximum of lighting around 9:00. A graph representing the natural lighting during these simulations is shown in Fig 2. In the simulation of scenario 1 on 21 Dec., the natural lighting is always under the acceptable level (mini-lux). For 21 March, the natural lighting can be considered above the acceptable level between 8:00 and 11:00 because it is increased above mini-lux minutes after 8:00. Also, for the case study of 21 Sept., daylight falls under 750 lux just before 11:00 as shown by the linear approximation in Fig 3.

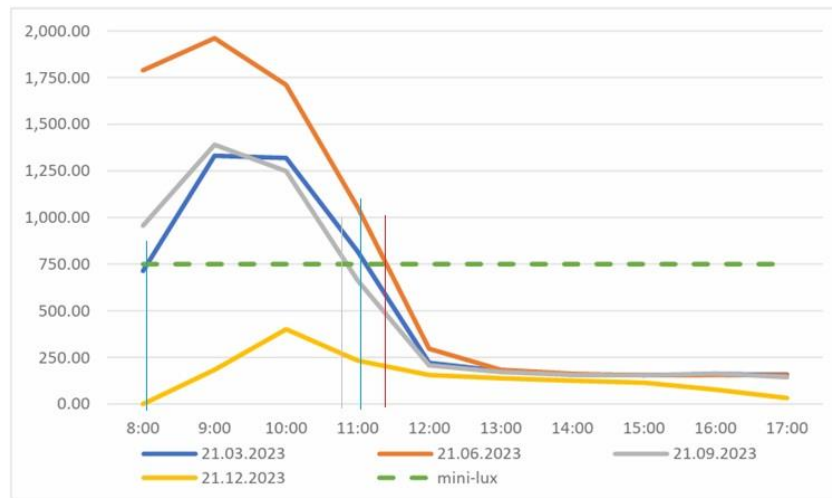


Fig 3. Daylight measurements for architectural Studio Room 1

2.2. Scenario 2: Studio Room 2

The simulation results for scenario 2 (Room 2) are outlined in Table 2 for the same timing and situation given previously in the scenario 1 simulation. Simulation 2 results demonstrate that the daylight level is efficient for students on 21 June from 8:00 to 11:00, while it falls short for 21 Dec. for all timing. 21 March simulations yield an efficient daylighting between 8:30 to 10:40 while it is efficient between 8:10 and 10:30 on 21 September. For the other timing, students need artificial lighting in the studio as presented in Fig 4.

Table 2: Results of architectural Studio Room 2

Date /hour	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00
21.03.2023	489	958	1003	626	162	133	118	111	104	93.1
21.06.2023	1381	1507	1325	815	206	137	121	114	112	107
21.09.2023	667	1015	971	504	153	128	116	109	103	87.2
21.12.2023	0	121	290	168	115	103	92.5	79.8	58.3	24

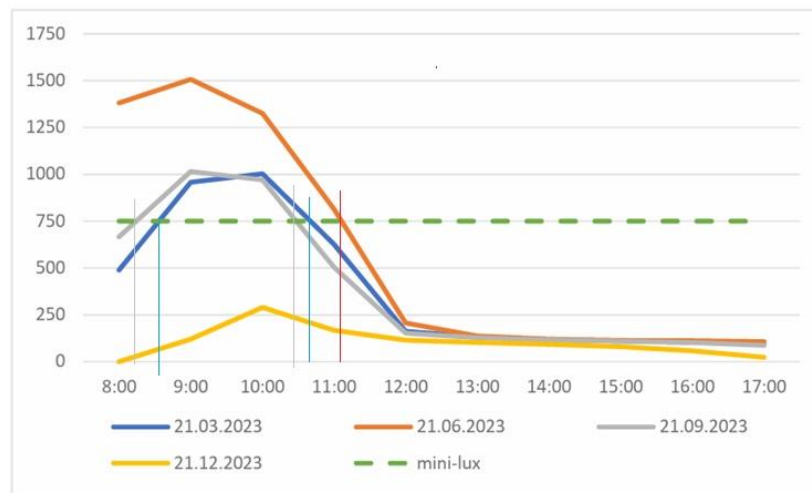


Fig 4. Daylight measurements for architectural studio room 2

2.3. Scenario 3: Studio Room 3

The simulation results for scenario 3 (Room 3) are presented in Table 3 for the same timing and dates. Simulation results show that daylight is effective afternoon instead of the morning due to the location of the room facing the sunset (west room). Between 13:30 and 17:00, the daylight is above the 750 Lux level in March, June, and September while it decreases under this level after 15:15 for the December simulation as depicted in Fig 5.

Table 3: Results of architectural studio room 3

Date /hour	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00
21.03.2023	67.5	110	126	140	165	425	1102	1594	1668	1343
21.06.2023	148	139	135	139	156	236	852	1457	1733	1673
21.09.2023	81.9	116	129	145	174	572	1252	1637	1627	1203
21.12.2023	0	46.3	81.4	112	147	466	799	851	543	82.2

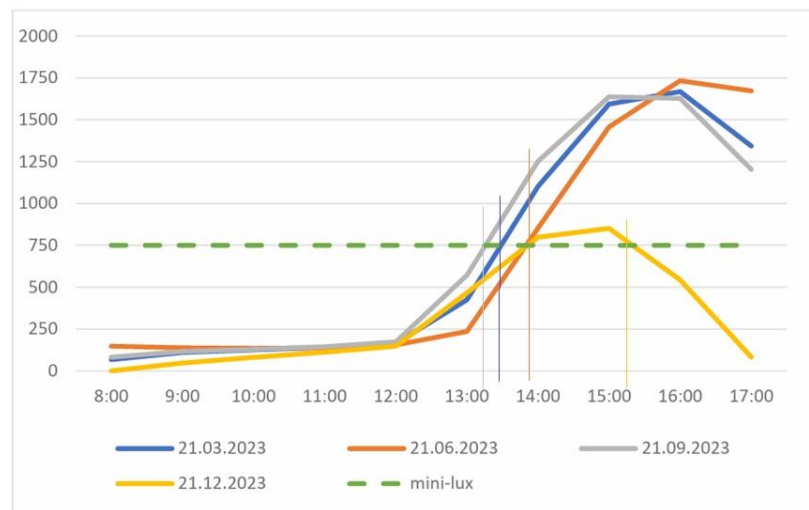


Fig 5. Daylight measurements for architectural studio room 3

2.4. Scenario 4: Studio Room 4

The simulation results for scenario 4 (Room 4) are presented in Table 4 for the same timing and dates. Given that this Studio Room is facing the sunset, daylight is effective afternoon instead of the morning. Linear approximation of the collected data indicates that on all dates the natural lighting becomes active after 13:00 and still until 17:00 except for the December simulation where it falls below the acceptable level at 16:00 as in Fig 6.

Table 4: Results of architectural studio room 4

Date /hour	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00
21.03.2023	80.2	137	149	167	200	513	1318	1916	2009	1584
21.06.2023	171	160	159	166	187	283	1027	1728	2056	1944
21.09.2023	99.9	141	153	173	210	684	1479	1969	1953	1415
21.12.2023	0	54.8	97.9	135	178	562	997	1090	706	99.8

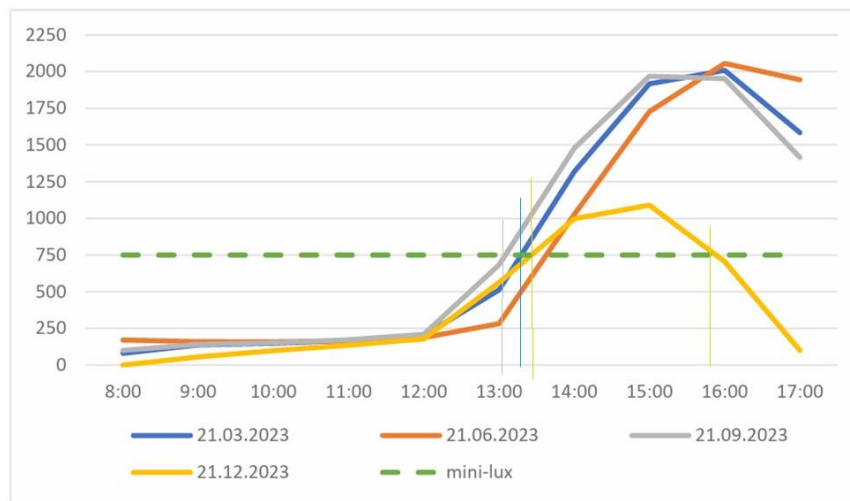


Fig 6. Daylight measurements for architectural Studio Room 4

4.5. Discussion

Analyzing the impact of natural lighting is important for all buildings, especially educational ones. This analysis usually takes place during the design stage of university buildings. In the case discussed here, these buildings were constructed before they were allocated to the Architecture Department in AYBU, so it is important to know the reality of the impact of natural lighting and the appropriate solutions to the various problems. The study focuses only on four Studio Rooms currently used by the Department of Architecture as a model for investigating problems and solutions.

Based on the analysis of the lighting level in AYBU architectural studios, it was found to be inappropriate at some working hours during the day (less than standard EN 12464-1:2002). Given the important nature of lighting for all students, especially for students in the Architectural

Department, during architectural drawing and design lessons, it is important to address these problems. Solutions can only improve the use of daylight by extending the period of total dependence on it. During other periods, lighting is treated by studying the quantity, location, and quality of artificial lighting to help obtain a sufficient amount of light according to standards.

One improvement solution is to use glass with a transmission value higher than 78% in windows. It is also possible that the windows in Studio Rooms 2 and 3 opened towards the south-east, as they do not exist now. This will contribute to increasing the effect of daylight in those places, especially after sunrise and until 10:00. Finally, the use of brighter Interior walls and Ceiling Paints will contribute to increasing the reflection of interior lighting and its spread in different spaces.

5. CONCLUSION

There is a proven positive health effect of natural lighting on building occupants compared to artificial lighting. In addition, making the most of daylight contributes to reducing energy consumption, which leads to many benefits related to the economy and environmental conservation. The lighting study is an important stage in the architectural design of all types of buildings. Educational buildings are places used by students, academics, and administrators during daylight hours. It is important to address the lighting in these buildings to obtain the greatest amount of natural lighting during the lesson period. In the case of studying lighting in already constructed buildings, there are improvement solutions to increase the benefit of natural lighting, including types of bright paint, modifying windows, adding windows in some places, and choosing the appropriate types of window coverings. It is also important that artificial lighting be similar in quality and intensity to natural lighting.

The study of studio rooms at AYBU aims to evaluate the current status of the impact of natural lighting around the clock and in all seasons of the year. Improvements that can be made will optimize the use of natural lighting and thus reduce energy consumption. The study also managed to gain a broad understanding of lighting in the Ankara region, which will help architects make better use of natural lighting in academic buildings that will be designed in the future.

REFERENCES

- Adnan, N. A., Sujali, N. S., & Amin, N. M. (2021). Case Study on the Impact of Artificial Light on Lighting Performance Quality for Architecture Studios. *International Journal of Integrated Engineering*, 13(3), 184-191.
- Alkan, F. S. N., & Yazıcıoğlu, F. (2016, October). Retrofitting buildings into energy-efficient architecture Schools: Istanbul. In *Proceedings of the 11th Conference on Advanced Building Skins, Bern, Switzerland* (pp. 10-11).
- Ahmad, A., Kumar, A., Prakash, O., & Aman, A. (2020). Daylight availability assessment and the application of energy simulation software—A literature review. *Materials Science for Energy Technologies*, 3, 679-689.
- Ashrafian, T., & Moazzen, N. (2019). The impact of glazing ratio and window configuration on occupants' comfort and energy demand: The case study of a school building in Eskisehir, Turkey. *Sustainable Cities and Society*, 47, 101483.
- Aslanoğlu, R., Kazak, J. K., Yekanielibeglou, S., Pracki, P., & Ulusoy, B. (2023). An international survey on residential lighting: Analysis of summer-term results. *Building and Environment*, 232, 109972.
- Boyce, P. R. (2022). Light, lighting, and human health. *Lighting Research & Technology*, 54(2), 101-144.
- Dogan, T., & Park, Y. C. (2019). A critical review of daylighting metrics for residential architecture and a new metric for cold and temperate climates. *Lighting Research & Technology*, 51(2), 206-230.
- European standard, EN 12464-1 (2002), European committee for standardization. Light and lighting - Lighting of workplaces - Part 1: Indoor work Places.
<https://www.en-standard.eu/bs-en-12464-1-2021-light-and-lighting-lighting-of-work-places-indoor-work-places/?msclkid=22911cfff68d5147bbd6979137c07ab5c>
- Gago, E. J., Muneer, T., Knez, M., & Köster, H. (2015). Natural light controls and guides in buildings. Energy saving for electrical lighting, reduction of cooling load. *Renewable and Sustainable Energy Reviews*, 41, 1-13.
- Mahmoud, N. S. A., El Samanoudy, G., & Jung, C. (2023). Simulating the natural lighting for a physical and mental Well-being in residential building in Dubai, UAE. *Ain Shams Engineering Journal*, 14(1), 101810.
- Mandala, A. (2019, February). Lighting Quality in the Architectural Design Studio (Case Study: Architecture Design Studio at Universitas Katolik Parahyangan, Bandung, Indonesia). In *IOP Conference Series: Earth and Environmental Science* (Vol. 238, No. 1, p. 012032). IOP Publishing.
- Nurrohman, M. L., Feros, P., Madina, R. F., & Pratiwi, N. (2021, April). Efficient Lighting Design for Multiuse Architecture Studio Classroom using Dialux Evo 9. In *IOP Conference Series: Earth and Environmental Science* (Vol. 738, No. 1, p. 012034). IOP Publishing.
- Omar, O., García-Fernández, B., Fernández-Balbuena, A. Á., & Vázquez-Moliní, D. (2018). Optimization of daylight utilization in energy saving application on the library in faculty of architecture, design and built environment, Beirut Arab University. *Alexandria engineering journal*, 57(4), 3921-3930.

- Osibona, O., Solomon, B. D., & Fecht, D. (2021). Lighting in the home and health: A systematic review. *International journal of environmental research and public health*, 18(2), 609.
- Pratiwi, N., & Djafar, A. G. (2021, April). Analysis of Lighting Performance in the Hall of the Faculty of Engineering, State University of Gorontalo by using the DIALux Evo 9.0 Simulation. In *IOP Conference Series: Earth and Environmental Science* (Vol. 738, No. 1, p. 012032). IOP Publishing.
- Pujiyanti, I., Hidayatullah, A. R., & Chairiyah, R. (2022, July). Architectural Studio Room Lighting Level in UNISA Yogyakarta Based on Software Dialux Evo 9.1. In *International Webinar on Digital Architecture 2021 (IWEDA 2021)* (pp. 201-205). Atlantis Press.
- Yüksek, İ., Görgülü, S., Kocabey, S., Tuna, M., & Dursun, B. (2015). Assessment of daylighting performances of classrooms: A case study in Kırklareli University, Turkey. *Light & Engineering*, 23(1), 32-38.
- Zamarreño-Suárez, M., Alcalá-González, D., Alfonso-Corcuera, D., & Pindado, S. (2020). Measuring the lighting quality in academic institutions: The UPM faculty of aerospace engineering (Spain). *Applied Sciences*, 10(23), 8345.

PV GÜNEŞ HÜCRELERİ VE MODÜLLERİNİN PARAMETRE TAHMİNİ İÇİN PARÇACIK SÜRÜ OPTİMİZASYONUNA DAYALI BİR YAKLAŞIM

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ÖZET

Doğru parametre tahmini, fotovoltaik (PV) güneş pilleri ve modüllerinin performansını ve verimliliğini optimize etmek için hayati öneme sahiptir. Bu yazıda, PV sistemlerinde hassas parametre tahmini elde etmek için Parçacık Sürü Optimizasyonunu (PSO) Dinamik Atalet Ağırlığı (DIW) stratejileriyle birleştiren yeni bir yaklaşım sunuyoruz. Çift üstel fonksiyon tabanlı DEDIW dahil olmak üzere DIW stratejileri, keşif ve kullanım arasında bir denge kurmak için atalet ağırlığını dinamik olarak ayarlar, böylece parametre tahmini için yakınsama hızını ve doğruluğunu artırır. Metodolojimiz optimizasyon problemini formüle ederek, tahmin edilecek parametreleri belirleyerek ve amaç fonksiyonunu tanımlayarak başlar. PSO algoritması, parçacık konumlarının ve hızlarının yinelemeli güncellemeleri yoluyla çözüm alanını etkili bir şekilde keşfederek, PV sisteminin güç çıkışını maksimuma çıkaran optimum parametre değerlerinin aranmasını sağlar. PSO'nun kullanımı, PV parametre tahmininde bulunan doğrusal olmayan durumları, belirsizlikleri ve çok boyutlu arama uzaylarını ele alma yeteneği de dahil olmak üzere belirgin avantajlar sunar. Üstelik PSO, uygulamada doğal paralellik ve basitlik sergiliyor, bu da onu gerçek zamanlı uygulamalar için çok uygun kılıyor. Bu çalışmada spesifik simülasyonlar veya deneysel doğrulamalar yapılmamış olsa da, önerdiğimiz yaklaşım umut verici faydalar ve çıkarımlar sergiliyor. Ancak gerçek dünya senaryolarındaki performansını ve uygulanabilirliğini değerlendirmek için daha fazla araştırmaya ihtiyaç vardır. DIW stratejilerine ve PSO parametrelerine ince ayar yapmak, algoritmanın performansını optimize etmenin kritik bir yönüdür ve değerlendirme sonuçları ve uzman bilgisinin yönlendirdiği yinelemeli ayarlamalar gerektirir. Genel olarak, önerilen yaklaşımımız, doğru parametreler aracılığıyla PV sistemlerinin optimizasyonunu ve performansını artırma konusunda önemli bir potansiyele sahiptir. Tahmin.

Gelecekteki araştırma çabaları, önerilen yaklaşımın pratik PV sistemlerinde hassasiyetini ve uygulanabilirliğini değerlendirmek için kapsamlı simülasyonlar ve deneysel doğrulamalar yürütmeye odaklanmalıdır. PSO'yu DIW stratejileriyle entegre eden yaklaşımımız, PV güneş pilleri ve modüllerinde parametre tahminini ilerletmek için ilgi çekici bir yolu temsil eder.

Anahtar Kelimeler: Parçacık Sürü Optimizasyonu, PV parametreleri Optimizasyonu, DIW stratejileri

AN APPROACH BASED ON PARTICLE SWARM OPTIMIZATION FOR PARAMETER ESTIMATION OF PV SOLAR CELLS AND MODULES

ABSTRACT

Accurate parameter estimation is vital for optimizing the performance and efficiency of photovoltaic (PV) solar cells and modules. In this paper, we present a novel approach that combines Particle Swarm Optimization (PSO) with Dynamic Inertia Weight (DIW) strategies to achieve precise parameter estimation in PV systems. The DIW strategies, including the double exponential function-based DEDIW, dynamically adjust the inertia weight to strike a balance between exploration and exploitation, thereby improving convergence speed and accuracy for parameter estimation. Our methodology begins by formulating the optimization problem, identifying the parameters to be estimated, and defining the objective function. Through iterative updates of particle positions and velocities, the PSO algorithm effectively explores the solution space, enabling the search for optimal parameter values that maximize the power output of the PV system. The utilization of PSO offers distinct advantages, including its capability to handle non-linearities, uncertainties, and multi-dimensional search spaces inherent in PV parameter estimation. Moreover, PSO exhibits inherent parallelism and simplicity in implementation, making it well-suited for real-time applications. While specific simulations or experimental validations were not performed in this study, our proposed approach showcases promising benefits and implications. However, further research is warranted to evaluate its performance and applicability in real-world scenarios. Fine-tuning the DIW strategies and PSO parameters is a critical aspect of optimizing the algorithm's performance, necessitating iterative adjustments guided by evaluation results and expert knowledge. Overall, our proposed approach holds significant potential for enhancing the optimization and performance of PV systems through accurate parameter estimation. Future research endeavors should concentrate on conducting comprehensive simulations and experimental validations to assess the precision and applicability

of the proposed approach in practical PV systems. By integrating PSO with DIW strategies, our approach represents a compelling pathway for advancing parameter estimation in PV solar cells and modules.

Keywords: Particle Swarm Optimization, PV parameters Optimization, DIW strategies

1. Introduction:

Photovoltaic (PV) solar energy is a promising renewable energy source that has gained significant attention in recent years. PV solar cells and modules are the fundamental building blocks of solar power systems, responsible for converting sunlight into electrical energy. Accurate estimation of the electrical parameters of these components is crucial for optimizing the performance and efficiency of PV systems.

The parameter estimation of PV solar cells and modules involves determining key electrical parameters such as the diode ideality factor, series resistance, shunt resistance, and photocurrent. These parameters directly affect the overall efficiency and power output of the solar system. Traditional methods of parameter estimation often rely on mathematical models and iterative algorithms, which can be time-consuming and computationally intensive.

In recent years, an approach based on Particle Swarm Optimization (PSO) has emerged as a powerful technique for parameter estimation in various fields, including solar energy systems. PSO is a population-based optimization algorithm inspired by the collective behavior of bird flocking or fish schooling. It simulates the movement of particles in a search space to find optimal solutions.

The application of PSO for parameter estimation in PV solar cells and modules offers several advantages. Firstly, PSO can effectively handle the non-linear and multi-modal nature of the optimization problem, enabling it to explore a wide range of parameter combinations. Secondly, PSO is computationally efficient, allowing for faster convergence and reduced computational costs compared to traditional methods. Lastly, PSO is robust and less likely to get trapped in local optima, ensuring a higher likelihood of finding the global optimal solution.

By utilizing the PSO-based approach for parameter estimation, researchers and engineers can accurately estimate the electrical parameters of PV solar cells and modules. This enables the

optimization of system performance, maximum utilization of solar energy, and improved overall efficiency of PV systems. Furthermore, the precise parameter estimation facilitates better design and configuration of solar power systems, leading to enhanced sustainability, cost-effectiveness, and environmental benefits.

In this study, we present an in-depth exploration of the approach based on Particle Swarm Optimization for parameter estimation of PV solar cells and modules. We discuss the underlying principles of PSO, its advantages, and its application in the context of PV systems. We also present experimental results and comparisons with traditional methods to demonstrate the effectiveness and efficiency of the PSO-based approach. The findings of this study contribute to the advancement of parameter estimation techniques in the field of solar energy and pave the way for enhanced performance and utilization of PV systems.

2. Study Area:

Solar photovoltaic (PV) systems consist of solar cells as their fundamental units, which have the capability to convert sunlight into electrical energy. These cells are then interconnected in series or parallel configurations to form PV modules. In applications requiring higher power output, these modules are further connected to create a PV array. The transformation from a single solar PV cell to a larger PV array is depicted visually in Figure 1 [1].

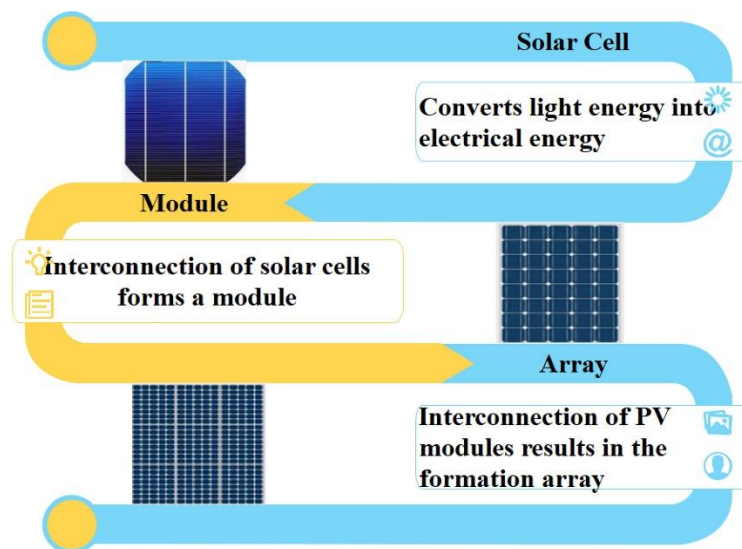


Figure 2.1. The process of creating a photovoltaic (PV) cell, module, and array [1]

Solar PV cell modeling methods have evolved to capture the nonlinearity and accurately predict the I-V (current-voltage) curve. These models are based on electrical equivalent circuits that typically include diodes, resistors, and a current source. There are different classifications of PV cell models based on the number of diodes included in the model, such as one diode, two diode, and three diode models. The accuracy of the I-V curve prediction depends on the number of diodes in the model [1][2].

The conventional approach involves using an ideal single diode model, which consists of a diode in parallel with a current source. To account for losses due to metallic junction and carrier recombination, series resistor (RS) and shunt resistance (RP) are introduced to modify the ideal model. This modified model, including RS and RP, is known as the single diode model (SDM). The SDM, known for its simplicity, accuracy, and reliability, is commonly used for modeling and simulation purposes [1][2].

In some cases, a SDM can provide satisfactory performance even without considering recombination losses in the diode. However, for more accurate curve reproduction, models that include recombination losses, such as the double diode models (DDMs), have been developed. DDMs improve modeling performance and accuracy, especially at low irradiance conditions, but at the cost of increased complexity. Additionally, the three-diode model has been developed to further enhance accuracy [2].

2.1. Single diode model (SDM):

The single diode model (SDM) is the most widely used PV model, and its I-V characteristics are expressed by Equation (1) [3][4]:

$$I_L = I_{ph} - I_0 \left[\exp\left(\frac{q(V_L + I_L R_s)}{n k T}\right) \right] - \frac{V_L - I_L R_s}{R_{sh}} \quad (1)$$

In this equation, the SDM is characterized by five parameters:

- 1) I_{ph} : Photocurrent, which represents the current generated by the PV cell under illumination.
- 2) I_0 : Diode saturation current, which accounts for the leakage current in the diode.

- 3) R_s : Series resistance, which represents the resistance in the series connection of the PV cell.
- 4) R_{sh} : Shunt resistance, which accounts for any parallel resistance in the PV cell.
- 5) n : Diode ideality factor, which describes the non-ideal behavior of the diode.

The figure 2 shows single diode model (SDM) [4]:

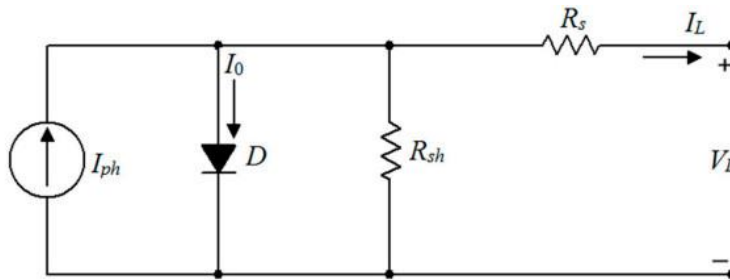


Figure 2.2. Equivalent circuit of single diode model (SDM) [4].

2.2. Double Diode Model:

The double diode model (DDM) is an extension of the single diode model, incorporating the presence of two diodes connected in parallel to the current generator. This model offers improved accuracy in simulating the behavior of PV modules under different irradiation conditions. Although the DDM increases the number of unknown parameters, it provides better modeling capabilities. Figure 3 illustrates the equivalent circuit model of the double diode [2][4].

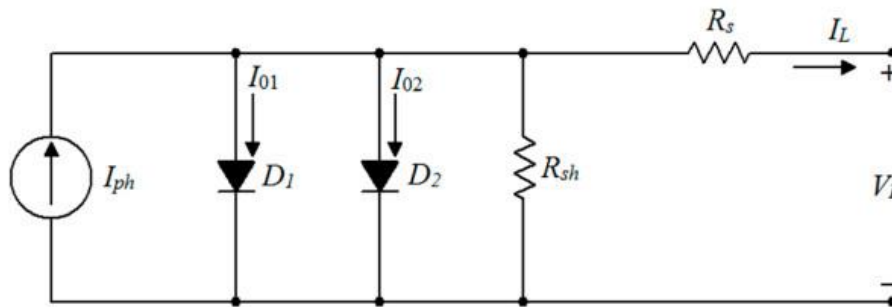


Figure 2.3. Equivalent circuit of double diode model (DDM) [4].

Similar to the single diode model, the generated current in the DDM is determined by applying Kirchhoff's law and can be described as follows [2][4]:

$$I_L = I_{ph} - I_{01} \left[\exp \left(\frac{q (V_L + I_L R_s)}{n_1 k T} \right) \right] - I_{02} \left[\exp \left(\frac{q (V_L + I_L R_s)}{n_2 k T} \right) \right] - \left(\frac{V_L - I_L R_s}{R_{sh}} \right)$$

In order to effectively model the double diode model (DDM), the following parameters need to be determined:

- 1) I_{ph} : Photocurrent, which represents the current generated by the PV module under illumination.
- 2) I_{01} and I_{02} : Diffusion and saturation currents for diodes D1 and D2, respectively. These parameters account for the leakage and saturation currents in the diodes.
- 3) n_1 and n_2 : Ideality factors for diodes D1 and D2. These factors describe the non-ideal behavior of the diodes and can vary based on the semiconductor material and fabrication design.
- 4) R_s : Series resistance, which represents the resistance in the series connection of the PV module. It accounts for losses due to the internal resistance of the module.
- 5) R_{sh} : Shunt resistance, which represents any parallel resistance in the PV module. It accounts for any leakage paths or bypass currents in the module.

3. Material and Method:

3.1.PV Module Parameter Estimation:

PV module parameter estimation is a crucial step in enhancing the modeling of solar PV cells, in addition to model selection. It is essential to accurately estimate all the unknown parameters involved in PV modeling. Figure 3.1 illustrates the various processes and methods used for parameter estimation in PV modeling. One straightforward method for determining the unknown parameters of solar PV is by applying specific operating conditions and employing a trial-and-error approach for solving. However, this technique typically yields low efficiency as the predicted values tend to vary significantly [1].

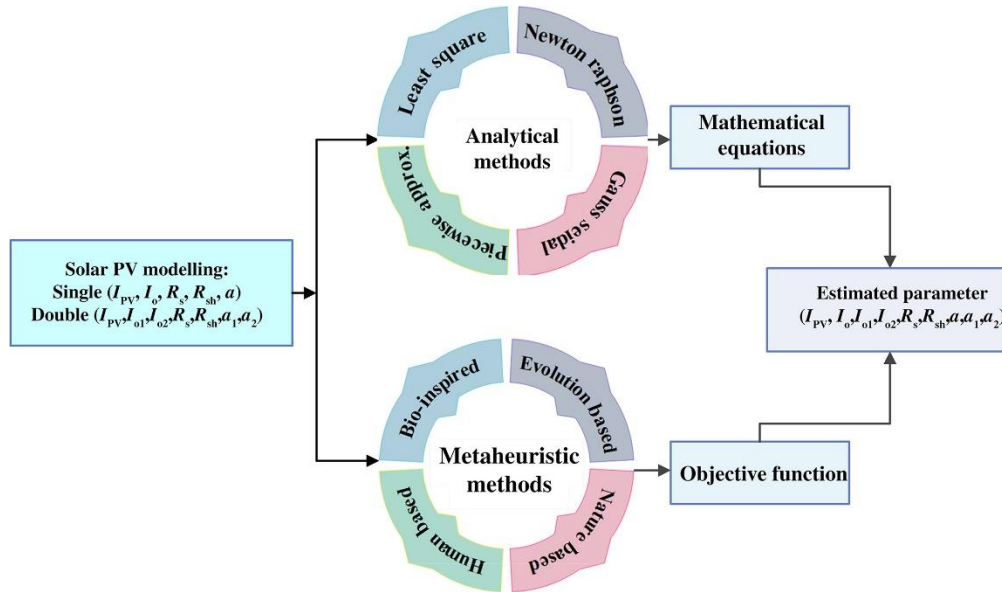


Figure 3.1. illustrates the process involved in photovoltaic (PV) modeling and its parameter estimation.[1]

There are two commonly used approaches for determining unknown parameters in the parameter estimation problem: the analytical method and the meta-heuristic optimization method.

In the analytical method, a nonlinear solar PV characteristic is obtained by applying various operating conditions and incorporating the available manufacturer datasheet values. This method aims to derive a mathematical representation of the PV system's behavior based on empirical data and known information [1].

On the other hand, the meta-heuristic optimization method employs curve fitting techniques to predict the IV (current-voltage) curve. This involves matching each data point on the predicted IV curve with the corresponding actual values. The meta-heuristic approach leverages optimization algorithms to search for the best-fit parameters that minimize the difference between the measured current and the calculated current [1].

To quantify the performance of the parameter estimation, an objective function is defined. In this case, the root mean square error (RMSE) is chosen as the performance criterion. The RMSE represents the square root of the average of the squared differences between the measured current and the calculated current. The RMSE, as given by Equation (3), is defined as follows [4]:

$$RMSE = J(\theta) = \sqrt{\sum_{i=1}^N \frac{[I_m - I_c(V_m, \theta)]^2}{N}} \quad (3)$$

In this equation, I_m represents the measured current, I_c represents the calculated current, and N is the number of measured data points. The parameter vector θ , which needs to be estimated, consists of five elements in the case of SDM, and consists of seven elements for DDM. Minimizing the RMSE indicates a better fit between the estimated and actual values.

3.2.PSO Algorithm for PV Parameter Estimation:

Particle Swarm Optimization (PSO) is a metaheuristic algorithm initially developed by Kennedy and Eberhart. It mimics the social behavior of bird flocks and uses a set of design variables to find an optimal solution. In PSO, a population of particles, typically denoted as np , is randomly distributed in the search space. Each particle represents a candidate solution and is characterized by its position and velocity. The next position of a particle is determined based on its current position and the newly calculated velocity. The velocity of each particle is updated using Equation (4), which takes into account its current velocity, current position, distance to the best personal particle's performance at iteration t ($pbest_i$), and the distance to the best particle in the particle's neighborhood at iteration t ($gbest$) [5].

$$velocity(t + 1) = W * velocity(t) + C_1 * rand_1 * (pbest_i - position(t)) + C_2 * rand_2 * (gbest - position(t)) \quad (4)$$

In this equation, W is the inertia factor that controls the influence of the particle's velocity on its next move, balancing exploration and exploitation. C_1 and C_2 are the cognitive and social coefficients, respectively. $rand_1$ and $rand_2$ are random variables distributed uniformly in the interval $[0, 1]$. The first part of Equation (4) contributes to the exploration capability of the PSO algorithm. The second part moves the particle towards its best position achieved so far ($pbest_i$), and the third part moves the particle towards the best position achieved by all particles in the population ($gbest$). The PSO algorithm is initialized with a population of particles, and their velocities are computed using Equation (4). The positions of particles are then updated based on Equation (5) [5].

$$position(t + 1) = position(t) + velocity(t + 1) \quad (5)$$

The process continues iteratively until an end criterion is met, which signifies that the optimization process has achieved a satisfactory solution. Figure 3.2. illustrates the workflow process employed in PSO [1].

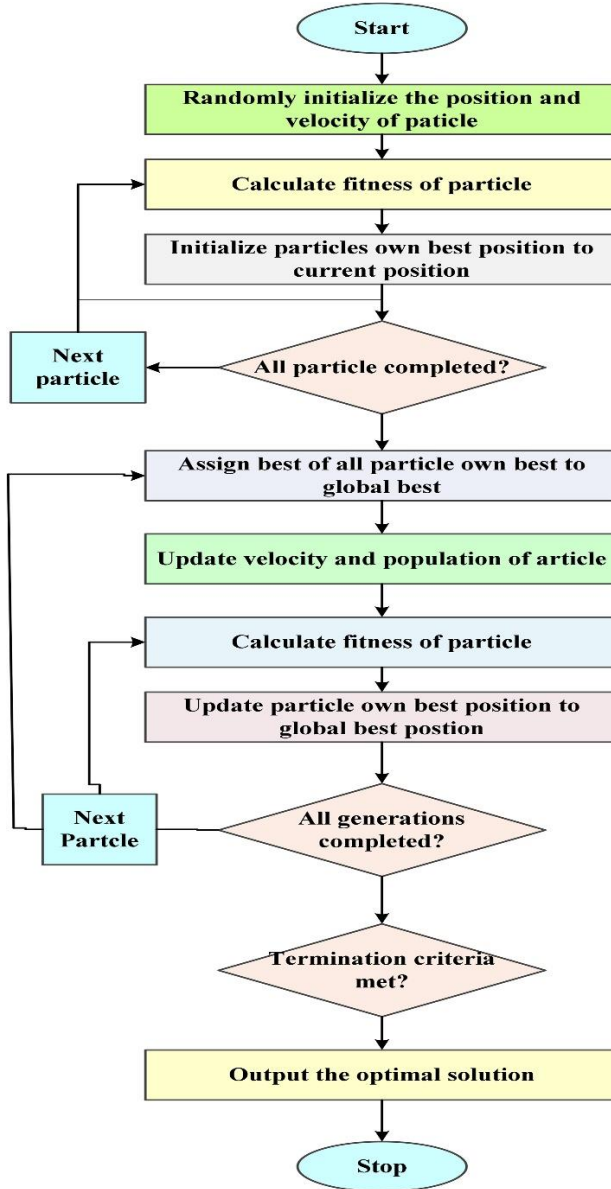


Figure 3.2. illustrates the workflow process employed in PSO [1].

3.3.Method:

To enhance the PSO algorithm for parameter estimation in PV systems, with a focus on single-diode and two-diode models, the following advanced methodologies can be considered:

- 1) **Hybrid PSO Algorithms:** Combining PSO with other optimization techniques, such as the Gravitational Search Algorithm (GSA), to create a hybrid PSOGSA algorithm. This approach has demonstrated improved accuracy in finding optimal solutions and enhanced explorative capabilities [6].
- 2) **Dynamic Inertia Weight Strategies:** Implementing dynamic inertia weight strategies, such as the double exponential function-based dynamic inertia weight (DEDIW), can help maintain a balance between the exploitation and exploration phases of the PSO algorithm. This helps mitigate premature convergence issues and improves the overall performance [7].
- 3) **Mathematical Modeling:** Developing mathematical models for the parameters of single-diode and two-diode PV cells using software tools like Eureqa. These models can be trained using data from thousands of PV modules to accurately predict the I-V curves under various conditions. This approach enables precise parameter estimation and enhances the accuracy of the optimization process [8].
- 4) **Error Analysis:** Conducting a comprehensive error analysis for the modified single-diode model (MSDM), modified double-diode model (MDDM), and potentially a modified three-diode model (MTDM) of PV cells. This analysis ensures the superiority and effectiveness of the chosen PSO approach by evaluating the accuracy of the estimated parameters [6].

By incorporating these strategies, the PSO algorithm can effectively optimize the root mean square error (RMSE) objective function and achieve more accurate parameter estimation. This, in turn, maximizes the power output of PV systems and enhances the performance and efficiency of PV solar cells and modules.

Hybrid PSO and Dynamic Inertia Weight Strategies approach:

To apply Dynamic Inertia Weight (DIW) strategies to the PSO algorithm for parameter estimation of PV solar cells and modules, you can follow the following steps:

1) Understand the Photovoltaic System

- **Objective:** Gain a comprehensive understanding of the PV system's operational characteristics and the parameters that need to be estimated.
- **Action:** Study the electrical characteristics of the PV system, such as the current-voltage (I-V) relationship, and identify the parameters that affect its performance.

2) Select a Dynamic Inertia Weight Strategy:

- **Objective:** Choose a suitable Dynamic Inertia Weight (DIW) strategy that aligns with the optimization goals.
- **Action:** Review the literature and select a DIW strategy, such as the double exponential function-based dynamic inertia weight (DEDIW), that balances the exploration and exploitation phases of the PSO algorithm.

3) Initialize the PSO Algorithm

- **Objective:** Set up the initial conditions for the PSO algorithm.
- **Action:** Define the initial swarm of particles, initialize the position and velocity vectors, and set the initial inertia weight.

4) Define the Objective Function

- **Objective:** Establish a measure of optimization success.
- **Action:** Implement the Root Mean Square Error (RMSE) between the actual and predicted power output values as the objective function.

5) Implement DIW in PSO

- **Objective:** Integrate the selected DIW strategy into the PSO algorithm.
- **Action:** Modify the velocity update equation of the PSO algorithm to include the DIW, ensuring that the inertia weight changes dynamically with each iteration.

6) Set PSO Parameters

- **Objective:** Determine the PSO parameters that will govern the behavior of the algorithm.
- **Action:** Decide on the number of particles, cognitive and social coefficients, and the limits for position and velocity.

7) Run the PSO Algorithm

- **Objective:** Execute the PSO algorithm to find the optimal parameter values.
- **Action:** Start the PSO process, allowing the particles to move through the search space towards the best solution.

8) Evaluate the Results

- **Objective:** Assess the effectiveness of the parameter estimation.
- **Action:** Compare the estimated parameters with the actual performance data of the PV system.

9) Fine-Tune the Algorithm

- **Objective:** Optimize the PSO algorithm for better accuracy.
- **Action:** Adjust the DIW strategy and PSO parameters based on the evaluation results to enhance performance.

10) Validation

- **Objective:** Confirm the accuracy of the optimized parameters.
- **Action:** Validate the parameters through simulations or experimental setups to ensure they accurately reflect the true performance of the PV system.

4. Results and Discussion:

The proposed approach involves applying Dynamic Inertia Weight (DIW) strategies to the Particle Swarm Optimization (PSO) algorithm for parameter estimation in PV solar cells and modules. The steps of the approach include understanding the PV system, selecting a DIW strategy, initializing the PSO algorithm, defining the objective function, implementing DIW in PSO, setting PSO parameters, running the algorithm, evaluating the results, fine-tuning the algorithm, and validating the optimized parameters.

One of the main advantages of incorporating DIW strategies into the PSO algorithm is the potential improvement in convergence speed and accuracy. By dynamically adjusting the inertia weight, the DIW strategies can effectively balance exploration and exploitation during the optimization process. This can help the algorithm efficiently explore the search space and exploit promising regions, leading to faster convergence towards optimal solutions.

The selection of an appropriate DIW strategy is crucial for achieving optimal results. The double exponential function-based DEDIW strategy has been shown in previous studies to be effective in balancing exploration and exploitation.

Although specific simulations or experiments were not conducted in this study, the proposed approach is expected to enhance the accuracy and convergence of parameter estimation. By

dynamically adjusting the inertia weight, the DIW strategies can balance exploration and exploitation in the optimization process. The selection of a suitable DIW strategy, such as the double exponential function-based DEDIW, is crucial for achieving optimal results. The evaluation and validation of the results can be done through simulations using MATLAB or experimental setups.

5. Conclusion:

the proposed approach of incorporating Dynamic Inertia Weight (DIW) strategies into the Particle Swarm Optimization (PSO) algorithm shows promise for parameter estimation in PV solar cells and modules. Although specific simulations or experimental validations were not conducted in this study, the approach holds potential benefits and implications. By dynamically adjusting the inertia weight, the DIW strategies aim to balance exploration and exploitation in the optimization process. This can result in improved convergence speed and accuracy, leading to more accurate parameter estimation in PV systems. The selection of an appropriate DIW strategy, such as the double exponential function-based DEDIW, is crucial for achieving optimal results. However, it is important to note that further simulations or experimental validations are necessary to evaluate the performance and applicability of the proposed approach in real-world scenarios. These validations would provide concrete results and insights into the accuracy and effectiveness of parameter estimation. Additionally, the fine-tuning of DIW strategies and PSO parameters is crucial for optimizing the algorithm's performance. Iterative adjustments based on evaluation results and expert knowledge are necessary to achieve accurate parameter estimation. Overall, the proposed approach has the potential to enhance the optimization and performance of PV systems by accurately estimating the parameters. However, the effectiveness and limitations of the approach can only be determined through specific simulations or experimental validations. Future research should focus on conducting these validations to further assess the accuracy and applicability of the proposed approach in practical PV systems.

References:

- [1] Venkateswari, R., & Rajasekar, N. (2021). Review on parameter estimation techniques of solar photovoltaic systems. *International Transactions on Electrical Energy Systems*, 31(11), e13113.
- [2] Olayiwola, T. N., Hyun, S. H., & Choi, S. J. (2024). Photovoltaic Modeling: A Comprehensive Analysis of the I–V Characteristic Curve. *Sustainability*, 16(1), 432.

- [3] Rezk, H., Arfaoui, J., & Gomaa, M. R. (2021). Optimal parameter estimation of solar PV panel based on hybrid particle swarm and grey wolf optimization algorithms.
- [4] Mughal, M. A., Ma, Q., & Xiao, C. (2017). Photovoltaic cell parameter estimation using hybrid particle swarm optimization and simulated annealing. *Energies*, *10*(8), 1213.
- [5] Issa, M., Helmi, A. M., & Ghetas, M. (2024). Estimation of solar cell parameters through utilization of adaptive sine–cosine particle swarm optimization algorithm. *Neural Computing and Applications*, 1-17.
- [6] Gupta, J., Hussain, A., Singla, M. K., Nijhawan, P., Haider, W., Kotb, H., & AboRas, K. M. (2022). Parameter estimation of different photovoltaic models using hybrid particle swarm optimization and gravitational search algorithm. *Applied Sciences*, *13*(1), 249.
- [7] Singh, A., Sharma, A., Rajput, S., Bose, A., & Hu, X. (2022). An investigation on hybrid particle swarm optimization algorithms for parameter optimization of PV cells. *Electronics*, *11*(6), 909.
- [8] Xuefeng, W., & Chen, M. (2021, April). Application of mathematical model based on optimization theory and particle swarm algorithm in radar station layout optimization. In *Journal of physics: conference series* (Vol. 1848, No. 1, p. 012087). IOP Publishing.

GENERATING ARABIC WORDS FROM ROOTS**Abdulmonem AHMED**

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Morfolojik analizin ardındaki ana fikir, kelimelerin köklerini veya köklerini belirleyebilmesi ve orijinal ifadeyle karşılaştırmaya olanak sağlamasıdır. Arapçanın morfolojisinin hem kapsamlı hem de karmaşık olduğu kabul edilmektedir. Pek çok araştırma projesi, çeşitli yöntem ve yaklaşımlar kullanılarak Arapça morfolojik analiz konusuna odaklanmış olsa da, nispeten az sayıda proje, metin yazarlığı için tamamen çekimli kelimeler üretme sorununu ele almıştır. Arapça morfolojisinin birleşik olmayan yapısına göre her bir kök veya gövdeye çok sayıda ek bağlanabilir, bu da üretilebilecek çekimli sözcük sayısını katlar. Arapçadaki sözlük bu nedenle belirsiz olabilir. Soru Yanıtlama ve Özetleme Sistemleri, Bilgi Erişimi ve Çıkarma, Makine Çevirisi ve Web Araması gibi iyi bilinen çalışma konularındaki sorunların büyük bir kısmı için doğru fiil tanıma ve ayıklama gereklidir. Bu çalışmamızda aynı köke ait tüm kelimeleri üreten bir yöntem anlatıyoruz. Yöntem iki algoritma sunmaktadır: Birincisi, belirlenen kelimedeki kök çıkaran kök çıkarma algoritması, ikincisi ise çıkarılan kökten Arapça kelime oluşturan algoritmadır. Algoritmanın değerlendirilmesi 500 farklı kelime girişine dayanıyordu; 465 geçerli kök bulunurken, 35 hatalı kök bulunamadı. Bu, algoritma sonuçlarının %93'ünün doğru bulunduğu anlamına gelir. Kök doğru olduğunda, onunla birlikte 15 kalıp uygulanır ve bu da algoritma için %100'lük bir kelime oluşturma yüzdesine neden olur. Kök tarafından yeni, doğru kelimeler oluşturulur.

Anahtar Kelimeler: Arapça, Morfoloji, Köklenme, Kök, Nesil**ABSTRACT**

The main idea behind morphological analysis is that it may determine the stems or roots of words and allow for comparison to the original phrase. The morphology of Arabic is regarded to be both extensive and intricate. Although many research projects have concentrated on the subject of Arabic morphological analysis using various methods and approaches, relatively few have tackled the problem of producing completely inflected words for text authoring. A large

number of affixes can be connected to each root or stem according to the non-concatenate nature of Arabic morphology, which multiplies the number of inflected words that can be produced. Lexical in Arabic may therefore be ambiguous. Accurate verb recognition and extraction are necessary for the bulk of problems in well-known study topics like Question Answering and Summarization Systems, Information Retrieval and Extraction, Machine Translation, and Web Search. In this research, we describe a method that generates all words belonging to the same root. The method offers two algorithms: the first is the root-extracted algorithm, which extracts roots from the determined word, and the second, which creates Arabic words from the extracted root. The algorithm's evaluation was based on 500 distinct word entries; 465 valid roots were found, while 35 incorrect roots were not found. This means that 93% of the algorithm's results were correctly found. When the root is right, 15 patterns are applied along with it, which results in a word creation percentage of 100% for the algorithm. New, accurate words are created by the root.

Keywords: Arabic, Morphology, Stemming, Root, Generation

1. Introduction

Within the discipline of computer science, artificial intelligence (AI) investigates and creates tools, systems, and theories that simulate human intelligence. (AI) has become a modern discipline with much-increased relevance in recent years in many fields [1]. Natural language processing (NLP) is one of the fields of study in artificial intelligence (AI). NLP allows computers to analyze and derive meaning from human languages cleverly and efficiently. This includes automatic text summarization, named entity recognition, relationship extraction, stemming, translation, and entity recognition [2, 3]. NLP has two subfields: linguistics and computer science. Language, comprising its structure, syntax, and meaning is the focus of the linguistics field. The computer science side is involved with applying linguistic knowledge by converting it into computer programs, using subfields such as (Machine Learning and Deep Learning) [4]. Stemming, which involves returning words to their morphological stem or root, is a crucial step [5]. It is an essential preprocessing step in a variety of (NLP) tasks [6, 7]. The stemming procedure cannot be regarded as a simple activity and has grown in importance [8]. The outcome of the stemming process is either a stem or a root; both stem and root is applied to extend queries to get the most pertinent data with the highest recall and precision. When a stem was obtained through the stemming process, the affixes (prefixes and suffixes) were removed [9,

10]. Arabic is the fourth most popular language on the Internet and the fifth most popular language overall [11]. Arabic is considered a highly difficult language because of its deep linguistic structure, which is characterized by a complex situation, and its incredibly rich morphology, both derivational and inflectional [12, 13]. Arabic terms are classified as either male or female and have three number forms: single, dual, or plural [21]. Arabic words are derived from roots that follow specific template morphological patterns and employ three or more consonants to define a broad meaning or notion [3, 12, 14]. Nouns, adjectives, and verbs are generated from roots by the use of patterns. The Arabic root is an essential part of any morphological study because traditional Arabic dictionaries are organized by root [15]. The roots usually consist of three or four letters, rarely five [16]. Arabic words are divided into three categories: nouns, verbs, and particles. Most research employs algorithms and strategies to extract the roots by removing affixes to obtain the correct root [5]. The creation of NLP technologies for Arabic is a difficult issue because it is a language with significant morphology and both derivational and inflectional forms [18, 19].

2. Arabic Morphology

The process by which the internal meaning of words in natural language is recognized is morphological analysis. Most NLP applications begin with morphological analysis, which is a crucial stage [23]. Three categories of words, verbs, nouns, and prepositions are used by traditional Arabic grammarians to categorize Arabic words [24]. Morphological analysis of Arabic words is a rather challenging task due to the wide range of affixes and numerous meanings that can be inferred from the root itself [24]. Linguistic morphology suggests that laws govern how new terms and word types are created and serve as redundancy rules for already complicated words that already exist in the lexicon [20, 21]. Arabic uses diacritical markings to indicate some linguistic and vocal characteristics, such as the morphological structure, grammatical function, and semantic meaning of words [25]. The form that Arabic words take depends on several variables, including pluralism (plural, singular, or dual), gender (feminine or masculine), and grammatical tension (present, past, future, and command) [23, 27]. In general, Arabic words are derived from their roots utilizing a pattern. The same root gives rise to numerous words with various grammatical structures, and additional words can be created by adding affixes. Vowels may also be present in the roots, and they will be regarded as essential

components of the root as well. In general, it is not possible to utilize an Arabic root or pattern alone; they must interact with one another to create words [29].

3. Related Works

There is a lot of previous scientific research in the field of word morphology and generation in the Arabic language. In general, the process of extracting the root and stemming is considered a basic process in this context, and after obtaining the root it is easy to generate all the required words with complete ease [30]. In this section, we will present some of the previous work in this field. *Mohamed Osman Hegazi (2016)*, proposes an innovative method for the evolution of the Arabic vocabulary and production of roots. The method offers three algorithms; the first algorithm creates Arabic word roots using the permutation and combination principle. The algorithm creates roots by applying permutations to the Arabic alphabetic letters. The second method is then utilized to create distinct words from that root using the Arabic morphology template; this algorithm creates Arabic words by constructing the roots by the Arabic template [15]. *Afnan Aqel, Sahar Alwadei, and Mohammad Dahab (2011)* suggested a technique that would enable almost all of the given words to be created as words. If words with inflections and words with derivatives could be generated using the same techniques, the method answered the question. They provided numerous examples of how to develop the proposed methodology [18]. *Ali Alnaied, Mosa Elbendak, and Abdullah Bulbul (2020)* discussed an Arabic stem method that produces stems by applying a set of rules on the correspondence between Arabic letters to identify the root or stem. They emphasize the benefits of the suggested guidelines for various Arabic content retrieval systems. They evaluated the system by comparing its performance to that of other approaches [28]. *In 2019, Bakeel Azman*, Proposed a revolutionary model for verb root recognition developed to circumvent verb root extraction without disambiguation utilizing traditional methods, employed in existing morphology systems. The method of choice entails mapping surface verbs to fully developed derivative verbs that have been applied in the relational database [26].

4. Material And Methods

To comprehend the method utilized to generate Arabic words, we'll go over a few fundamental concepts first. The most basic form of a word is its root; the root has a broad, fundamental meaning that acts as the basis for many different meanings [22]. These roots are combined with a variety of vowel patterns to create simple nouns and verbs, to which affixes can be added for

more complex derivations [17]. The main objective of this paper is to produce words. Before generating new words, we have to design and implement an algorithm to extract or detect the root of the entered word using patterns, and from the determined root the algorithm can easily produce and generate all desired words belonging to the same root. By comparing the word with certain patterns, the algorithm may quickly access the roots without having to remove affixes, which reduces the amount of time needed to do so. When the root of a word is found, a set of patterns is used to create new words. The procedure of generating a word regarding the letters of the root involves appending letters from patterns to the resulting word. The newly created word's structure is derived from both the pattern and the root; the basic letters are from the root, and the other reminder is from the pattern. Our study is mainly concentrated on word structure as it relates to the existence, arrangement, and comparison of letters in pattern letters. In addition to the time required for the removal procedure itself, the removal of affixes can occasionally result in errors by omitting some of the original word's core letters. Even though the algorithm's concept is straightforward, it is extremely effective when working with other algorithms, which is seen as one of the benefits of modular programming. Figure (1) shows an algorithm that receives a word as input and outputs the root.

```

1. Algorithm generate_Words(word)
2.   // input word as Arabic Word.
3.   // output: List of Generated words.
4.   for Patt in PatternsList:
5.     Root = ''
6.     for each char in Patt:
7.       if char in ['F','A','L']:
8.         root = root + char
9.       end if
10.    end for
11.  end for
12.  index = 0
13.  for Patt in Generate_Patterns:
14.    newWord = ''
15.    for char in Patt:
16.      if char == ['F', 'A', 'L']:
17.        newWord += Root[index]
18.        index +=1
19.      else:
20.        newWord += char
21.      end if
22.    endfor
23.    print(newWord)
24.  endfor
25. end Algorithm

```

Figure 1. Algorithm to generate words

The input of the algorithm is the entered word and the output is a list of generated words belonging to the entered word. The algorithm starts by detecting the root of the entered word in steps (4-11), the patterns used in these steps are used to do this task. In steps (13-24), there is a loop of all patterns that want to generate new words. There is an inside loop in steps (15-22) of letters of pattern compared with letters of root and check in step (16) if these letters belong to root or not, if yes, put root letter index to the newly generated word as in step (17), otherwise the newly generated word letter comes from the pattern as in step (20). After we have finished designing the algorithm, we have implemented it. We implemented the method using the Python programming language since it is now one of the most widely used programming languages in a variety of industries and domains, including machine learning and natural language processing. One other benefit is that Python is an open-source, free programming language. This means that we can simply build upon and reuse some of the procedures and functions we developed, as well as utilize them in other projects in the future. Furthermore, we have used the PyQt5 package to implement the suggested algorithm for producing Arabic words in a Graphical User Interface (GUI).

5. Results And Discussion

The relationship between the pattern and the root is the main focus of the Arabic term. We investigate the relationships among the three elements "word," "pattern," and "root." First, we determine the root of the input word by comparing the word with different patterns that have the same length of word length. This speeds up the procedure and avoids removing the word's beginning letters because we can directly reach the roots without removing affixes. After confirming the correct root of the word, this root is used with a group of different patterns to generate the required words. Figure (2) below, shows the output and illustrates the outcome of the implementation.

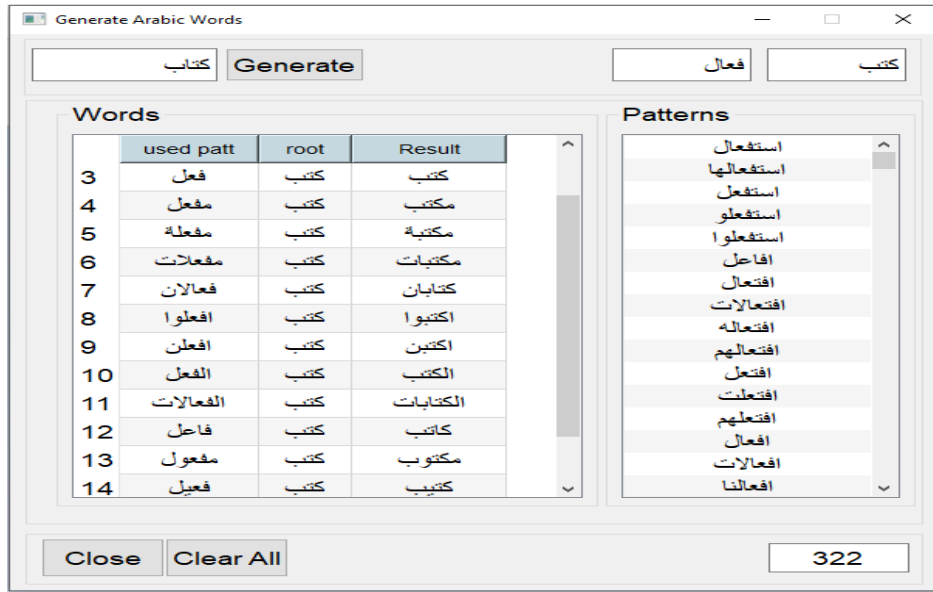


Figure (2). Generate words Algorithm GUI

To evaluate the methods we have designed and developed, a group of different 500 Arabic words has been entered into the algorithm, and the result of the root-extracted algorithm is (465) valid roots are extracted truly, while the remainder (35) words cannot be extracted are either their origin are not Arabic word or some other reasons. As a result, the efficiency of the first part of the algorithm is (93%). The part of producing new words uses (15) different patterns with the extracted root and the efficiency of this stage is (100%). We manually calculated the efficiency ratio in all parts by checking the correctness of the root produced for all the entered words as well as the new words produced.

6. Conclusion

There is a large degree of word overlap and word migration into Arabic despite Arabic being one of the strongest and most widely spoken languages in the world. The Arabic word is allegedly connected to roots. When interacting with a pattern, the same root can produce different words. In this study, we introduced an algorithm based on morphological features and patterns to extract the root from Arabic words and then use the retrieved root to generate all terms linked to this root. Instead of concentrating on the existence or location of specific letters inside the word, our method primarily concentrates on the word's structure. This study introduced a technique for locating Arabic roots and using them to create new words that can be applied to other NLP areas like information retrieval or machine translation. By providing a technique for verb recognition, this work contributes. By examining the pattern, the approach first determines the root; using the

root and pattern, it may then determine the verbs. The method was created for morphological analysis to find Arabic roots. The suggested method does not remove any affixes at all in any of its steps but rather compares two original words and a pattern with the same amount of letters. An arbitrary candidate root is produced as a result of this comparison and is then utilized to produce the same word as the one that was extracted. We implement this algorithm using Python.

References

- [1] Mei, L., & Cheng, F. (2010, April). The use of artificial intelligence in the information retrieval system epoch-making changes in information retrieval system. In 2010 2nd IEEE International Conference on Information Management and Engineering (pp. 310-313). IEEE.
- [2] Yousfi, A. (2010). The morphological analysis of Arabic verbs by using the surface patterns. *IJCSI International Journal of Computer Science Issues*, 7(3), 11.
- [3] El-Defrawy, Mahmoud, Nahla A. Belal, and Yasser El-Sonbaty. "An efficient rank based Arabic root extractor." 2017 Intelligent Systems Conference (IntelliSys). IEEE, 2017.
- [4] Al-Sughaiyer, Imad A., and Ibrahim A. Al-Kharashi. "Arabic morphological analysis techniques: A comprehensive survey." *Journal of the American Society for Information Science and Technology* 55.3 (2004): 189-213.
- [5] Yaseen, Qussai, and Ismail Hmeidi. "Extracting the roots of Arabic words without removing affixes." *Journal of Information Science* 40.3 (2014): 376-385.
- [6] Abu-Errub, Aymen, et al. "Arabic roots extraction using morphological analysis." *International Journal of Computer Science Issues (IJCSI)* 11.2 (2014): 128.
- [7] Mustafa, M., Aldeen, A. S., Zidan, M. E., Ahmed, R. E., & Eltigani, Y. (2019). Developing Two Different Novel Techniques for Arabic Text Stemming. *Intelligent Information Management*, 11(01), 1.
- [8] Naili, Marwa, Anja Habacha Chaibi, and Henda Hajjami Ben Ghezala. "Comparative Study of Arabic Stemming Algorithms for Topic Identification." *Procedia Computer Science* 159 (2019): 794-802.
- [9] Al-Kabi, Mohammed N., et al. "A novel root based Arabic stemmer." *Journal of King Saud University-Computer and Information Sciences* 27.2 (2015): 94-103.
- [10] El Bazzi, Mohamed Salim, et al. "Stemming versus multi-words indexing for Arabic documents classification." 2016 11th International Conference on Intelligent Systems: Theories and Applications (SITA). IEEE, 2016.
- [11] Guellil, Imane, et al. "Arabic natural language processing: an overview." *Journal of King Saud University-Computer and Information Sciences* (2019).
- [12] Mubarak, Hamdy. "Build fast and accurate lemmatization for Arabic." arXiv preprint arXiv: 1710.06700 (2017).
- [13] Kanan, Tarek, et al. "Arabic Light Stemming: A Comparative Study between P-Stemmer, Khoja Stemmer, and Light10 Stemmer." 2019 Sixth International Conference on Social Networks Analysis, Management and Security (SNAMS). IEEE, 2019.
- [14] Al-Zyoud, Ahmad, and Wafaa A. Al-Rabayah. "Arabic stemming techniques: comparisons and new vision." 2015 IEEE 8th GCC Conference & Exhibition. IEEE, 2015.
- [15] HEGAZI, Mohamed Osman. An approach for Arabic root generating and lexicon development. *IJCSNS Int. J. Comp. Sci. Network Security*, 2016, 16.1.
- [16] Odeh, Ashraf, et al. "Arabic text categorization algorithm using vector evaluation method." arXiv preprint arXiv: 1501.01318 (2015).

- [17] Boudchiche, M., & Mazroui, A. (2018, April). Improving the Arabic root extraction by using the quadratic splines. In 2018 International Conference on Intelligent Systems and Computer Vision (ISCV) (pp. 1-5). IEEE.
- [18] AQEL, Afnan; ALWADEI, Sahar; DAHAB, Mohammad. Building an Arabic Words Generator. International Journal of Computer Applications, 2015, 112.14.
- [19] Shaalan, K., Attia, M., Pecina, P., Samih, Y., & van Genabith, J. (2012, May). Arabic word generation and modelling for spell checking. In LREC (pp. 719-725).
- [20] Ramadhan, T. I., Bijaksana, M. A., & Huda, A. F. (2019). Rule Based Pattern Type of Verb Identification Algorithm for the Holy Qur'an. Procedia Computer Science, 157, 337-344.
- [21] Sawalha, M., Atwell, E., & Abushariah, M. A. (2013, February). SALMA: standard Arabic language morphological analysis. In 2013 1st International Conference on Communications, Signal Processing, and their Applications (ICCSPA) (pp. 1-6). IEEE.
- [22] Mohammed, Rafea. "New Arabic stemming based on Arabic patterns." Iraqi J. Sci. 57.3 (2016): 2324-2330.
- [23] Abouenour, L., El Hassani, S., Yazidy, T., Bouzouba, K., & Hamdani, A. (2008). Building an Arabic morphological analyzer as part of an open Arabic NLP platform. In the Language Resources and Evaluation Conference (LREC), Marrakech, Morocco, 31st May.
- [24] Kwaik, K. A., Saad, M., Chatzikyriakidis, S., & Dobnika, S. (2018). A Lexical Distance Study of Arabic Dialects. Procedia computer science, 142, 2-13.
- [25] Chennoufi, A., & Mazroui, A. (2017). Morphological, syntactic and diacritics rules for automatic diacritization of Arabic sentences. Journal of King Saud University-Computer and Information Sciences, 29(2), 156-163.
- [26] Azman, B. (2019). Root Identification Tool for Arabic Verbs. IEEE Access, 7, 45866-45871.
- [27] Alnaied, A., Elbendak, M., & Bulbul, A. (2020). An intelligent use of stemmer and morphology analysis for Arabic information retrieval. Egyptian Informatics Journal.
- [28] Alnaied, A., Elbendak, M., & Bulbul, A. (2020). An intelligent use of stemmer and morphology analysis for Arabic information retrieval. Egyptian Informatics Journal.
- [29] Karin C. Ryding, A Reference Grammar of Modern Standard Arabic, Cambridge University Press, August 2005.
- [30] Shaalan, Khaled, Marwa Magdy, and Aly Fahmy. "Analysis and feedback of erroneous Arabic verbs." Natural Language Engineering 21.2 (2015): 271-323.

GÜNEŞ FOTOVOLTAİK SİSTEMLERİ İÇİN BULANIK MANTIK VE PARÇACIK SÜRÜ OPTİMİZASYONUNA DAYALI MAKSİMUM GÜÇ NOKTASI TAKİBİ

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ÖZET

Bu makale, güneş fotovoltaik (PV) sistemlerinde güç noktası izlemeyi (MPPT) en üst düzeye çıkarmak için bulanık mantık kontrolü (FLC) ve parçacık sürüsü optimizasyonu (PSO) algoritmalarını birleştiren yeni bir yaklaşım sunmaktadır. Amaç, değişen çalışma koşulları ve çevresel değişiklikler altında MPPT tekniklerinin verimliliğini ve sağlamlığını arttırmaktır. FLC, mevcut güneş ışınımına ve panel sıcaklığına bağlı olarak PV sisteminin çalışma noktasında gerçek zamanlı ayarlamalar yapmak için kullanılırken, PSO, dinamik ve belirsiz koşullarda optimum performans için FLC parametrelerini optimize eder. Kapsamlı simülasyon çalışmaları, önerilen MPPT stratejisini kısmi gölgeleme, ani ışınım değişiklikleri ve sıcaklık değişimlerini içeren senaryolar altında değerlendirir. Geleneksel MPPT teknikleriyle yapılan karşılaştırmalı analiz, üstün izleme doğruluğunu ve çevresel değişikliklere daha hızlı yanıt verdiğini gösterir. Sonuçlar, hibrit FLC-PSO MPPT algoritmasının güneş PV sistemlerinde enerji çıkarma verimliliğini artırmadaki etkinliğini doğruluyor ve böylece yenilenebilir enerji teknolojilerinin ilerlemesine katkıda bulunuyor.

Anahtar Kelimeler: PV sistemi, Pil depolama, MPPT, Bulanık MPPT, Parçacık Sürü Optimizasyonu

MAXIMUM POWER POINT TRACKING BASED ON FUZZY LOGIC AND PARTICLE SWARM OPTIMIZATION FOR SOLAR PHOTOVOLTAIC SYSTEMS

ABSTRACT

This paper presents a novel approach that combines fuzzy logic control (FLC) and particle swarm optimization (PSO) algorithms to maximize power point tracking (MPPT) in solar

photovoltaic (PV) systems. The objective is to enhance the efficiency and robustness of MPPT techniques under varying operating conditions and environmental changes. FLC is employed to make real-time adjustments to the PV system's operating point based on the current solar irradiance and panel temperature, while PSO optimizes the FLC parameters for optimal performance in dynamic and uncertain conditions. Extensive simulation studies evaluate the proposed MPPT strategy under scenarios including partial shading, sudden irradiance changes, and temperature variations. Comparative analysis with conventional MPPT techniques demonstrates superior tracking accuracy and faster response to environmental changes. The results confirm the effectiveness of the hybrid FLC-PSO MPPT algorithm in enhancing energy extraction efficiency in solar PV systems, thereby contributing to the advancement of renewable energy technologies.

Keywords: PV system, Battery storage, MPPT, Fuzzy MPPT, Particle Swarm Optimization

1. Introduction:

Solar photovoltaic (PV) systems have gained significant attention as a renewable energy source due to their environmental benefits and potential for sustainable power generation. However, the efficiency of PV systems is highly dependent on the ability to track the maximum power point (MPP) of the solar panels, which is the operating point where the system can extract the maximum available power from the solar irradiance.

Maximum power point tracking (MPPT) algorithms play a crucial role in optimizing the performance of PV systems by continuously adjusting the operating point to match the varying environmental conditions such as solar irradiance and temperature. Numerous MPPT techniques have been proposed in the literature, aiming to improve the energy extraction efficiency and enhance the system's robustness against variations and uncertainties.

In recent years, the combination of fuzzy logic control (FLC) and particle swarm optimization (PSO) algorithms has emerged as a promising approach for MPPT in solar PV systems. FLC provides a flexible and adaptive control mechanism by using linguistic rules and fuzzy membership functions to adjust the operating point based on real-time measurements of the solar irradiance and temperature. On the other hand, PSO is a population-based optimization algorithm

inspired by the behavior of bird flocking or fish schooling, which optimizes the parameters of the FLC system to achieve the best performance under varying and uncertain conditions.

2. Study Area:

A photovoltaic (PV) system is a sustainable and renewable energy solution that harnesses sunlight and converts it into usable electrical energy through a process called the photovoltaic effect. This process (is shown in figure 2.1) involves the use of photovoltaic modules, a DC-DC converter, and an MPPT controller, which work together to optimize power generation and maximize efficiency [1].

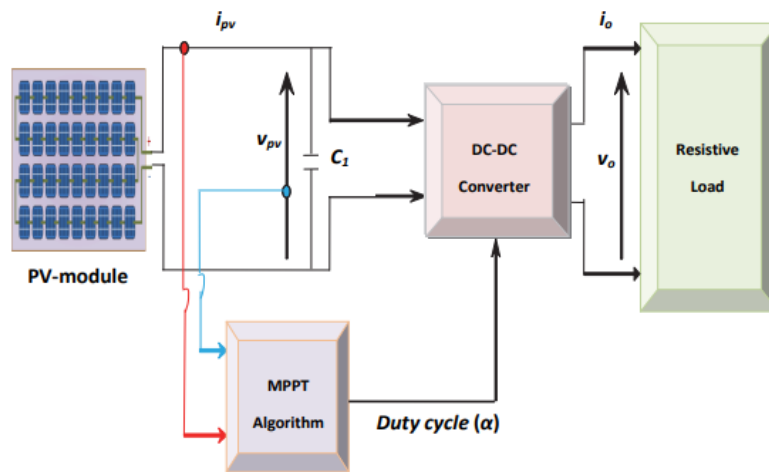


Figure 2.1. Scheme of a PV system with a MPPT controller [1].

The core component of a PV system is the Photovoltaic Generator (PVG), which consists of interconnected PV modules. These modules are made up of semiconductor materials, typically silicon, that directly convert sunlight into electricity. When sunlight strikes the PV modules, it excites electrons within the semiconductor material, generating a flow of electrons and creating a direct current (DC) electrical output [1].

To optimize power transfer between the PVG and the load, a DC-DC converter is used as an intermediary. The DC-DC converter adjusts the voltage and current levels to match the requirements of the load. It may step up or step down the DC voltage accordingly, ensuring efficient power transfer and maximizing the energy harvested from the PVG [1][2].

The MPPT (Maximum Power Point Tracking) controller plays a crucial role in the PV system. It continuously monitors the output of the PVG and adjusts the operating conditions of the DC-DC converter to track the maximum power point (MPP) of the PVG. The MPP represents the optimum combination of voltage and current at which the PVG can deliver the maximum power output for a given set of environmental conditions. By tracking the MPP, the MPPT controller ensures that the PVG operates at its optimal efficiency, maximizing the amount of power extracted from the sunlight [3].

3. Material and Method:

3.1. Fuzzy Logic Control (FLC):

Fuzzy Logic Control (FLC) is a control methodology based on fuzzy set theory that handles imprecise or uncertain information. It uses linguistic rules and fuzzy membership functions to provide a flexible and adaptive approach to control systems. FLC has been successfully applied in various fields, including engineering, robotics, and control systems such as Maximum Power Point Tracking (MPPT) for solar PV systems [4].

The FLC consists of three main components (is shown in figure 3.1): fuzzification, inference engine, and defuzzification.

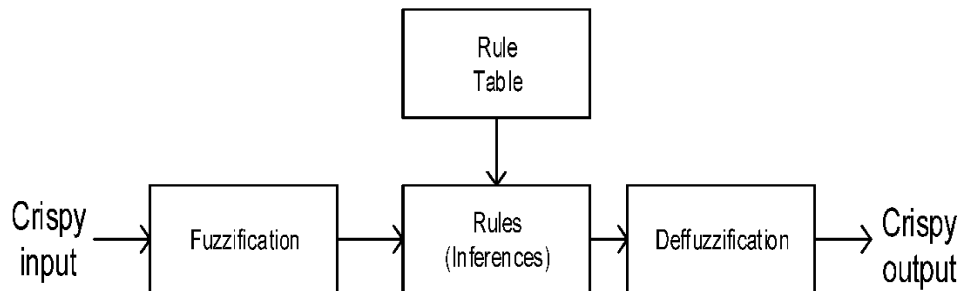


Figure 3.1. The basic stages in a fuzzy logic controller [4]

- 1) The fuzzification process involves dividing the input variables (error and change in error) into several categories using membership functions. These membership functions represent the different degrees of membership for each input category. Figure 3 illustrates the membership functions used in the fuzzy logic controller [1][5].
- 2) The fuzzy inference engine processes the fuzzy rules and combines them to determine appropriate control actions. It applies fuzzy logic operators, such as "AND", "OR", and

"NOT", to evaluate the fuzzy rules. By considering the linguistic variables and their degrees of membership, the inference engine generates fuzzy output variables that represent the control actions to be taken [2][5].

- 3) Defuzzification is the process of converting the fuzzy output variables into crisp (precise) control actions. Various defuzzification methods can be used, such as the centroid, mean of maximum, or weighted average methods. These methods calculate a crisp value that represents the final control action to be applied to the system [2][5].

The FLC-MPPT controller design is based on the power-voltage curve of the PV system, which is divided into three regions and represents the relationship between the power output and the voltage of the PV system. The structure of the FLC-MPPT controller consists of two inputs: The input $E(k)$ represents the slope of the P-V curve and determines the position of the maximum power point (MPP) in the PV module, as shown in Equation (1). On the other hand, the $CE(k)$ input indicates whether the operating point is moving towards or away from the MPP, as shown in Equation (2). The output variable ($d\alpha$), representing the change in the duty cycle α , which can have positive or negative values depending on the operating point's position. This output is then used to drive the load through the dc-dc converter. The controller provides the value of $d\alpha$, which is accumulated to obtain the duty cycle value. This structure allows the controller to analyze the inputs and make control decisions based on the current operating region of the PV system as shown in figure 3.2 [1].

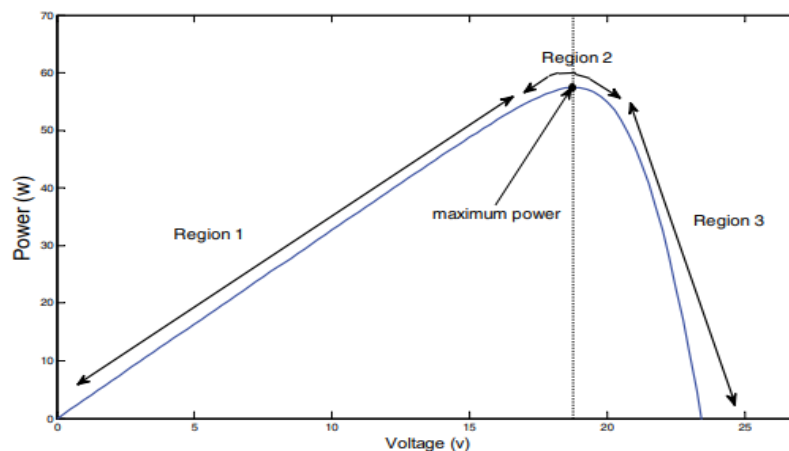


Figure 3.2. The P-V curve of a typical PV module displays various regions representing its different operating conditions [1].

The variables E and CE are calculated based on the slope of the p-v characteristic curve of the PV module, as described in [1]:

$$E(k) = \frac{\Delta p}{\Delta v} = \frac{p(k)-p(k-1)}{v(k)-v(k-1)} \quad (1)$$

$$CE = E(k) - E(k-1) \quad (2)$$

the membership functions in Figure 3.3 are defined using five levels of linguistic variables:

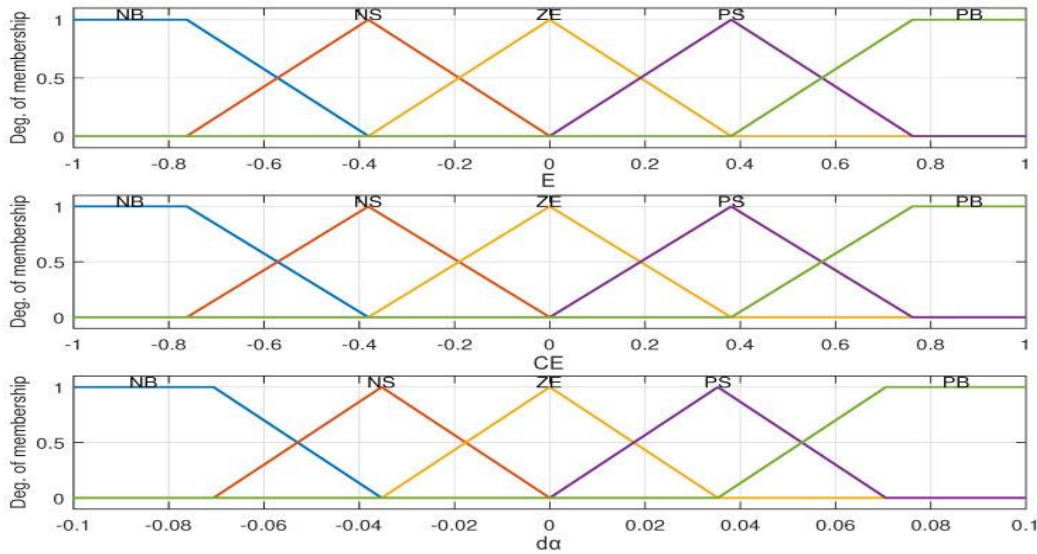


Figure 3.3. membership function of fuzzy logic controller (inputs (E and CE) and output (dα)) [5].

negative big (NB), negative small (NS), zero (ZE), positive small (PS), and positive big (PB). Typically, employing five language variables is generally sufficient to achieve effective regulation or satisfactory trajectory tracking, as stated in [1]. The chosen forms of the membership functions, depicted in Figure 4, are specifically designed to facilitate easy computation and provide immediate solutions to the optimization problems that arise in fuzzy modeling [6,7]. The fuzzy rules are given in Table 3.1, where Ri (I = 1, ..., 25) can be one of the five linguistic variables (NB, NS, ZE, PS, PB). These rules are designed based on the p-v characteristic.

Table 3.1. the rule base of the FLC, which consists of the inputs E and CE, and the output $d\alpha$ [5].

$CE E$	NB	NS	ZE	PS	PB
NB	ZE	ZE	PB	PB	PB
NS	ZE	ZE	PS	PS	PS
ZE	PS	ZE	ZE	ZE	NS
PS	NS	NS	NS	ZE	ZE
PB	NB	NB	NB	ZE	ZE

The figure 3.4 illustrates the 25 fuzzy rules, expressed as If-Then statements, that establish the relationship between the inputs and outputs of the Fuzzy Logic Controller (FLC) system [5].

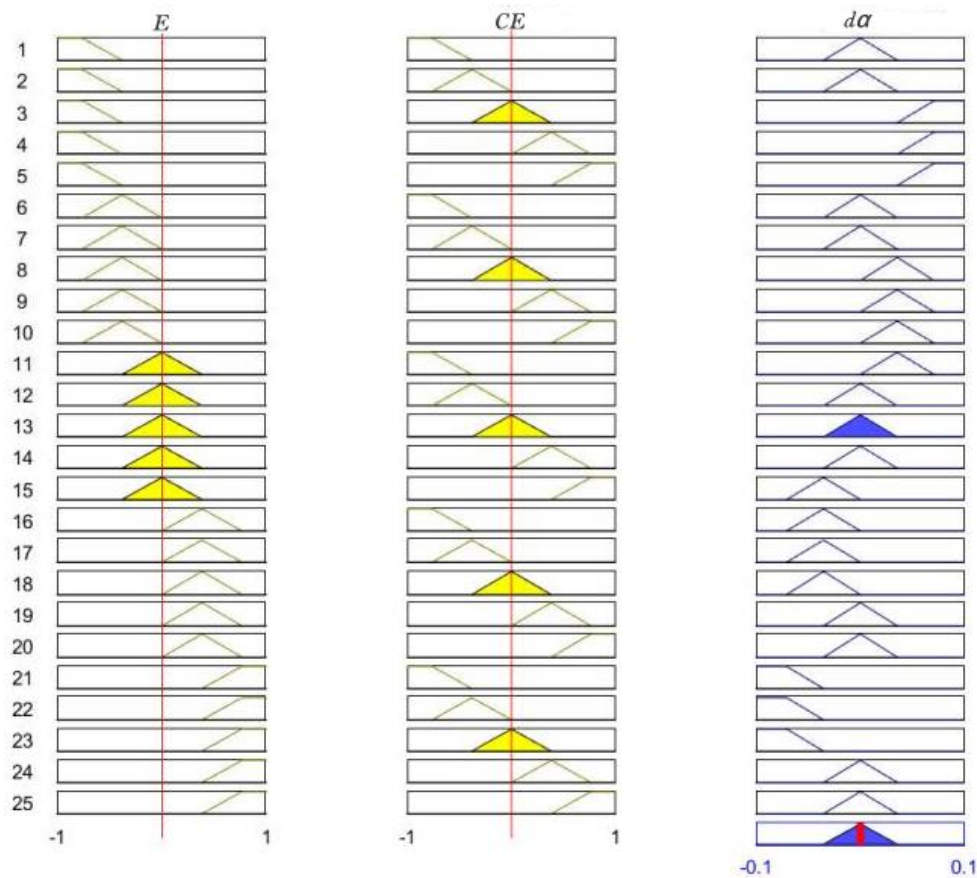


Figure 3.4. the 25 fuzzy rules that related between the inputs and outputs of the FLC system [5].

FLC allows for the adjustment of the fuzzy membership functions and the fuzzy rules through parameter optimization techniques. Techniques like particle swarm optimization (PSO), genetic algorithms, or gradient descent can be used to optimize the parameters of the FLC system. Parameter optimization aims to improve the performance, accuracy, and robustness of the FLC-based control system.

3.2. Particle Swarm Optimization (PSO):

Particle Swarm Optimization (PSO) [8] is a popular population-based optimization algorithm that is widely used to solve nonlinear problems. It is inspired by the collective behavior of bird flocks or fish schools, where individual particles in the swarm cooperate and communicate to find the best solution.

In PSO, particles representing optimization solutions, such as the duty cycle of a DC-DC converter, are assigned random initial values within specified boundaries [1]. These particles move within the search space, with their best movement in the early stages referred to as P_{best} . The overall best movement across iterations is known as G_{best} . Each particle is characterized by its velocity (V_i) and position (X_i) in the search space, which are updated in each iteration until an optimal solution is found. The velocity and position of particles are updated using Equations (3)&(4) [4]:

$$V_i(k + 1) = W * V_i(k) + C_1 * rand1 * (P_{best}_i(k) - X_i(k)) + C_2 * rand2 * (G_{best}(k) - X_i(k)) \quad (3)$$

$$X_i(k + 1) = X_i(k) + V_i(k + 1) \quad (4)$$

The inertia weight (W) determines the impact of the particle's previous velocity on its current velocity. It balances exploration and exploitation in the search process.

PSO starts with initializing the swarm by assigning random positions and velocities to the particles within predefined boundaries. The optimization process continues for a specified number of iterations or until a termination condition is met. In each iteration, particles update their velocities and positions based on Equations (3&4), seeking better solutions.

The flowchart of the PSO algorithm can be seen in Figure 3.5 [9]:

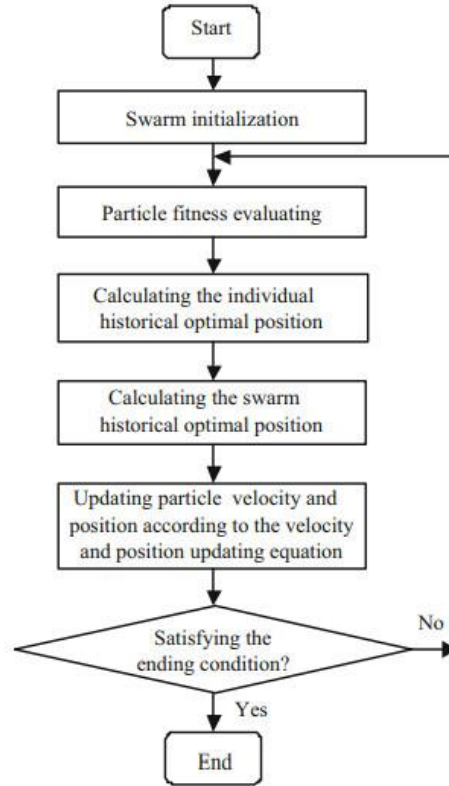


Figure 3.5. The flowchart of the PSO algorithm [9]

In the context mentioned, the particles in the PSO algorithm can be interpreted as optimization solutions that represent the duty cycle of the DC-DC converter, the objective function aims to find the global voltage and power in the P-V characteristics curve. The algorithm is initiated by setting parameters such as maximum number of iterations, the swarm size (N), and the dimensionality of the voltage and power variables to be optimized. The global voltage, represented as V_g according to Equations (3&4), is computed and stored as a vector [4]:

$$X_i(k) = V_g = [V_{g1}, V_{g2}, V_{g3}, V_{g4}, \dots, V_{gj}] \text{ for } j = 1, 2, 3, \dots, N \quad (5)$$

The best voltage and power values discovered by the PSO algorithm up to the current iteration are stored in Pbest. The process continues until the best solution, denoted as Gbest, is found.

3.3.Method:

In this research, we propose an innovative approach to MPP tracking by combining fuzzy logic control (FLC) and particle swarm optimization (PSO).

The proposed PSO-FLC-MPPT controller incorporates three inputs: the voltage and current of the PV panel and the temperature of the panel. The temperature parameter is considered due to its significant impact on the MPP. Changes in temperature can cause a shift in the MPP, adversely affecting the MPPT performance. Therefore, the inclusion of the temperature parameter enables the controller to regulate the MPPT operation and compensate for temperature-induced variations.

The fuzzy logic controller in proposed approach is designed using the Mamdani inference system. It employs a set of rules that capture the relationships between the inputs and the desired control actions. By utilizing fuzzy logic, the controller can make informed decisions based on the uncertainties and linguistic nature of the inputs, resulting in improved MPPT performance.

To further enhance the performance of the fuzzy logic controller, it is integrated with the PSO algorithm. The output of the fuzzy logic system, representing the control actions, is used as input to the PSO algorithm. The PSO algorithm optimizes the control actions based on the desired performance criteria, such as maximizing power extraction or minimizing error.

proposed approach incorporates an adaptive learning mechanism. Real-time data collection and analysis of the PV system's voltage, current, and temperature provide feedback for adaptation. The system continuously monitors the performance and environmental conditions to make informed adjustments to the control strategy. This adaptive learning mechanism ensures that the controller remains effective and accurate, enabling optimal MPPT performance in various climatic conditions.

The proposed approach follows a specific data flow, which can be summarized as follows:

- **Step 1: Establishing the Inputs:** The system takes three inputs:
 - Voltage of the photovoltaic (PV) panel
 - Current of the PV panel
 - Temperature of the PV panel
- **Step 2: Analyzing the Temperature:** The temperature of the PV panel is analyzed because of its significant impact on the Maximum Power Point (MPP). An increase in temperature can cause a shift in the MPP, which negatively affects the Maximum Power Point Tracking (MPPT).

- **Step 3: Incorporating Temperature into MPPT:** To counteract the negative effects of temperature on MPPT, the temperature parameter is included as a regulatory factor in the MPPT process.
- **Step 4: Creating Fuzzy Logic Rules:** A fuzzy logic controller is developed with a set of rules based on the Mamdani inference system. This system allows for approximate reasoning and decision-making under uncertain conditions.
- **Step 5: Integrating Fuzzy Logic with PSO:** Initialize a population of particles with random positions and velocities. Each particle represents a potential solution, i.e., a set of FLC parameters.
- **Step 6: Optimizing Performance:** The PSO algorithm works to improve the results of the fuzzy logic controller, by definition a fitness or cost function to evaluate each particle's performance. The cost function CF takes into account the difference between the PV module power P_{pv} and the maximum power P_{max} under a given climatic condition. By maximizing this cost function, the objective is to minimize the deviation between P_{pv} and P_{max} , thereby achieving effective power tracking.
- **Step 7: Ensuring Climate Adaptability:** The combined use of fuzzy logic and PSO enables the system to function efficiently in various climatic conditions, ensuring adaptability and robustness.

4. Results and Discussion:

In this study, a proposed hybrid approach combining fuzzy logic control (FLC) and particle swarm optimization (PSO) for maximum power point tracking (MPPT) in photovoltaic (PV) systems is presented. Although experimental results are not available at this stage, the discussion will focus on the theoretical expectations and potential benefits of the proposed approach.

The integration of fuzzy logic control and particle swarm optimization offers several anticipated advantages. Firstly, the fuzzy logic controller can effectively incorporate inputs such as voltage, current, and temperature to make intelligent decisions regarding the control actions. By considering the temperature parameter, the controller can adapt to temperature-induced variations and optimize the MPPT operation accordingly.

The particle swarm optimization algorithm complements the fuzzy logic controller by optimizing its parameters. Through iterative adjustments, the PSO algorithm can enhance the controller's performance by fine-tuning the control actions, maximizing power extraction efficiency, and improving tracking accuracy. The PSO algorithm's ability to search for global optima and adapt to changing operating conditions makes it a suitable optimization technique for this hybrid approach.

The proposed PSO-FLC-MPPT controller offers the potential for improved power extraction efficiency and tracking accuracy compared to conventional MPPT techniques. By dynamically adjusting the control actions based on real-time input parameters, the controller can effectively track the maximum power point and optimize power extraction under varying environmental conditions. This adaptability and robustness are crucial for maximizing the PV system's performance and increasing energy yield.

While the proposed approach holds promising potential, there are certain challenges and limitations to consider. These include computational complexity associated with the integration of fuzzy logic and PSO, the tuning of fuzzy logic rules and PSO parameters, and the accuracy of PV panel modeling. These challenges can be addressed through careful system design, optimization techniques, and validation procedures.

It is important to note that the absence of experimental results is a limitation of this study.

5. Conclusion:

The presented paper introduces a hybrid approach that combines fuzzy logic control and particle swarm optimization for maximum power point tracking (MPPT) in photovoltaic (PV) systems. The integration of these techniques offers promising potential for enhancing MPPT performance by improving power extraction efficiency, tracking accuracy, and adaptability to changing operating conditions. The use of fuzzy logic control allows for the incorporation of expert knowledge and the creation of a rule-based system that can effectively regulate the MPPT operation. By considering inputs such as voltage, current, and temperature, the fuzzy logic controller can make intelligent decisions and adjust the control action accordingly. The integration of particle swarm optimization further enhances the performance of the fuzzy logic control by leveraging swarm intelligence and optimization algorithms. The particle swarm

optimization algorithm optimizes the control action based on the fuzzy logic output and the current operational conditions of the PV system. This dynamic adjustment enables the system to adapt to varying environmental factors and achieve more accurate MPPT. While the proposed hybrid approach shows promising potential, it is important to acknowledge that further research and experimentation are necessary. Real-world validation is needed to assess the practical performance and effectiveness of the proposed approach in different PV systems and under various operating conditions. Theoretical expectations indicate that the integration of fuzzy logic control and particle swarm optimization can lead to improved MPPT performance. However, practical implementation may uncover challenges or limitations that need to be addressed. Therefore, continued research efforts are essential to refine the approach, optimize parameter settings, and evaluate its performance in real-world scenarios.

References:

- [1] Bouarroudj, N., Abdelkrim, T., Farhat, M., Feliu-Batlle, V., Benlahbib, B., Boukhetala, D., & Boudjema, F. (2021). Fuzzy logic controller based maximum power point tracking and its optimal tuning in photovoltaic systems. *SJEE*, 18(3), 351-384.
- [2] Robles Algarín, C., Taborda Giraldo, J., & Rodriguez Alvarez, O. (2017). Fuzzy logic based MPPT controller for a PV system. *Energies*, 10(12), 2036.
- [3] Abdelaziz, A. Y., & Almoataz, Y. (2020). Modern maximum power point tracking techniques for photovoltaic energy systems. Springer Nature Switzerland AG.
- [4] Worku, M. Y., Hassan, M. A., Maraaba, L. S., Shafiullah, M., Elkadeem, M. R., Hossain, M. I., & Abido, M. A. (2023). A comprehensive review of recent maximum power point tracking techniques for photovoltaic systems under partial shading. *Sustainability*, 15(14), 11132.
- [5] Ali, M. N., Mahmoud, K., Lehtonen, M., & Darwish, M. M. (2021). Promising MPPT methods combining metaheuristic, fuzzy-logic and ANN techniques for grid-connected photovoltaic. *Sensors*, 21(4), 1244.
- [6] Pedrycz, W. (1994). Why triangular membership functions?. *Fuzzy sets and Systems*, 64(1), 21-30.
- [7] Karthika, S., Velayutham, K., Rathika, P., & Devaraj, D. (2014). Fuzzy Logic Based Maximum Power Point Tracking Designed for 10kW Solar Photovoltaic System with Different Membership Functions. *WASET International Journal of Electrical and Computer Engineering*, 8(6), 1022-1027.
- [8] Eberhart, R., & Kennedy, J. (1995, October). A new optimizer using particle swarm theory. In *MHS'95. Proceedings of the sixth international symposium on micro machine and human science* (pp. 39-43). Ieee.
- [9] Wang, D., Tan, D., & Liu, L. (2018). Particle swarm optimization algorithm: an overview. *Soft computing*, 22, 387-408.

UNVEILING BIOACTIVE WONDERS IN OLIVE POMACE FOR HUMAN WELL-BEING

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ABSTRACT

Delving into the realm of international science and innovation, this seminar is dedicated to unraveling the health-promoting attributes concealed within olive pomace—an often overlooked byproduct of olive oil extraction. Our exploration begins with an in-depth analysis of the chemical composition of olive pomace, spotlighting polyphenols, tocopherols, sterols, and other compounds renowned for their antioxidant properties. As we navigate recent scientific studies, we will articulate the potential health benefits linked to the ingestion of these bioactive compounds. These benefits encompass a spectrum, from cardiovascular disease mitigation and immune system fortification to anti-inflammatory effects. Additionally, we will probe into the versatile applications of olive pomace in both the food and pharmaceutical industries, presenting groundbreaking perspectives aligned with the overarching theme of innovation.

Keywords: olive pomace; bioactive compounds ; polyphenols; health benefits; chemical composition ; extraction process

ÇİZGE MADENCİLİĞİ KULLANARAK SOSYAL AĞLARDA TOPLULUKLARIN TESPİT EDİLMESİ

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ÖZET

Online sosyal ağ platformları, bireylerin birbirleriyle etkileşimde bulunmasını ve bilgi paylaşmasını sağlamaktadır. Bireylerin sosyal ağ kullanımının yaygınlaşması, analiz edilecek zengin ve karmaşık veri sunmaktadır. Bir sosyal ağ, bireyleri temsil eden düğümler ve bu düğümler arasındaki bağlantıları temsil eden kenarlardan oluşan bir çizge olarak tanımlanabilir. Bir çizge veritabanı bir sosyal ağı temsil eden düğümleri ve kenarları içerir. Çizge veritabanları sayesinde bilgi çizgeleri, sosyal ağlar, genom ağlar gibi farklı yapılar temsil edilebilir. Çizge madenciliği, çizge verisinden yararlı ve gizli bilgi çıkarma işlemidir ve topluluk tespiti çizge madenciliğindeki problemlerden biridir. Sosyal ağ çizgelerinde topluluk tespiti, benzer ilgi ve özelliklere sahip insan gruplarını çıkarmayı amaçlamaktadır [1]. Topluluk keşfi süreci, grupların karar alması gibi durumlarında çok faydalı olabilir, örneğin bir reklamı gruptaki her üyeye ayrı ayrı yönlendirmek yerine topluluğa yaymak gibi bağlamlarda çok faydalı olabilmektedir.

Sık alt çizge madenciliği, bir çizge veri tabanından sık olarak tekrarlanan alt çizgelerin çıkarılma sürecidir. Literatürde sık öge kümesi madenciliği, sosyal ağlarda topluluk tespiti için kullanılır, ancak topluluk tespiti için sık alt çizge madenciliğini kullanan önceki bir çalışma yoktur. Sık öge kümesi madenciliği ile sık alt çizge madenciliği arasındaki en temel fark; sık alt çizgelerin düğümler arasındaki ilişki yapısını korumasıdır, oysa sık öge kümelerinde düğümler arasındaki ilişki yapısını korumak mümkün değildir. Bu çalışmada, veri tabanından önce maksimum sık alt çizgeler çıkartılarak küçük tutarlı insan toplulukları bulunmaktadır. Sonrasında, bu topluluklar, daha büyük topluluklar oluşturmak için önceden belirlenen kurallar ile birbirleriyle birleştirilmektedir.

Sık alt çizgeleri ortaya çıkarmak için GSPAN [2] algoritması kullanılmıştır ve ortaya çıkarılan sık alt çizgeler tutarlı toplulukların özet bilgisini içeren maksimum sık alt çizgelere indirgenmiştir. Bu çalışmanın mevcut çalışmalardan temel farkı, topluluk tespiti için maksimum sık alt çizge madenciliği kullanmasıdır.

Anahtar Kelimeler: Sosyal Ağ, Topluluk Belirleme, Çizge Madenciliği, Yapay Zeka, Bilgi Çizgesi

[1] Moosavi, S. A., Jalali, M., Misaghian, N., Shamsirband, S., Anisi, M. H., Community detection in social networks using user frequent pattern mining. Knowledge and Information Systems, 51, 159-186, 2017.

[2] Yan, X. and Han, J.. gspan: Graph-based substructure pattern mining. In 2002 IEEE International Conference on Data Mining, 721-724, 2002.

DETECTING COMMUNITIES IN SOCIAL NETWORKS USING GRAPH MINING

ABSTRACT

Online social network platforms enable individuals to interact and share information with each other. The expansion of social network usage by individuals offers rich and complex data to be analyzed. A social network can be represented as a graph consisting of vertices and edges, where vertices refer to individuals and edges refer to connections between these vertices. A graph database stores vertices and edges that represent a social network. Graph databases have the capability to represent different structures, including knowledge graphs, social networks, and genomic networks. Graph mining is the process of extracting useful and hidden knowledge from graph-structured data and one of the problems in graph mining is community detection. Community detection in a social graph refers to extracting groups of people with similar interests and activities [1]. The community discovery process in social network can be very beneficial in contexts where group decision making is important, such as disseminating an advertisement of interest to a community rather than directing it individually to each member in the group.

Frequent subgraph mining is the process of extracting frequently occurring subgraphs from a graph database. In the literature, frequent itemset mining is used for community detection in social networks, but there is no previous study that employed frequent subgraph mining for community detection. The main difference between frequent itemset mining and frequent subgraph mining is that frequent subgraphs maintain the relation forms between vertices, while it

is impossible to maintain the relation structure between vertices in frequent itemsets. In this study, we first identify small cohesive groups of people by extracting maximal frequent subgraphs. Next, these communities are joined with each other to generate larger communities, as in [2]. We extracted frequent subgraphs using the GSPAN algorithm and then reduced the frequent subgraphs to maximal frequent subgraphs, as maximal subgraphs contain the summary information of cohesive groups. The primary difference between this study and existing works is that this study employs maximal frequent subgraph mining for community detection.

Keywords: Social Network, Community Detection, Graph Mining, Artificial Intelligence, Knowledge Graph

[1] Moosavi, S. A., Jalali, M., Misaghian, N., Shamshirband, S., Anisi, M. H., Community detection in social networks using user frequent pattern mining. *Knowledge and Information Systems*, 51, 159-186, 2017.

[2] Yan, X. and Han, J.. gspan: Graph-based substructure pattern mining. In 2002 IEEE International Conference on Data Mining, 721-724, 2002.

ÇİFT BESLEMELİ ENDÜKSİYON MOTORLARININ HIZ KONTROLÜNÜNDE KULLANILAN PID PARAMETRELERİNİN BALİNA OPTİMİZASYONU ALGORİTMASI İLE OPTİMİZASYONU

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ÖZET

Çift beslemeli endüksiyon makineleri (ÇBEM), yenilenebilir enerji sistemlerinde, kompresörlerde, konveyör sistemlerinde ve birçok endüstriyel uygulamada yaygın olarak kullanılan bir endüksiyon motoru türüdür. Geleneksel endüksiyon motorları genellikle sadece stator kısmından beslenirken, ÇBEM'lerin hem stator hem de rotor kısmı ayrı güç kaynaklarından beslenir. Bu şekilde elde edilen verimlilik ve performans artırılmış olur. Bu çalışmanın giriş bölümünde, ÇBEM'lerin kullanım yerleri, amaçları ve kullanılan kontrol yöntemleri ile ilgili literatür taramasına yer verilmiştir. Bir sonraki bölümde, ÇBEM'lerin matematiksel modellenmesi ve PI parametrelerinin Balina Optimizasyon Algoritması (BOA) ile kontrolü açıklanırken; sonuç bölümünde ise Matlab /Simulink yazılımı kullanılarak yapılan hız kontrolü optimizasyonuna ait simülasyon sonuçları incelenerek analiz edilmiştir.

Anahtar Kelimeler: ÇBEM, Balina optimizasyon algoritması, yenilenebilir enerji, PI kontrol

OPTIMIZATION OF PID PARAMETERS IN DOUBLE FED INDUCTION MOTOR SPEED CONTROL USING WHALE OPTIMIZATION ALGORITHM

ABSTRACT

Double Fed Induction Motors (DFIMs) are a type of induction motor widely used in renewable energy systems, compressors, conveyor systems, and various industrial applications. Unlike traditional induction motors that are typically fed only from the stator, DFIMs are powered from separate power sources for both the stator and the rotor, enhancing efficiency and performance. The introduction of this study provides a literature review on the applications, purposes, and control methods of DFIMs. The subsequent section discusses the mathematical modelling of DFIMs and the control of PI parameters using the Whale Optimization Algorithm (WOA). In the

results section, simulation results of speed control optimization conducted using Matlab/Simulink software are examined and analysed.

Keywords: DFIM, Whale Optimization Algorithm, renewable energy, PI control

1. GİRİŞ

Çift beslemeli endüksiyon makineleri hem stator hem de rotor kısmından beslenen endüksiyon motorlarıdır. Bu motor yapısı, endüstriyel uygulamalarda kullanılan diğer motorlarla kıyaslandığında yüksek performansı, sağlamlığı ve basit yapısı nedeniyle tercih sebebidir. Bu nedenle, çoğunlukla rüzgar türbinleri olmak üzere yenilenebilir enerji sistemlerinde; demiryolu taşımacılığı ve gemi tahrik sistemlerinde; endüstride kullanılan fan ve pompalarda; konveyör sistemleri, pompa sistemleri ve diğer endüstriyel makinelerde güç kaynağı olarak kullanılmaktadır. ÇBEM'lerin bahsedilen avantajlarına rağmen doğrusal olmayan yapısı nedeniyle kontrolü zor makinelerdir. İşlem sırasında gerçekleşen parametre değişikliği ve yük momenti gibi bozuculara karşı da açıktır. ÇBEM'lerin kontrolü, enerji verimliliği, güvenilirlik ve performans gibi önemli faktörler dikkate alındığında, elektrik enerjisi üretimi ve kullanımı için önemli bir unsurdur. Bu nedenle, literatürde ÇBEM'lerin kontrolü üzerine birçok çalışma bulunmaktadır. Bu çalışmaları, kontrol stratejileri ve performans analizi, güç elektroniği ve dönüştürücü tasarımı, güç sistem entegrasyonu ve grid bağlantısı, kararlılık ve güvenilirlik analizi ve modelleme- simülasyon çalışmaları olarak sınıflandırmak mümkündür.

Standart bir ÇBEM denetleyicisinde, iki eksenli yüksek kazançlı rotor akımı PI kontrol döngüleriyle denetlenir ve kontrol sinyalleri akı odaklı bir referans çerçevesinde uygulanır. Tork ve reaktif güç için iki ayrı denetleme algoritması oluşturulur ve bu değerler referans değeriyle karşılaştırılır. Literatürdeki çalışmalar incelendiğinde; Leonard (Leonhard, 1995), Yamamoto ve Motoyoshi (Yamamoto ve Motoyoshi, 1992), Pena vd. (Pena vd., 1996a), Hopfensperger vd. (Hopfensperger vd., 2000) ve Walczyna (Walczyna, 1991)' tarafından gerçekleştirilen çalışmalar dikkat çekmektedir. Bu çalışmalarda, doğrudan stator akı yönlendirmesi yapılmıştır. Elde edilen çözümler bazı varsayımlar içermektedir. Bu varsayımlara göre, stator direnci genellikle ihmal edilir. Bu varsayım, yüksek güçlü ÇBEM'ler için tipik olan bir durum olup, denetleyici tasarımında stator akı vektörünün her zaman hat gerilim vektörü ile çeyrek açıda sabit kaldığı prensibine dayanır. Bogalecka ve Kzreminski (Bogalecka ve Kzreminski, 1993) ÇBEM kontrol problemi çözümü için durum-geri beslemesi kullanmıştır. Akım beslemeli rotor modelinin

kontrol döngüsünde ise birinci dereceden bir filtre kullanılmaktadır. Xu ve Cheng (Xu ve Cheng, 1995), Hopfensperger vd. (Hopfensperger vd., 2000) ve Bogalecka (Bogalecka, 1993) tarafından yapılan çalışmalarda rotor pozisyonu için sensörsüz çözümler önerilmektedir. İzole bir yüke güç sağlayan bir vektör kontrollü ÇBEM'in işlemesi, Pena, Clare ve Asher (Pena, Clare ve Asher, 1996b) tarafından yapılan çalışmada gerçekleştirilmiştir. Leonard tarafından gerçekleştirilen çalışmada DBEM vektör kontrolü için klasik yaklaşım modelinde (Leonard, 1995), stator, rotor akımlarının ve rotor pozisyonunun ölçümleri kullanılmaktadır. Ayrıca, hat gerilimleriyle birlikte, akıları hesaplamak için motorun endüktanslarının (doyma etkisi de dahil olmak üzere) da bilinmesi gerekmektedir. Xu ve Cheng (Xu ve Cheng, 1995) tarafından yapılan çalışmada, yüksek hassasiyetli rotor pozisyon ölçümünün gerekliliği vurgulanmaktadır. Pena vd. (Pena vd., 1996a, b)'de, yazarlar stator akılarını tahmin etmek için stator voltaj denklemlerinin entegrasyonunu kullanmıştır. Burada önerilen çözümde, stator direncinin ve ölçüm ofsetinin varyasyonlarından kaynaklanan açık döngü entegrasyon sapmasını önlemek için özel ayarlamalar gerekmektedir. ÇBEM'ler için böyle bir etkinin telafi edilmesi, tipik indüksiyon motor tahriklerinden daha kolaydır. Çünkü, bir sabit a-b referans çerçevesindeki stator akı bileşenleri, hat şebekesinin frekansıyla eşit olan sinüzoidal bir frekansa sahiptir ve stator dirençleri, genellikle endüstriyel uygulamalarda kullanılan büyük ÇBEM'lerde çok küçüktür. Stator akı odaklı referans çerçevesinin uygulanmasına yönelik farklı yaklaşımlar, Hopfensperger vd. (Hopfensperger vd., 2000)'de tartışılmıştır.

En önemli sonuçlar Leonard (Leonard, 1995), Pena, Clare ve Asher (Pena, Clare ve Asher, 1996a) ile Hopfensperger, Atkinson ve Lakin (Hopfensperger, Atkinson ve Lakin, 2000)'de rapor edilmiştir. Tümü, indüksiyon motor kontrolü için bir tork-akı dekoplenme tekniği olarak kullanılan klasik alan yönlendirme (stator veya hava boşluğu akısı) konseptine dayanmaktadır. ÇBEM'de hem stator hem de rotor akımları ölçümden elde edilebildiğinden, akı vektörleri (stator, hava boşluğu veya rotor), akı-akımı korelasyon denklemleri kullanılarak hesaplanabilir. Dolayısıyla, ÇBEM kontrol problemi tipik olarak bir doğrusal olmayan durum-geri besleme problemi olarak sınıflandırılır.

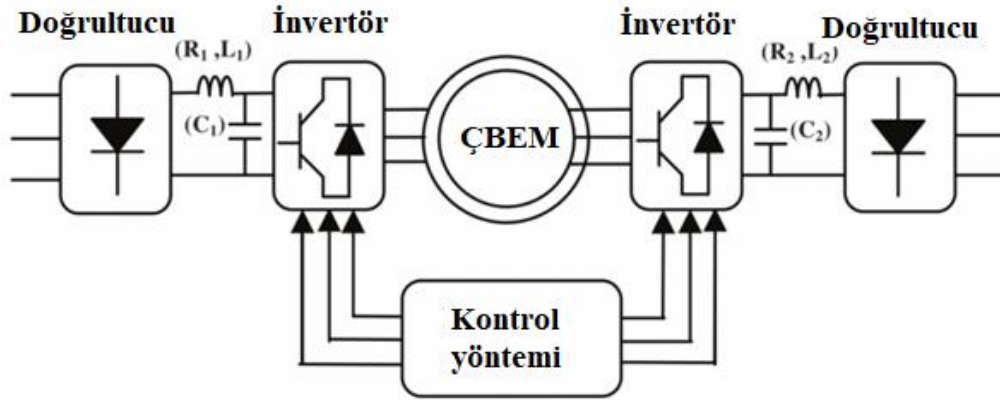
Rotor akım beslemeli ÇBEM ve ihmal edilebilir stator direnci varsayımı altında, tork ve stator tarafı reaktif güç kontrol problemi, rotor akımının bir alan yönlendirme referans çerçevesinde tanımlanması durumunda rotor akımı kontrolüne aktarılır. Tork (aktif güç) veya hız kontrol

hedefi, stator tarafı reaktif güç düzenlemesi (stabilizasyon) ile birlikte tipik olarak göz önünde bulundurulur (Presada, Tilli ve Tonielli, 2024).

2. ÇİFT BESLEMELİ ENDÜKSİYON MOTORU MODELİ VE KONTROL YAKLAŞIMI

2.1. ÇBEM

ÇBEM'ler, belirli uygulama gereksinimlerine uygun olarak tasarlanmış ve optimize edilmiş özel indüksiyon motorlarıdır. Bu nedenle, her bir ÇBEM modeli, kullanılacağı uygulamanın gereksinimlerine göre değişiklik gösterebilir. Ancak genel olarak ÇBEM'nin enerji dönüşüm modeline bakıldığında hem stator hem de rotor üzerinde birer doğrultucu, invertör ve bunların arasından ise bir filtreleme devresi bulunmaktadır. ÇBEM, genellikle güç elektroniği devreleri ile çalışır. Bu devreler, motorun hızını kontrol etmek ve işletim koşullarına uyum sağlamak için güç akışını düzenler. Güç elektroniği devrelerinde genellikle, invertörler ve frekans dönüştürücüler gibi bileşenler kullanılır. Kontrol katı, rotor akımı düzeyini kontrol etmek için rotor devresi ve bu devrenin kontrolünü sağlayan bir kontrol stratejisi içerir. Kontrol stratejisi, motorun hızını, torkunu ve diğer performans parametrelerini istenen seviyede tutmak için geliştirilmiş bazı yöntemler içerir. Şekil 1'de çift beslemeli indüksiyon motorunun elektriksel kontrolünün genel yapısı verilmektedir.



Şekil 1. Çift beslemeli indüksiyon motorunun elektriksel kontrolünün genel yapısı (El Ouanjli, 2017).

2.1. ÇBEM matematiksel modeli

ÇBEM'in matematiksel modeli, motorun elektromekanik davranışını tanımlayan bir dizi diferansiyel denklem ve matris denklemleri ile ifade edilir. Motorun dinamik davranışlarını ifade eden bu denklemler genellikle bilgisayar simülasyonları veya kontrol tasarımı için kullanılır. Motorun hız kontrolü, tork kontrolü, güç faktörü iyileştirmesi, performans parametrelerini analiz

etmek ve optimize etmek için bir araç sağlar. Çalışmada kullanılan ÇBEM modeli Farançois Bonnet'in (Bonnet, 2013) doktora tezinden alınmıştır. Bu modelde, başlangıçta motorun bakır kaybını azaltmak hedeflendiği için, statik dönüştürücü kullanılmamıştır. Asıl amaç ÇBEM'in çalışmasına odaklanmak olduğu için model basitleştirilmiştir (Bonnet, 2012 ve Gillet, 2013).

$$f_s(t) = k x u(t) x t \text{ ve } f_R(t) = u(t) x t \quad (1)$$

Eşitlik 1'deki formülde yer alan:

$f_s(t)$: stator frekansının elektriksel ifadesi,

$f_R(t)$: rotor frekansının elektriksel ifadesi,

$u(t)$: sistemin kontrol değişkeni,

k : rotor ve statorun arasındaki frekans bölücü katsayısı,

Eşitlik 2'de yer alan formül frekans basamağını atlamak için kullanılır. Kullanılan kontrole göre (statik V/f kuralı) stator akımlarının etkin değeri şu şekildedir:

$$V_s(t) = f_s(t) x 2\pi x \Phi_{SN} \text{ ve } V_R(t) = f_R(t) x 2\pi x \Phi_{RN} \quad (2)$$

Φ_{SN} : nominal stator akısı,

Φ_{RN} : nominal rotor akısı,

$V_s(t)$: stator geriliminin etkin değeri,

$V_R(t)$: rotor geriliminin etkin değeri.

Eşitlik 3, Eşitlik 4, Eşitlik 5 ve Eşitlik 6'da verilen denklemlerde, gerilim sisteminin akı ile ifade edilmesi için sabit bir çerçeveye (Concordia temelleri) dönüştürülür.

$$\begin{bmatrix} V_{S\alpha} \\ V_{S\beta} \\ V_{R\alpha} \\ V_{R\beta} \end{bmatrix} = x L_{Mat}^{-1} \begin{bmatrix} \Phi_{S\alpha} \\ \Phi_{S\beta} \\ \Phi_{R\alpha} \\ \Phi_{R\beta} \end{bmatrix} + \frac{d}{dt} \begin{bmatrix} \Phi_{S\alpha} \\ \Phi_{S\beta} \\ \Phi_{R\alpha} \\ \Phi_{R\beta} \end{bmatrix} \quad (3)$$

$$R_{mat} = \begin{bmatrix} R_{SS} & 0 \\ 0 & R_{RR} \end{bmatrix} \quad (4)$$

$$R_{SS} = \begin{bmatrix} R_s & 0 \\ 0 & R_s \end{bmatrix}, \quad R_{RR} = \begin{bmatrix} R_R & 0 \\ 0 & R_R \end{bmatrix} \quad (5)$$

$$L_{mat} = \begin{bmatrix} L_S & 0 & M \cos \theta & -M \sin \theta \\ 0 & L_S & M \sin \theta & M \cos \theta \\ M \cos \theta & M \sin \theta & L_R & 0 \\ -M \sin \theta & M \cos \theta & 0 & L_R \end{bmatrix} \quad (6)$$

Akı ve akım arasındaki ilişki Eşitlik 7’de verilmektedir:

$$\begin{bmatrix} I_{S\alpha} \\ I_{S\beta} \\ I_{R\alpha} \\ I_{R\beta} \end{bmatrix} = L_{Mat}^{-1} \begin{bmatrix} \Phi_{S\alpha} \\ \Phi_{S\beta} \\ \Phi_{R\alpha} \\ \Phi_{R\beta} \end{bmatrix} \quad (7)$$

Eşitlik 7’de yer alan:

$L_S L_R$: döngüsel stator, rotor indüktansı

M : stator ve rotor arasındaki döngüsel indüktansı,

$R_S R_R$: stator rotor direnci,

$I_{S\alpha} I_{S\beta}$: α, β eksenlerindeki stator akımları,

$I_{R\alpha} I_{R\beta}$: α, β eksenlerindeki rotor akımları,

$V_{S\alpha} V_{S\beta}$: α, β eksenlerindeki stator gerilimleri,

$V_{R\alpha} V_{R\beta}$: α, β eksenlerindeki rotor gerilimleri,

$\Phi_{S\alpha} \Phi_{S\beta}$: α, β eksenlerindeki stator akısı,

$\Phi_{R\alpha} \Phi_{R\beta}$ α, β eksenlerindeki rotor akısı,

Rotor elektriksel konumu ve hız değeri Eşitlik 8’de verilmiştir.

$$\theta = \frac{d\omega}{dt} \text{ ve } \omega = 2\pi(f_s(t) - f_r(t)) \quad (8)$$

Model denklemleri, optimizasyon için uygun bir forma yerleştirilir. Durum vektör matrisi Eşitlik 9’da ve dinamik sistem matrisi Eşitlik 10’da verilmektedir.

Durum vektör matrisi: $X^* = AX + B(u) \quad (9)$

Dinamik sistem matrisi: $X = \begin{bmatrix} I_{S\alpha} \\ I_{S\beta} \\ I_{R\alpha} \\ I_{R\beta} \end{bmatrix} \quad A=R_{mat} \times L_{mat}^{-1} \quad (10)$

2.3. Balina Algoritması Tabanlı PI Parametrelerinin Optimizasyonunu

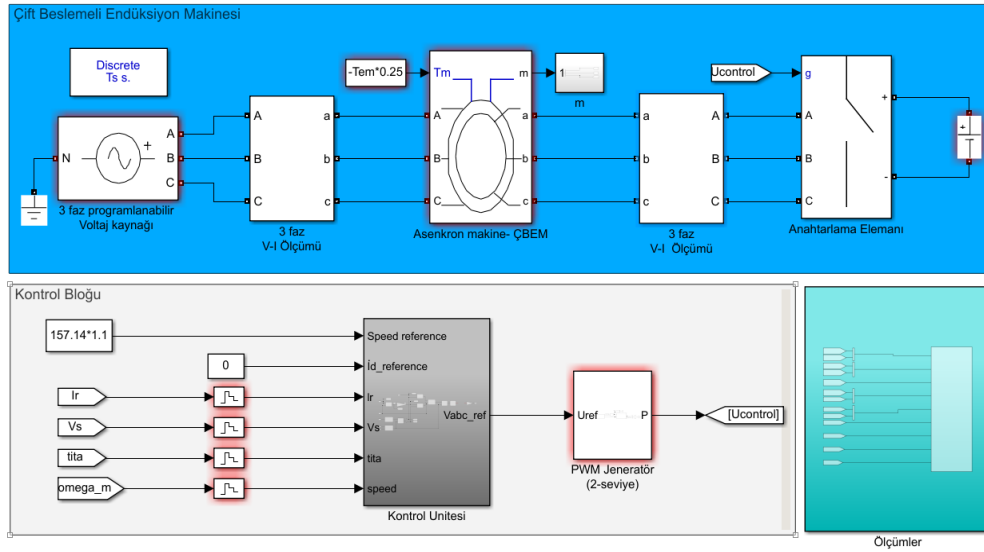
Birçok optimizasyon problemi, makul bir süre içinde, oldukça karmaşık kısıtlamalar altında, bir problemin en uygun çözümünü bulmayı amaçlar (Çelik, 2013). Bu çözümlerden biri olarak kullanılan BOA, doğal bir fenomen olan balinaların gruplar halinde avlanma stratejilerinden esinlenerek tasarlanmış bir sürü davranışı algoritmasıdır. Grubun lideri olan balina belirli bir hedefe doğru yön alırken diğer balinalar da onun etrafında gruplanır ve liderin izlediği yönü takip ederler 2016 yılında Mirjalili ve Lewis tarafından geliştirilen algoritma (Mirjalili, ve Lewis, 2016). Humpback balinalarının av arayışını, avı kuşatma ve balon ağı ile avlanma davranışını taklit eden üç operatörden oluşur. Burada her çözüm bir balina olarak kabul edilir. Balinaların av konumu aramak ve saldırmak için kullanılmak üzere iki mekanizması vardır. İlk olarak, avlar kuşatılır ve balon ağları oluşturur. Optimizasyon açısından, balinalar bir av aradığında, arama uzayının keşfi gerçekleşir ve saldırı davranışı sırasında ise sömürü gerçekleşir (Rostami, 2021). İlk keşfedilmesinin ardından BOA algoritması birçok farklı optimizasyon problemine ve özellik seçimine başarıyla uygulanmıştır. Mafarja ve Mirjalili 2017’de (Mafarja ve Mirjalili, 2017) geliştirdikleri çalışmada, hibrit bir BOA ile simüle edilmiş bir anma algoritması, özellik seçimi için geliştirilmiştir. Bu hibrit yöntemde, simüle edilmiş anma algoritmasının kullanılma amacı, BOA algoritması tarafından belirlenen en umut vadeden bölgeleri arayarak sömürüyü iyileştirmektir. Mafarja ve Mirjalili 2018’de, (Mafarja ve Mirjalili, 2018) geliştirdikleri çalışmada BOA tabanlı sargı özellik seçim algoritmasından bahsedilmektedir. BOA algoritmasının arama sürecinin keşfi ve sömürüsünü iyileştirmek için turnuva ve rulet çarkı seçim mekanizması ve ayrıca çaprazlama ve mutasyon operatörleri kullanılmıştır. Nematzadeh ve ark. (Nematzadeh vd. 2019) yaptıkları çalışmada, yüksek boyutlu tıbbi veri kümelerinde balina algoritması kullanarak frekans tabanlı bir filtre özellik seçim yöntemi tanıtmıştır. Bu yöntemde, BOA’nın gereksiz özelliklerini elemek için bir filtre kullanılmıştır. Ardından, kalan özellikler başka bir filtreleme yöntemi olan Mutual Congestion’a dayalı olarak sıralanır. Bu başlangıç çalışmalarının ardından BOA algoritması genellikle karmaşık ve çok boyutlu problemleri çözmek için kullanılan bir meta-sezgisel optimizasyon algoritması olarak pek çok çalışmada tercih edilmiştir. Özellikle global optimize edilmek istenen çok değişkenli fonksiyonların optimize edilmesinde oldukça başarılıdır.

BOA pseudo kod şu şekildedir (Karadeniz ve Çelik, 2020):

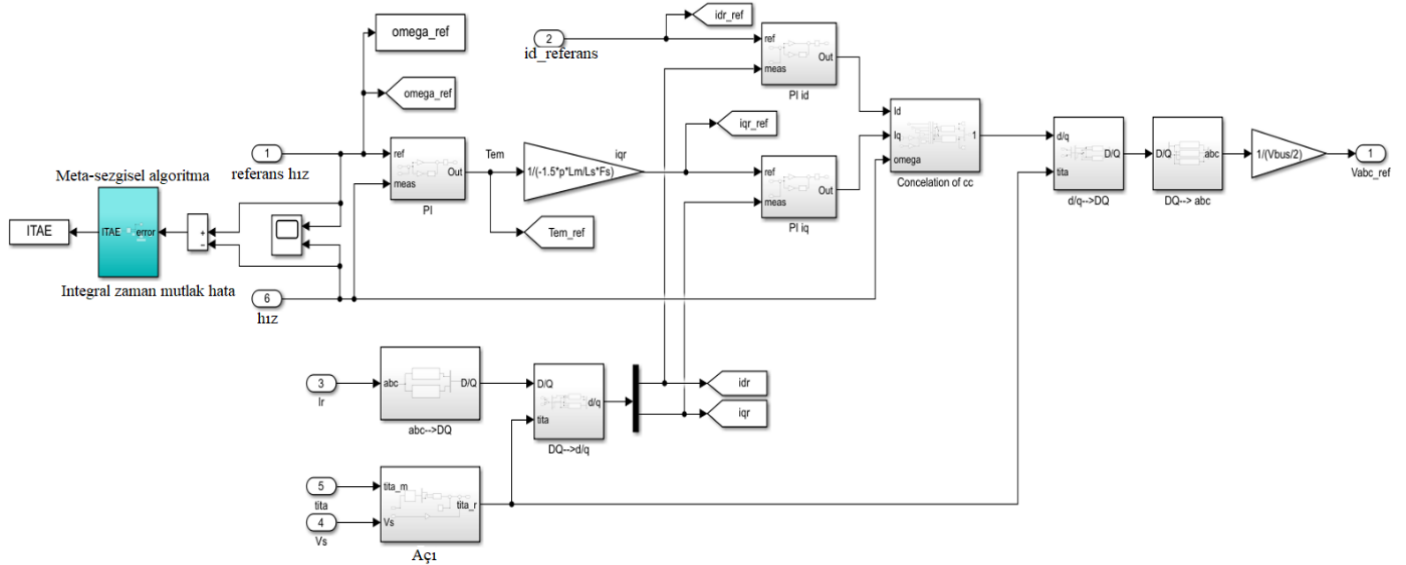
```
Initialize the population  $X_i$  ( $i=1,2,\dots,n$ )
//Her arama ajanının uygunluğunu hesaplayın
 $X^*$ =the best search agent
While ( $t < \text{Max\#iterations}$ )
    for (each search agent)
        update  $a$ ,  $A$ ,  $C$ ,  $l$  and  $p$ 
            if ( $p < 0.5$ )
                if ( $|A| < 1$ )
                    //Mevcut aramanın konumunu güncelle
                    else if ( $|A| \geq 1$ )
                        Select a random search agent ( $X_{rand}$ )
                        //Mevcut aramanın konumunu güncelle
                    end if
                else if ( $p \geq 0.5$ )
                    //Mevcut aramanın konumunu güncelle
            end if
        end for
    //Sınırların dışına çıkan bireyler için limit değerleri atayın
    //Amaç fonksiyonunun değerini hesaplayın
    //Daha iyi bir çözüm varsa arama ajanını güncelleyin.
     $t = t + 1$ ;
end while
return  $X^*$ 
```

3. SİMULASYON SONUÇLARI VE BULGULAR

Çalışmada gerçekleştirilen ÇBEM simülasyon çalışması Matlab/Simulink programında hazırlanmıştır. Şekil 2’de Asenkron makine bloğuyla gösterilen ÇBEM’nin 3 faz ile bağlantısı verilmektedir. Bu simülasyona göre motorun çift yönlü beslemesi ve Voltaj-akım ölçümleri gerçekleştirilmektedir. Motorun hareketleri “universal bridge” olarak adlandırılan anahtarlama elemanı ile sağlanmaktadır. Anahtarlama elemanının kontrolü PWM sinyali ile yapılmaktadır. PWM sinyalinin görev süresinin kontrolü PI kontrol bloğuyla sağlanmaktadır. Kontrol bloğunun detaylandırılmış modeli Şekil 3’te verilmektedir.

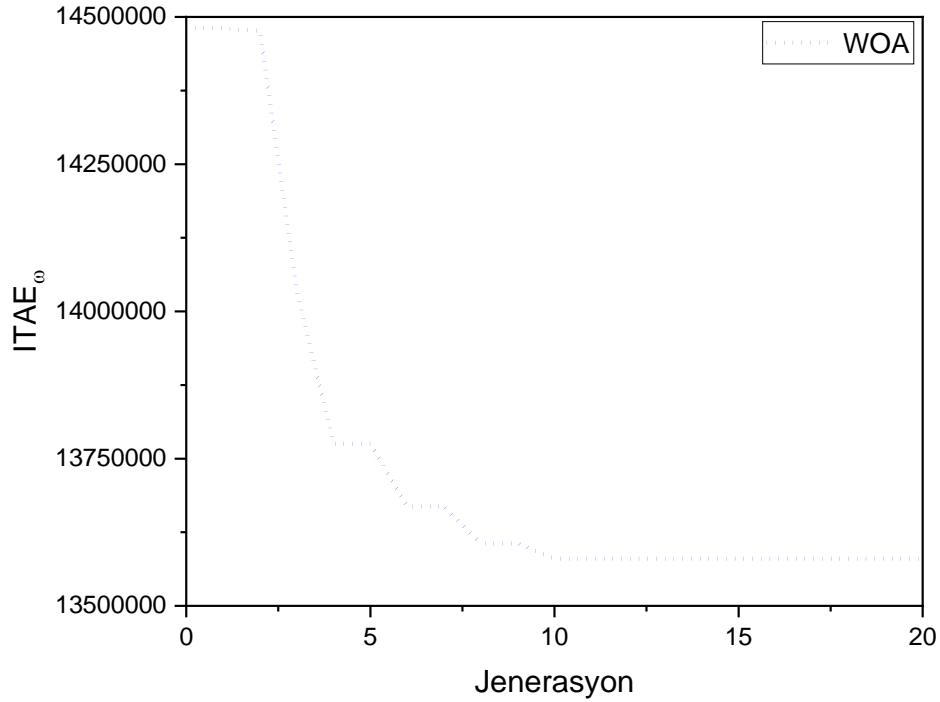


Şekil 2. Çift beslemeli endüksiyon makinesinin Matlab/Simulink programında oluşturulan modellemesi.



Şekil 3. Çift beslemeli endüksiyon motorunun kontrol bloğu.

Şekil 3'te verilen kontrol bloğunda görüldüğü gibi PWM sinyalinin kontrolü PI parametreleriyle gerçekleştirilmektedir. Parametre değerlerinin en uygun cevabı verecek şekilde ayarlanması için optimizasyon parametrelerinden olan Balina optimizasyonu kullanılmıştır. Optimizasyon parametreleri için buradaki gerçek hız ile referans değeri olarak belirlenen değer arasındaki fark olan hatadan uygunluk fonksiyonu (fitness function) hesaplanır. Modelde yer alan hatanın mutlak değerinin zaman ağırlıklı integrali (ITAE – Integral of Time-weighted Absolute Error) bloğu bu amaçla kullanılmıştır. Optimizasyon algoritmasının, popülasyon boyutu 50 ve maksimum iterasyon sayısı 50'dir. Sonuçların doğruluğu açısından, optimizasyon algoritması 20 kez çalıştırılmıştır. PI denetleyici parametrelerinin değer aralığı (0 - 1) olarak belirlenmiştir. Optimizasyon algoritmasının belirlenen referans değerleri için uygunluk değerindeki değişimin grafikleri Şekil 4'te verilmiştir.



Şekil 4. Uygunluk fonksiyonu değerleri.

Ayrıca algoritmanın ITAE sonucu Tablo 1'de, optimizasyon algoritmaları tarafından belirlenen PI denetleyici parametreleri Tablo 2'de sunulmaktadır.

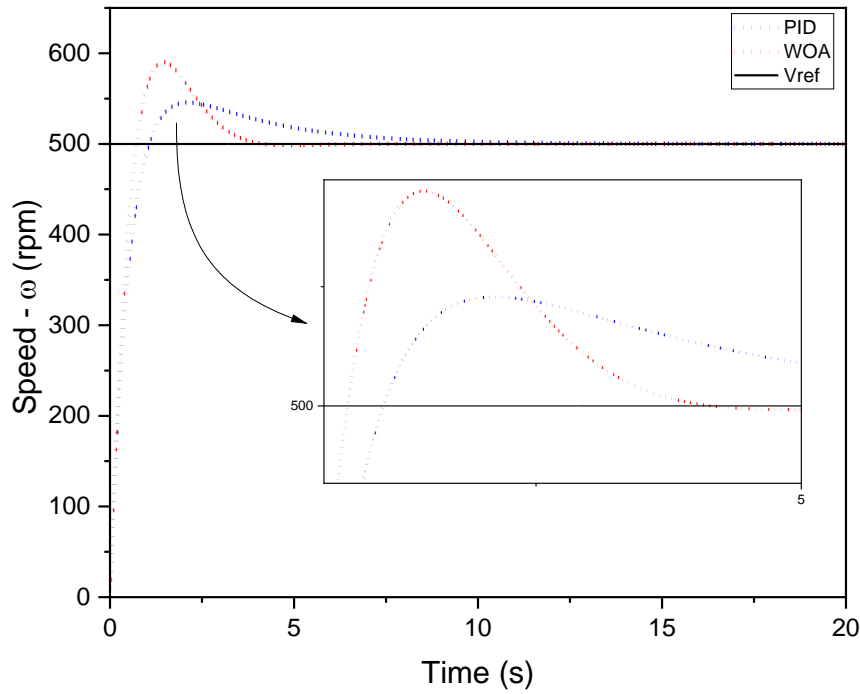
Tablo 1. Uygunluk değeri

Referans hız	BOA
500 rpm	1.3580x10 ⁷

Tablo 2. Belirlenen PI parametreleri.

Algoritma	k_p	k_i
PI	0.7870	0.0059
BOA	0.9699	0.3268

Şekil 5'te mavi renk ile ifade edilen grafik balina optimizasyonu ile ayarlanmış; kırmızı renk ile ifade edilen grafikte ise geleneksel yöntem olan Ziegler-Nichols yöntemi ile ayarlanmış PI parametre değerleri için elde edilen sonuçlar görülmektedir. Klasik yöntem ile ayarlanan PI parametre sonucu aşım miktarı açısından avantajlıdır. Bunun dışında yerleşme zamanı ve yükselme zamanı açısından balina optimizasyon algoritması ile daha başarılı sonuçlar elde edilmiştir.



Şekil 5. ÇBEM'nin (ω) hız grafiği. BOA: balina optimizasyon algoritması; PI kontrolcü.

Optimizasyon algoritmasına dayalı hız (ω) grafiğine göre performans karşılaştırmaları, aşım miktarı, yerleşme süresi ve yükselme süresi değerlerine göre Tablo 3'te verilmiştir. Hız (ω) tepkisinde en düşük aşım değeri PI denetleyicide meydana gelir. En büyük aşım değeri BOA'da gözlemlenir. En düşük ve en yüksek aşım değerleri arasında yaklaşık iki kat fark bulunmaktadır.

Yerleşme süresi açısından en iyi sonuç BOA'dan elde edilir. En uzun yerleşme süresi PI denetleyicide gözlemlenir. En kısa ve en uzun yerleşme süreleri arasındaki fark %91'dir. Yükselme süresi açısından en iyi sonuç BOA'dan elde edilir. En uzun yükselme süresi PI denetleyicide gözlemlenir. En kısa ve en uzun yükselme süreleri arasındaki fark %35'tir.

Algoritma	Aşım miktarı (%)	Yerleşme süresi (s)	Yükselme süresi (s)
PI	9.1307	6.4128	0.7335
BOA	18.0210	3.3566	0.5421

Tablo 3. Hız değerinde (ω) kontrolcü performansı

KAYNAKÇA

- Bogalecka, E., & Kzreminski, Z. (1993). Control system of a doubly fed induction machine supplied by current controlled voltage source inverter. Proceedings of the IEE Conference on Electrical Machines and Drives 1996, London, UK (pp. 168–172).
- Bonnet, F. (2012) Contribution à l'Optimisation de la Commande d'une Machine Asynchrone à Double Alimentation utilisée en mode Moteur » pp. 43-49, Ph-D Thesis, INP-Toulouse. <http://ethesis.inp-toulouse.fr/archive/00000679/01/bonnet.pdf>
- Çelik, Y. (2013). Optimizasyon problemlerinde bal arıları evlilik optimizasyonu algoritmasının performansının geliştirilmesi, Konya: Selçuk Üniversitesi Fen Bilimleri Enstitüsü Doktora Tezi, 2013.
- El Ouanjli, N., Derouich, A., El Ghzizal, A., Chebabhi, A., & Taoussi, M. (2017, November). A comparative study between FOC and DTC control of the Doubly Fed Induction Motor (DFIM). In 2017 International Conference on Electrical and Information Technologies (ICEIT) (pp. 1-6). IEEE.
- Gillet, J., David, M. P., & Messine, F. (2013, June). Optimization of the control of a doubly fed induction machine. In 2013 IEEE 11th International Workshop of Electronics, Control, Measurement, Signals and their application to Mechatronics (pp. 1-5). IEEE.
- Hopfensperger, B., Atkinson, D. J., & Lakin, R. A. (2000). Stator-flux oriented control of a doubly fed induction machine with and without position encoder. Electric Power Applications, IEE Proceedings, 147(4), 241–250.
- Karadeniz, A., & Çelik, Y. (2020). Whale optimization algorithm for numerical constrained optimization. Academic Platform-Journal of Engineering and Science, 8(3), 547-554.
- Leonhard, W. (1995). Control of electric drives. Berlin, Germany: Springer
- Mafarja, M. M., & Mirjalili, S. (2017). Hybrid whale optimization algorithm with simulated annealing for feature selection. Neurocomputing, 260, 302-312.
- Mafarja, M., & Mirjalili, S. (2018). Whale optimization approaches for wrapper feature selection. Applied Soft Computing, 62, 441-453.
- Mirjalili, S., & Lewis, A. (2016). The whale optimization algorithm. Advances in engineering software, w95, 51-67.
- Nematzadeh, H., Enayatifar, R., Mahmud, M., & Akbari, E. (2019). Frequency based feature selection method using whale algorithm. Genomics, 111(6), 1946-1955.
- Pena, R., Clare, J. C., & Asher, G. M. (1996a). Doubly fed induction generator using back-to-back PWM converters and its applications to variable-speed wind-energy generation. Electric Power Applications, IEE Proceedings, 143(3), 231–241.

- Pena, R., Clare, J. C., & Asher, G. M. (1996b). A doubly fed induction generator using back-to-back PWM converters supplying an isolated load from a variable-speed wind turbine. *Electric Power Applications, IEE Proceedings*, 143(5), 380–387.
- Peresada, S., Tilli, A., & Tonielli, A. (1999b). Robust output feedback control of a doubly fed induction machine. *Proceedings of the IEEE Annual Conference of Industrial Electronics Society IECON'99*, San Jose, CA, USA (pp. 1348–1354).
- Peresada, S., Tilli, A., & Tonielli, A. (2004). Power control of a doubly fed induction machine via output feedback. *Control Engineering Practice*, 12(1), 41-57.
- Rostami, M., Berahmand, K., Nasiri, E., & Forouzandeh, S. (2021). Review of swarm intelligence-based feature selection methods. *Engineering Applications of Artificial Intelligence*, 100, 104210.
- Xu, L., & Cheng, W. (1995). Torque and reactive power control of a doubly fed induction machine by position sensorless scheme. *IEEE Transactions on Industry Applications*, 31(3), 636–642.
- Walczyna, A. (1991). Comparison of the dynamics of the DFM in field and rotor axes. *Proceedings of the EPE Conference 1991*, Florence, Italy (pp. 231–236).
- Yamamoto, M., & Motoyoshi, O. (1992). Active and reactive power control for doubly fed wound rotor induction generator. *IEEE Transactions on Power Electronics*, 6(4), 624–629.

1.2379 SOĞUK İŞ TAKIM ÇELİĞİNDE TEKRARLI CO₂ LAZER HATTI İŞLEMLERİNDEN KAYNAKLANAN YÜZEY MORFOLOJİSİ DEĞİŞİKLİKLERİNİN KARAKTERİZASYONU

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ÖZET

Günümüzde sektörel uygulamalar yüksek aşınma direnci, iyi korozyon direnci, sertlik gibi belirli yüzey özelliklerine sahip malzemelerin kullanımı gerektirmektedir. Ancak bu özellikleri taşıyan malzemeler genellikle yüksek maliyete sahip olduğu için malzemelerin gereksinimleri karşılayabilmesi amacıyla maliyetlerinin azaltılması konusunda araştırmalar yapılmaktadır. Bu kapsamda nispeten uygun maliyetli bir teknik olan lazer ile yüzey işleme tekniği ile lazer ışınının ısısını kullanarak ve malzeme yüzeyinde kontrollü termal etkiler oluşturularak malzeme yapısı ve fiziksel özellikleri değiştirmektedir. Böylece malzemelerin yüzey özelliklerinde iyileşme kaydedilmektedir. Bu amaçla bu çalışmada 1.2379 soğuk iş takım çeliği yüzeyine CO₂ lazer ile 1

mm/s ilerleme hızı ve ortalama 105 W lazer gücünde 1 ile 10 arasında değişen tekrar sayısı ile ön yüzey işlemleri uygulanmıştır. Tekrarlanan lazer darbeleri ile malzemenin yüzey topoğrafyasının nasıl değiştiği optik profilometre cihazı yardımıyla incelenmiştir. Yapılan çalışmada, numunelerin yüzey topoğrafyaları analiz edilirken, CO₂ lazer hattı işlemlerinin tekrar sayısı ile yüzey pürüzlülüğünü temsil eden Sa (ortalama alansal yüzey pürüzlülük değeri) arasında bir ilişki tespit edilmiştir. Tekrar sayısının 1'den 3'e çıkarılmasıyla Sa değeri de 2.719 µm'den 5.754 µm'ye önemli ölçüde artmıştır. Üçüncü tekrarın ardından ise Sa değeri nispeten yüksek bir aralıkta dalgalanma sergilemiştir. Profilin ortalama kare yüksekliği olarak da bilinen pürüzlülük değeri Sv ve tanımlanan alan içindeki en büyük tepe yüksekliği ile en büyük çukur derinliği değerinin toplamı olarak tanımlanan Sz değerlerinde de benzer eğilimler söz konusudur. Bununla birlikte lazer tekrar sayısına bağlı olarak oluşan çizgi kesitleri incelendiğinde tek tekrarda elde edilen en iyi simetrik ve düzgün geometriye sahip olduğu ve tekrar sayısının artmasıyla çizgi kesit geometrisindeki simetrinin bozulduğu gözlemlenmiştir.

Anahtar Kelimeler: Soğuk İş Takım Çeliği, Lazer, Optik Profilometre, Ön Yüzey İşlemi, Yüzey Topografyası

CHARACTERIZATION OF SURFACE MORPHOLOGY CHANGES IN COLD WORK TOOL STEEL 1.2379 FROM REPETITIVE CO₂ LASER LINE OPERATIONS

ABSTRACT

Nowadays, sectoral applications require the use of materials with certain surface properties such as high wear resistance, good corrosion resistance and hardness. However, since materials with these features generally have high-costs, research is being carried out to reduce the costs of the materials in order to meet the requirements. In this context, the laser surface treatment technique, which is relatively affordable technique, changes the material structure and physical properties by using the heat of the laser beam and creating controlled thermal effects on the material surface. For this purpose, in this study, surface pretreatment was applied to 1.2379 cold work tool steel surfaces with CO₂-laser at a feed rate of 1 mm/s and an average laser power of 105 W, with a number of repetitions ranging from 1 to 10. How the change in the surface topography of the material changes with repeated laser pulses was examined with the help of optical-profilometer device. While analyzing the surface topographies of the samples, a relationship was

detected between the number of repetitions of CO₂-laser line processes and Sa (average-areal-surface-roughness-value), which represents the surface roughness. By increasing the number of repeats from 1 to 3, the Sa value increased significantly from 2.719 μm to 5.754 μm . After the third repetition, the Sa value fluctuated in relatively high range. There are similar trends in the roughness value Sv (the average square height of the profile) and the Sz (the sum of the largest peak height and the largest pit depth value) within the defined area. However, when the line sections formed depending on the number of laser repetitions were examined, it was observed that the one obtained in a single repetition had the best symmetrical and smooth geometry, and as the number of repetitions increased, the symmetry in the line section geometry was disrupted.

Keywords: Cold Work Tool Steel, Laser, Optical Profilometer, Surface Pretreatment, Surface Topography

1. INTRODUCTION

Automating the final polishing operation for large metallic surfaces in the die, tool and mold industry presents a significant opportunity to reduce manufacturing time, lower production costs, and shorten lead times. By implementing automated polishing processes, manufacturers can achieve greater efficiency and consistency in surface finishing while reducing reliance on highly skilled manual labor (Ukar et al., 2010). In automotive applications, cold forging is a widely utilized method for producing medium and small-sized components such as constant velocity joints, input/output shafts, sun gears in automatic transmissions, pinion shafts for steering systems, and space frame components. However, enhancing tool life in the cold forging process is a significant demand within the industry to improve efficiency and reduce production costs. Surface structuring by laser melting presents a novel approach to addressing this demand (Temmler et al., 2019). Laser accompanied with shock peening, cleaning, transformation hardening, glazing, surface alloying, surface cladding and laser surface melting. The advantages of laser surface melting are being highly adaptable to manufacture, due to software control, and possibilities in automation. The others are shortening of lead times for product development, smooth surfaces, resulting reduced work after processing (Yasavol et al., 2013). Unlike traditional methods that involve material removal, laser melting operates on a unique active principle where no material is subtracted; instead, it is redistributed in the liquid phase. One of the key advantages of the laser process is the achievement of a low micro roughness on the surface (Temmler et al., 2019).

During the laser polishing process, the energy from the laser beam is directed onto the surface of the workpiece, aiming to alter its topographic profile through interactions between the laser and the material. Regardless of whether it's conducted at the macro or micro scale, remelting is the primary mechanism involved in laser polishing. This process involves the formation of a molten pool of material on the surface, which then redistributes around the area adjacent to each initial surface irregularity under the influence of surface tension. As a result, surface asperities, or irregularities, are typically diminished during a well-executed laser polishing operation. This leads to significant reductions in surface roughness, whether analyzed in one or two dimensions (Bordatchev et al., 2014). In recent years, considerable progress has been made in laser melting applications on metal surfaces. The surface polishing of SKD61 tool steel specimens was carried out using a microsecond fiber laser system. The operating conditions of laser controlling factors and fluence for the minimization of the areal average surface roughness (S_a), wear rate and friction coefficient were determined. The results showed that the laser fluence was the dominant factor for S_a and the pattern of surface roughness. The average areal surface roughness obtained at various fluences can be regressed well by a concave curve. The polished surfaces had S_a values greater than that of the as-received specimen if the fluence was either insufficient or excessively high (Chang et al., 2016). A novel laser polishing-hardening method with integration and high efficiency for the treatment of AISI D2 tool steel using a large-size laser beam was proposed, and the effects of laser hardening, laser polishing and laser polishing-hardening treatments on the surface topography and microhardness were examined. The results showed that the laser hardening method had a negligible effect on the surface roughness of the treated sample, while the surface roughness R_a of laser polishing and laser polishing-hardening specimens was reduced by 74.6% and 80.9%, respectively (Liu et al., 2022). The research conducted on laser micro polishing of tool steel 1.2379 (AISI D2) using a square, top-hat shaped intensity distribution aimed to understand the influence of different quadratic laser beam sizes (100 μm , 200 μm , 400 μm side length) and fluences up to 12 J/cm^2 on surface topography and roughness. A significant increase in laser fluence above the polishing laser fluence led to a change of the discrete, pulsed remelting process to a continuous remelting process. Particularly in the continuous remelting process, macro-roughness was partially increased, and surface rippling was observed (Temmler, et al., 2021). The research investigated the initiation conditions for the formation of ultra-short pulse laser-induced periodic structures (LIPSS) and sub-nano

structures on the surface of stainless steel. Regardless of the scanning speed and polarization configuration, the study found that the width of the induced structures increased as the irradiation fluence increased. This indicates a direct correlation between fluence and structure width. Higher fluences lead to broader structures on the stainless steel surface (Choi, et al., 2012).

In the light of literature survey, it is considered that the change in the surface topography of cold work tool steel 1.2379 material is a subject that needs to be examined in detail with repeated laser pulses. In this study, pre-surface treatments were performed with CO₂ laser on the surface of cold work tool steel 1.2379 at different laser pulses (1-10). Surface roughness, track width and depth values were determined depending on the number of laser pulse repetitions. After laser treatments, the material surfaces were imaged with the help of a 3D optical profilometer device and the outputs obtained were presented.

2. MATERIALS AND METHODS

2.1. Material

In this study, 1.2379 cold work tool steel with high carbon and chromium content was preferred as the main material. This material has high wear resistance and toughness and is suitable for surface treatments. 1.2379 cold work tool steel was supplied from Korkmaz Çelik, Istanbul/Turkiye and its chemical composition is shown in Table 2.1.

Tablo 2.1. Chemical Composition of 1.2379 cold work tool steel (Korkmaz Çelik, 2024)

C	Si	Mn	P	S	Cr	Mo	V	W	Ni
1.45	0.10	0.20	0.03	0.03	11.00	0.60	0.90	-	-

2.2. Laser Processing

The schematic diagram of the 130 W gas-fed laser equipment used to create a notch on cold work steel 1.2379 plate is depicted in Fig. 2.1. Different gases can be fed into the laser device, but air was utilized in this study. The wavelength of the laser employed is 10,600 nm. The laser parameters chosen for the experiment are as follows: feed speed of 1mm/s, average laser power of 105 W, and stand-off distance of 5 mm. Laser power is generated at 25 kHz with an 81% duty cycle, resulting in a laser pulse duration of 32.4 µs. The air inlet, which can be supplied with alternative gases when required, serves as a protective gas, eliminating molten residues in the cutting area and safeguarding the lens from resultant fumes. A vacuum system is employed to remove the resulting particles and smoke.

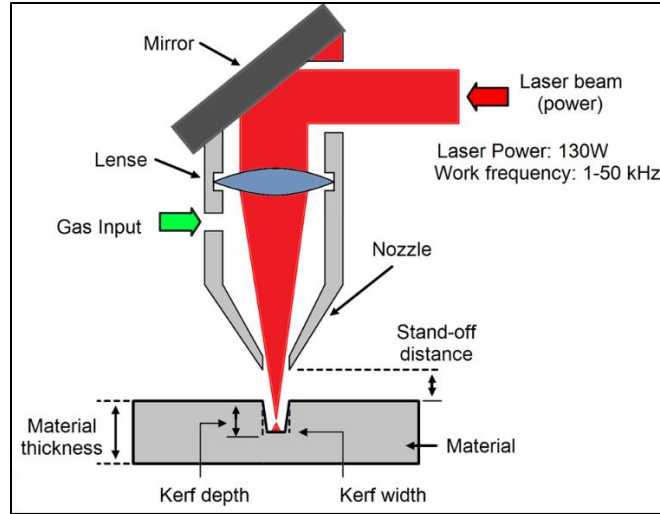


Figure 2.1. Schematic diagram of the experimental setup used to cold work steel 1.2379 plate

2.3. Surface Characterization

Surface topographic analysis of the lines appearing depending on the number of repetitions on cold work steel 1.2379 plate and characterization of the depth, width, and superficial roughness of the line were carried out with the help of a non-contact laser profilometer (Fig. 2.2). The analysis was measured with a Nanovea 3D Non-Contact Profilometer PS50 (Nanovea, 6 Morgan Ste156, Irvine, CA, USA) equipped with Mountain Software version 6.2.7487 (DigitalSurf) software. An area of 0,5 x 1 mm² was scanned for each parameter with a profilometer at a velocity of 0.1 mm/s and steps of 1 μm in both X and Y directions. The acquisition rate for profilometer surface scanning was selected as 1000 Hz.

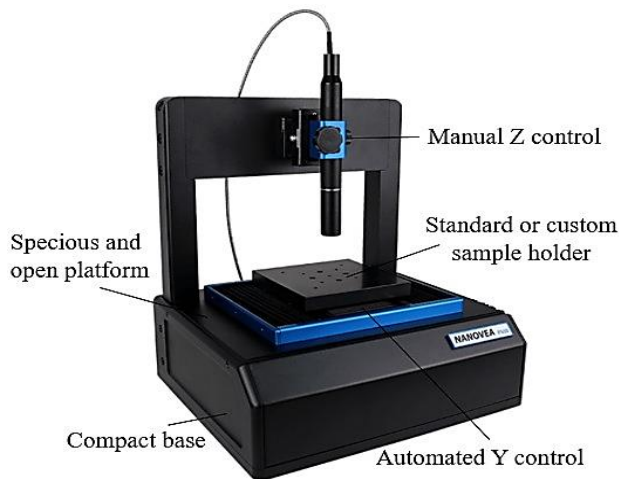


Figure 2.2. 3D optical profilometer device

3. RESULTS AND DISCUSSION

In Fig. 3.1, the three-dimensional surface topographies of the lines created by the CO₂ laser on the cold work steel 1.2379 plate surfaces are shown, depending on the number of repetitions. Homogeneous line geometries were observed to be formed homogeneously and symmetrically on the material surface after single, 2, and 3 repeated surface line creation processes. However, it was observed that the line symmetry and surface textures deteriorated as the number of repetitions increased after 3 repetitions. Guo et al., 2012 stated that the surface gradually became coarser when the pulse energy was increased. It was clearly determined from surface 3D topographies of lines that the number of repetitions affected the surface roughness values. The trend of the data illustrated the increase in surface roughness with an increase of the irradiated pulse energy.

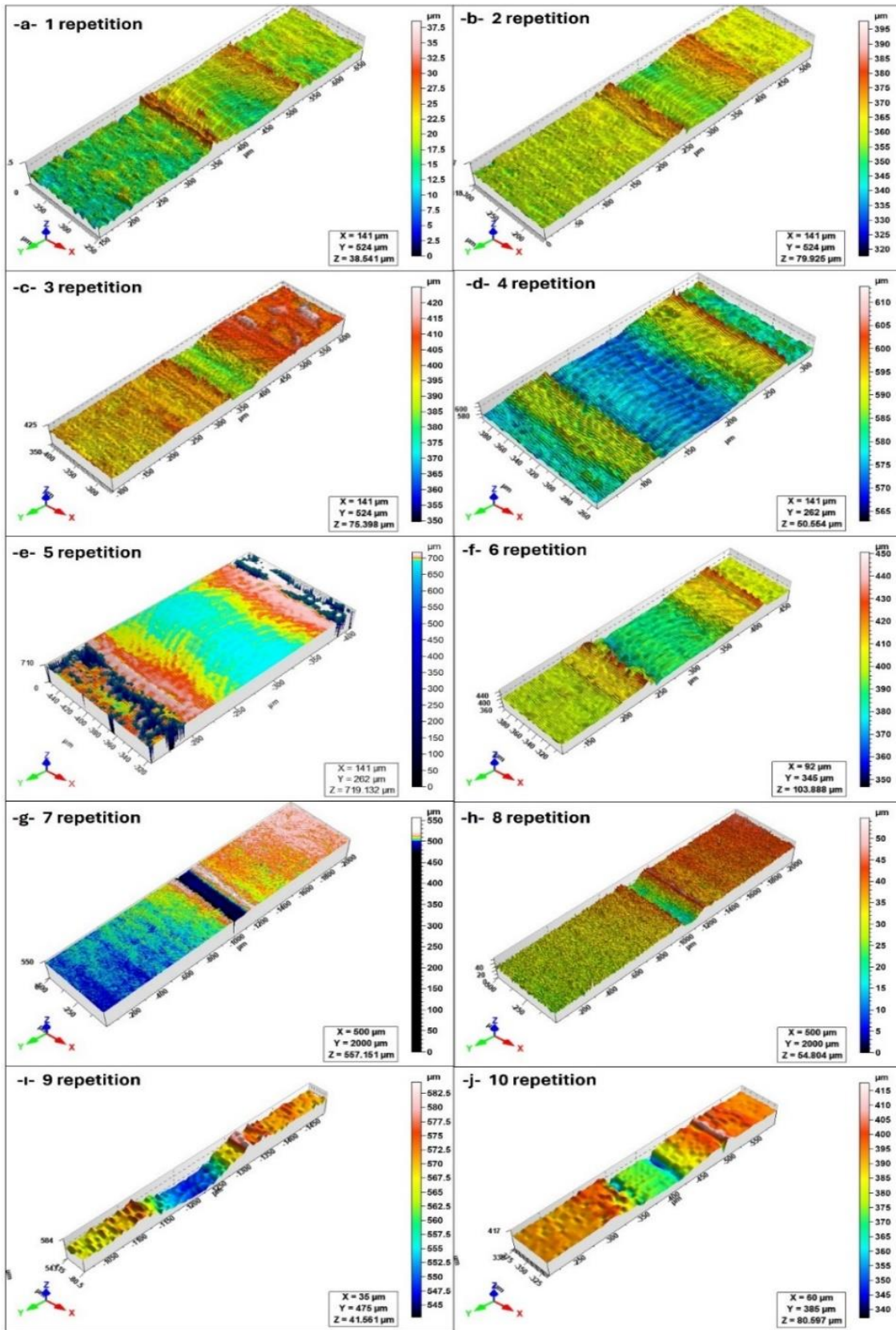


Figure 3.1. Surface 3D topographies of lines induced by CO₂ laser

The roughness value S_a , also known as the arithmetic mean deviation of the profile, is defined as the average height deviation of the surface profile from the mean line within a specified sampling length. It provides a measure of the surface roughness, with higher S_a values indicating a rougher surface and lower S_a values indicating a smoother surface. When analyzing the surface topographies from Fig. 3.2., a relationship between the repetition number of CO₂ laser line operations and the S_a value, which represented the surface roughness, was observed. Initially, as the repetition number increased from 1 to 3, a significant increase in the S_a value from 2,719 μm to 5,754 μm was noted, indicating a roughening of the surface. It was suggested that additional repetitions led to increased material removal and deeper penetration into the the cold work steel 1.2379 surfaces, resulting in higher roughness. However, beyond the third repetition, the S_a value fluctuated around a relatively high range, indicating that further increased in repetition number did not consistently increase roughness values. This could be attributed to various factors such as material properties, laser parameters, and heat accumulation effects, which may reach a plateau or exhibit diminishing returns in terms of surface roughness with higher repetition numbers. Overall, the relationship between repetition number and S_a value demonstrated the complex interplay between laser processing parameters and surface morphology alterations in the cold work steel 1.2379 material.

The roughness value S_v , also known as the root mean square height of the profile, is defined as the root mean square deviation of the surface profile from the mean line within a specified sampling length. It provides a measure of the surface roughness, with higher S_v values indicating a rougher surface and lower S_v values indicating a smoother surface. From Fig. 3.2, a relationship between the repetition number of CO₂ laser line operations and the S_v value, which represented the surface roughness was observed. Initially, as the repetition number increased from 1 to 3, a significant increase in the S_v value from 18,932 μm to 50,638 μm was determined. It was thought that additional repetitions caused to occur deeper penetration into the material surfaces. Up to third repetitions, the S_v values of the cold work steel samples fluctuated.

S_z is defined as the sum of the largest peak height value and the largest pit depth value within the defined area. When the data provided in Figure 3 was examined, a relationship between the repetition number of CO₂ laser line operations and the S_z value could be discerned. First of all, as the repetition number increased to 3, there was a substantial increase in the S_z value (38,541 $\mu\text{m}/1$ repetition - 75,398 $\mu\text{m}/3$ repetition), indicating an escalation in the surface roughness. It was determined that additional repetitions caused larger peak heights and

pit depths within the defined area. However, as the repetition number continued to increase, fluctuations in the Sz value were observed. For instance, while the Sz value peaked at 103,888 μm for the sixth repetition, it decreased to 27,230 μm for the fifth repetition. This variability in the Sz value may be attributed to various factors such as material properties, laser parameters, and the formation of surface irregularities during laser processing.

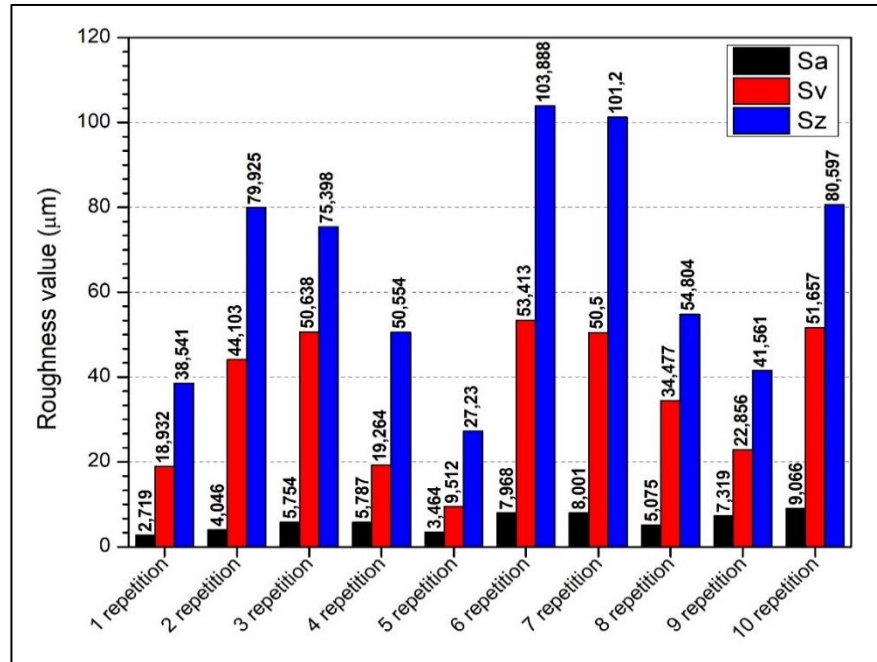


Figure 3.2. Comparison of Sa, Sv and Sz roughness parameters according to the number of repetitions of lines created with CO₂ laser

In Fig. 3.3, cross-sectional views of the lines created depending on the number of laser repetitions were displayed. Measurements made for cross-sectional area comparison were indicated by red areas in the sections. Upon examination of the line sections formed depending on the number of laser repetitions, it was clearly observed that the line section with symmetrical and smooth geometry was the best obtained in a single repetition. As the number of repetitions began to increase, it was evident that the symmetry in the line section geometry was disrupted. It was concluded that the heat and deformations occurring in the material base made it difficult to create a symmetrical line section. Irregular and non-geometric line sections in the material topography resulted from heat-related deformations in the material.

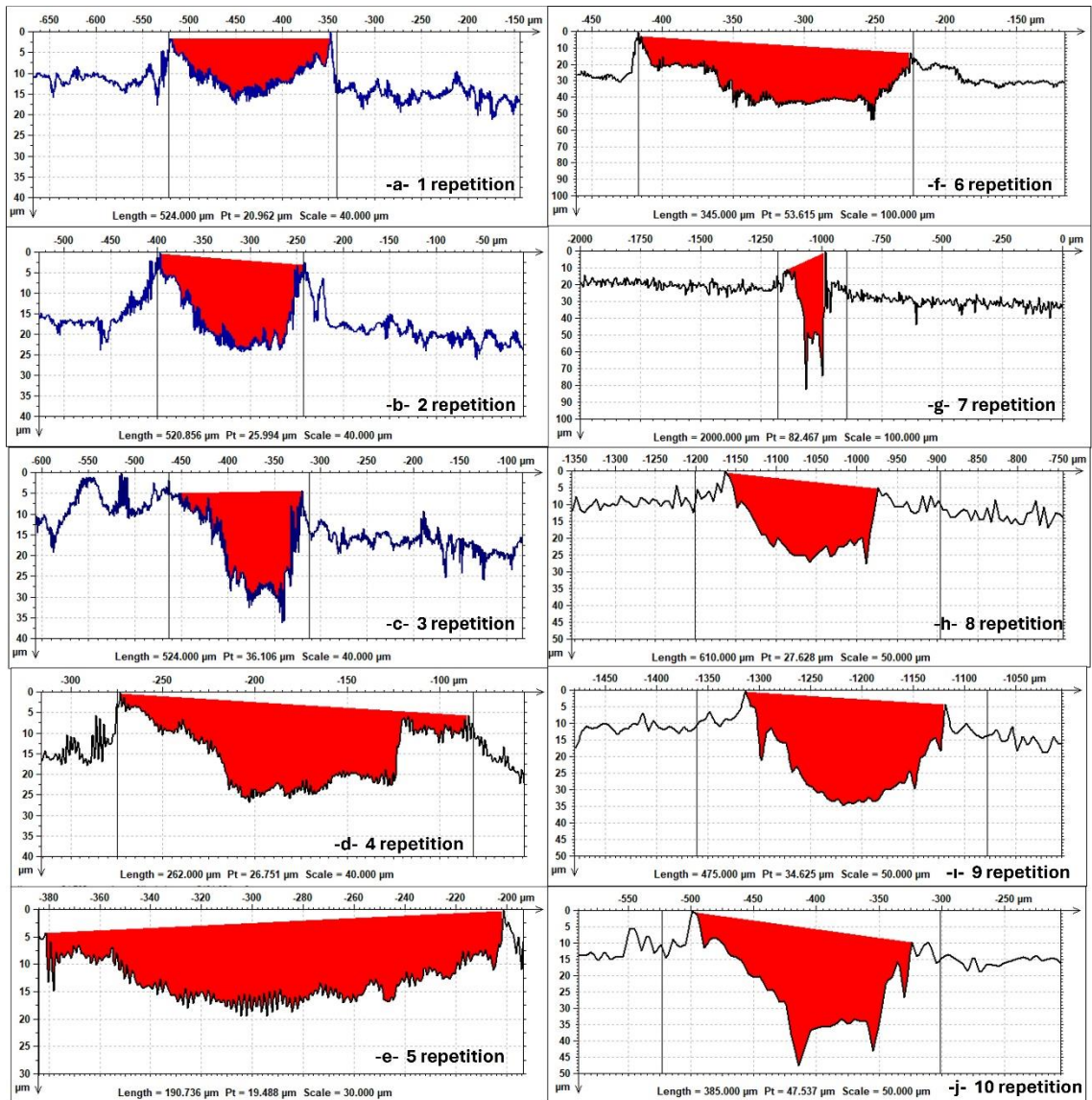


Figure 3.3. Comparative cross-sectional images and line cross-section areas according to the number of repetitions of lines created with CO₂ laser

The depth of the lines formed in the steel material can be altered by repeated laser pulses of the same power. Several factors contribute to the line depth during the laser process. Upon examination of Fig. 3.4., it was observed that the line depth was increased through the utilization of repeated laser pulses at constant power. Deeper lines were generally created with higher laser power. However, a linear relationship in this change may not always be evident. Upon careful examination of the Fig. 3.4., it was noted that the depth increased up to three repetitions and began to decrease after the four repetitions. This phenomenon may be attributed to phase changes. Nonetheless, after number of repetition 5, the line depth began increasing again.

Following the phase change in the eighth repetition, the depth started to decrease once more. Upon analysis of the line width in Fig. 3.4., a contrasting characteristic with the line depth was observed. Depending on the laser power, the width value commenced decreasing as the depth increased. The thermal conductivity and melting point of the steel material influenced the effect of laser pulses and, consequently, the notch depth. The contrast between line width and depth during laser processing of metals was influenced by the nature of the machining process and material behavior. A thermal impact zone was created on the material by the laser beam during processing, where the material underwent heating, melting, and evaporation. Laser materials processing with ultra-short pulses allowed very precise and high quality results with a minimum extent of the thermally affected zone. However, with increasing average laser power and repetition rates the so-called heat accumulation effect became a considerable issue (Liu et al., 2022).

The line width was determined by the beam width at the point where the laser was focused, while the line depth was generally influenced by the extent of material heating and evaporation. Wider and deeper lines were typically observed with higher laser powers. Following material melting and evaporation, material flew within the notch may occur, potentially increasing the line width while reducing the depth. Additionally, rapid cooling and solidification of the material can cause the depth of the line to decrease faster than its width.

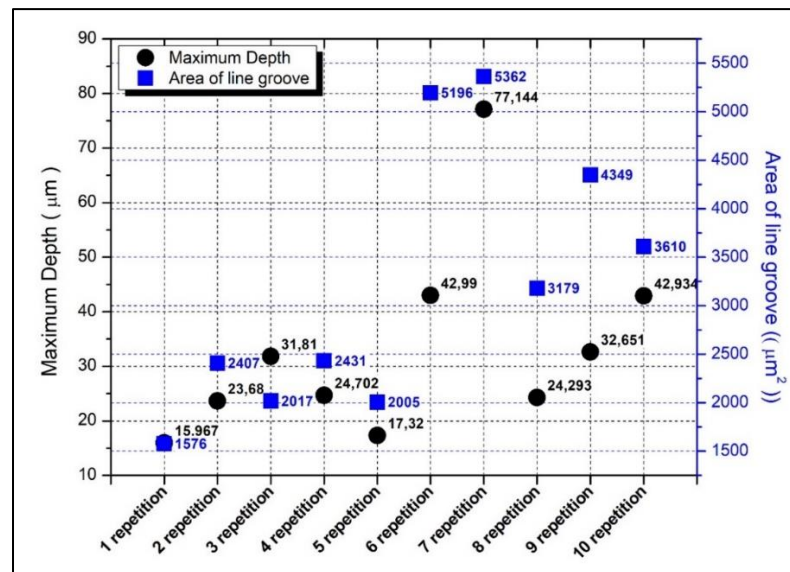


Figure 3.4. Comparison of maximum depth and area of line groove according to the number of repetitions created with CO₂ laser

4. CONCLUSION

In this study, surface pretreatment was applied to 1.2379 cold work tool steel surfaces with CO₂ laser at a feed rate of 1 mm/s and an average laser power of 105 W, with a number of repetitions ranging from 1 to 10. How the change in the surface topography of the material changes with repeated laser pulses was examined with the help of a 3D optical profilometer device. The results obtained in the study are as follows:

- While analyzing the surface topographies of the samples, a relationship was detected between the number of repetitions of CO₂ laser line processes and Sa (average areal surface roughness value), which represents the surface roughness. By increasing the number of repeats from 1 to 3, the Sa value increased significantly from 2.719 μm to 5.754 μm . After the third repetition, the Sa value fluctuated in a relatively high range.
- A relationship was observed between the number of repetitions of CO₂ laser line operations and the Sv and Sz values representing the surface roughness. Initially, as the number of repetitions increased from 1 to 3, a significant increase in Sv value was detected from 18.932 μm to 50.638 μm . Similarly, as the number of repetitions increased to 3, a significant increase occurred in the Sz value (38.541 $\mu\text{m}/1$ repetition - 75.398 $\mu\text{m}/3$ repetitions). This indicates high surface roughness. After the third repetition, fluctuations were detected in the Sv and Sz values of the samples.
- When the line sections formed depending on the number of laser repetitions were examined, it was observed that the one obtained in a single repetition had the best symmetrical and smooth geometry, and as the number of repetitions increased, the symmetry in the line section geometry was disrupted.
- The depth of the lines formed on the steel material can be changed with repeated laser pulses of the same power. It has generally been found that line depth was increased by using repeated laser pulses at constant power. However, it had been observed that the width values begin to decrease as the depth increases depending on the laser power.
- In future studies, it is aimed to increase the laser parameters to be examined and to conduct studies to examine the effects of different surface pretreatments on the surface morphology.

REFERENCES

- Ukar, E., Lamikiz, A., López de Lacalle, L.N., del Pozo, D., Arana, J.L. 2010. Laser polishing of tool steel with CO₂ laser and high-power diode laser. *International Journal of Machine Tools and Manufacture*, 50(1), 115-125, <https://doi.org/10.1016/j.ijmachtools.2009.09.003>.
- Temmler, A., Comiotto, M., Ross, I., Kuepper, M., Liu, D. M., & Poprawe, R. 2019. Surface structuring by laser remelting of 1.2379 (D2) for cold forging tools in automotive applications. *Journal of Laser Applications*, 31(2), 022017. <https://doi.org/10.2351/1.5070077>.
- Yasavol, N., Abdollah-zadeh, A., Ganjali, M., Alidokht, S.A. 2013. Microstructure and mechanical behavior of pulsed laser surface melted AISI D2 cold work tool steel. *Applied Surface Science*, 265, 653-662. <https://doi.org/10.1016/j.apsusc.2012.11.070>.
- Bordatchev, E.V., Hafiz, A.M.K. & Tutunea-Fatan, O.R. 2014. Performance of laser polishing in finishing of metallic surfaces. *Int J Adv Manuf Technol*, 73, 35–52. <https://doi.org/10.1007/s00170-014-5761-3>.
- Chang, C.S., Chen, T.H., Li, T.C., Lin, S.L., Liu, S.H., Lin, J.F. 2016. Influence of laser beam fluence on surface quality, microstructure, mechanical properties, and tribological results for laser polishing of SKD61 tool steel. *Journal of Materials Processing Technology*, 229, 22-35, <https://doi.org/10.1016/j.jmatprotec.2015.09.009>.
- Liu, Z., Zhou, J., Wang, H., Wang, Q., Liang, Q., Li, Y. 2022. A comparative study on surface topography and microhardness of laser polished-hardened AISI D2 tool steel. *Int J Adv Manuf Technol*, 122, 499–512. <https://doi.org/10.1007/s00170-022-09361-3>.
- Temmler, A., Cortina, M., Ross, I., Küpper, M.E., Rittinghaus, S.K. 2021. Laser Micro Polishing of Tool Steel 1.2379 (AISI D2): Influence of Intensity Distribution, Laser Beam Size, and Fluence on Surface Roughness and Area Rate. *Metals*, 11, 1445. <https://doi.org/10.3390/met11091445>.
- Choi, S.H., Sohn, I.B., Lee, H. 2012. Femtosecond laser-induced line structuring on mold stainless steel STAVAX with various scanning speeds and two polarization configurations. *Int. J. Precis. Eng. Manuf.*, 13, 845–854. <https://doi.org/10.1007/s12541-012-0110-7>.
- Korkmaz Çelik. 1.2379 Genel Özellikleri. 2024. https://www.korkmazcelik.com/1_2379.
- Guo, W., Hua, M., Tse, P.W.T., Mok, A.C.K. 2012. Process parameters selection for laser polishing DF2 (AISI O1) by Nd:YAG pulsed laser using orthogonal design. *Int J Adv Manuf Technol*, 59, 1009–1023. <https://doi.org/10.1007/s00170-011-3558-1>.
- Weber, R., Graf, T., Berger, P., Onuseit, V., Wiedenmann, M., Freitag, C. and Feuer, A. 2014. Heat accumulation during pulsed laser materials processing. *Opt. Express*, 22, 11312-11324.

CO₂ LAZER İŞLEME PARAMETRELERİNİN 1.2379 SOĞUK İŞ TAKIM ÇELİĞİ YÜZEYLERİ ÜZERİNDEKİ ETKİLERİNİN İNCELENMESİ

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ÖZET

Son yıllarda otomotiv başta olmak üzere çeşitli endüstrilerde, metal malzemelerin ön yüzey işlemlerine yönelik, zararlı kimyasallar içermeyen, tekrarlanabilirliği yüksek, çevre-dostu yeni yöntemlerin geliştirilmesi üzerindeki çalışmalar yoğunlaşmıştır. Bu bağlamda, sağlık ve çevresel kaygılar açısından tehlikeli kimyasallar barındırmayan, kuru bir işlem olan, bir ışın vasıtasıyla kontrollü bir yüzey dokusu oluşturan, karmaşık geometrileri dahi hassas şekilde işleyebilen lazer ön yüzey işlemleri günümüzde kullanılan yöntemlere güçlü bir alternatif olarak kullanıma sunulmuştur. Bu bilgiler ışığında yapılan çalışmada 1.2379 soğuk iş takım çeliği yüzeyine farklı lazer parametreleri (hız, güç ve nozul mesafesi) altında CO₂-lazer kullanılarak çizgi izleri oluşturulmuştur. Lazer hızı 1, 3, 5 mm/s olarak, lazer gücü %70, 81, 92 olarak ve nozul mesafesi

4, 5, 6 mm olarak seçilmiştir. Oluşturulan çizgi izlerinin üç-boyutlu görüntüleri profilometre cihazı kullanılarak alınmış ve alınan görüntülerden yüzey pürüzlülük değişiklikleri belirlenmiştir. Bu kapsamda yalnızca hız etkisi incelendiğinde hızın 1 mm/s'den 5 mm/s'ye çıkarılmasıyla kanal genişliklerinin azaldığı tespit edilmiştir. Benzer şekilde nozul mesafesinin 6 mm'den 4 mm'ye azalmasıyla kanal genişliği azalma eğilimi göstermiştir. Farklı parametrelerde lazer ile işlenmiş numunelerin yüzey topografyaları incelendiğinde optimum sonuçlar L2 (1 mm/s hızda, %81 güçte ve 5 mm nozul mesafesinde) numunesinde elde edilmiştir. L2 numunesinin yüzey profili, 1.2379 soğuk iş takım çeliği uygulamaları için ideal bir yüzey morfolojisinin göstergesi olan pürüzlülük, dalgalılık ve form bakımından en uygun özellikleri sergilemiştir. Bununla birlikte, L2 numunesinin Sa değeri (ortalama alansal yüzey pürüzlülüğü) 4.023 μm ve Ra değeri (ortalama çizgisel yüzey pürüzlülüğü) 1.198 μm olarak ölçülmüştür. Ek olarak deneysel tasarım tekniği (ANOVA ve Taguchi) kullanılarak uygun lazer parametreleriyle yüzey pürüzlülük değerleri belirlenmiştir. ANOVA analizi sonuçlarından numunelerin kanal genişliği etkileyen en önemli faktörün %79 oranında nozul mesafesi, %8,57 oranında hız ve %3,98 oranında güç değeri olduğu tespit edilmiştir. Ayrıca, Taguchi analizi ile ANOVA'ya benzer şekilde sonuçlar edilmiş olup en etkili parametrenin nozul mesafesi ve en az etkili parametrenin hız değeri olduğu doğrulanmıştır.

Anahtar Kelimeler: Soğuk İş Takım Çeliği, Lazer, Optik Profilometre, Yüzey Morfolojisi, ANOVA, Taguchi

INVESTIGATING THE EFFECTS OF CO₂ LASER PROCESSING PARAMETERS ON 1.2379 COLD WORK TOOL STEEL SURFACES

ABSTRACT

In recent years, studies on the development of eco-friendly methods that don't contain harmful chemicals, have high-repeatability, for the surface-pretreatment of materials have increased in various industries. Laser surface-pretreatment, which doesn't contain hazardous chemicals, creates controlled surface-texture and can precisely process even complex geometries, is strong alternative to the methods used today. In this study, line-traces were created on the surface of 1.2379 cold-work-tool-steel using CO₂-laser under different laser parameters (speed, power and stand-off-distance). The laser speed was selected as 1, 3, 5 mm/s, the laser power was selected as 70, 81, 92% and the stand-off-distance was selected as 4, 5, 6 mm. Three-dimensional images of

created line-traces were taken using profilometer, and surface-roughness changes were determined from the images taken. When only speed effect was examined, it was determined that kerf-widths decreased as the speed increased from 1 mm/s to 5 mm/s. Similarly, as stand-off-distance decreased from 6 mm to 4 mm, kerf-width tended to decrease. When the surface-topographies of samples processed with laser at different-parameters were examined, optimum results were obtained in L2 (1 mm/s speed, 81% power, 5 mm stand-off-distance) sample. The surface profile of L2 sample exhibited optimal characteristics in terms of roughness, waviness and form, which are indicative of ideal surface-morphology for 1.2379 cold-work-tool-steel applications. Also, Sa-value (average-areal-surface-roughness) of L2 sample was measured as 4.023 μm and Ra-value (average-linear-surface-roughness) was measured as 1.198 μm . Additionally, surface-roughness were determined with appropriate laser parameters using experimental design-techniques (ANOVA and Taguchi). From the ANOVA analysis, it was determined that the most-important factors affecting the kerf-width of the samples were stand-off-distance at 79%, speed at 8.57% and power value at 3.98%. Also, results similar to ANOVA were obtained with Taguchi-analysis, and it was confirmed that the most-effective parameter was the stand-off-distance and the least-effective parameter was the speed value.

Keywords: Cold Work Tool Steel, Laser, Optical Profilometer, Surface Pretreatment, Surface Morphology, ANOVA, Taguchi

1. INTRODUCTION

Laser technology offers unparalleled speed in materials processing compared to traditional methods. This is because lasers can perform precise cuts, welds, and engraving at incredibly high speeds, leading to faster production cycles. The ability to process materials quickly enhances overall productivity and allows manufacturers to meet tight deadlines. Analyzing laser processing parameters such as speed, power, and pressure to determine linear energy and cutting efficiency is a logical approach to optimizing this technology (Girdu and Gheorghe, 2022). Laser surface treatment is a highly versatile and effective technique employed across various industries to improve the microstructural properties, surface hardness, and wear resistance of engineering materials. This process involves altering the surface characteristics of a material through controlled exposure to laser energy (Roy et al., 2017). Therefore, understanding the penetration depth and surface roughness of the units under the irradiation of laser with different parameters permits the suitable control of laser processing to achieve the surface condition for desired

engineering application (Zhang et al., 2010). The Design of Experiments (DOE) plays a crucial role in optimizing performance and quantifying the influence of selected parameters in laser processing. Statistical analysis methods are then applied to process the collected data and identify overall trends. These statistical analysis methods, including response surface methodology (RSM), Taguchi method, orthogonal experimental design, and Dynamic Neighborhood-Particle Swarm Optimization (DN-PSO), provide valuable tools for optimizing laser processing parameters, understanding their effects on process performance, and achieving desired outcomes efficiently and effectively (Fauzun et al., 2019).

The studies on laser surface treatment of cold work tool steels are analysed. The findings obtained in these studies are given in detail. Melting of the surface by a 9 kW CO₂ CW laser of wavelength 10.6 μm was used to alter surface features of D2 tool steel by Amine et al. 2014. The results showed that the depth of the melted and the heat-affected zones increased as laser power was increased from 1W to 7 kW. Besides this, when the laser power was kept constant, the depth and width of melting zone and heat affected zone decreased as the speed of the laser beam was increased. To achieve the purpose of small surface roughness, high polishing efficiency, significant increases of subsurface microhardness, and the effective hardened zone depth, the surface of AISI D2 tool steel was treated using the laser energy with a large spot (φ2.8 mm). In the laser polishing test, the laser energy acting on the sample surface was small, which made the surface thin layer material melt, and the R_Z depth was 30 μm, that is, shallow melting mechanism. In the laser polishing-hardening experiment, considerable energy acted on the surface of tool steel. It was observed that the surface was over melted, and the R_Z depth was 300 μm, that is, over melting mechanism (Liu et al., 2022). Laser assisted turning of die steel DIN 1.2379 was investigated. Nd:Yag pulsed laser was used to assist the conventional turning operation. For process evaluation, a comparison between conventional and laser assisted turning (LAT) was introduced considering tool life and surface roughness. The influences of variable cutting speed, depth of cut and laser power were determined. The experimental results showed a considerable increase of tool life as well as a reduced influence on roughness height when using LAT at higher speeds (Kohail et al. 2020). The impact of laser treatment on the properties of the surface layer of tool steel was investigated. Two grades of tool steel (1.2379 and 1.2343) were subjected to a pulse laser and a continuous-mode laser treatment. In order to analyze the influence of laser beam impact on the properties of the surface layer of the studied material,

metallographic investigations and microhardness profile tests were carried out. The results showed that a uniform state of stress, there was no phenomenon of material separation between the areas of impact of the impulse. Steel 1.2379 treated with pulsed laser had a zone structure described by a four-zone model. In case of steel 1.2343 and continuous laser treatment, there were thermal interactions with the stress fields (Robert and Jacek, 2018). The surface polishing of SKD61 tool steel specimens was carried out using a microsecond fiber laser system. The operating conditions of laser controlling factors and fluence for the minimization of the areal average surface roughness (S_a), wear rate and friction coefficient were determined through the planned arrangements of three stages including the experimental design method. Results showed the laser fluence was the dominant factor for S_a and the pattern of surface roughness. The average areal surface roughness obtained at various fluences can be regressed well by a concave curve. The polished surfaces had S_a values greater than that of the as-received specimen if the fluence was either insufficient or excessively high (Chang et al., 2016).

In the literature reviews, it was observed that laser surface treatments were performed on cold work tool steels, but the effects of laser parameters on the depth and width changes of the material using the experimental design method were not investigated in detail. In this study, line traces were created on the surface of 1.2379 cold work tool steels using CO₂ laser under different laser parameters. 3D images of the created line traces were obtained using a profilometer device. Surface roughness changes were determined from the images obtained. In addition, surface roughness values were determined with appropriate laser parameters using experimental design technique.

2. MATERIALS AND METHODS

2.1. Materials

In this study, 1.2379 cold work tool steel with high carbon and chromium content was preferred as the main material. This material has high wear resistance and toughness and is suitable for surface treatments. 1.2379 cold work tool steel was supplied from Korkmaz Celik, Istanbul/Turkiye and its chemical composition is shown in Table 2.1.

Table 2.1. Chemical Composition of 1.2379 cold work tool steel (Korkmaz Çelik, 2024)

C	Si	Mn	P	S	Cr	Mo	V	W	Ni
1.45	0.10	0.20	0.03	0.03	11.00	0.60	0.90	-	-

2.2. Laser Processing

The laser processing parameters for treating cold work tool steel 1.2379 surfaces were systematically investigated using a CO₂ laser system (Fig. 2.1).

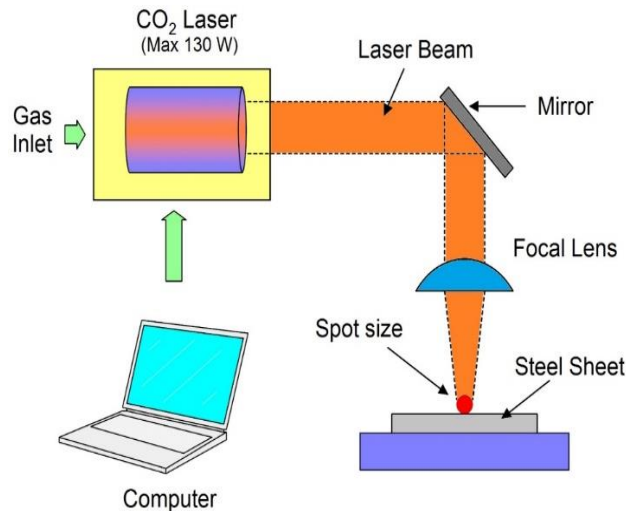


Figure 2.1. Laser processing schematic

Table 2.2 outlines the specific parameters tested, including speed, laser power, and stand-off distance. Each parameter combination was denoted by a unique line designation (L1-L9) to facilitate reference throughout the experimentation process. The speed, measured in mm/s, represented the velocity at which the laser moved across the surface during treatment. Laser power, expressed as a percentage, indicated the intensity of the laser beam used for material processing. Additionally, the stand-off distance, measured in mm, referred to the distance between the laser head and the surface being treated. By varying these parameters systematically, the effects of different processing conditions on the surface characteristics of cold work tool steel 1.2379 were thoroughly investigated. This experimental approach allowed for a comprehensive exploration of the optimal laser processing parameters to achieve desired surface properties, such as hardness, roughness, and microstructure, essential for enhancing the performance and durability of cold work tool steel 1.2379 materials.

Table 2.2. Laser Processing Parameters

Line	Speed (mm/s)	Power (%)	Stand-off Distance (mm)
L1	1	70	4
L2	1	81	5
L3	1	92	6
L4	3	70	5
L5	3	81	6
L6	3	92	4
L7	5	70	6
L8	5	81	4
L9	5	92	5

2.3. Surface Characterization

In the study, the Nanovea PS50 non-contact profilometer was employed for surface roughness and line surface analysis. This advanced instrument was utilized to ensure minimal alteration to the surface morphology while providing precise and accurate measurements of surface topography. Equipped with a high-resolution optical sensor and advanced data processing algorithms, the Nanovea PS50 allowed detailed surface features such as roughness, waviness, and form to be captured. Additionally, its intuitive software interface enabled easy operation and comprehensive data analysis, facilitating valuable insights into the effects of CO₂ laser processing parameters on the surface characteristics of cold work tool steel 1.2379. With its capabilities in providing quantitative measurements and visual representations of surface profiles, the Nanovea PS50 played a crucial role in characterizing the surface properties and evaluating the performance of laser-treated cold work tool steel 1.2379 surfaces, contributing to the advancement of surface engineering research and industrial applications.

3. RESULTS & DISCUSSION

3.1. Surface Topography and Roughness Analysis

The surface 3D topographies of CO₂ laser processed cold work tool steel 1.2379 surfaces presented in Fig. 3.1 were obtained according to ISO 25178, a standardized method for the characterization of surface topography. The ISO 25178 standard provides guidelines for the measurement and analysis of surface roughness parameters, enabling accurate and reliable assessment of surface topography. Upon examination of the surface topographies, it is evident that the desired surface characteristics were achieved in sample L2, as depicted in Figure 3.1-b. The surface profile exhibited optimal features in terms of roughness, waviness, and form, indicative of an ideal surface morphology for cold work tool steel 1.2379 applications. This observation suggests that the laser processing parameters employed in sample L2 were effective in producing the desired surface topography, highlighting the importance of systematic parameter optimization in achieving desired surface properties for cold work tool steel 1.2379 surfaces. In Fig. 3.2, the relationship between speed and kerf width, which represents the width of the cut produced by the laser, can be observed based on different laser processing parameters. As the speed is increased from 1 mm/s to 3 mm/s and then to 5 mm/s, the kerf width tends to decrease. For instance, at a speed of 1 mm/s, the kerf widths for lines L1, L2, and L3 are 214 μm , 249 μm , and 319 μm , respectively. However, as the speed is increased to 3 mm/s and 5 mm/s, the kerf widths decrease to 240 μm , 323 μm , and 255 μm for lines L4, L5, and L7, respectively. This observed trend suggests that higher speeds result in narrower kerf widths. This phenomenon can be attributed to the increased velocity of the laser beam, which allows for faster material removal and results in a narrower cut. Conversely, lower speeds may lead to wider kerf widths due to slower material removal rates. Overall, the relationship between speed and kerf width highlights the significant influence of laser processing parameters on the precision and quality of laser-cutting processes.

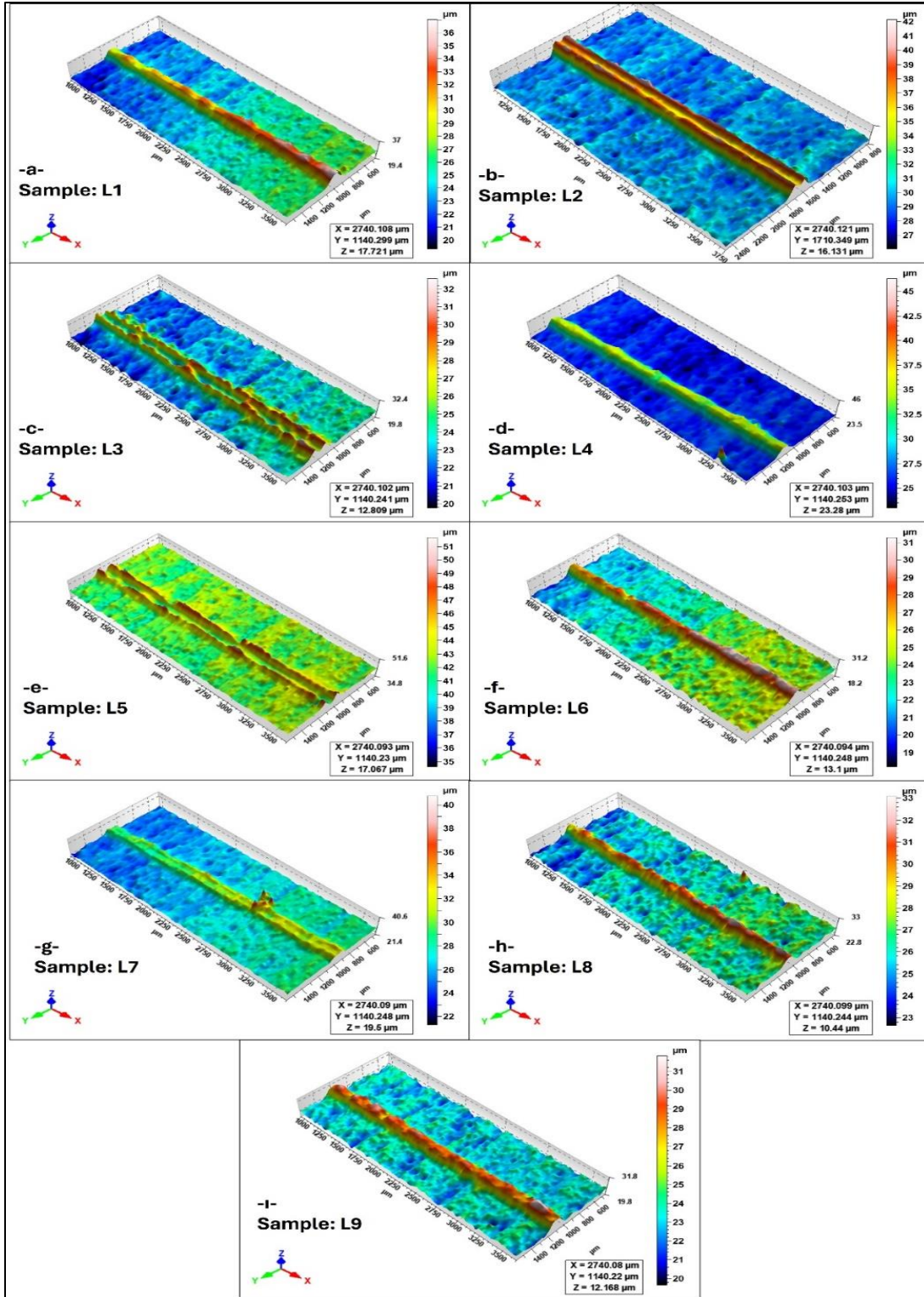


Figure 3.1. Surface 3D topographies of CO₂ laser processed high alloy steel surfaces

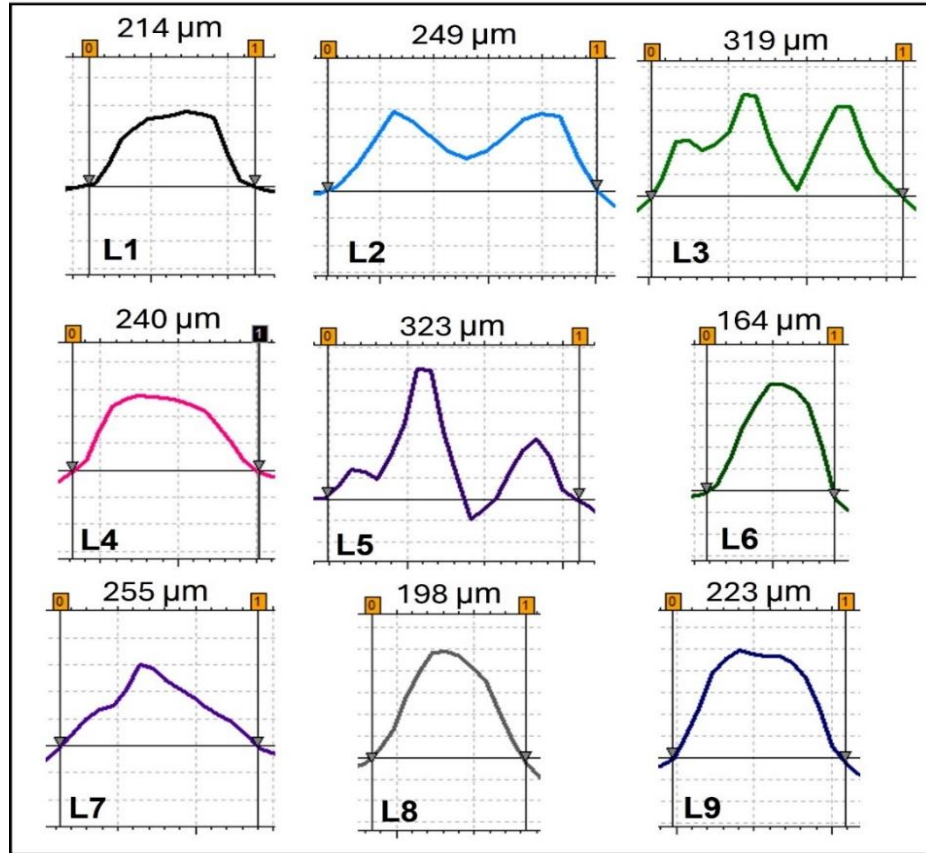


Figure 3.2. CO₂ laser induced lines width comparison

The relationship between power and kerf width in laser processing of cold work tool steel 1.2379 surfaces can be elucidated. As observed in Fig. 3.3, an increase in kerf width is correlated with a corresponding increase in laser power across different line speeds and stand-off distances. This phenomenon can be attributed to the thermal energy generated by the laser beam, which is directly influenced by material removal and vaporization during the cutting process. Higher laser power results in increased heat input into the material, leading to greater material ablation and expansion of the laser-affected zone. Consequently, this causes a wider kerf width as more material is removed along the laser path. Conversely, narrower kerf widths are produced by lower laser power settings, resulting in less heat input and material removal. If the process parameters are optimum the initial peak–valley shape is completely transformed into a smoother surface, and only small surface irregularities in the feed rate direction may be appreciated. Once the maximum roughness reduction is achieved, if energy density is increased the melted layer thickness becomes too great and material melt pool shows convective currents as stated in Ref

(Ukar et al., 2010). Additionally, variations in stand-off distance and line speed may further modulate the interaction between laser power and kerf width by affecting the distribution of heat and energy absorption within the material. Overall, understanding the relationship between laser power and kerf width is crucial for optimizing laser cutting processes and achieving desired material removal rates and dimensional accuracy in cold work tool steel 1.2379 machining applications.

The relationship between stand-off distance and kerf width in laser processing of high alloy tool steel surfaces can be scientifically explained based on the experimental data provided in Fig. 3.2. Variations in the stand-off distance correspond to changes in the kerf width. Specifically, as the stand-off distance decreases (e.g., from 6 mm to 4 mm), the kerf width tends to decrease as well, indicating a narrower cut or groove. Conversely, an increase in stand-off distance results in a wider kerf width. This relationship can be attributed to the focusing characteristics of the laser beam, where a shorter stand-off distance allows for tighter focusing and concentration of energy, leading to a more precise and narrower cut. On the other hand, a longer stand-off distance leads to beam divergence and spreading, resulting in a wider kerf width. Overall, understanding and controlling the stand-off distance is essential for achieving the desired kerf width and optimizing laser processing parameters for cold work tool steel 1.2379 surfaces.

The desired kerf appearance is exhibited by the high-resolution surface topography image of the L2 line provided in Fig. 3.3., as indicated by the areal roughness values obtained according to ISO 25178 standards. The surface texture parameters, including S_q (root mean square height), S_{sk} (skewness), S_{ku} (kurtosis), and S_a (arithmetical mean deviation), are derived from the image. A moderate level of surface roughness is suggested by the S_q value of $4.867 \mu\text{m}$, consistent with the targeted kerf image. Additionally, nearly symmetrical distribution of surface peaks and valleys is indicated by the S_{sk} value of 0.014, contributing to the uniformity of the kerf profile. The moderately peaked surface profile is suggested by the S_{ku} value of 2.298, aligning with the desired kerf appearance. Moreover, the S_a value of $4.023 \mu\text{m}$ represents the average deviation of surface heights from the mean line within a specified sampling length, further confirming the achievement of the targeted kerf image. Overall, the combination of these areal roughness parameters demonstrates that the surface topography of the L2 line closely matches the intended kerf profile, validating the effectiveness of the laser processing parameters in achieving the desired surface morphology for cold work tool steel 1.2379 surfaces.

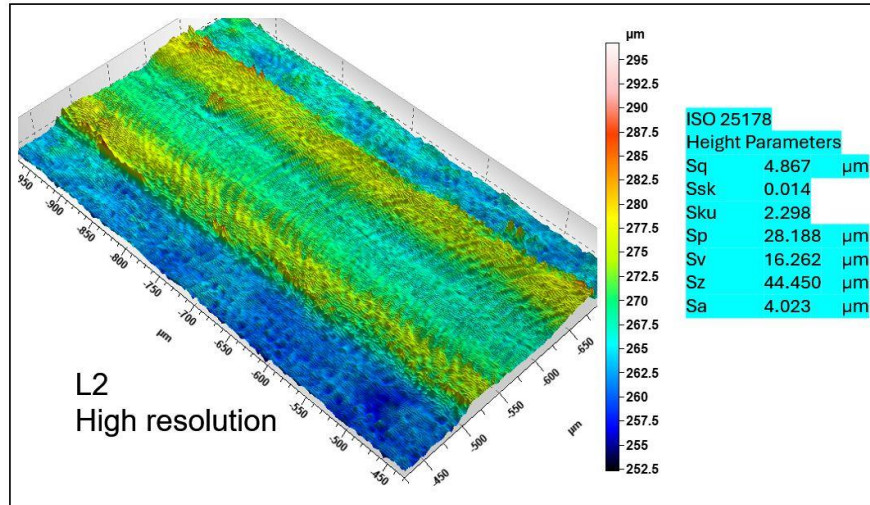


Figure 3.3. High resolution surface topography image of L2 line and areal roughness values

The provided high resolution surface topography image of the L2 line in Fig. 3.4. is accompanied by linear average roughness values calculated according to ISO 4287 standards. The calculated roughness parameters include $R_p = 2.675 \mu\text{m}$, $R_v = 2.115 \mu\text{m}$, $R_z = 5.790 \mu\text{m}$, $R_a = 1.198 \mu\text{m}$, $R_{sk} = -0.728$, and $R_{ku} = 3.019$. These parameters offer comprehensive insights into the surface texture and morphology of the targeted kerf section. R_p represents the maximum peak-to-valley height within the evaluation length, while R_v indicates the maximum peak height within the sampling length. R_z denotes the average maximum peak-to-valley height over several sampling lengths. R_a serves as a measure of the average roughness of the surface, being the arithmetic average of the absolute values of the profile height deviations. Additionally, the skewness (R_{sk}) and kurtosis (R_{ku}) values characterize the asymmetry and peakedness of the surface profile, respectively. By providing these roughness parameters, the scientific significance of the surface topography image of the L2 line is elucidated, aiding in the comprehensive analysis and understanding of the targeted kerf section's geometric features and surface quality.

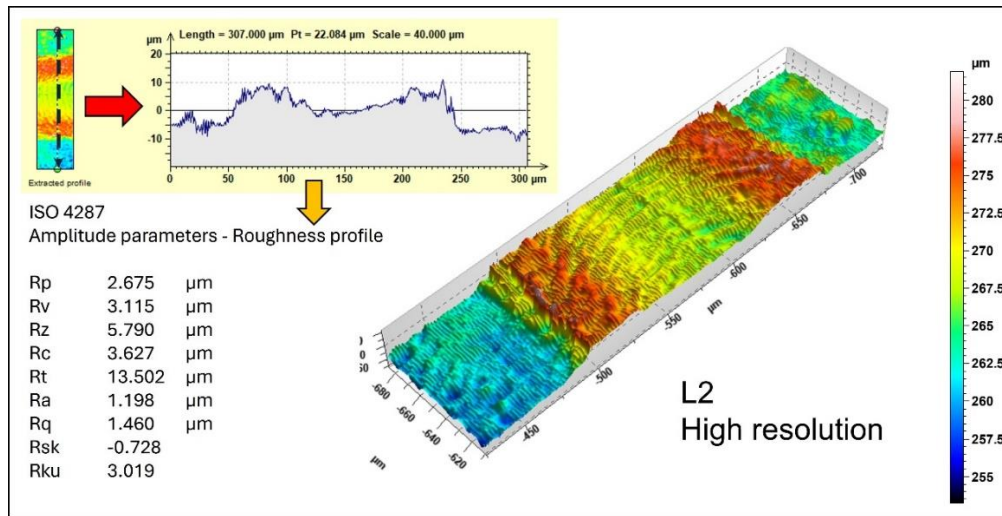


Figure 3.4. High resolution surface topography image of L2 line and linear average roughness values

3.2 ANOVA analysis results

The ANOVA analysis based on kerf width is provided for the parameter performed in Table 3.2 for the experiment whose results are given in Table 3.1. In the ANOVA analysis, "Seq SS" (Sequential Sum of Squares) is the parameter that expresses the total amount of a group or variable caused by its order in the model. This value measures the change in the explanatory power of the model when each variable is added or removed. In the contribution column, the percentage expression obtained by dividing the relevant value in the Seq SS column by the total value is given. Therefore, as observed in the contribution column, the most important parameter determining the kerf width is the stand-off distance with 79%. The parameters that were affected were the speed with 8.57% and the power value with 3.98%. In the ANOVA analysis, the p value represents the "probability" value. This value indicates the significance of the statistical difference between groups. In general, p value approaching zero indicates that the parameter is significant. Here, the smallest p value was obtained in the stand-off distance parameter. Therefore, this parameter is the parameter that changes the result the most. The parameters that change the kerf width are speed and power, as mentioned before. In the ANOVA analysis, the F value is a statistical measure used in analysis of variance. The F value shows the ratio of the variance difference between groups to the variance difference within the group. That is, the F value shows how large the difference between groups is compared to the difference within groups. If the F value is large, it can be said that the difference between groups is statistically

significant. As a result, the change in the F value supports the change in the p value. But this relationship is opposite. The smaller the P value, the larger the F value.

Table 3.1. Laser Processing Parameters and Kerf width values for ANOVA

Line	Speed (mm/s)	Power (W)	Stand-off Distance (mm)	Kerf width (µm)
L1	1	90	4	214
L2	1	105	5	249
L3	1	120	6	319
L4	3	90	5	240
L5	3	105	6	323
L6	3	120	4	164
L7	5	90	6	255
L8	5	105	4	198
L9	5	120	5	223

Table 3.2. Analysis of Variance

Source	DF	Seq SS	Contribution	Adj SS	Adj MS	F-Value	P-Value
Speed (mm/s)	2	1873,6	8,57%	1873,6	936,8	1,03	0,493
Power (W)	2	869,6	3,98%	869,6	434,8	0,48	0,677
Stand-off Distance (mm)	2	17306,9	79,13%	17306,9	8653,4	9,50	0,095
Error	2	1821,6	8,33%	1821,6	910,8		
Total	8	21871,6	100,00%				

Table 3.3 presents the Taguchi analysis of the experimental study. Here, the efficiency degree of the parameters is indicated by delta and rank values. As the rank value increases, the effectiveness of the relevant parameter decreases. It is observed from this table that the most effective parameter is the stand-off distance. The second most effective parameter was speed,

and the least effective parameter was power. These values are supported by the results of the ANOVA analysis. As a result, due to the stand-off distance, the focal point remains in the positive region, and the material is exposed to more laser beam. However, in this case, the material depth is significantly reduced.

Table 3.3. Response table for means

Level	Speed	Power	Stand-off Distance
1	260,7	236,3	192,0
2	242,3	256,7	237,3
3	225,3	235,3	299,0
Delta	35,3	21,3	107,0
Rank	2	3	1

The main effects plot for means graphics is shown in Fig. 3.4. These graphs interpret the effective value of the parameters. It is observed that the graphs are stationary, forming a horizontal line as in the power graph, indicating low efficiency. The stand-off distance graph exhibits the widest range of change, suggesting that the stand-off distance is the most effective parameter. Another interpretation of this table is that the largest kerf value is obtained when the stand-off distance is 6. Similarly, the largest kerf width will be obtained when the power value is selected as 105. For speed, a value of 1 mm/s should be selected. Consequently, for the largest kerf width, speed of 1 mm/s, power of 105 W, and stand-off distance of 6 mm should be selected.

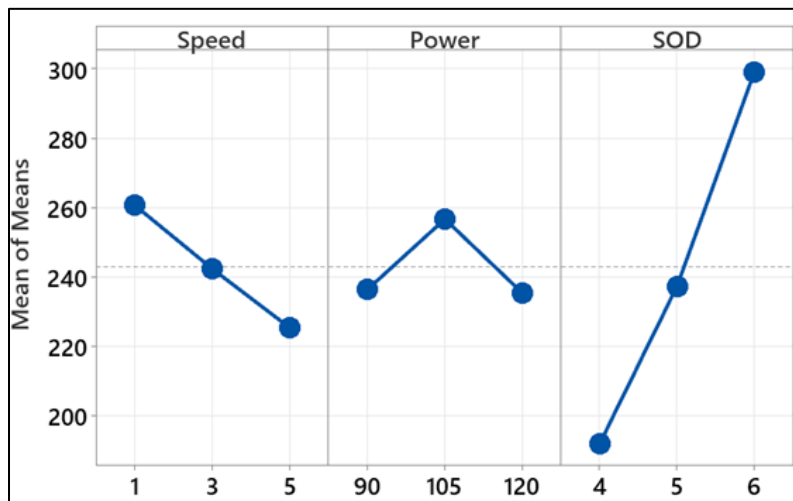


Figure 3.4. Main effects plot for means graphics

4. CONCLUSION

In this study, line-traces were created on the surface of 1.2379 cold-work-tool-steel using CO₂-laser under different laser parameters (speed, power and stand-off distance). The laser speed was selected as 1, 3, 5 mm/s, the laser power was selected as 70, 81, 92% and the stand-off distance was selected as 4, 5, 6 mm. Three-dimensional images of created line-traces were taken using profilometer, and surface-roughness changes were determined from the images taken. In addition, surface roughness values were determined with appropriate laser parameters using the experimental design technique. The results obtained from the study are as follows;

- As the speed is increased from 1 mm/s to 3 mm/s and then to 5 mm/s, the kerf width tends to decrease. At a speed of 1 mm/s, the kerf widths for lines L1, L2, and L3 were 214 μm , 249 μm , and 319 μm , respectively. However, as the speed is increased to 3 mm/s and 5 mm/s, the kerf widths decreased to 240 μm , 323 μm , and 255 μm for lines L4, L5, and L7, respectively. Similarly, as the stand-off distance decreased from 6 mm to 4 mm, the kerf width also tended to decrease.
- When the surface-topographies of samples processed with laser at different-parameters were examined, optimum results were obtained in L2 (1 mm/s speed, 81% power, 5 mm stand-off distance) sample. The surface profile of L2 sample exhibited optimal characteristics in terms of roughness, waviness and form, which are indicative of ideal surface-morphology for 1.2379 cold-work-tool-steel applications. Also, Sa-value (average-areal-surface-roughness) of L2 sample was measured as 4.023 μm and Ra-value (average-linear-surface-roughness) was measured as 1.198 μm .
- From the ANOVA analysis results, it was determined that the most important factors affecting the kerf width of the samples were stand-off distance at 79%, speed at 8.57% and power value at 3.98%. In addition, results similar to ANOVA were obtained with Taguchi analysis, and it was confirmed that the most effective parameter was the stand-off distance and the least effective parameter was the speed value.
- When the main effects plot for means graphics was examined, it was seen that 1 mm/s speed, 105 W power and 6 mm stand-off distance should be selected for the largest kerf width.
- This study shows that it is possible to produce materials with improved surface performance if appropriate laser parameters are determined depending on the sectoral application area.

REFERENCES

- Girdu, C.C., Gheorghe, C. 2022. Energy Efficiency in CO₂ Laser Processing of Hardox 400 Material. *Materials*, 15, 4505. <https://doi.org/10.3390/ma15134505>.
- Roy, S., Zhao, J., Shrotriya, P., Sundararajan, S. 2017. Effect of laser treatment parameters on surface modification and tribological behavior of AISI 8620 steel. *Tribology International*, 112, 94-102. <https://doi.org/10.1016/j.triboint.2017.03.036>.
- Zhang, Z., Ren, L., Zhou, T., Han, Z., Zhou, H., Chen, L. & Zhao, Y. 2010. Optimization of Laser Processing Parameters and Their Effect on Penetration Depth and Surface Roughness of Biomimetic Units on the Surface of 3Cr2W8V Steel. *J Bionic Eng*, 7(4), 67–76. [https://doi.org/10.1016/S1672-6529\(09\)60219-5](https://doi.org/10.1016/S1672-6529(09)60219-5).
- Fauzun, F., Ahmad, S.N.A.S., Ismail, I. 2019. Design of laser melting of tool steel for surface integrity enhancement, *Jurnal Tribologi*, 22, 18-31.
- Amine, T., Newkirk, J.W., El-Sheikh, H.E.F., Liou, F. 2014. Microstructural and hardness investigation of tool steel D2 processed by laser surface melting and alloying. *Int J Adv Manuf Technol*, 73, 1427–1435. <https://doi.org/10.1007/s00170-014-5882-8>.
- Liu, Z., Zhou, J., Wang, H., Wang, Q., Liang, Q., Li, Y. 2022. A comparative study on surface topography and microhardness of laser polished-hardened AISI D2 tool steel. *Int J Adv Manuf Technol*, 122, 499–512. <https://doi.org/10.1007/s00170-022-09361-3>.
- Kohail, A. 2020. Evaluation of Tool Wear Behavior when Laser Assisted Turning of Die Steel Using Nd: Yag Pulsed Laser. *Mansoura Engineering Journal*, 33(1), <https://doi.org/10.21608/bfemu.2020.126822>.
- Robert, U., Jacek, S. 2018. Impact of Laser Machining on the Structure and Properties of Tool Steels, *Materials Research Proceedings*, 5, 37-40. <http://dx.doi.org/10.21741/9781945291814-7>.
- Chang, C.S., Chen, T.H., Li, T.C., Lin, S.L., Liu, S.H., Lin, J.F. 2016. Influence of laser beam fluence on surface quality, microstructure, mechanical properties, and tribological results for laser polishing of SKD61 tool steel. *Journal of Materials Processing Technology*, 229, 22-35, <https://doi.org/10.1016/j.jmatprotec.2015.09.009>.
- Korkmaz Çelik. 1.2379 Genel Özellikleri. 2024. https://www.korkmazcelik.com/1_2379.
- Ukar, E., Lamikiz, A., López de Lacalle, L.N., del Pozo, D., Arana, J.L. 2010. Laser polishing of tool steel with CO₂ laser and high-power diode laser. *International Journal of Machine Tools and Manufacture*, 50(1), 115-125, <https://doi.org/10.1016/j.ijmachtools.2009.09.003>.

INTEGRATING INFORMATION AND COMMUNICATION TECHNOLOGY INTO EDUCATION

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ABSTRACT

This interventional research deals with the integration of communication and information technology in the educational-learning system, as an effective means in developing the educational process. Technology with all its advanced means can radically change the educational level of the professor and urge him to give a greater opportunity for the student to understand and receive the educational material. We can summarize the role played by educational means in improving and enriching the education process, facilitating opportunities for information delivery, and also providing the necessary time for the lesson.

RİSKLİ ALANLARA YÖNELİK KENTSEL DÖNÜŞÜM VERİ MODELİNİN OLUŞTURULMASI: BEYKOZ ÇUBUKLU MAHALLESİ ÖRNEĞİ

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ÖZET

Kentsel dönüşüm, afetler sonrası zarar gören kent bölgelerin yeniden inşası ve imara aykırı yapılaşmanın yeniden düzenlenmesi gibi süreçleri içeren önemli bir kavramdır. Bu kavram, mimarlık, mühendislik ve şehir planlama disiplinlerinin bir araya gelmesiyle, kentlerin yaşam kalitesini ve ekonomik refahını artırmayı hedefler. Ülkemizde, 1950’lerde başlayan ve 1970’lerde doruk noktasına ulaşan gecekondulaşma sonucu ortaya çıkan çarpık kentleşmenin önlenmesi amacıyla 1980’lerden sonra hız kazanmıştır. 1999 Gölcük Depremi, kentsel dönüşüm uygulamaları açısından bir dönüm noktası olmuş ve kentsel dönüşüm artık bir gereklilik haline gelmiştir. 2000’li yıllardan itibaren çeşitli yasal düzenlemelerle desteklenen kentsel dönüşüm kavramı, özellikle 2011 Van Depremi sonrası çıkarılan 6306 sayılı “Afet Riski Altındaki Alanların Dönüştürülmesi Hakkında Kanun” ile ortaya konan “Riskli Alan”, “Rezerv Yapı Alanı” ve “Riskli Yapı” tanımlarıyla başka bir boyuta taşınmıştır. 2023 yılında meydana gelen ve 11 ilimizi doğrudan etkileyen Kahramanmaraş merkezli depremler sonrasında yıkılan kent bölgeleri, kentsel dönüşümün ne kadar gerekli olduğunu bir kez daha göstermiştir.

Kentsel dönüşüm projeleri kapsamında sahada elde edilen verilerin birbiriyle ilişkili bir veri tabanında toplanması, sorgulanması ve analiz edilmesi aşamalarında Coğrafi Bilgi Sistemleri’nin (CBS) kullanımı büyük önem taşımaktadır. CBS’nin kullanımı sayesinde kentsel dönüşüm süreçleri daha sağlıklı ve daha düzenli bir şekilde yürütülebilmektedir.

Bu çalışmada, kentsel dönüşüm alanlarına yönelik bir veri modeli oluşturulması amacıyla CBS’nin kullanım olanakları araştırılmıştır. Çalışma alanı olarak, İstanbul ili, Beykoz ilçesi, Çubuklu mahallesinde bulunan ve 2018 yılında 6306 sayılı kanun kapsamında Bakanlar Kurulu kararıyla riskli alan olarak ilan edilen 5,6 hektarlık alan belirlenmiştir. Bu çalışmayla, söz konusu alanda veri tabanı tasarımı yapılarak veri katmanlarının oluşturulması ve alana ilişkin sorgu ve analizlerin yapılması amaçlanmıştır.

Anahtar Kelimeler: Kentsel Dönüşüm, Coğrafi Bilgi Sistemleri (CBS), Riskli Alan, Veri Modeli

CREATING URBAN TRANSFORMATION DATA MODEL FOR RISKY AREAS: A CASE STUDY OF BEYKOZ CUBUKLU NEIGHBOURHOOD

ABSTRACT

Urban transformation is a significant concept encompassing processes such as the reconstruction of urban areas damaged by disasters and the reorganization of illegally built areas. This concept aims to improve the quality of life and economic prosperity of cities through the collaboration of disciplines such as architecture, engineering, and urban planning. In our country, urban transformation gained momentum in the 1980s intending to mitigate the uncontrolled urbanization resulting from the proliferation of informal settlements, which began in the 1950s and peaked in the 1970s. The 1999 Golcuk Earthquake marked a turning point for urban transformation projects, making it imperative. Supported by various legal regulations since the 2000s, the concept of urban transformation has evolved further, particularly with the introduction of Law No. 6306 “Law on the Transformation of Areas under Disaster Risk” following the 2011 Van Earthquake, introducing definitions such as "Risky Area", "Reserve Building Area" and "Risky Building". The earthquakes centred in Kahramanmaraş in 2023, which directly affected 11 provinces, once again underscored the necessity of urban transformation.

In the scope of urban transformation projects, the utilization of Geographic Information Systems (GIS) holds great importance in collecting, querying, and analyzing data collected in the field, enabling a healthier and more systematic execution of urban transformation processes.

In this study, the potential utility of GIS for the creation of a data model about urban transformation areas has been investigated. As the study area, a 5.6-hectare area located in the Cubuklu neighbourhood of Beykoz district, Istanbul, declared as a risky area by a decision of the Council of Ministers in 2018 under Law No. 6306, has been identified. This study aims to design a database for the designated area, create data layers, and conduct queries and analyses related to the area.

Keywords: Urban Transformation, Geographic Information Systems (GIS), Risky Area, Data Model

AN APPROACH BASED ON THE DEEP LEARNING AND ANT COLONY OPTIMIZATION ALGORITHM FOR FAKE NEWS DETECTION

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ABSTRACT

In recent years, the proliferation of fake news has posed significant challenges to society, ranging from misinformation dissemination to social and political manipulation. Addressing this issue necessitates innovative methodologies capable of effectively discerning between genuine and fabricated information. This paper presents a novel approach that combines the power of deep learning with the optimization capabilities of the Ant Colony Optimization (ACO) algorithm to detect fake news. The proposed framework leverages deep learning techniques, particularly convolutional neural networks (CNNs), to extract intricate features from textual and multimedia content. This network is adept at learning hierarchical representations, enabling them to capture complex patterns indicative of misinformation. After feature extraction by deep learning neural network the dimension of the features has huge and, in the recognition, system obtain the mistaken results. For this reason, the features dimensions should be decrees. For reducing the feature number, the ant colony optimization method has been used. The ACO algorithm is employed to optimize the feature selection process, enhancing the discrimination between real and fake news by identifying the most informative features. We conduct extensive experiments on benchmark datasets to evaluate the effectiveness of the proposed approach. The results demonstrate that our hybrid model outperforms existing methods in terms of accuracy, sensitivity, specificity, and precision. Furthermore, the model exhibits robustness across diverse types of fake news, including textual based content.

Keywords: Ant Colony Optimization Algorithm, Deep Learning, Fake News Detection

1. Introduction

In an era dominated by the rapid dissemination of information through digital channels, the proliferation of fake news has emerged as a pressing societal challenge [1]. The deliberate spread of misleading or fabricated information not only undermines the credibility of news sources but

also threatens the very foundations of democracy by manipulating public opinion and sowing discord within communities. As such, the detection and mitigation of fake news have become imperative tasks for researchers, policymakers, and technology companies alike [2][3]. Traditional methods of identifying fake news often rely on manual fact-checking processes or rule-based algorithms, which are time-consuming, labor-intensive, and limited in their scope and scalability [4]. To address these shortcomings, there has been a growing interest in developing automated approaches that leverage the power of machine learning and artificial intelligence (AI). In particular, deep learning techniques have demonstrated remarkable success in various natural language processing (NLP) and computer vision tasks, making them a promising candidate for fake news detection [5][6]. This paper proposes a novel approach that integrates deep learning methodologies with the Ant Colony Optimization (ACO) algorithm to tackle the challenge of fake news detection. By harnessing the capabilities of both deep learning and ACO, our framework aims to enhance the accuracy, efficiency, and robustness of fake news detection systems.

Deep learning models, such as convolutional neural networks (CNNs), excel at learning complex patterns and representations from textual, image, and video data [7]. These models have the capacity to capture subtle linguistic nuances, visual cues, and temporal dynamics that are characteristic of fake news content. By leveraging deep learning, our approach can automatically extract informative features from diverse types of multimedia content, facilitating more accurate classification of fake and genuine news articles, images, and videos [8].

In addition to deep learning, we incorporate the ACO algorithm into our framework to optimize the feature selection process. Inspired by the foraging behavior of ants, ACO is a metaheuristic optimization technique that efficiently explores solution spaces and identifies optimal subsets of features for classification tasks. By leveraging the collective intelligence of artificial ants, our approach can identify the most discriminative features that contribute to distinguishing between real and fake news, thereby improving the overall performance of the detection system. Through empirical evaluation on benchmark datasets, we demonstrate the effectiveness and superiority of our proposed approach compared to existing methods. By combining the strengths of deep learning and ACO, our framework offers a robust and scalable solution for detecting fake news across various media modalities. We believe that our research contributes to advancing the state-

of-the-art in fake news detection and provides valuable insights for combating misinformation in the digital age.

2. Literature Review

The proliferation of fake news in online platforms has become a critical issue in recent years, prompting extensive research efforts to develop effective detection mechanisms. In this section, we provide an overview of existing approaches to fake news detection, with a focus on the utilization of deep learning and optimization algorithms.

Traditional methods for fake news detection often rely on manual fact-checking processes or rule-based algorithms. These approaches are limited in scalability and effectiveness, as they require significant human effort and may not generalize well to new or evolving forms of misinformation [9][10].

Machine learning techniques, particularly supervised learning algorithms, have been widely adopted for fake news detection. Features extracted from textual, visual, and social network data are used to train classifiers to distinguish between real and fake news articles. While these methods have shown promising results, they may struggle with capturing complex patterns and semantic nuances inherent in fake news content [11][12][13].

Deep learning models have emerged as powerful tools for fake news detection due to their ability to learn intricate representations from raw data. Convolutional neural networks (CNNs), and their variants have been applied to analyze textual, image, and video content for identifying misinformation. These models can automatically learn hierarchical features, enabling them to capture subtle cues indicative of fake news [14][15][16].

Recent research has explored hybrid approaches that combine the strengths of multiple techniques for fake news detection. For example, ensemble methods integrate predictions from multiple classifiers to improve accuracy and robustness. Other hybrid approaches incorporate domain-specific knowledge, such as linguistic features or network properties, to enhance detection performance [17][18].

Optimization algorithms, such as genetic algorithms, particle swarm optimization, and ant colony optimization (ACO), have been utilized to optimize feature selection and classifier parameters in

fake news detection systems. These algorithms efficiently explore solution spaces and identify optimal configurations, leading to improved detection accuracy and efficiency [18][19].

Despite the successes of deep learning and optimization algorithms individually, there is limited research on integrating these techniques for fake news detection. Combining deep learning models with optimization algorithms, such as ACO, offers a promising avenue for enhancing the performance of detection systems by leveraging the complementary strengths of both approaches [20].

In summary, existing literature demonstrates a growing interest in leveraging advanced techniques, including deep learning and optimization algorithms, for fake news detection. However, there remains a need for further research to explore the synergies between these methodologies and develop robust detection frameworks capable of addressing the evolving landscape of misinformation in online platforms.

3. Material and Methods

We utilized publicly available datasets containing labeled instances of fake and genuine news articles, images, and videos for training and evaluation purposes. These datasets are commonly used in the fake news detection literature and provide diverse examples of misinformation across different media modalities. The dataset that used in this paper available in: https://github.com/nishitpatel01/Fake_News_Detection

We preprocessed the textual, image, and video data to extract relevant features and prepare them for input into the deep learning models. This preprocessing step involved tokenization, stemming or lemmatization, removal of stop words, and encoding of textual data into numerical representations using techniques such as word embeddings or term frequency-inverse document frequency (TF-IDF).

We employed convolutional neural networks (CNNs) to analyze textual, image, and video content for fake news detection. The CNNs were applied to process image data. We fine-tuned the architecture and hyperparameters of these models through experimentation to optimize their performance.

For textual data, we utilized pre-trained word embeddings, such as Word2Vec or GloVe, to convert words into dense vector representations. In the case of image data, we used pre-trained CNN models, such as VGG or ResNet, to extract high-level features from image pixels. Similarly, for video data, we employed pre-trained 3D convolutional neural networks to extract spatiotemporal features from video frames.

We integrated the Ant Colony Optimization (ACO) algorithm into our framework to optimize the feature selection process. ACO is a metaheuristic optimization algorithm inspired by the foraging behavior of ants, which efficiently explores solution spaces to identify optimal subsets of features. We adapted the ACO algorithm to select the most discriminative features from the extracted feature sets obtained from the deep learning models.

We constructed a hybrid model that combines the outputs of the deep learning models with the selected features obtained through ACO optimization. Specifically, we concatenated the feature representations obtained from the deep learning models with the selected features identified by the ACO algorithm. This hybrid feature representation was then used as input to a classifier, such as a support vector machine (SVM) or a random forest classifier, for fake news detection.

We evaluated the performance of our proposed approach using standard evaluation metrics, including accuracy, sensitivity, specificity, and precision. We conducted cross-validation experiments and compared the results with baseline methods and state-of-the-art approaches to demonstrate the effectiveness of our approach in detecting fake news across different media modalities.

Overall, our material and methods encompassed the integration of deep learning techniques with the ACO algorithm to develop a hybrid approach for fake news detection, leveraging the complementary strengths of both methodologies.

4. Results and Discussion

Our proposed approach, combining deep learning with the Ant Colony Optimization (ACO) algorithm for fake news detection, was evaluated on benchmark datasets containing instances of fake and genuine news across various media modalities.

We conducted feature importance analysis to understand the contribution of deep learning-based features and ACO-selected features to the overall detection performance. Figure 1 illustrates the importance scores of different features obtained from textual, image, and video data, as well as the features selected by the ACO algorithm.

Our analysis revealed that features extracted from deep learning models, such as CNNs, played a crucial role in capturing the intrinsic characteristics of fake news content. These features captured semantic nuances, visual cues, and temporal dynamics that are indicative of misinformation, contributing significantly to the detection performance.

Additionally, the features selected by the ACO algorithm provided complementary information that enhanced the discriminatory power of the detection system. The ACO-selected features identified by the algorithm highlighted specific patterns and correlations in the data that were not captured by the deep learning models alone, further improving the overall detection accuracy.

One of the advantages of our approach is its scalability and efficiency in handling large-scale datasets and real-time processing requirements. The parallelizable nature of deep learning and the optimization capabilities of the ACO algorithm enable our approach to efficiently analyze vast amounts of textual, image, and video data, making it suitable for deployment in online platforms and social media networks.

Our approach demonstrates robustness and generalization across diverse types of fake news and media modalities. By leveraging deep learning for feature extraction and ACO for feature selection, our approach adapts to evolving forms of misinformation and maintains high detection performance even in the presence of adversarial attacks and novel manipulation techniques. The confusion matrix for train data based on ACO method is shown in figure 1.

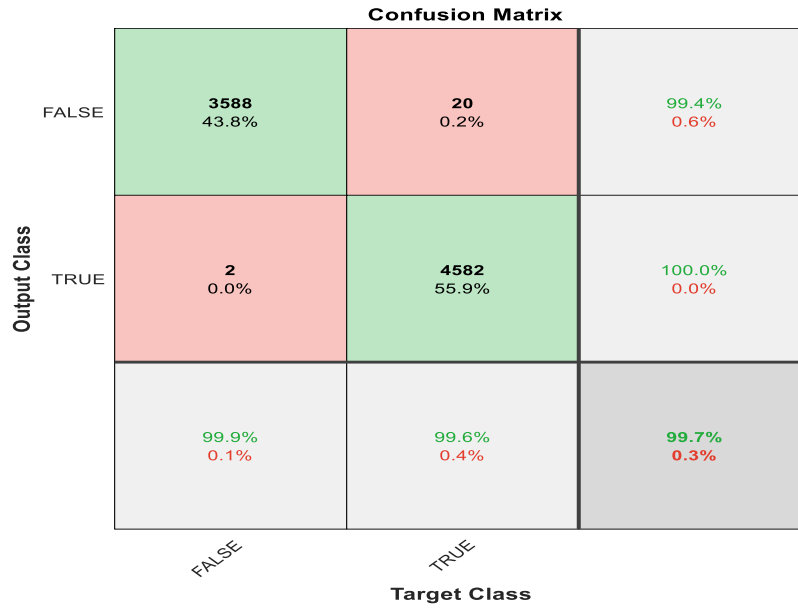


Figure 1. Confusion matrix for train data with ACO

The confusion matrix for test data based on ACO method is shown in figure 2.

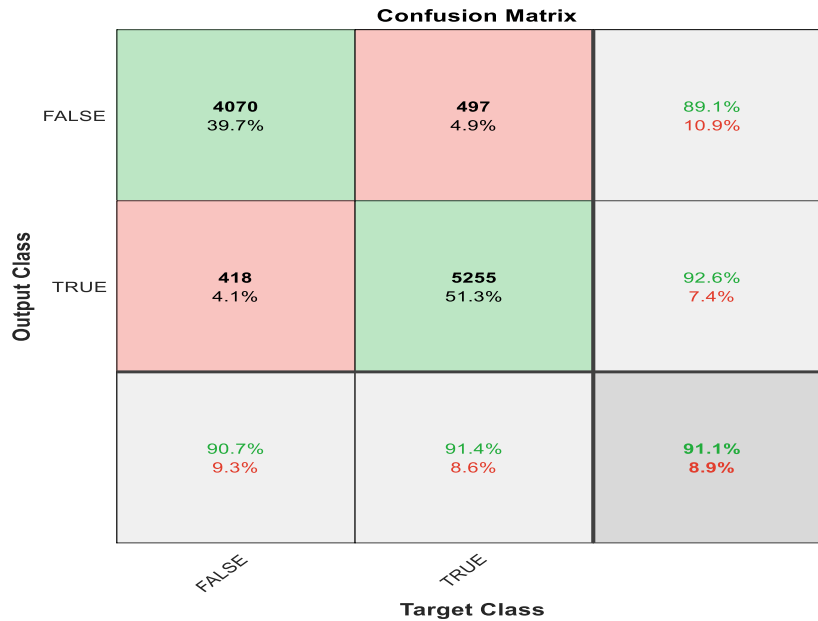


Figure 2. The confusion matrix for test data with ACO

We compared our results with particle swarm optimization (PSO) algorithm and genetic algorithm (GA). The result that obtained from PSO is shown in figure 3, and figure 4.

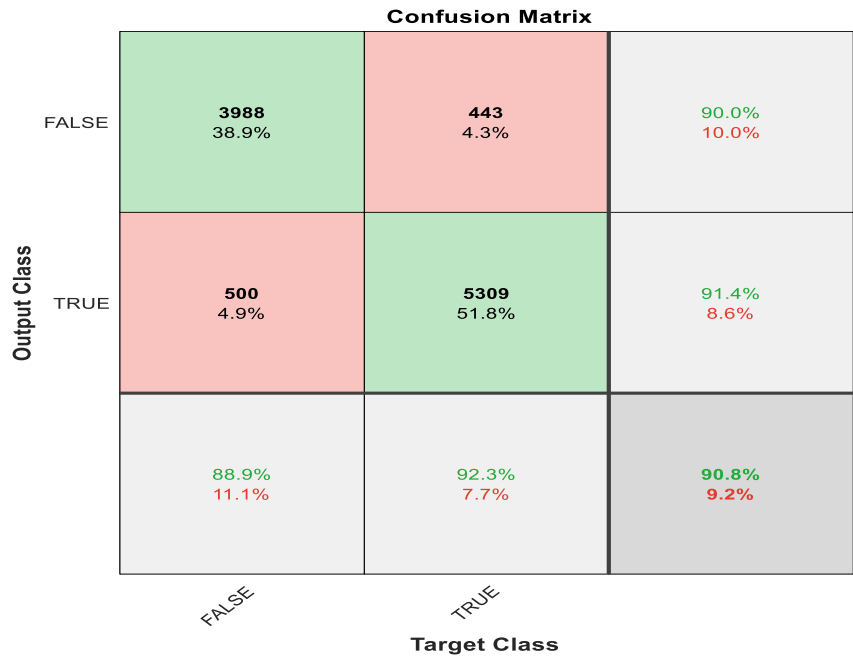


Figure 3. Confusion matrix for train data with PSO

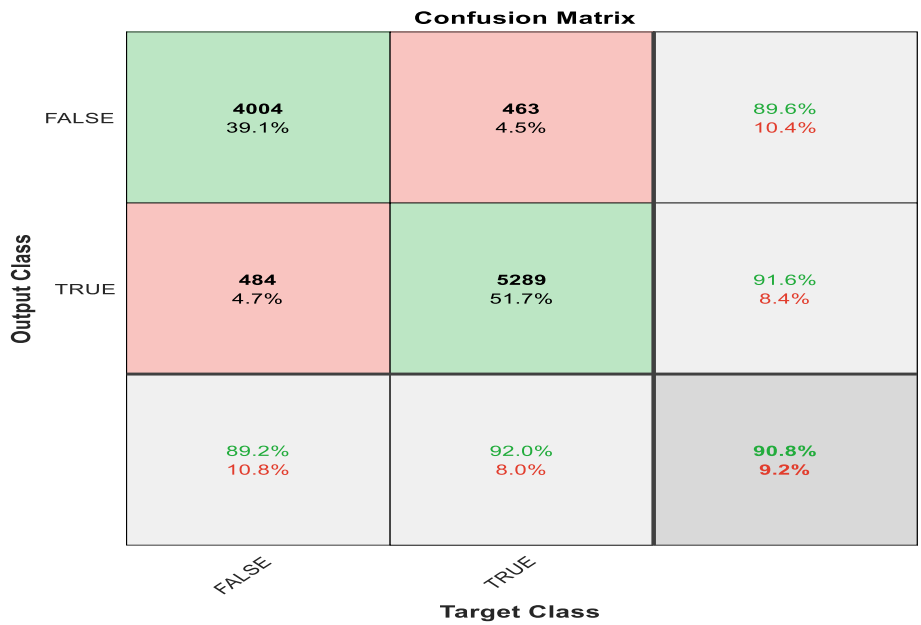


Figure 4. The confusion matrix for test data with PSO

The result that obtained from GA is shown in figure 5, and figure 6.

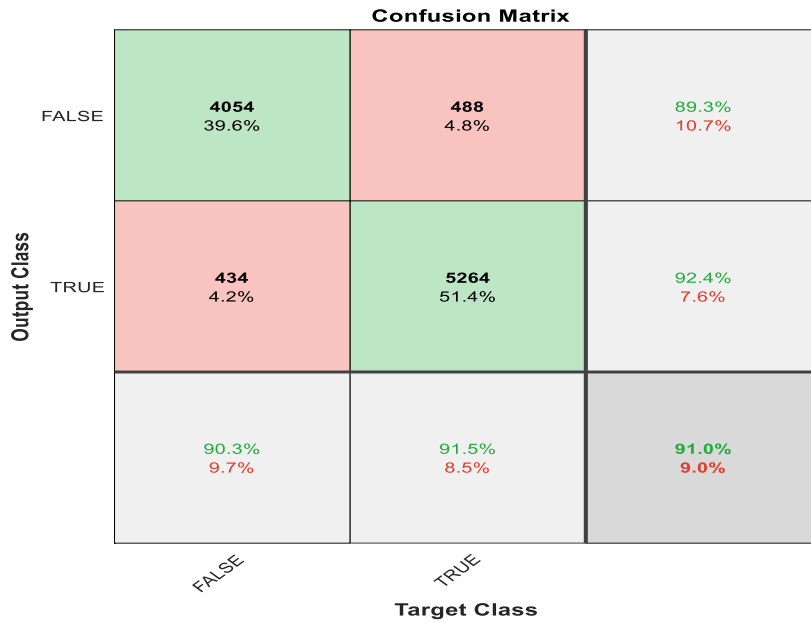


Figure 5. Confusion matrix for train data with GA

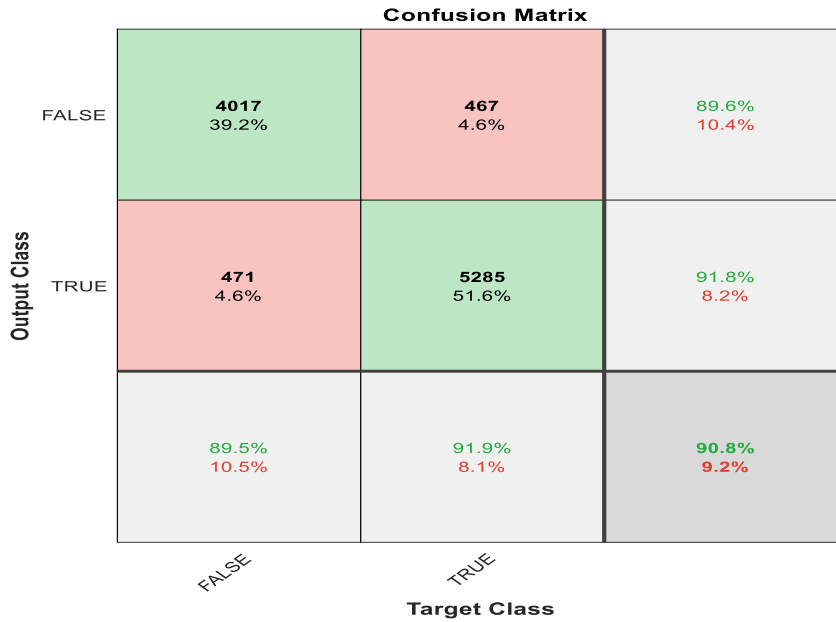


Figure 6. The confusion matrix for test data with GA

The Comparative results between ACO, PSO, and GA is shown in table 1.

Table 1. Comparative results between ACO, PSO, and GA

	Sensitivity (%)	Specificity (%)	Precision (%)	Accuracy (%)
ACO	89.60	92.30	90.20	91.10
PSO	88.70	92.30	90.20	90.70
GA	89.40	92.20	90.00	90.90

The graphical illustration of the results is shown in figure 7.

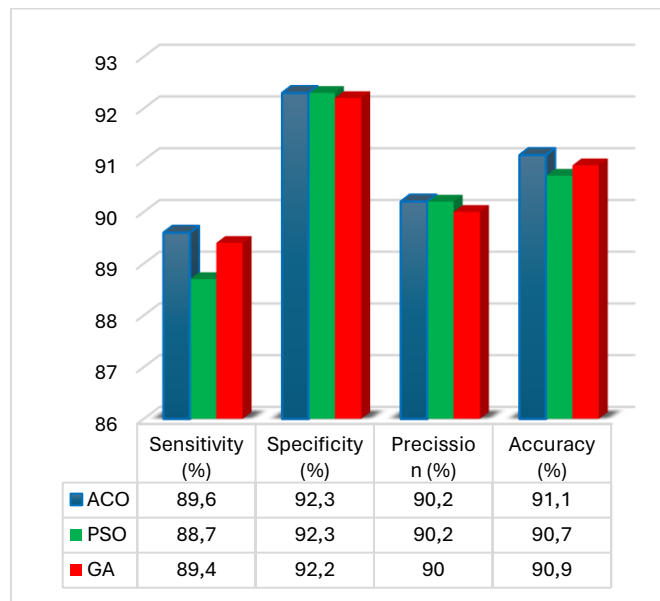


Figure 7. The graphical illustration of the results

The training process is shown in figure 8.



Figure 8. The training process

The classes of distribution data for fake and real news data are shown in figure 11.



Figure 11. The classes of distribution data for fake and real news data

Table 2 summarizes the performance of our approach compared to baseline methods and state-of-the-art approaches in terms of accuracy, sensitivity, specificity, and precision. Our hybrid approach achieved superior performance compared to baseline methods and state-of-the-art approaches across all evaluation metrics. The accuracy, sensitivity, specificity, and precision of our approach consistently outperformed other methods, demonstrating the effectiveness of integrating deep learning with ACO for fake news detection. The confusion matrix of our approach indicates its robustness in distinguishing between fake and genuine news instances across different media modalities, including textual, image, and video content. This suggests that our approach generalizes well to diverse types of misinformation and is capable of achieving high detection performance across various scenarios.

Table 2. The performance of our approach compared to baseline methods and state-of-the-art approaches in terms of accuracy, sensitivity, specificity, and precision.

	Sensitivity (%)	Specificity (%)	Precision (%)	Accuracy (%)
Proposed method	89.60	92.30	90.20	91.10
Elhadad et al. [21]	58.00	63.00	64.00	58.00
Nasir et al. [22]	60.00	59.00	59.00	60.70

Proposed method results confirm the efficacy of the proposed approach based on deep learning and Ant Colony Optimization algorithm for fake news detection. By leveraging the complementary strengths of deep learning and optimization techniques, our approach achieves superior detection performance, scalability, efficiency, robustness, and generalization across different media modalities, contributing to the advancement of fake news detection technologies in combating misinformation in online platforms.

5. Conclusion

In conclusion, the fusion of deep learning and ACO algorithm offers a promising solution for combating the pervasive threat of fake news. By effectively integrating text and multimedia analysis with feature optimization, our approach provides a robust framework for accurately identifying misinformation, thereby contributing to the preservation of truth and integrity in online communication platforms.

References

- [1] P. Meel and D. K. Vishwakarma, "Fake news, rumor, information pollution in social media and web: A contemporary survey of state-of-the-arts, challenges and opportunities," *Expert Syst. Appl.*, vol. 153, p. 112986, 2020.
- [2] M. D. Molina, S. S. Sundar, T. Le, and D. Lee, "'Fake news' is not simply false information: A concept explication and taxonomy of online content," *Am. Behav. Sci.*, vol. 65, no. 2, pp. 180–212, 2021.
- [3] C. Shao, G. L. Ciampaglia, O. Varol, A. Flammini, and F. Menczer, "The spread of fake news by social bots," *arXiv Prepr. arXiv1707.07592*, vol. 96, p. 104, 2017.
- [4] K. Shu and H. Liu, *Detecting fake news on social media*. Springer Nature, 2022.
- [5] R. Oshikawa, J. Qian, and W. Y. Wang, "A survey on natural language processing for fake news detection," *arXiv Prepr. arXiv1811.00770*, 2018.
- [6] Z. Shahbazi and Y.-C. Byun, "Fake media detection based on natural language processing and blockchain approaches," *IEEE Access*, vol. 9, pp. 128442–128453, 2021.
- [7] N. Singh and H. Sabrol, "Convolutional neural networks-an extensive arena of deep learning. A comprehensive study," *Arch. Comput. Methods Eng.*, vol. 28, no. 7, pp. 4755–4780, 2021.
- [8] M. R. Kondamudi, S. R. Sahoo, L. Chouhan, and N. Yadav, "A comprehensive survey of fake news in social networks: Attributes, features, and detection approaches," *J. King Saud Univ. Inf. Sci.*, vol. 35, no. 6, p. 101571, 2023.
- [9] S. Hangloo and B. Arora, "Fake News Detection Tools and Methods--A Review," *arXiv Prepr. arXiv2112.11185*, 2021.

- [10] P. Meesad, “Thai fake news detection based on information retrieval, natural language processing and machine learning,” *SN Comput. Sci.*, vol. 2, no. 6, p. 425, 2021.
- [11] A. Choudhary and A. Arora, “Linguistic feature based learning model for fake news detection and classification,” *Expert Syst. Appl.*, vol. 169, p. 114171, 2021.
- [12] S. R. Sahoo and B. B. Gupta, “Multiple features based approach for automatic fake news detection on social networks using deep learning,” *Appl. Soft Comput.*, vol. 100, p. 106983, 2021.
- [13] N. Seddari, A. Derhab, M. Belaoued, W. Halboob, J. Al-Muhtadi, and A. Bouras, “A hybrid linguistic and knowledge-based analysis approach for fake news detection on social media,” *IEEE Access*, vol. 10, pp. 62097–62109, 2022.
- [14] A. Mallik and S. Kumar, “Word2Vec and LSTM based deep learning technique for context-free fake news detection,” *Multimed. Tools Appl.*, vol. 83, no. 1, pp. 919–940, 2024.
- [15] Q. Chang, X. Li, and Z. Duan, “Graph global attention network with memory: A deep learning approach for fake news detection,” *Neural Networks*, vol. 172, p. 106115, 2024.
- [16] S. M. Dwivedi and S. B. Wankhade, “Deep Learning Based Semantic Model for Multimodal Fake News Detection,” *Int. J. Intell. Eng. Syst.*, vol. 17, no. 1, 2024.
- [17] V. Barpha and P. S. Nair, “A Smart Model to Detect Hindi Fake News for Social Media Platform using Hybrid Deep Learning,” *Int. J. Intell. Syst. Appl. Eng.*, vol. 12, no. 5s, pp. 486–493, 2024.
- [18] G. Yildirim, “A novel hybrid multi-thread metaheuristic approach for fake news detection in social media,” *Appl. Intell.*, vol. 53, no. 9, pp. 11182–11202, 2023.
- [19] M. Patil *et al.*, “A Novel Approach to Fake News Detection Using Generative AI,” *Int. J. Intell. Syst. Appl. Eng.*, vol. 12, no. 4s, pp. 343–354, 2024.
- [20] A. M. Luvembe, W. Li, S. Li, F. Liu, and X. Wu, “CAF-ODNN: Complementary attention fusion with optimized deep neural network for multimodal fake news detection,” *Inf. Process. Manag.*, vol. 61, no. 3, p. 103653, 2024.
- [21] M. K. Elhadad, K. F. Li, and F. Gebali, “A novel approach for selecting hybrid features from online news textual metadata for fake news detection,” in *Advances on P2P, Parallel, Grid, Cloud and Internet Computing: Proceedings of the 14th International Conference on P2P, Parallel, Grid, Cloud and Internet Computing (3PGCIC-2019) 14*, 2020, pp. 914–925.
- [22] J. A. Nasir, O. S. Khan, and I. Varlamis, “Fake news detection: A hybrid CNN-RNN based deep learning approach,” *Int. J. Inf. Manag. Data Insights*, vol. 1, no. 1, p. 100007, 2021.

PAPAĞANLARDA KANİBALİZM ANORMAL DAVRANIŞI VE ENFEKSİYON RİSKLERİ

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ÖZET

Papağanlar ortalama 92 cins altında kategorize edilen 398 tür ile temsil edilen parlak tüylü kuşlardır. Papağanlar çoğunlukla Amerika, Asya, Afrika ve Okyanusya'nın tropik coğrafyalarının sıcak topraklarında ve ormanlarda yaşayan canlılardır. Günümüzde 50 milyon civarında papağan kafeslere hapsedilerek yaşamaktadır. Çoğu papağan türü zamanlarının büyük bir kısmını ağaçların gölge kısımlarında tüneyerek veya tırmanarak geçirir. Ağaçların içine yaptıkları yuvalarında yaşamlarını sürdürür ve yumurtalarını bırakırlar. Türkiye'de kafes harici doğal ortamda yaşayan iki papağan türü bulunmaktadır. Bunlar Yeşil papağan ve İskender papağanıdır. Kargalar gibi çok zeki olmaları ve insan seslerini taklit edebilmeleri onlara evcil hayvan gibi muamele edilmesinin en büyük sebebidir. Kafese kapatılan papağanlarda aşırı korku, kanibalizm ve delirme gibi anormal davranışlar görülmektedir. Bu anormal davranışlar papağanların davranışlarını neredeyse yarı yarıya kısaltmakta ve refahlarını olumsuz yönde etkilemektedir. Doğal ortamlarında 70 yıla kadar yaşayabilen papağanlar, kafeslerde ortalama 40 yıl kadar yaşayabilmektedirler. Kanibalizm, hayvanlarda tüy döküntüsü ve bu bölgelerde meydana gelen eritematöz papüller ile karakterize anormal bir davranıştır. Sebebi genellikle stres faktörleri, beslenme eksiklikleri, çeşitli bakteriyel enfeksiyonlar, yetiştirme hataları ve ektoparaziter kaynaklıdır. Bu anormal davranışı sergileyen papağanlar huzursuzdur ve yemden yararlanamazlar. Tedavi protokolünde stres faktörlerini ortadan kaldırmak, medikal tedavi ve hijyen kurallarına uyulması önerilmektedir. Bu çalışma, papağan yetiştiriciliğinde önemli bir anormal davranış olan kanibalizmin sebepleri ve yetiştiriciliğe olan olumsuz etkileri üzerinde durmak, meslektaşlara ve yetiştiricilere yarar sağlamak amacı ile yapılmıştır.

Anahtar Kelimeler: Papağan, Kanibalizm, Anormal Davranış, Yetiştiricilik

CANNIBALISM ABNORMAL BEHAVIOR AND INFECTION RISKS IN PARROTS

ABSTRACT

Parrots are brightly feathered birds represented by 398 species, categorized under 92 genera on average. Parrots are mostly found in the forests and warm lands of the tropical regions of the Americas, Asia, Africa and Oceania. Today, around 50 million parrots live in cages. Most parrot species spend most of their time perching or climbing in the shade of trees. They live and lay their eggs in the nests they build in the trees. In Turkey, there are two parrot species that live in the natural environment outside the cage. These are the Green parrot and the Alexander parrot. The fact that they are very intelligent like crows and can imitate human voices is the biggest reason why they are treated as pets. Caged parrots exhibit abnormal behaviors such as extreme fear, cannibalism and insanity. These abnormal behaviors shorten the parrots' behavior by almost half and negatively affect their welfare. Parrots can live up to 70 years in their natural habitat, but in cages they can live an average of 40 years. Cannibalism is an abnormal behavior characterized by feather rashes and erythematous papules. The cause is usually due to stress factors, nutritional deficiencies, various bacterial infections, breeding errors and ectoparasites. Parrots exhibiting this abnormal behavior are restless and do not benefit from feed. Elimination of stress factors, medical treatment and compliance with hygiene rules are recommended in the treatment protocol. This study was conducted with the aim of focusing on the causes of cannibalism, which is an important abnormal behavior in parrot breeding, and its negative effects on breeding, and to benefit colleagues and breeders.

Keywords: Parrot, Cannibalism, Abnormal Behavior, Breeding

1-GİRİŞ

Papağanın Tarihçesi

Papağan çeşitliliğinin, Güney Amerika, Avustralya ve Yeni Zelanda'yı kapsayan Gondvana'da evrimleşmiş olabileceği düşünülmektedir. Fosil kayıtlarındaki papağanların azlığı, bu hipotezin doğrulanmasını zorlaştırmaktadır. Moleküler araştırmalar, papağanların Gondvana'da evrimleşmiş olduğunu doğrulamakta ve 59 milyon yıl önce evrimleştiğini ortaya koymaktadır. Modern papağanların en eski kayıtları 20-23 milyon yıl öncesine aittir. Papağanlar çoğunlukla

Amerika, Asya, Afrika ve Okyanusya'nın tropik coğrafyalarının sıcak topraklarında ve ormanlarda yaşayan canlılardır. Papağanların bilinen 400'e yakın türü bulunmaktadır. Sadece Psittacidae ailesinde bilinen ve sınıflandırılmış 322 tür bulunmaktadır. Psittacoidea üst familyasına ait türlerin yaklaşık 18 kadarının nesli son 500 yılda tükenmiştir (Wright ve ark., 2008). Psittacoidea üst familyasını oluşturan yaklaşık 350 türden oluşan renkli, uçabilen, gagaları kanca şeklinde ve genel olarak otçul (omnivor) kuşlardır. Gerçek papağanlar dünyada yaygın bir biçimde görülebilir. Loriket, amazon papağanı, jako ve muhabbet kuşu en çok bilinen gerçek papağan türleridir (del Hoyo ve ark., 1997).

Tablo-1: Biyolojik Sınıflandırma

Âlem:	<u>Animalia</u>
Şube:	<u>Chordata</u>
Sınıf:	<u>Aves</u>
Takım:	Psittaciformes
Familya:	Psittacidae
Üst familyalar:	<ul style="list-style-type: none">• <u>Cacatuoidea</u>• <u>Psittacoidea</u>• <u>Strigopoidea</u>• Arinae• Psittacinae
Alt familyalar:	

Papağanlarda Enfeksiyöz Hastalıklar

Anormal davranışı sergileyen papağanlar huzursuzdur ve yemden yararlanamazlar. Genel olarak kanatlılar ve papağanlar bakteri kaynaklı hastalıklara karşı oldukça duyarlıdırlar. Özellikle davranışsal hastalıklarının sebepleri arasında hijyen eksikliği ve yaşadıkları stres yer alır. Davranış bozukluğu sonrasında enfeksiyon kapmış kuşun yaşadığı stresten ve enfeksiyondan kurtulması için içtiği suya, yediği yemeğe antibiyotik uygulanmalıdır. Kuşun yaşadığı ortamın ise gerekli hijyen tedbirleri alınarak temizlenmiş olması gerekmektedir.

Papağanlarda, diğer hastalıklara bağlı olarak hastalıkların bulaşma durumu, canlının yaşadığı çevresel ve duygusal strese bağlı olarak düşen bağışıklığı ile bağlantılıdır (Samanta ve Bandyopadhyay, 2017). Kanatlılarda olduğu gibi papağanlarda da hastalıklar nonenfeksiyöz ve enfeksiyöz diye 2'ye ayrılmaktadır. Hastalıklarda yaygın olarak görülen semptomlardan bir kaçısı; halsizlik, kilo ve tat kaybıdır (Samanta ve Bandyopadhyay, 2017). Daha spesifik olarak, mide enfeksiyonları sindirim sisteminde rastlanacak rahatsızlıklar ile (tat kaybı ve ishal gibi) ortaya çıkar. Özellikle kanibalizmus gibi yaralanmalı davranış bozukluklarında hijyene dikkat etmek gerekir. Kafes içerisinde herhangi bir enfeksiyon riski oluşmaması için, yaralanmalara acil müdahale önemlidir (Jacob ve ark., 2011). Kuşlarda hastalığa sebep olan çokça bakteri bulunmaktadır. Bunlar arasında; E.coli, Pseudomonas, Aeromonas, Serratia marcescens, Salmonella, Mycobacteria, Clostridia, Klebsiella, Enterobacter, Proteus, Citrobacter, Pasteurella gibi bakteriler bulunmaktadır (Evans, 2011; Jacob ve ark., 2011). Özellikle Pasteurella bakterisi kediler ve fareler gibi hayvanlarda bulunur. Bu bakterinin kuşlara geçme yolu ise ısırma değildir. Kuşlarda görülmüş enfeksiyonlardan bazıları kuş tüberkülozu (mikrobakteriyoz), psittakoz (papağan ateşi veya klamidiyoz) ve klostridyal gibi hastalıklardır (Fogell ve ark., 2019; Greenwood ve Keighley, 1992; Jacob ve ark., 2011).

Kanibalizmin Davranışa Etkileri

Papağanlar doğduklarında hiçbir şey bilmezler. Birkaç ay veya yılda ailelerinden davranışların ve zihinsel gelişimlerin tamamını öğrenirler. Bu süre içerisinde diğer kuşlarla iletişim, sosyalleşme, beslenme, üreme ve diğer canlılardan korunma gibi birçok normal davranışı hayatta kalabilmek için ailelerinden öğrenirler. Papağanların birkaç türü hariç vahşidirler. Muhabbet kuşu, cockateil, peach-faced, lovebird, rignneck parakeet ve bazı Avustralya çayır parakeetleri evcil papağan türlerindedir. Kafeste yaşayan papağanlar doğada yaşayanlara oranla daha sakin ve sosyaldir. Papağanlar yiyecek aramak ve bulmak için günün 1/3'ünü ayırırlar bu sayede uzun mesafe uçmaları gerekir. Uzun mesafe uçuşlarında egzersiz, fiziksel aktivite, yuvalarını koruma ve eş seçimi gibi bazı davranışları yaşamları için gerçekleştirmek zorundadır. Fakat elde yetiştirilen ve kafes ortamında yaşaması için beslenen papağanlar yüksek enerjili yemler yedirilerek gerekli aktivite ve davranışları sergileyemeyeceklerinden bu yetiştirilme şekli doğal yaşamlarına ters düştüğü için davranış problemlerinin oluşumuna sebep olmaktadır. Papağanların parlak tüy yapısı, konuşma ve taklit etme özellikleri yetiştiricilerin bu hayvan türlerini tercih

etmelerini sağlar. Bunun yanı sıra papağanlar zeki, kompleks ve çok sosyal hayvanlardır. Diğer canlılar gibi papağanlarda davranış ve psikolojik bozukluklara karşı hassastır. Kafese kapatılan papağanlarda aşırı korku, saldırganlık, ısırma, kanibalizm ve delirme gibi anormal davranışlar görülmektedir. Kanibalizm görülen papağanlarda tüylerini yolma (kellik derecesi), kendine zarar verme, kendini ısırma, depresyon, iştahsızlık, aşırı stres ve korku davranışları görülmektedir (Özsoy, 2012).

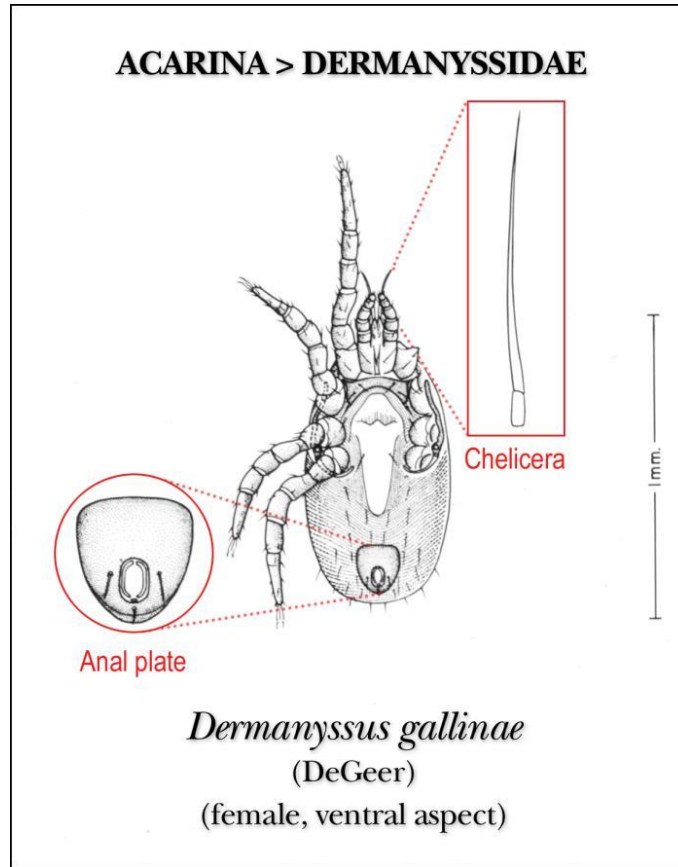


Şekil-1: Kanibalizm sonucu tüylerini koparmış papağan

Kanibalizmin Sebepleri

Kanibalizmin sebepleri stres, beslenme ve yetiştirme hataları, mineral eksikliği, aşırı aydınlık ortam, havanın çok sıcak veya çok soğuk olması, kaşıntı, ilgi arama, sahibinden ayrılma endişesi, korku, tüy travması, uygun olmayan kanat kesimi, üreme ve ektoparaziter kaynaklıdır (Özsoy, 2012). Yüksek enerjili (çekirdek, ceviz fıstık) besinler ile sürekli beslenen papağanlarda kanibalizm çok sık görülmektedir. Aynı zamanda papağanlarda *Dermanyssus gallinae* adı verilen bir dış parazit etkeni sebebiyle de kanibalizm görülmektedir. Bu parazit tavuk, güvercin,

kanarya, muhabbet kuşu, serçe, papağan ve sığırcık dahil en az 30 kanatlı türünde rastlanmıştır (Roy ve Chauve, 2007). Kanatlı hayvanların dışında geçici olarak, insan, kedi, köpek, sığır, fare ve diğer memelilerde de enfestasyona sebep olmaktadır ve zoonoz karakterde bir ektoparazitir (Mullen ve Durden, 2002). Özellikle geceleri konak canlılardan kan emen *D. Gallinae*, bakteri ve virusların taşıyıcı vektörleridir (Koç ve ark., 2017). Uykusuzluk, irritasyon, anemi, yemden yararlanma kapasitesinde azalma, buna bağlı olarak bağışıklığın zayıflaması ve hatta ölüme sonuçlanabilen doğrudan zararları da bulunmaktadır. Son zamanlarda yapılan bazı çalışmalarda, *D. gallinae* enfestasyonunun kanatlılarda kanibalizmi tetiklediği de bildirilmiştir (Kilpinen ve ark., 2005; Sparagano ve ark., 2014). *D. gallinae* papağanlarda kaşıntı ve tüy yolma sonucu tüylerin koparıldığı bölgelerde eritematöz papüllerin oluşmasına sebep olur (Koç ve ark., 2017).



Şekil-2: *Dermanyssus gallinae*

Papağanların Davranışsal ve Enfeksiyon Hastalıklara Karşı Alınabilecek Önlemler

1. Yeni tüm kuşları karantinaya almak gerekir.
2. Kafeste bulunan kuşların sayısını artırmamak ve onları kalabalıktan sakınmak çok önemlidir.
3. Papağan ve genel olarak kanatlıların stresli olabileceği ortamlardan uzakta stressiz bir bölge oluşturulmalıdır.
4. Papağanın bulunduğu ortamın iyi havalandırılmış olmasına dikkat edilmelidir.
5. Papağanlara dengeli hazırlanmış diyetler uygulanmalıdır.
6. Özellikle kafes ortamının, yumurtlama bölgelerinin ve kuşların sürekli etkileşim halinde olduğu aletlerin dezenfeksiyonuna dikkat edilmelidir. Mutlaka hijyen kurallarına uyulmalı, belirli aralıklarla dezenfekte edilmeli ve rutin bakımları aksatılmamalıdır.

Kanibalizmin Tedavisi

Kanibalizm davranış bozukluğu görülen papağanlarda;

- Stres ve korku kaynaklı şikâyetlerde, korkutucu maddelerin uzaklaştırılması, kafesin yükseltilmesi, medikal uygulama (butorphanol ve tirisiklik antidepresanlar) uygulanabilir.
- Beslenme kaynaklı şikâyetlerde, yağ oranı çok yüksek besinlerin beslenme programından kaldırılması, türlerine uygun hazırlanmış kaliteli yemler, mineral eksikliği durumlarında mineral takviyesi, A ve B vitamini kaynağı içeren taze sebze ve meyvelerin beslenme programına eklenmelidir.
- İlgi arama ve sahibine bağlılık sonucu görülen durumlarda ilgilenme, ödüllendirme, banyo yaptırma, egzersiz yaptırma ve oynaması için oyuncak verilebilir.
- Tüy travması ve uygun olmayan kanat kesimine bağlı durumlarda, zarar gören tüylerin anestezi altında uzaklaştırılması, yakalık kullanımı ve medikal uygulama (butorphanol ve NSAİ)
- Ektoparaziter kaynaklı şikâyetlerde ise 15 mg Selamektin (Stronghold) 10 gün ara ile iki kez uygulanmalıdır. Aynı zamanda hijyen koşullarının sağlanması için kafes ve ekipmanların temizliğine de dikkat edilmiştir.
- Bakteriyel enfeksiyonlara karşı ise enfeksiyona neden olan bakterinin türüne etkili kuşlara uygulanabilecek etken madde içeren antibiyotikler kullanılmalıdır (Fogell ve ark., 2019; Fox, 1924; Özsoy, 2012; Weston ve Memon, 2009).

SONUÇ

Bu çalışma, papağan yetiştiriciliğinde önemli bir anormal davranış olan kanibalizmin sebepleri ve yetiştiriciliğe olan olumsuz etkileri üzerinde durmak, meslektaşlara ve yetiştiricilere yarar sağlamak amacı ile yapılmıştır.

KAYNAKÇA

- 1-** del Hoyo, J., Elliott, A., Sargatal, J. (1997). Handbook of the Birds of the World. Lynx Editions, 4, 281.
- 2-** Evans, E.E. (2011). Zoonotic Diseases of Common Pet Birds: Psittacine, Passerine and Columbiform Species. *Veterinary Clinics: Exotic Animal Practice*, 14(3), 457-476.
- 3-** Fogell, D.J., Groombridge, J.J., Tollington, S., Canessa, S., Henshaw, S., Zuel, N., Ewen, J.G. (2019). Hygiene and Biosecurity Protocols Reduce Infection Prevalence But Do Not Improve Fledging Success in an Endangered Parrot. *Scientific Reports*, 9(1), 4779.
- 4-** Fox, H. (1924). The Practice of Hygienic Control and It's Results at the Philadelphia Zoological Garden. *Journal of Mammalogy*, 5(3), 153-164.
- 5-** Greenwoodma, A.G., Keighley, W. (1992). Infectious Disease Risks to Parrot Aviculture and Reintroduction.
- 6-** Jacob, J.P., Gaskin, J.M., Wilson, H.R., Mather, F.B. (2011). Avian Diseases Transmissible to Humans. Lexington: Cooperative Extension Services, University of Kentucky.
- 7-** Kilpinen, O., Roepstorff, A., Permin, A., Norgaard-Nielsen, G., Lawson, L.G., Simonsen, H.B. (2005). Influence of *Dermanyssus Gallinae* and *Ascaridia Galli* Infections on Behaviour and Health of Laying Hens (*Gallus gallus domesticus*). *Br Poult Sci.*, 46, 26–34.
DOI: 10.1080/00071660400023839.
- 8-** Koç, N., Yücesan, B., Nalbantoğlu, S. (2017). Papağanlarda *Dermanyssus Gallinae* Kaynaklı Kanibalizm. *MAE Vet Fak Derg*, 2 (2), 147-151. DOI: 10.24880/maevfd.363443.
- 9-** Mullen, G.R., Durden, L.A. (2002). *Medical and Veterinary Entomology*.
- 10-** Özsoy, S. (2012). Papağangil ve Ötücü Kafes Kuşu Hastalıkları. Nobel Tıp Kitabevleri Ltd. Şti., 4 (17), 231-243.
- 11-** Samanta, I., Bandyopadhyay, S. (2017). *Pet Bird Diseases and Care*. Singapore: Springer, 6, 253-262.
- 12-** Sparagano, O., George, D.R., Harrington, D.W.J., Giangaspero, A. (2014). Significance and Control of the Poultry Red Mite, *Dermanyssus gallinae*. *Annu Rev Entomol.* 59, 447-66.
DOI: 10.1146/annurev-ento-011613-162101.
- 13-** Roy, L., Chauve, C.M. (2007). Historical Review of the Genus *Dermanyssus* Dugès, 1834 (Acari: Mesostigmata: Dermanyssidae). *Parasite*, 14 (2), 87-100.
<https://doi.org/10.1051/parasite/2007142087>
- 14-** Weston, M.K., Memon, M.A. (2009). The Illegal Parrot Trade in Latin America and It's Consequences to Parrot Nutrition, Health and Conservation. *Bird Populations*, 9, 76-83.
- 15-** Wright, T. F., Schirtzinger, E.E., Matsumoto, T., Eberhard, J.R., Graves, G.R., Sanchez, J.J., Sara Capelli, S., Müller, H., Scharpegge, J., Chambers G.K., Fleischer, R.C. (2008). A Multilocus Molecular Phylogeny Of The Parrots (Psittaciformes): Support For A Gondwanan Origin During The Cretaceous. *Mol. Biol. Evol.*, 25 (10), 2141–2156.

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At eğitimi, rehberliği ve yetiştiriciliğini optimize etmek için, at davranışlarının derinlemesine anlaşılması vazgeçilmezdir. Bilişsel kapasitelerini aydınlatarak ve özel eğitim rejimleri uygulayarak, insanlar bu muhteşem hayvanların çeşitli alanlardaki potansiyelini tam olarak kullanabilirler. Davranış, organizmaların çevrelerine karşı sergiledikleri sayısız tepkiyi kapsar. Atlarda bu spektrum beslenme, hareket ve sosyal etkileşim gibi normatif davranışlardan stereotipler ve saldırganlık gibi anormal tezahürlere kadar uzanır. Atlarda sosyal öğrenmenin temel taşlarından biri olan taklit davranışı, özellikle erken gelişim dönemlerinde göze çarpar. Yavru atlar genellikle akranlarının veya daha deneyimli bireylerin hareketlerini taklit eder, bu da sürü içinde öğrenmeyi ve sosyal uyumu kolaylaştıran bir süreçtir. Örneğin, taylor sıklıkla annelerinin otlama düzenlerini ve lokomotor davranışlarını taklit eder. Taklit sosyal öğrenmeyi teşvik ederken, at toplulukları içinde saldırganlık veya kötü alışkanlıklar gibi istenmeyen davranışları da sürdürebilir. Atlarda tahta kemirme ve beşik dokuma gibi anormal davranışların yaygınlığı, etiyojilerini ve hafifletici faktörleri anlamının önemini vurgulamaktadır. Stres, sosyal izolasyon ve çevresel eksiklikler, uyumsuz davranışların gelişmesine katkıda bulunan başlıca etkenlerdir. Bu nedenle, stres faktörlerini azaltmayı ve türe özgü davranışları teşvik etmeyi amaçlayan etkili yönetim stratejileri, atların refahını ve performansını sağlamak için çok önemlidir.

Özetle, hem normatif hem de anormal tezahürleri kapsayan at davranışının incelikli bir şekilde anlaşılması, at yönetimi uygulamalarını optimize etmek ve refahlarını ve performanslarını artırmak için gereklidir.

Anahtar Kelimeler: At Davranışı, Sosyal Öğrenme, Taklitçi Davranış, Stres Azaltma, At Refahı, At Eğitimi, Bilişsel Gelişim

IMITATION BEHAVIOR IN HORSES

ABSTRACT

To optimize horse training, guidance, and breeding, a profound understanding of equine behavior is indispensable. Through elucidating their cognitive capacities and implementing tailored training regimes, humans can fully harness the potential of these magnificent animals across various domains. Behavior encompasses the myriad responses organisms exhibit to their environment. In horses, this spectrum ranges from normative behaviors like feeding, locomotion and social interaction to aberrant manifestations such as stereotypies and aggression. Imitative behavior, a cornerstone of equine social learning, is particularly salient during early developmental stages. Juvenile horses often mimic the actions of their peers or more experienced individuals, a process that facilitates learning and social cohesion within the herd. For instance, foals frequently replicate the grazing patterns and locomotor behaviors of their dams. While imitation fosters social learning, it can also perpetuate undesirable behaviors like aggression or vices within equine communities. The prevalence of aberrant behaviors in horses, including crib-biting and weaving, underscores the significance of understanding their etiology and mitigating factors. Stress, social isolation and environmental deficiencies are primary contributors to the development of maladaptive behaviors. Thus, effective management strategies aimed at reducing stressors and promoting species-typical behaviors are pivotal for ensuring equine welfare and performance.

In summary, a nuanced comprehension of equine behavior, encompassing both normative and aberrant manifestations, is essential for optimizing horse management practices and fostering their well-being and performance.

Keywords: Equine Behavior, Social Learning, Imitative Behavior, Stress Mitigation, Equine Welfare, Horse Training, Cognitive Development.

Atın Tarihçesi

Yıllar önce binek amaçlı evcilleştirilen at, farklı dönemlerde çeşitli amaçlarla insanoğlu için önemini korumuştur. Atların ortalama 5 bin yıl önce evcilleştirildiği düşünülmektedir. Arkeolojik çalışmalarda ilk çağlarda atın doğuda ve batıda etinden ve sütünden yararlanıldığı tespit edilmiştir. İlk olarak orta asyada evcilleştirilen at sonraları hızlıca dünyanın her yerinde yetiştirilmeye başlanmıştır. Binek hayvanı, taşımacılık, iletişim hizmetleri, besin kaynağı ve spor

amaçlı yetiştirilmeye devam edilmiştir. Teknolojinin ve sanayinin gelişmesi ile birlikte günümüzde sportif amaçlarla yapılan at yetiştiriciliği dünyanın hemen her yerinde önemli sosyal ve kültürel bir etkidir (Karabağ, 2016).

Tablo-1: Biyolojik Sınıflandırma

Âlem:	<u>Animalia</u>
Şube:	<u>Chordata</u>
Sınıf:	<u>Mammalia</u>
Takım:	<u>Perissodactyla</u>
Familya:	<u>Equidae</u>
Oymak:	<u>Equini</u>
Cins:	<u>Equus</u>
Tür:	<u>E. ferus</u>
Alt tür:	E. f. caballus

Atlarda Davranış

Davranış, canlıların çevrelerine karşı verdiği tepkiler bütünüdür. At davranışlarının bilinmesi atlarla olan ilişkilerin belirlenmesinde ve atların eğitilerek onlardan yeterli oranda verim alabilmek için çok önemli bir husustur. Diğer hayvanlarda olduğu gibi atlar da normal ve anormal davranışlar sergilerler. Normal davranışlara örnek olarak; beslenme, üreme, analık, dinlenme, uyuma, arkadaşlık kurma ve taklit etme gösterilebilir. Atlar, bu davranışları küçük yaştan itibaren analarından, yaşlılarından ya da daha ergin atlardan öğrenebilmektedir. Normal davranışların iyi bilinmesi anormal davranış sergileyen sürü fertlerinin çabuk teşhis edilmesini ve erken tedavi yöntemleriyle meydana gelen stereotipin ortadan kaldırılmasını sağlamaktadır. Tahta kemirme, tekme atma, kendi etrafında dönme ve kıskançlık ise atların anormal davranışlarına örnek gösterilebilir. Anormal davranış sergileyen atlar yemden yararlanmama, huzursuzluk, hırçınlık ve düşük verim problemleri gösterebilirler. At yetiştiriciliğinde yeterli

verimin alınabilmesi için normal ve anormal davranışların çabuk bir şekilde tespit edilerek tedavi edilmesi çok önemlidir (Danışan ve ark., 2014).

Atların Taklit Davranışı

Taklit davranışı, atlarda çok genç yaşta başlar ve genellikle yaşamları boyunca devam eder. Taklit davranışı genellikle tayların analarını kopyalamasıyla başlar. Yeterli erginliğe ulaşan tay anasının yem yemesini, su içmesini ve padokta otlamasını taklit eder. Buna ek olarak, taylar padokta akranlarını taklit ederek oyun oynama ve arkadaşlık kurma becerilerini geliştirebilirler. Taylar, kendilerinden daha olgun atları örnek alarak insanlarla ilişki kurma, sürü liderliği ve koşma becerilerini geliştirebilirler (Danışan ve ark., 2014). Birbirine komşu tavlalarda yetiştirilen atlar birbirlerinin davranışını taklit etme eğilimindedirler. Örneğin; ahırında odun kemiren ya da kendi etrafında dönen bir at, tavlada komşu olduğu atlara kötü bir örnektir ve diğer atların onu taklit etme eğilimleri yüksektir (Özbeyaz ve Akçapınar, 2006). Yeterince sosyallaşemeyen, kötü bakım besleme koşullarına maruz kalan, bulunduğu çevrede stres faktörleri olan ve sürü içinde olumsuz davranışlar sergileyen sürü üyelerinin bulunması anormal davranışların taklit edilmesi riskini arttırmaktadır. Buna karşın, uygun çevre şartlarında yetişen ve sakin mizaçlı atların bulunduğu sürüye dahil olan bireylerin olumlu davranışları taklit ettiği bildirilmiştir (Weiss ve Chapman, 2010; Wickens ve Heleski, 2010). Sürü içerisinde bulunan atların ortak hareket etmesi de taklit davranışına örnektir. Farklı bir hareket yapan yıldı içerisindeki bir üye diğer bireyleri de olumlu ya da olumsuz etkiler. Korkak bireyler çoğunlukla yıldı sürüsünün en arkasında bulunmayı tercih ederler ve ürkek hareketlerle diğer atları takip ederler. Bu ürkek bireyler asla yıldıının ön tarafına geçmezler. Aynı arabaya birlikte koşulan atlar birbirlerini taklit eder ve aynı yöne koşma eğilimindedirler (Griffin, 2015; Köseman ve Şeker, 2016; McDonnell, 2015).

Taklit Davranışının Yetiştiriciliğe Olumlu Etkileri

- Taylar analarını taklit ederek ilk öğrenmelerini hızlı bir şekilde gerçekleştirirler.
- Taylar akranlarını ve ergin atları taklit ederek oyun oynama ve arkadaşlık kurma becerilerini geliştirirler.
- Atlar, taklit davranışı sayesinde sürü üyelerinin olumlu davranışlarını öğrenirler.

- Atlar, taklitçilik sayesinde insan davranışlarını taklit eder ve insanlarla iyi ilişkiler kurarlar (Griffin, 2015; Köseman ve Şeker, 2016; McDonnell, 2015).

Taklit Davranışının Yetiştiriciliğe Olumsuz Etkileri

- Atlar, komşu tavlada bulunan diğer atları taklit ederek onların kötü davranışlarını örnek alabilirler. Tahta kemirme, kendi etrafında dönme, aşırı kişneme, yem saatinde kapıya vurma, insanları ısırma ve duvara tekme atma bu anormal davranışlara örnek verilebilir.
- İnsanlarla kötü ilişki içerisinde olan atlar, diğer atları kötü yönde etkileyebilir.
- Otlanırken üstünlük kurmak isteyen atlar, diğer atlara zarar verebilir ve bu davranışı sürü üyeleri tarafından taklit edilebilir.
- Hırçnılık, yetiştiricilikte kötü bir davranıştır ve genellikle diğer atların mizacını etkiler (Griffin, 2015; Karabağ, 2016; Köseman ve Şeker, 2016; McDonnell, 2015).

SONUÇ

Taklit davranışı, atların sosyal öğrenme ve iletişim yoluyla çevrelerindeki diğer bireyleri taklit etme eğilimi olarak tanımlanır. Bu davranış, atların genç yaşlardan itibaren gösterdiği ve yaşamları boyunca devam eden bir özelliktir. Taklit davranışının yetiştiriciliğe olan etkileri hem olumlu hem de olumsuz yönde belirgindir. Atlar, taklit yoluyla hızlı bir şekilde öğrenir ve sosyal becerilerini geliştirirken, aynı zamanda olumsuz davranışları da taklit ederek sorunlar yaratabilirler. Bu nedenle, atların eğitim ve bakımı sürecinde taklit davranışının yönetilmesi ve olumlu davranışların teşvik edilmesi önemlidir. Bu doğru yaklaşımlarla, atların sağlıklı ve dengeli bir şekilde gelişmeleri sağlanabilir, hem atların refahı hem de yetiştiricilik uygulamalarının verimliliği artırılabilir.

KAYNAKÇA

1- Danişan, S., Çalışkan, H., Özbeyaz, C. (2014). Atların Öğrenme ve Eğitilebilme Yetenekleri. Lalahan Hay. Araşt. Enst. Derg. 54 (2), 77-84.

2- Griffin, A. (2015). "Types of Equine Behavior".

<http://www.extension.org/horses/>

3- Karabağ, İ. (2016). Türk ve Alman kültüründe "At" (İçinde "At" Sözcüğü Geçen Atasözleri ve Deyimler). Atatürk Üniversitesi Sosyal Bilimler Enstitüsü Dergisi, 20 (2), 721-730.

4- Köseman, A., Şeker, İ. (2016). Atlarda Davranış ve Sportif Amaçlı Atlarda Önemi. Fırat Üniversitesi Sağlık Bilimleri Veteriner Dergisi, 30 (2), 147-155.

5- McDonnell, S.M. (2015). “Normal and Abnormal Behavior of Stabled Horses”.

<http://www.agriculture.alberta.ca/>

6- Özbeyaz, C., Akçapınar, H. (2006). At Yetiştiriciliği Ders Notları. Ankara Üniversitesi Veteriner Fakültesi Zootekni Anabilim Dalı, Ankara.

7- Weiss, D.J., Chapman, K. (2010). Animal Learning and Behavior, Corsini Encyclopedia of Psychology.

8- Wickens, C.L., Heleski, C.R. (2010). Crib-biting Behavior in Horses. Applied Animal Behaviour Science, 128, 1-9.

BAZI YERLİ ÇİLEK ÇEŞİTLERİ'NİN DİYARBAKIR EKOLOJİSİNDEKİ PERFORMANSLARININ BELİRLENMESİ

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ÖZET

Bu çalışma, Diyarbakır GAP Uluslararası Tarımsal Araştırma ve Eğitim Merkezi arazisinde 2016-2018 yılları arasında yürütülmüştür. Çalışmada Atatürk Bahçe Kültürleri Merkez Araştırma Enstitüsü tarafından ıslah edilerek, tecil edilen 7 adet çilek çeşidinin (Erenoğlu 77, Dorukhan 77, Doruk 77, Bolverim 77, Hilal 77, Eren 77, Ata 77) Diyarbakır koşullarında adaptasyon denemesi kurulmuştur. Tesadüf blokları deneme desenine göre göre 4 tekerrür ve her tekerrürde 30 adet bitki olacak şekilde deneme kurulmuştur. Taze fidelerin kullanıldığı denemede bitkiler 65–70 cm genişlik ve 20–25 cm yükseklikte hazırlanan seddelere sıra arası 30 cm, sıra üzeri 25 cm mesafe ile çapraz dikim metoduyla dikilmiştir.

İlk çiçeklenmeler, 2017 yılında 30 Mart, 2018 yılında ise 24 Şubatta ATA 77 çeşidinde görülmüş olup; ilk hasat 2017 yılında Doruk 77, Eren 77 ve Erenoğlu 77 çeşitlerinde 6 Mayıs tarihinde yapılmıştır. 2018 yılında ise Eren 77 çeşidinde ilk hasat 3 Mayıs tarihinde hasat edilmiştir. Çeşitler içerisinde en uzun hasat periyodu 2017 yılında Eren ve Erenoğlu çeşitlerinde; 2018 yılında ise Erenoğlu 77 çeşidinde gerçekleşmiş, en kısa hasat periyodu ise çalışmanın her her iki yılında da Ata 77 çeşidinde görülmüştür. Meyve iriliği, en yüksek Bolverim 77 (11.52 g) çeşidinde, en düşük ise Eren (7.45 g) çeşidinde saptanmıştır. Çalışmadaki Dorukhan 77 çeşidi, verim açısından ortalama değerler göstermiş ancak meyve eti sertliği ve meyve iriliği bakımından ortalamanın üzerinde değerler göstermiş ve sofralık tüketim için önerilmiştir.

Anahtar Kelimeler: Çilek, Diyarbakır, adaptasyon, yerli çeşitler, *Fragaria x ananassa*

DETERMINATION OF THE PERFORMANCE OF SOME LOCAL STRAWBERRY VARIETIES IN DIYARBAKIR ECOLOGY

ABSTRACT

This study was conducted between 2016 and 2018 on the land of Diyarbakır GAP International Agricultural Research and Training Center. This study was carried which established out in Diyarbakır conditions adaptation trial of 7 strawberry varieties (Erenoğlu-77, Dorukhan-77, Doruk-77, Bolverim-77, Hilal-77, Eren-77, Ata-77), which were bred and registered by Atatürk Horticulture Central Research Institute. The experiment was designed according to the randomized block design with 4 replications and 30 plants in each replication, and cross-planting. In the experiment where fresh seedlings were used, the plants were planted on the prepared banks of 65–70 cm in width and 20–25 cm in height, with a distance of 30 cm between rows and 25 cm between rows, using the cross planting method.

The first blooms were seen in the ATA 77 variety on March 30 in 2017 and on February 24 in 2018. The first harvest was harvested in the Doruk 77, Eren 77 and Erenoğlu varieties on May 6 in 2017, and the Eren 77 variety was harvested on May 3 in 2018. Among the varieties, the longest harvest period was in Eren and Erenoğlu varieties in 2017; In 2018, it was observed in the Erenoğlu 77 variety, and the shortest harvest period was observed in the Ata 77 variety in both years of the study. The highest fruit size was found in Bolverim 77 (11.52 g) and the lowest in Eren (7.45 g). In the study, Dorukhan 77 variety showed average values in terms of yield, but showed above average values in terms of fruit flesh hardness and fruit size and was recommended for table consumption.

Key Words: Strawberry, Diyarbakır, adaptation, local varieties, *Fragaria x ananassa*

DİYARBAKIR YÖRESİNDE KOYUNLARDA *BABESIA OVIS*'İN ELISA YÖNTEMİYLE SEROLOJİK OLARAK PREVALANSININ BELİRLENMESİ

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ÖZET

Babesia ovis'in neden olduğu babesiosis, Türkiye'nin farklı coğrafi bölgelerinde koyun ve keçilerde yaygın olarak görülen, özellikle *Rhipicephalus bursa* türü kenelerin baskın olduğu bölgelerde, ateş, anemi, sarılık ve hemoglobiniüri gibi semptomlara yol açan, yüksek ölüm oranlarına neden olan mevsimsel bir hastalıktır. Bu hastalık, küçükbaş hayvan (koyun, keçi) yetiştiriciliğinde önemli ekonomik kayıplara neden olmaktadır. Türkiye'de *B. ovis*'in prevalansını ortaya koyan mikroskopik, serolojik ve moleküler yöntemlerin kullanıldığı çok sayıda epidemiyolojik çalışma yapılmıştır. Babesiosisin serolojik olarak tespitinin, epidemiyolojik araştırmalarda oldukça önemli olduğu bilinmektedir. Türkiye koyun yetiştiriciliğinde önemli bir yere sahip olan Diyarbakır ilinde, ELISA yöntemiyle koyunlarda *B. ovis*'in serolojik olarak prevalansının belirlenmesi amaçlanmıştır. Bu amaçla Nisan-Temmuz 2023 tarihleri arasında Diyarbakır iline bağlı Çermik, Bismil, Bağlar, Çınar, Sur ve Yenişehir ilçelerinde rastgele seçilen 13 işletmede bulunan 414 adet koyundan serum tüplerine kan örneği alınmıştır. Toplanan kan örnekleri Fırat Üniversitesi Veteriner Fakültesi Parazitoloji Anabilim Dalında 3000 devirde 15 dakika santrifüj edilerek serumları çıkarılmıştır ve ELISA testinde kullanılabilecek kadar -20°C de muhafaza edilmiştir. Serolojik prevalansı belirlemek için *B. ovis* ile enfekte koyunların serum örneklerinde tespit edilebilir olan ve enfekte eritrositlerin sitoplazmasında bol miktarda bulunduğu bildirilen *B. ovis*-SA1 (BoSA1) adı verilen immün reaktif protein kullanılmıştır.

ELISA testi ile incelenen 414 adet serum örneğinin 248 (%59.9) tanesi anti-*B.ovis* antikorları yönünden pozitif bulunmuştur. Bu sonuç Diyarbakır ilindeki koyunlarda *B.ovis*'in seroprevalansının oldukça yüksek olduğunu göstermiştir.

Anahtar Kelime: *Babesia ovis*, ELISA, Koyun, rBoSA1

KEDİLERİN ENFEKSİYÖZ PERİTONİTİSİ'NİN OFTALMİK SUNUMLARI, BELİRTİLERİ VE TEDAVİ SEÇENEKLERİ

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ÖZET

Kedilerin enfeksiyöz peritonitisi (FIP), kedi koronavirüs (FCoV) kaynaklı bir hastalıktır ve genellikle ölümcül sonuçlar doğurur. Bu hastalık, genellikle vaskülit ile ilişkilendirilir ve sistemik etkiler gösterdiği gibi bazı vakalarda gözlemlenen oftalmik belirtilerle de ilişkilendirilmiştir. FIP hastalarında, çeşitli oftalmik bulguların varlığı araştırmalar ve raporlar tarafından belgelenmiştir. Bu bulgular genellikle asemptomatikten ciddi bozukluklara kadar değişen bir yelpazede görülür. Konjunktivit, korneal ülser, piyogranülomatöz anterior üveit, glokom, retina dekolmanı ve retina vaskülitli koroidi klinik bulgular arasında yer alır. FIP'nin oküler belirtileri, özellikle kuru formda, diğer belirtilerden önce ortaya çıkabilir ve bazen sistemik semptomlar olmadan seyredebilir. Bu nedenle, erken tanı ve etkili tedavi, hastalığın seyrini belirleyebilir ve etkilenen kedinin yaşam kalitesini önemli ölçüde arttırabilir. FIP'nin antemortem tanısı genellikle karmaşık ve veteriner hekimler için zorlayıcı bir süreçtir, genellikle fiziksel muayene, laboratuvar testleri ve doku örneklerinin histopatolojik incelemesini içerir ve çoğu zaman klinik muayene, kan testleri, biyokimyasal profiller ve görüntüleme tekniklerinin bir kombinasyonunu gerektirir. Dolayısıyla, FIP ile ilişkili oftalmik bulguların tanısı ve tedavisi, multidisipliner bir yaklaşımı ve güncel literatür bilgileri gerektirir. FIP genellikle ölümcül bir hastalık olduğundan, oftalmik belirtilerin tedavisi genellikle semptomların kontrolüne odaklanır ve hastanın genel durumunu iyileştirmeye yöneliktir.

Bu sunum, gözden geçirilmiş literatür temelinde oküler belirtilerin FIP enfeksiyonuyla ilişkisini güncellemeyi ve bu belirtilerin erken teşhisi, tedavisi ve müdahalesinin önemini vurgulamayı hedeflemektedir; aynı zamanda, kedilerin enfeksiyöz peritonitisin oftalmik sunumu, belirtileri ve tedavi seçeneklerine dair mevcut bilgiyi özetlemekte ve gelecekteki araştırmalara ve tedavi stratejilerine ışık tutmaktadır.

Anahtar Kelimeler: FIP, göz bulguları, kedi, tanı, tedavi.

FELINE INFECTIOUS PERITONITIS: OPHTHALMIC PRESENTATIONS MANIFESTATIONS AND TREATMENT OPTIONS

ABSTRACT

Feline Infectious Peritonitis (FIP) is a disease caused by feline coronavirus (FCoV) and typically results in fatal outcomes. This disease is typically associated with vasculitis and has also been linked to ocular symptoms observed in some cases, as it demonstrates systemic effects. In patients, the presence of various ocular manifestations has been documented by research and reports. These manifestations are typically observed across a spectrum ranging from asymptomatic to severe disorders. Conjunctivitis, corneal ulcer, pyogranulomatous anterior uveitis, glaucoma, retinal detachment, and choroiditis with retinal vasculitis are among the clinical findings. The ocular symptoms of FIP, especially in the dry form, can appear before other symptoms and sometimes may progress without systemic symptoms. Therefore, early diagnosis and effective treatment can determine the course of the disease and significantly improve the quality of life for the affected cat. The ante-mortem diagnosis of FIP is generally complex and challenging for veterinarians, typically involving physical examination, laboratory tests, and histopathological examination of tissue samples, often requiring a combination of clinical examination, blood tests, biochemical profiles, and imaging techniques. Therefore, the diagnosis and treatment of ocular manifestations associated with FIP require a multidisciplinary approach and current literature knowledge. Since FIP is generally a fatal disease, the treatment of ocular symptoms typically focuses on controlling symptoms and improving the overall condition of the patient. This presentation aims to update the relationship between ocular signs and FIP infection based on reviewed literature and emphasize the importance of early diagnosis, treatment, and intervention of these signs. Additionally, it summarizes the current knowledge on the ocular presentation, symptoms, and treatment options of feline infectious peritonitis (FIP) and sheds light on future research and treatment strategies.

Keywords: FIP, ocular manifestations, cats, diagnosis, treatment.

FOTOVOLTAİK ENERJİ BESLEMELİ ELEKTRİKLİ DALGIÇ SU POMPALARINDA DEĞİŞKEN FREKANSLI SÜRÜCÜLER

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ÖZET

Bu çalışmada, su pompalama sistemlerinde güneş enerjili elektrikli dalgıç pompaların (ESP) kullanıldığı Değişken frekanslı sürücü (VFD) sistemleri genel bir bakışla ele alınmaktadır. Fotovoltaik (PV) beslemeli su pompalama sistemleri, özellikle uzak bölgelerde tarımsal uygulamalar ve evsel kullanım için ekonomik açıdan en uygun yenilenebilir enerji uygulamalarından biridir. Uygun güneş radyasyonu koşulları ve yeterli ortalama günlük güneş radyasyonu yoğunluğu altında, bir PV su pompalama sisteminin ekonomik değeri kurulum ve işletme maliyetlerinin çok üzerindedir. Bataryasız bir sistemin temel bileşenleri PV paneller, invertör, zırh korumalı güç kablosu ve dalgıç pompa. Bataryasız sistemler, güneşlenme süresi ve güneş yoğunluğu ile orantılı miktarlarda su pompalama özelliğine sahip olup, batarya ile çalışan sistemlere göre daha basit ve daha az maliyetlidir. Dalgıç pompa sistemlerinde asenkron motorlar daha güvenilir olması ve bakım gerektirmemesi gibi özellikleriyle öne çıkmaktadır. Dalgıç pompa uygulamalarında tüm yüklerde maksimum verim elde etmek için değişken hızda çalışmaya da ihtiyaç vardır. Dalgıç pompa motorunun hızı frekansla doğru orantılıdır. Statordaki doygunluğu ve kayıpları en aza indirmek için terminal gerilimi frekansla değiştirilerek gerilim/frekans oranı skaler kontrolle sabit tutulmalıdır. Motorun hızı, su pompalama sistemi tarafından emilen gücün her zaman PV sistemi tarafından anında sağlanan güce eşit olacağı şekilde uyarlanabilir. İntertör (veya VFD), PV panelinin DC voltajını artırarak AC voltajına dönüştüren ve dalgıç pompa hız kontrolü ve yumuşak başlatma sağlayan PWM prensibine (Histerez-PWM, sinüs PWM veya uzay vektör modülasyonu) göre çalışır. VFD ayrıca PV sisteminin her koşulda optimum verimlilikte çalışmasını sağlamak için maksimum güç noktası izleme (MPPT) sistemi ile donatılmıştır. VFD gücü toplam pompa gücünden %30 daha fazla olmalıdır. Skaler kontrolün yanı sıra, ek donanım gerektiren ancak sistem performansını artıran vektör kontrolü ve doğrudan tork kontrolü gibi daha karmaşık kontrol yöntemleri de invertörde kullanılabilir.

Sabit su mevcudiyeti ve pompa koşulları varsayıldığında, hız kontrolü için basit V/F kontrolü yeterlidir. Panel çıkışlarında farklı DC-DC konfigürasyonları ve DC-AC dönüşümü için farklı invertör devreleri tasarlanabilmektedir

Anahtar Kelimeler: Fotovoltaik, Değişken Frekanslı Sürücüler, Elektrikli Dalgıç Su Pompaları

VARIABLE FREQUENCY DRIVES IN PHOTOVOLTAIC ENERGY FED ELECTRIC SUBMERSIBLE WATER PUMPS

ABSTRACT

In this study, Variable frequency drive (VFD) systems using solar powered electric submersible pumps (ESP) in water pumping systems are discussed with an overview. Photovoltaic (PV) fed water pumping systems are one of the most economically viable renewable energy applications for agricultural applications and domestic use, especially in remote areas. Under suitable solar radiation conditions and sufficient average daily solar radiation intensity, the economic value of a PV water pumping system far exceed the installation and operating costs. The basic components of a battery-free system are PV panels, inverter, an armor-protected power cable and submersible pump. Battery-free systems have the ability to pump water in amounts proportional to the sunlight hours and sun intensity, and are simpler and less costly than battery-powered systems. In submersible pump systems, asynchronous motors stand out with their features such as being more reliable and maintenance-free. In submersible pump applications, variable speed operation is also needed to achieve maximum efficiency at all loads. Submersible pump motor speed is directly proportional to frequency. In order to minimize saturation and losses in the stator, the terminal voltage should be changed with the frequency so that the voltage/frequency ratio is kept constant with scalar control. The speed of the motor can be adapted so that the power absorbed by the water pumping system is always equal to the power instantly supplied by the PV system. The inverter (or VFD) works according to the PWM principle (Hysteresis-PWM, sine PWM or space vector modulation), which increases the PV panel DC voltage and converts it into AC voltage and provides speed control and soft start in the submersible pump. The VFD is also equipped with a maximum power point tracking (MPPT) system to ensure that the PV system operates at optimum efficiency under all conditions. VFD power should be 30% more than the total pump power. In addition to scalar control, more complex control methods such as vector control and direct torque control can also be used in the inverter, which require additional

hardware but improve system performance. Assuming constant water availability and pump conditions, simple V/F control is sufficient for speed control. Different DC-DC configurations at panel outputs and different inverter circuits for DC-AC conversion can be designed..

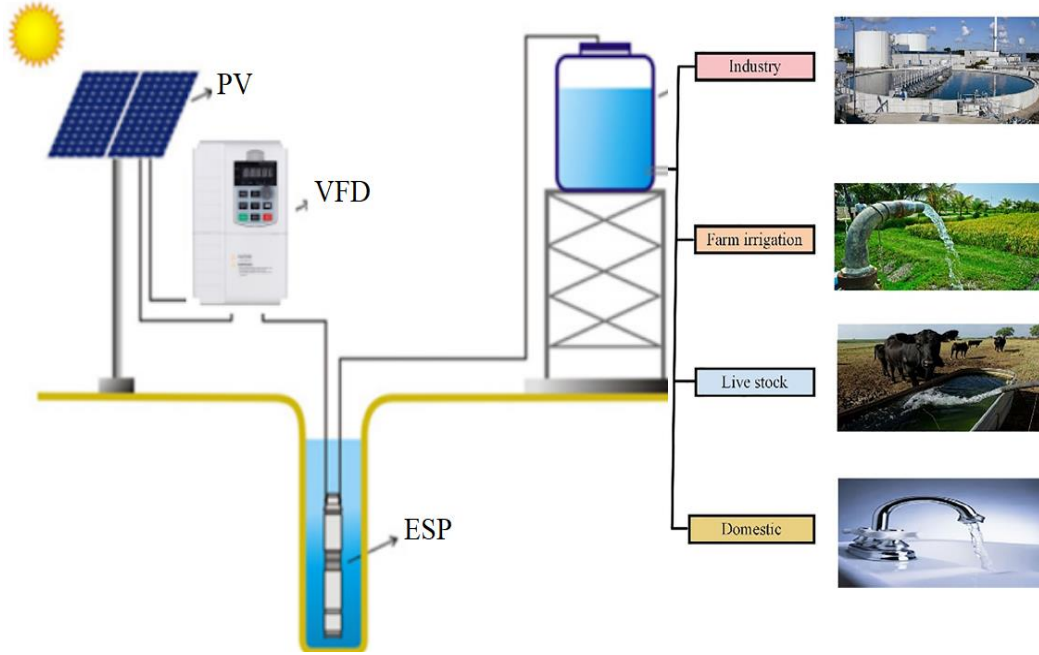
Keywords: Keywords: Photovoltaics, Variable Frequency Drives, Electric Submersible Water Pumps

1. GİRİŞ

Yenilenebilir enerjiye dayalı su pompalama sistemlerinin evsel, endüstriyel ve tarımsal sulama uygulamaları günümüzde giderek yaygınlaşmaktadır (Akhila ve Arun, 2018). Fotovoltaik beslemeli su pompalama sistemleri özellikle şebekeden uzak alanlarda ve yüksek güneş enerjisi potansiyeli olan yerlerde bir çok avantaja sahiptir. Organik yakıt tüketmeyen bu sistemler aynı zamanda çok az bakım gerektirir. Doğru şekilde tasarlanmış ve boyutlandırılmış sistemler uzun vadeli önemli tasarruf sağlama kapasitesine sahiptir. Fotovoltaik beslemeli güneş enerji sistemleri ile ilgili ilk çalışmalar yaklaşık 60 yıl önce başlamıştır (Shepvalova ve diğ., 2020). PV beslemeli pompalama sistemleri genel olarak yüzey pompa, yüzen pompa ve dalgıç pompalar olarak sınıflandırılır. Yerüstü su pompaları sığ kuyulardan, göletlerden veya nehirlerden su çeker. Yüzen pompalar yüksekliğini rezervuar sularının yüksekliğine göre ayarlar. Dalgıç ve yüzer pompalarda motor ve pompa tek bir üniteden oluşur. Yüzey suyu pompalarında ise motor ve pompa ayrı ayrı seçilebilir (Verma ve diğ., 2021). Yüze monte pompa sistemleri uzak mesafelere su taşıyabilir ancak Derinkuyularda emme sınırlamalarına sahiptir. Bu nedenle dalgıç pompalar sahip oldukları su itme kuvveti nedeniyle derinkuyularda daha avantajlıdır. PV beslemeli yüzey pompaları ayrıca yaklaşık 6m gibi derinliklerde uygundur ve meteorolojik şartlara maruzdur. Su çekme dinamikleri nedeniyle daha yüksek oranda mekanik sorun ve arızaya sahiptir.

2. PV BESLEMELİ ESP SİSTEMİ YAPISI

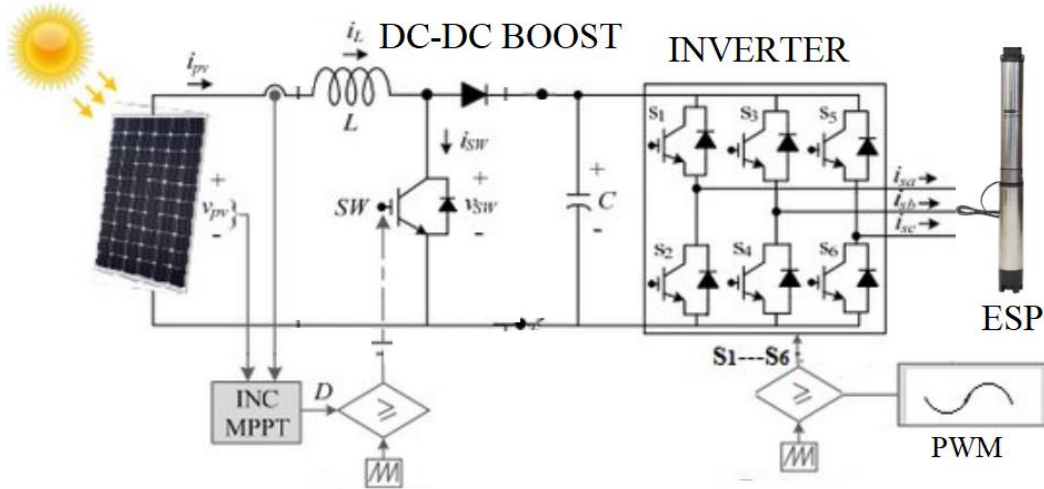
Tipik bir PV beslemeli ESP sistemi Şekil 2.1'de görülmektedir. Şekilde görüldüğü gibi sistem PV dizisi, VFD, ESP'den oluşmaktadır. PV panellerin ürettiği elektrik VFD aracılığıyla doğrudan ESP'ye verilmektedir.



Şekil 2.1. PV beslemeli ESP sistemi

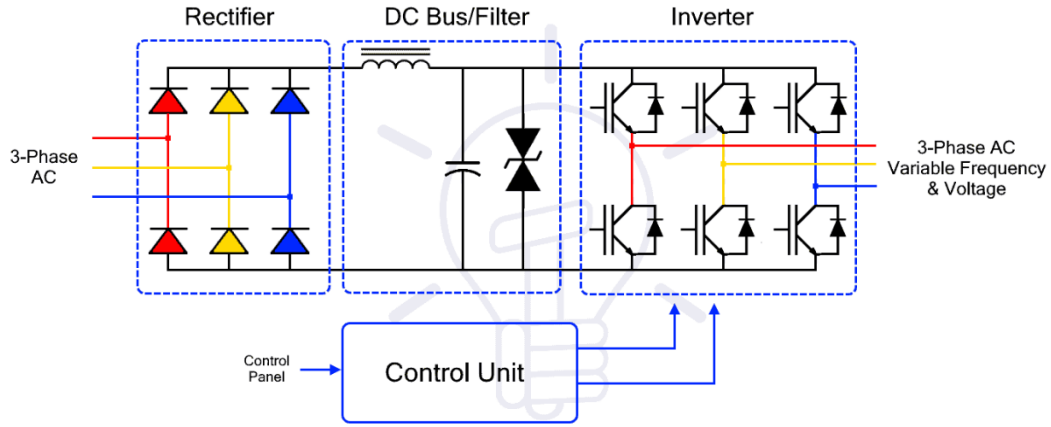
ESP'ler tamamen suya batırıldığında çalışacak şekilde ve suyu yüzeye itmek için tasarlanmıştır. Tipik ESP'ler 50-120 cm uzunluğunda, çapı ise 8-13 cm aralığındadır (Akhila ve Arun, 2018). Motor pompa gövdesine hava geçirmez bir bağlantı ile monte edilmiştir. ESP, tek bir ünite olarak bir elektrik motoru ve pompadan oluşur. Motor suyla doldurulduğundan stator sargılarının suya dayanıklı olması için genellikle PVC kaplı tel kullanılarak sarım yapılır. Su soğutması sargılarda 8-10A/mm² civarında yüksek akım yoğunluğu sağlar (Kalyan and Syal, 2023). Motora bağlı zırlı güç kablosu ve taşıyan borudan meydana gelmiştir. PV sistemler için tasarlana çoğu sistemin genel verimliliği %40-70 arasındadır (Akhila ve Arun, 2018). Şekil 2.1'deki ESP sisteminde batarya yoktur ve sadece gündüzleri su pompalamaktadır. Güneş paneline gelen ışınım yoğunluğu o esnada pompalanan su miktarını belirler. Gün içinde panel üzerine düşen güneş ışınımı ve açısının değişmesi ile panel voltajının/akımının azalması ile birlikte sürücü çıkışında voltaj ve frekansının azalması ile motorun hızındaki değişme ile birlikte pompalanan su miktarı sürekli değişmektedir. Sistem de batarya bulunmadığından yapısı basit ve maliyeti düşüktür. Gölgelemenin olmadığı açık havalı günlerde gün ışığının panel üzerinde daha dik geldiği sabahın geç saatleri ve öğle sonrasının erken saatlerinde maksimum su miktarı elde edilebilmektedir. Sabahın erken, akşamın geç saatlerinde ve bulutlu günlerde daha az su pompalanır. Sistemde eğer şebeke bağlantısı varsa bu durumda gece saatlerinde de su

sağlanabilmektedir (Sontake ve Kalamkar, 2016). ESP sistemlerinde DC motor, sabit mıknatıslı senkron motor ve asenkron motorlar kullanılabilir. Asenkron motorlar sağlam yapılı, güvenilir, düşük maliyetli, yüksek verimli, az bakım gerektiren, kirli alanlarda kullanılabilmesi gibi özellikleri ile dalgıç pompalarda tercih sebebi olmaktadır. Asenkron motorlu sistemlerde PV'den maksimum güç elde etmek için DC-DC dönüştürücü de MPPT algoritmaları çalıştırılmaktadır, DC-DC dönüştürücü çıkışları ise DC-AC inverter (VFD) aracılığıyla pompayı besler (Şekil 2.2). Sistem modülasyon frekansını değiştirerek maksimum güç noktasını izler PV'den maksimum güç elde edilerek düşük ışınmında bile su pompalanabilir. (Akhila ve Arun, 2018). VFD motora değişken voltaj ve frekans sağlayarak pompa hızında esneklik, enerji tasarrufu ve yumuşak başlatma sağlar (Liang, Ilochonwu, ve Adedun, 2012,). VFD'ler endüstriyel uygulamalarda pompa ve fan gibi motorların hızını kontrol etmek için kullanılmaktadır. VFD, Şekil 2.3'de görüldüğü gibi genel olarak, doğrultucu, DC link, inverter ve kontrol devresinden oluşmaktadır. VFD'ler daha çok PWM kontrollü gerilim kaynaklı invertör (VSI) kullanır.



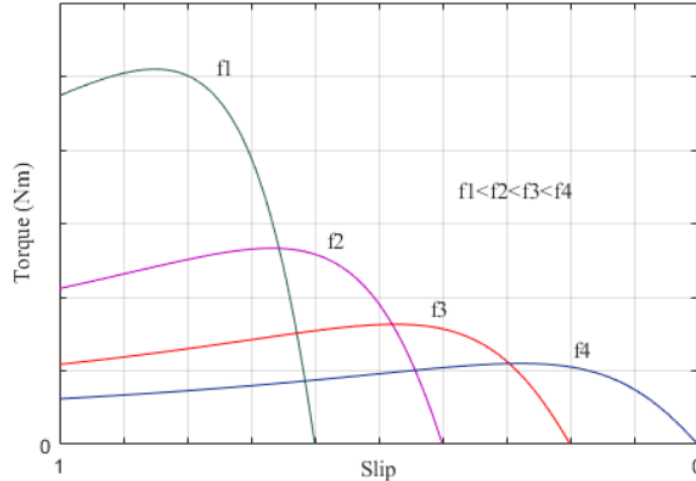
Şekil 2.2. DC-DC dönüştürücü ve inverterli ESP sistemi

Pompa uygulamalarında VFD gücü motor gücünden % 30 daha fazla olmalıdır (Osseily, 2023). VSI'de skaler (V/f kontrolü), doğrudan tork kontrolü ve vektör kontrolü kullanılır. Motor hızını kontrol etmek için düşük maliyetli, uygulanması kolay ve kontrolü basit olduğu için genellikle skaler V/f yaklaşımı kullanılır.



Şekil 2.3. VFD temel yapısı

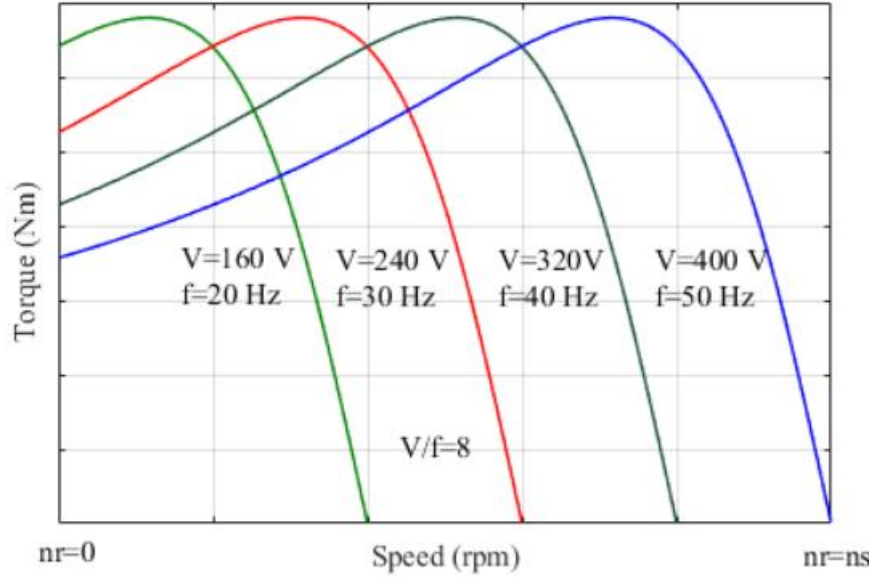
ESP’de kullanılan asenkron motorun hızı frekansın değiştirilmesi ile ayarlanır. Frekanstaki değişiklik torkunda değişmesine neden olur. Sabit bir maksimum torku korumak için voltajın frekansla birlikte değiştirilmesi gerekir. Frekans, şebeke frekansının üstüne veya altına değiştirilerek motor hızı, temel hızın altına veya üstüne değiştirilebilir. İnvörtörün çıkış voltajının genliği ve frekansı, anahtarlama için kullanılan yöntemle bağlı olarak değişken veya sabit olabilir. Hız, senkron hız ile torkun üretilebildiği hız arasında değiştirilebilir. Frekansın azalması hızı azaltır ancak Şekil 2.4’te görüldüğü gibi torkta artışa neden olur. Ancak motor bu tork kapasitesini kullanmaz ve artan tork düşük hızlarda gereksiz yüksek akımlara neden olur.



Şekil 2.4. Sabit voltaj ve değişken frekans şartlarında asenkron motorun tork-hız grafiği

Dolayısıyla frekans değişimi ile hız geniş bir aralıkta kontrol edilebilse de, düşük hızlarda şebekeden çekilen yüksek akım ve kayıplara neden olması nedeniyle kullanışlı değildir. Sabit

gerilim altında frekans azaltılırsa, indüklenen emk'yi sabit tutmak için akının artırılması gerekir. Ancak akının artışı doygunluğa neden olur. Bunun için voltajda frekansla birlikte azaltılmalıdır. Tüm hızlarda sabit tork ile çalışma sağlamak için voltaj/frekans oranının tüm frekanslar için aynı tutulması gerekir (Şekil 2.5).

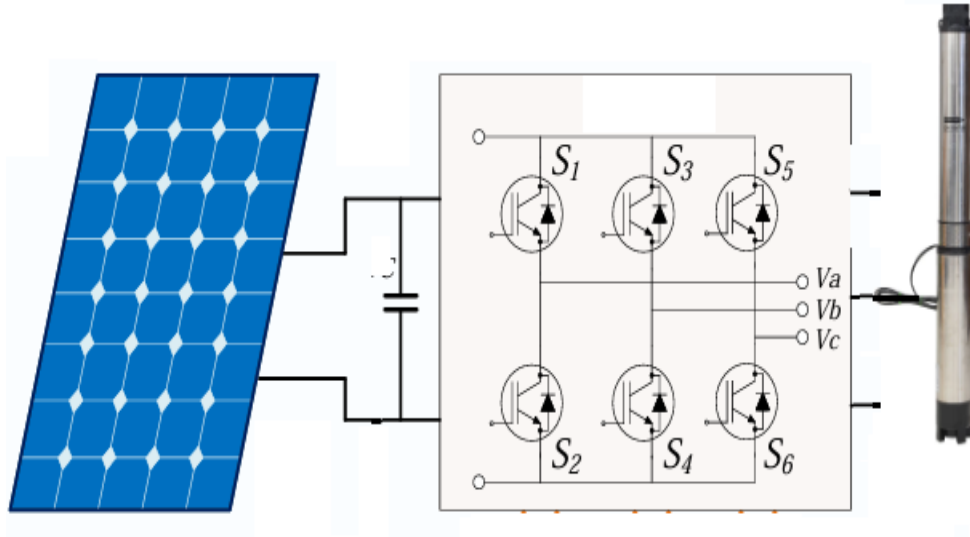


Şekil 2.5. Speed/torque curves with constant V/f ratio in an asynchronous motor

Sabit V/f oranı korunduğunda sıfıra yakın hız dışında geniş aralıkta hız değişimine ulaşılabilir. Bu durumda tork ve dolayısıyla motor akımı sabit kalır. Sıfır hıza yakın hızlarda voltaj düşmesini karşılamak için V/f oranından daha fazla voltaj uygulanır (Duranay ve diğ., 2020). V/f oranı, düşük hız aralığı dışında doğrusal olarak alınır. Senkron hızdan daha yüksek hız değerlerinde ise voltaj nominal değer üstüne çıkarılmadan sadece frekans artırılarak azalan torka karşılık sabit güç bölgesinde çalışma sağlanır. Bu özelliği V/f yöntemini yaygın hale getirmektedir (Bharti ve diğ., 2019).

DTC ve VC yaklaşımları akım sensörü gerektirir ve yaklaşımları karmaşıktır. V/f aynı zamanda asenkron motorun başlatmak akımını sınırlandırarak yumuşak başlatma sağlar. Anahtarlama için Histeresiz, sinusoidal ve uzay vektör modülasyonu PWM teknikleri kullanılır. V/f kontrolde tepkinin yavaş olması, torkun doğrudan kontrol edilmemesi gibi dezavantajlarının üstesinden gelmek için vektör kontrol (alan yönlendirmeli kontrol) uygulanabilmektedir. Üç faz vektörleri iki boyutlu referans çerçeveye dönüştürülür. Akı ve tork bileşenleri elde edilerek ayrı ayrı

kontrol edilebilir. Vektör kontrolünde stator akımları ve rotor konumu ek donanım maliyetleri ile ölçülerek tüm hız aralığında kontrol gerçekleştirilebilir. Ancak çerçeve dönüşümleri bu yöntemi karmaşık hale getirmektedir. DTC'de ise sabit bir anahtarlama düzeni yoktur. VSI yük ihtiyacına göre DTC tarafından anahtarlanır. Anlık yük değişimlerinde DTC yanıtı çok hızlıdır. DTC çalışma basitliği, karalı ve geçici durumda iyi tork kontrolü sağlar. DTC yüksek güç aralığı uygulamaları için daha uygundur. Uzak vektör modülasyonu, sinüsoidal darbe genişlik modülasyonuna göre azaltılmış anahtarlama frekansı, düşük akım dalgalanmaları, DC bara geriliminin etkin kullanımı, harmonik distorsiyonu azaltma gibi avantajlara sahiptir. Değişken hızlı uygulamalar için uygundur(Akhila and Arun, 2018). PV beslemeli ESP sistemlerinde DC-DC dönüştürücü kullanılmadan sadece inverter kullanan ve MPPT'nin inverterde gerçekleştirildiği Şekil 2.6'da görülen sistemlerde bulunmaktadır.



Şekil 2.6. Sadece inverter kullanılan PV beslemeli ESP sistemi

Tablo 2.1. PV beslemeli pompa sistemleri literatür özeti

Kaynak	Çalışma konusu
(Çayır ve Özbay, 2023)	iki farklı MPPT algoritması DC-DC dönüştürücü kullanmadan sadece VSI'de alan yönlendirmeli kontrol kullanılarak simülasyon çalışması olarak gerçekleştirilmiştir.
(Yadav ve diğ., 2015)	MPPT'siz inverter kullanan bir sistem ile DC-DC Boost ve İnverter Kullanan MMPT'li sistemi karşılaştırmış. MPPT'li sistemin daha verimli bulunmuştur.
(El-Koliel et all., 2022)	VFD içindeki VSI uzay vektör modülasyon tekniği ve bulanık mantık kontrolden oluşmuştur. Hız kontrolü için geleneksel PID'ye göre daha etkili olduğu bulunmuştur.
(Bhattacharjee ve diğ., 2021)	VFD'li ESP sistemi tasarlanmış kullanılan bölgeden sistemin daha verimli ve maliyetinin daha düşük olduğu bulunmuştur.
(Gunawan ve diğ., 2022)	Dalgıç pompada üç fazlı motorun bir fazlı motora göre daha iyi performans sağladığı bulunmuştur.
(Samal ve Das, 2017)	DC-DC boost dönüştürücü ve VFD bulunan sistemde dspic4011 denetleyici ile MPPT algoritması çalıştırılmış VSI'da Sinusoidal PWM ve Asenkron motor kullanılmıştır.
(yussif ve diğ., 2020)	PV beslemeli sistemde yeni bir v/f yöntemi (QV/f) önerilmiştir. Simülasyon ve deneysel çalışmada önerilen sistemin klasik sisteme göre daha iyi performans sağladığı görülmüştür.
(Liang ve diğ., 2012)	VFD sistemli ESP de sürücünün arıza tepkisi incelenmiştir.
(Aydogmu, 2012)	PV panel doğrudan invertere bağlanan sistemin basitlik ve yüksek verimlilik elde etmek için alçak gerilim ve düşük güçlü motorlarda kullanılabilir olduğu belirtilmiştir.
(Bojang ve diğ., 2023)	Bir fazlı indüksiyon motorunun sürüldüğü ve iki farklı MPPT tekniği kullanılan sistemin enerji tasarrufu sağlama ve etkili sulama çözümü sunduğu vurgulanmıştır.
(Akhila ve Arun, 2018)	Düşük performanslı bir sürücü için skaler kontrol, değişken frekanslı uygulamalarda vektör kontrolü, yüksek güç aralığı uygulamaları için. DTC yönteminin uygun olduğu belirtilmiştir.
(Narendra ve diğ., 2023)	Altı anahtarlı inverter yerine 4 anahtarlı inverter önerilmektedir. Ayrıca hız kontrolü dolaylı vektör control yöntemi ile yapılmaktadır.
(Badachi, 2022)	Akım harmonikleri ve voltaj düşüşlerini azaltmak için 12 pulse modüler VSI önerilmiştir.
(Aazmi ve diğ.,)	VFD'lerin hız değişimi ile enerji tasarrufu sağladığı belirtilmektedir. V/f düşük tepki, yüksek tork dalgalanmalı, basit yapıli tork kontrolü ve alan yönlendirmenin yüksek dinamik tepkili akımı düşük bulunmuştur.

3. SONUÇ

Bu sitemlerde iyileştirme çalışmaları temel olarak;

- PV modüllerde, inverter ve pompa gibi bileşenlerin özel yapılarının geliştirilmesi,
- Maksimum güç noktası takip sistemleri,
- Elektrik motoru kontrolünü iyileştirme,
- Motor-pompa etkileşiminin ve PV-motor etkileşiminin güneş ışınımı değişiminde iyileştirilmesi
- DC-DC dönüştürücüsüz topoloji geliştirme çalışmalarını kapsamaktadır.

KAYNAKÇA

- Aazmi, M. A., Fahmi, M. I., Aihsan, M. Z., Liew, H. F., & Saifizi, M. (2021, November). A review on VFD control and energy management system of induction motor for electric vehicle. In 2021 IEEE 19th Student Conference on Research and Development (SCORED) (pp. 36-41).
<https://doi.org/10.1109/SCORED53546.2021.9652673>
- Akhila, V. T., & Arun, S. (2018, August). Review of Solar PV Powered Water Pumping System Using Induction Motor Drive. In IOP Conference Series: Materials Science and Engineering (Vol. 396, No. 1, p. 012047).
<https://doi.org/10.1088/1757-899X/396/1/012047>
- Aydogmus, O. (2012). Design of a solar motor drive system fed by a direct-connected photovoltaic array. *Advances in Electrical and Computer Engineering*, 12(3), 53-58
<https://doi.org/10.4316/aece.2012.03008>
- Badachi, C. (2022, October). Performance Analysis of Three Phase Induction Motor Using Solar PV Array Fed Modular Voltage Source Inverter. In 2022 IEEE 2nd Mysore Sub Section International Conference (MysuruCon) (pp. 1-6).
<https://doi.org/10.1109/MysuruCon55714.2022.9972659>
- Bharti, R., Kumar, M., & Prasad, B. M. (2019, March). V/f control of three phase induction motor. In 2019 International conference on vision towards emerging trends in communication and networking (ViTECoN) (pp. 1-4).
<https://doi.org/10.1109/ViTECoN.2019.8899420>
- Bhattacharjee, B., Sadhu, P. K., Ganguly, A., & Naskar, A. K. (2021). Integrated green submersible pumping system for future generation. *Facta Universitatis, Series: Electronics and Energetics*, 34(1), 037-051.
<https://doi.org/10.2298/FUEE2101037B>
- Bojang, D., Nhantumbo, E., Verma, M., & Kulkarni, A. (2024). PV-Fed Single-Phase Induction Motor for Irrigation Application. *Journal of The Institution of Engineers (India): Series B*, 1-8.
<https://doi.org/10.1007/s40031-023-00975-z>
- Çayır, M., & Özbay, H. (2023). Solar Sulama Sistemleri için MPPT tabanlı Üç Fazlı Evirici Tasarımı. *Mühendislik Bilimleri ve Araştırmaları Dergisi*, 5(2), 243-254.
- Duranay, Z. B., Guldemir, H., & Tuncer, S. (2020). Implementation of a V/F controlled variable speed induction motor drive. *EMITTER International Journal of Engineering Technology*, 8(1), 35-48.
- El-Koliel, S. M., Eleissawi, H., & Nada, A. S. (2022). Speed control of electrical submersible pumps using fuzzy logic control. *Int. J. Power Electron. Drive Syst*, 13, 2515-2528.

- Gunawan, Y., Nurliyanti, V., Akhriyanto, N., Kasbi, S., Ahadi, K., Rizkillah, M. N. M., & Permana, M. R. F. (2022). A Comparative Study of Photovoltaic Water Pumping System-Driving Conventional AC Single-phase and Three-phase Motor Submersible Pumps.
- Kalyan, H., & Syal, P. (2023, June). Motors used for the development of Solar Pumping System: A Systematic Review. In 2023 5th International Conference on Energy, Power and Environment: Towards Flexible Green Energy Technologies (ICEPE) (pp. 1-6).
- Liang, X., Ilochonwu, O., & Adedun, R. (2012, May). Dynamic response of variable frequency drives in electrical submersible pump systems. In 48th IEEE Industrial & Commercial Power Systems Conference (pp. 1-11).
- Narendra, A., Panda, A. K., & Lenka, R. K. (2023). Solar PV fed FSVSI based Variable Speed IM Drive using ASVM Technique. *Engineering Science and Technology, an International Journal*, 40, 101366.
- Osseily, H. A. O. H. A. (2023). Matlab Design of Variable Frequency Drive to Control a Submersible Water Pump based on Photovoltaic Energy. *Power System Technology*, 47(4), 414-425.
- Samal, S., & Das, S. K. (2017). Solar Energy Fed to 3-Phase Induction Motor using Matlab Simulink and their analysis. *Materials Today: Proceedings*, 4(14), 12615-12624.
- Shepvalova, O. V., Belenov, A. T., & Chirkov, S. V. (2020). Review of photovoltaic water pumping system research. *Energy Reports*, 6, 306-324.
- Sontake, V. C., & Kalamkar, V. R. (2016). Solar photovoltaic water pumping system-A comprehensive review. *Renewable and Sustainable Energy Reviews*, 59, 1038-1067.
- Verma, S., Mishra, S., Chowdhury, S., Gaur, A., Mohapatra, S., Soni, A., & Verma, P. (2021). Solar PV powered water pumping system—A review. *Materials Today: Proceedings*, 46, 5601-5606.
- Yadav, K., Sastry, O. S., Wandhare, R., Sheth, N., Kumar, M., Bora, B., ... & Kumar, A. (2015). Performance comparison of controllers for solar PV water pumping applications. *Solar Energy*, 119, 195-202
<https://doi.org/10.1016/j.solener.2015.06.050>
- Yussif, N., Sabry, O. H., Abdel-Khalik, A. S., Ahmed, S., & Mohamed, A. M. (2020). Enhanced quadratic V/f-based induction motor control of solar water pumping system. *Energies*, 14(1), 104.
<https://doi.org/10.3390/en14010104>

ELEKTRİKLİ ARAÇ SİSTEMLERİNDE ÇİFT YÖNLÜ İZOLE DC-DC DÖNÜŞTÜRÜCÜLER

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ÖZET

Bu çalışma elektrikli araçlarda kullanılan iki yönlü DC-DC dönüştürücülere genel bir bakış sağlamayı hedeflemektedir. Güç elektroniği dönüştürücüleri ve elektrik motorları saf, hibrit ve yakıt hücreli elektrikli araçların (EV) en önemli parçalarıdır. EV’lerde kullanılan DC-DC dönüştürücünün düşürme ve yükseltme modunda çift yönlü çalışabilmesi gerekir. Böylece normal çalışmada bataryadan motora, frenleme modunda ise motordan bataryaya şarj için güç akışı sağlanır. Batarya şarjı azaldığında çıkış voltajı da azalır. Motor tarafında yüksek DC voltaja ihtiyaç olduğundan akü tarafındaki düşük voltajın DC-DC dönüştürücü ile yüksek gerilimli DC baraya dönüştürülmesi gerekir. İki yönlü DC-DC dönüştürücü, çıkışındaki regüle edilmiş DC voltaj ile inverteri besleyerek motorun verimliliğini artırır. İzoleli ve izolesiz topolojileri bulunan iki yönlü DC-DC dönüştürücüde, izoleli tip daha maliyetli ve karmaşık olmasına rağmen galvanik izolasyon sayesinde sistem güvenliğini, güvenilirliğini ve esnekliğini artırır. Dönüştürücüdeki galvanik izolasyonu sağlayan yüksek frekans (YF) transformatörünün dönüştürme oranı ayarlanarak daha yüksek voltaj kazancı sağlanabilir. Ancak YF transformatörünün düşük frekanslarda doyuma gitmesi, yüzey ve yakınlık etkilerinden kaynaklanan bakır kaybı ve yüksek frekanslardaki çekirdek kaybı frekans kontrol aralığını sınırlandırmaktadır. Çift yönlü izole edilmiş DC-DC dönüştürücü, yüksek gerilim tarafı ile alçak gerilim tarafı arasındaki gerilim oranının, transformatör dönüş oranına eşit olduğu optimum bir çalışma noktasına sahiptir. Çift yönlü izoleli temel dönüştürücüde bulunan köprülerden biri DC-AC inverter olarak çalışır ve YF transformatöre güç sağlar. İkinci bir köprü ise AC-DC doğrultucu olarak çalışır. Yarım köprü ve tam köprü topolojileri bulunmaktadır. Daha düşük gerilim ve akım stresi nedeniyle tam köprü topolojisinin yüksek güçlü uygulamalar için daha uygun olduğu bilinmektedir. İzoleli çift yönlü dönüştürücü tasarımı ile ilgili yapılan çalışmalar incelendiğinde; yüksek verimlilik, küçük hacim, giriş çıkış dalga biçimlerinde yüksek kalite, küçük ağırlık, yüksek gerilim kazancı aralığı, düşük gürültü, yumuşak anahtarlama, yüksek güç

yoğunluğu, kontrol yöntemleri ve maliyetin dikkate alınan en önemli özellikler olduğu görülmektedir.

Anahtar Kelimeler: Elektrikli Araç, İki Yönlü İzoleli DC-DC Dönüştürücü

BIDIRECTIONAL ISOLATED DC-DC CONVERTERS IN ELECTRIC VEHICLE SYSTEMS

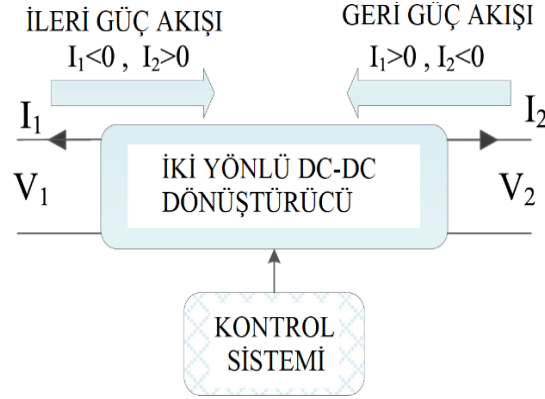
ABSTRACT

This study aims to provide an overview of two-way DC-DC converters used in electric vehicles. Power electronic converters and electric motors are the most important parts for pure, hybrid and fuel cell electric vehicles (EV). The DC-DC converter used in EVs must be able to operate bidirectionally in step-down and step-up modes. Thus, power flow is provided from the battery to the electric motor in normal operation, and from the motor to the battery in braking mode for charging. When the battery charge decreases, the output voltage also decreases. Since high DC voltage is needed on the motor side, the low voltage on the battery side must be converted to a high voltage DC bus with a DC-DC converter. The bidirectional DC-DC converter increases the efficiency of the motor by feeding the inverter with regulated DC voltage at its output. In the bidirectional DC-DC converter, which has isolated and non-isolated topologies, although the isolated type is more costly and complex, it increases system safety, reliability and flexibility thanks to galvanic isolation. Higher voltage gain can be achieved by adjusting the conversion ratio of the high frequency (HF) transformer that provides galvanic isolation in the converter. However, the saturation of the HF transformer at low frequencies, copper loss due to surface and proximity effects, and core loss at high frequencies limit the frequency control range. The bidirectional isolated DC-DC converter has an optimum operating point where the voltage ratio between the high voltage side and the low voltage side is equal to the transformer turns ratio. One of the bridges in the bidirectional isolated basic converter works as a DC-AC inverter and provides power to the HF transformer. A second bridge works as an AC-DC rectifier. There are half bridge and full bridge topologies. It is known that the full bridge topology is more suitable for high power applications due to lower voltage and current stress. When studies on isolated bidirectional converter design are examined, the features seen are high efficiency, small volume, high quality in input and output waveforms, small weight, high voltage gain range, low noise, soft switching, high power density, control methods and cost.

Keywords: Electric Vehicle, Bidirectional Isolated DC-DC Converter

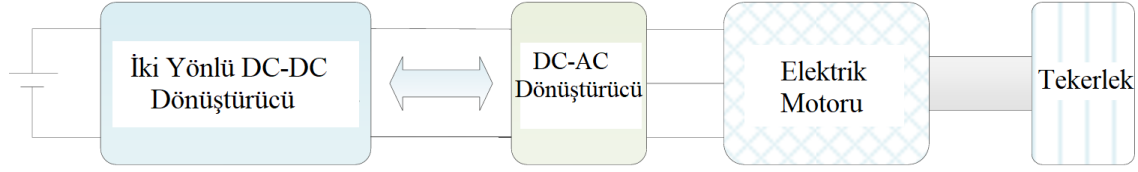
1. GİRİŞ

Fosil yakıtların tükenme ihtimali ve iklim ve çevre üzerindeki olumsuz etkilerinin bir sonucu olarak son yıllarda elektrikli araçlar (EV) giderek daha yaygınlaşmakta ve EV'ler konusunda daha fazla araştırma yapılmaktadır. Yeni nesil elektrikli araçlar, çok yüksek güç yoğunluğuna ve aynı zamanda uygun maliyetli ve yüksek verimli güç dönüştürücülere ihtiyaç duymaktadır (Tang ve diğ., 2017). Yüksek güç yoğunluklu güç dönüştürücüler hafif ve kompakt olup yerden tasarruf etmeye ve EV'nin toplam ağırlığı azaltarak uzun mesafeli sürüş için verimli hale getirir (Yu ve Choi, 2021). EV'lerde enerji depolama elemanı olarak sadece batarya kullanılabildiği gibi batarya ya ilave olarak yakıt hücresi (FC) ve süper kapasitör (SC) ile hibrit depolama sistemleri de kullanılmaktadır. Hibrit depolamalı sistemlerde güç talebi düşük olduğunda batarya enerji sağlarken, güç talebi sık sık değiştiğinde SC anlık güç sağlar, bataryanın enerjisi yetersiz kaldığında ise FC çalışmaya başlar. Batarya normal çalışmada EV'de DC bara beslemesini yaparken frenleme esnasında tekerlekler aracılığıyla üretilen enerji geri besleme ile bataryayı şarj edebilir. Aynı şekilde SC ihtiyaç durumunda anlık güç sağlarken geri beslemede enerji depolayabilir. Bunu gerçekleştirebilmek için çift yönlü DC-DC dönüştürücüler kullanılır. Çift yönlü DC-DC dönüştürücü SC ve DC bara arasındaki voltaj eşleşmesini ve çift yönlü güç akışını sağlar. Batarya tarafında bulunan çift yönlü DC-DC dönüştürücü batarya ve DC bara arasında voltaj uyumunu ve normal çalışma da bara beslemesini frenlemede ise geri besleme enerjisinin akışını gerçekleştirir (Wang ve diğ 2022). Çift yönlü DC-DC güç dönüştürücüler, ileri ve geri yönde güç akışı sağlayabilme özellikleri ile elektrikli araçlar, enerji depolama sistemleri, yenilenebilir enerji sistemleri, kesintisiz güç kaynakları gibi uygulamalarda giderek daha fazla kullanılmaya başlamıştır. Güç kaynakları ve enerji depolama elemanları arasındaki ileri ve geri yönde güç akışı için iki ayrı dönüştürücünün kullanılmasına gerek olmadığından çift yönlü konfigürasyonlar sistemin boyutunu küçültür ve verimliliğini ve performansını artırır. Çift yönlü DC-DC dönüştürücülerin genel yapısı Şekil 1.1'de gösterilmektedir (Gorji ve diğ., 2019).



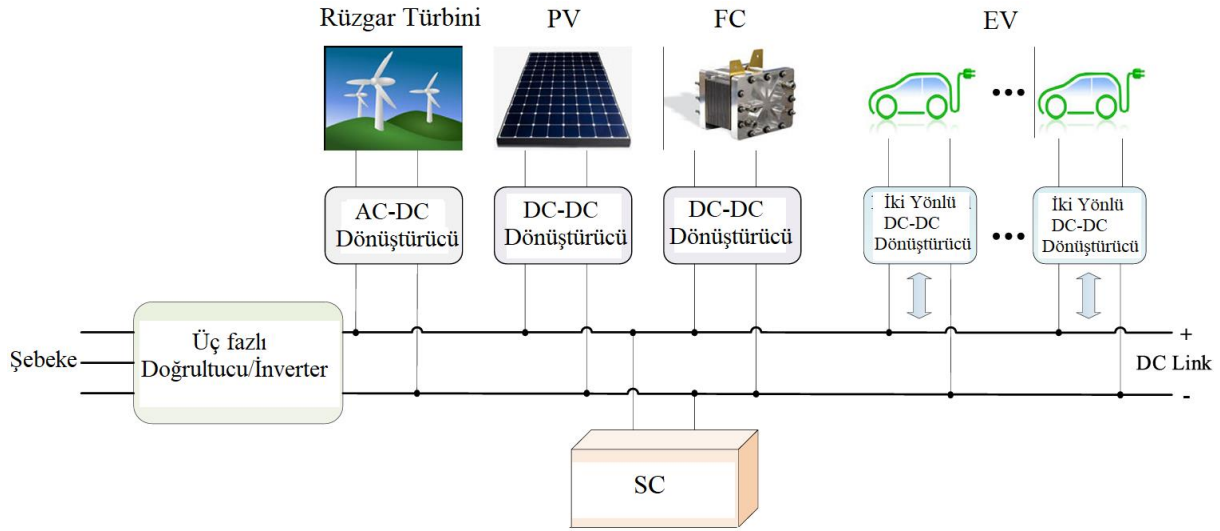
Şekil 1.1. Çift yönlü DC-DC dönüştürücü

Çift yönlü DC-DC güç dönüştürücüler sahip oldukları özellikler sayesinde, çalışma moduna bağlı olarak akımın iki yönde de sağlanmasının gerekli olduğu güç elektroniği devrelerinde kullanılırlar. EV'lerin güç aktarma organlarındaki bu uygulamaların örnek bir diyagramı Şekil 1.2'de gösterilmektedir. EV'nin çalıştırılması, hızlandırılması veya yokuş yukarı sürülmesini sağlamak için yüksek gerilim veriyolunu güçlendirmek üzere ekstra güce ihtiyaç vardır. Bu güç, motor çalıştırıldığında aküden tepe akımını sağlayan çift yönlü DC-DC dönüştürücünün bataryası ile elde edilebilir. Tek yönlü topolojilerden farklı olarak, akım akışının ve gücün yönünü tersine çevirebilirler; yani enerji depolama bataryası, yavaşlama sırasında elektrik motoru tarafından geri beslenen rejeneratif enerji ile şarj olur (Gorji ve diğ., 2019). EV'ler, saf hibrit ve yakıt hücresi ve benzeri gibi çeşitli türlerde gelir. Bu araçların hepsinde batarya DC voltajı motora voltaj kaynaklı invertörler (VSI'ler) aracılığıyla bağlanır. Elektrik motorunun gücü ile voltajı arasındaki doğrudan ilişki nedeniyle motor tarafında yüksek DC voltajına ihtiyaç duyulur. Bu nedenle batarya tarafındaki düşük gerilimin DC-DC dönüştürücü ile yüksek gerilimli DC-baraya dönüştürülmesi gerekmektedir. Bataryanın şarj durumu azaldığında çıkış voltajı da azalır. Ancak kullanılan DC-DC dönüştürücü, motor tarafındaki invertörün DC bağlantısında regüle edilmiş bir DC voltajı üreterek motorun verimliliğini artırır (Sedaghati ve diğ., 2018). EV'lerde kullanılan DC-DC dönüştürücü çift yönlü moda çalışabilmelidir (Farzamkia ve diğ., 2020, Hosseini ve diğ., 2020). Bu özellik, dönüştürücünün gücü batarya tarafından motor tarafına ve tersi yönde iletmesini sağlar. Sonuç olarak, batarya frenleme modunda şarj edilebilir. Yüksek verimlilik, küçük hacim, düşük akü akımı dalgalanması ve düşük ağırlık, bu dönüştürücülerin tasarımında dikkate alınması gereken en önemli özelliklerdendir (Yahyazadeh ve diğ., 2020).



Şekil 1.2. EV güç aktarma organlarındaki çift yönlü DC-DC dönüştürücünün özellikleri

Çift yönlü DC-DC dönüştürücü, Şekil 1.3'te gösterildiği gibi akıllı şebekelerde ve prizle şarj edilebilir elektrikli (PHEV) şarj istasyonlarında da kullanılmaktadır. Şebekeden şarj talebi ve talep halinde bataryada depolanan enerjiyi şebekeyi geri beslemek için kullanılır. Bu nedenle şarj istasyonları için düşük maliyetli, yüksek verimli ve yüksek güvenilirliğe sahip çift yönlü DC-DC dönüştürücüler şarttır (Gorji ve diğ., 2019).



Şekil 1.3. EV şarj istasyonlarındaki çift yönlü DC-DC dönüştürücü

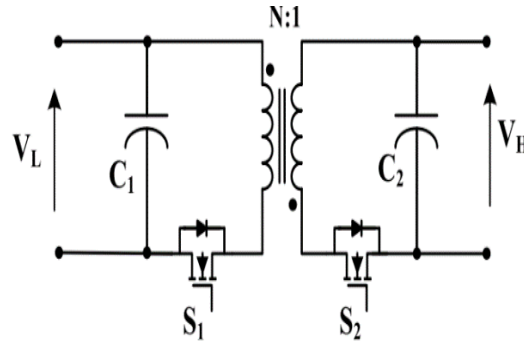
Çift yönlü DC-DC dönüştürücüler bobinli (empedanslı) izolesiz ve YF transformatörlü izoleli topolojiler olmak üzere iki ana gruba ayrılabilir. Yalıtılmamış topolojiler, gücü manyetik galvanik izolasyon olmadan diğer tarafa aktarır. İzolesiz olanlar daha basit bir yapıya sahiptir, manyetik girişim oluşturmaz, hafiftir ancak YF trafonun sağladığı voltaj kazancından yoksundur. İzolesiz Çift yönlü DC-DC dönüştürücüler boyut ve ağırlığın önemli olduğu durumlar için uygundur. Buna karşılık izole edilmiş topolojilerde DC voltaj önce yüksek frekanslı AC voltaja dönüştürülür ve YF transformatörden geçirildikten sonra tekrar AC-DC dönüştürücü ile DC forma dönüştürülür. Voltaj kazancı YF transformatör sayesinde yüksektir. Ancak YF

transformatör tasarım süreci ve kaçak endüktans etkisinin azaltılması önemli faktörlerdir. YF transformatör sarımları ile orantılı olacak şekilde yüksek voltaj kazancı sağlayabilir. Geniş giriş voltaj aralığı ve geniş yük regülasyon aralığı sağlar. YF transformatör ayrıca çok girişli veya çok çıkışlı topolojilerin gerçekleştirilmesini ve güvenliğin çok önemli olduğu gürültüye karşı hassas yükler için giriş ve çıkış tarafı arasında izolasyon sağlar.(Gorji ve diğ., 2019).

2. İZOLELİ ÇİFT YÖNLÜ DC-DC DÖNÜŞTÜRÜCÜ TOPOLOJİLERİ

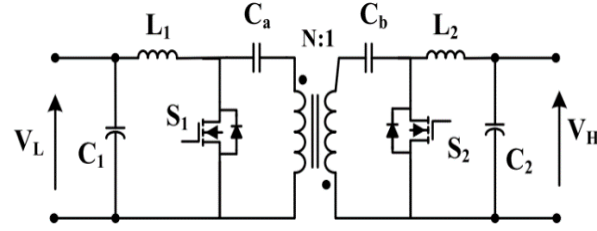
İzoleli Çift yönlü DC-DC dönüştürücü topolojilerinden bazıları aşağıda özetlenmiştir. EV'lerde montaj alanından tasarruf etmek için çift yönlü DC-DC dönüştürücünün yüksek güç yoğunluğuna sahip olması gerekir. Isınma ve enerji kaybını önlemek için dönüşüm verimliliği yüksek olmalıdır. Yüksek frekanslı PWM'in neden olduğu ekstra EMI'yi önlemek için çift yönlü DC-DC dönüştürücünün giriş ve çıkışı ortak toprak olmalıdır(Wang ve diğ 2022).

Standart tek yönlü flyback dönüştürücü (Şekil 2.1) buck-boost dönüştürücünün indüktörünün yerini bir transformatör aldığında gerçekleştirilir. Bu devre ile iki yönlü yalıtılmış bir buck-boost dönüştürücü elde edilebilir. Dönüştürücü kazancı flyback dönüştürücünün voltaj kazanç oranıyla aynıdır Transformatör tasarım prosedürüne dikkat edilmeli ve YF transformatör kaçak akımını bastırmak için voltaj clamp snubber gereklidir. Voltaj kazancını arttırmak için bu dönüştürücünün başka varyasyonları da bulunmaktadır(Gorji ve diğ., 2019).



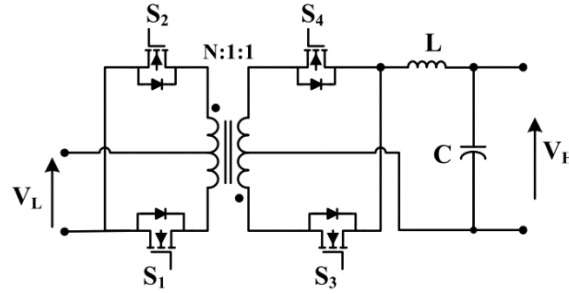
Şekil 2.1. İzoleli Buck-Boost Çift Yönlü DC-DC Dönüştürücü (Çift Yönlü Flyback)

İzoleli Çuk ve SEPIC/Zeta Çift Yönlü DC-DC Dönüştürücü (Şekil 2.2) sürekli bir giriş/çıkış akımına sahip olup, transformatörün dönüş oranını da içeren yüksek voltaj kazanç oranıyla giriş-çıkış tarafları arasında izolasyon sağlar. Giriş ve çıkış indüktörünün birleştirilmesi, giriş ve çıkış akımı dalgalanmalarının ortadan kaldırılmasına sağlar. Aynı yaklaşım, çift yönlü SEPIC/Zeta dönüştürücülerin izole edilmiş bir versiyonunu içinde geçerlidir(Gorji ve diğ., 2019).



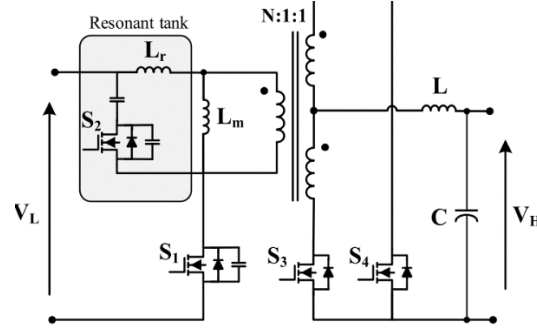
Şekil 2.2. İzoleli Çuk ve SEPIC/Zeta Çift Yönlü DC-DC Dönüştürücü

Tek yönlü itme-çekme dönüştürücü esas alınarak, gücün her iki yönde de akmasını sağlamak amacıyla çift yönlü itme-çekme dönüştürücü (Şekil 2.3) oluşturulmuştur. Tek yönlü Push-Pull dönüştürücülerde olduğu gibi, çift yönlü Push-Pull dönüştürücüler de gücü dönüştürmek için çok sargılı bir transformatör kullanır. Bu topolojiyi yüksek güç uygulamalarında çalıştırmak için üç fazlı çift yönlü bir itme-çekme dönüştürücü de önerilmektedir(Gorji ve diğ., 2019).



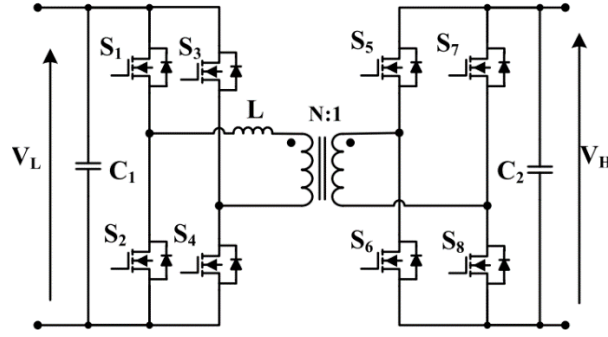
Şekil 2.3. Push-Pull Çift Yönlü DC-DC Dönüştürücü

Forward Çift Yönlü DC-DC Dönüştürücüde (Şekil 2.4) sıfır voltaj anahtarlama elde etmek için kelepçeli bir devre kullanılabilir. Çift yönlü ileri DC-DC dönüştürücü hakkında daha fazla araştırma, dönüştürücünün rezonans versiyonunu önermek için transformatör kaçak endüktansının rezonans indüktörü olarak kullanılabilir. Uygulama ve özelliklere göre hibrit kombinasyonları vardır. Bu hibrit dönüştürücülerde, transformatörün birincil tarafı bahsedilen izole edilmiş topolojilerden birinden, ikincil tarafı ise akım beslemeli veya gerilim beslemeli bir diğerinden türetilir(Gorji ve diğ., 2019).



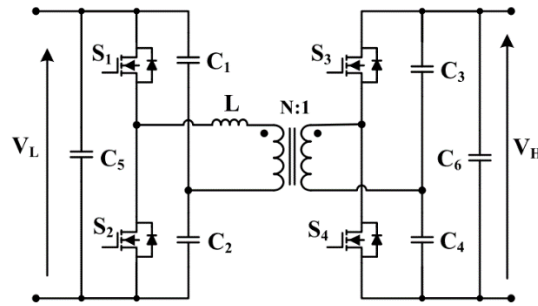
Şekil 2.4. Forward Çift Yönlü DC-DC Dönüştürücü

En popüler tekniklerden biri olan Çift Aktif Köprü (DAB) Çift Yönlü DC-DC Dönüştürücü (Şekil 2.5), yüksek frekanslı bir transformatör tarafından izole edilen sırt sırta çift yönlü topolojilerin kullanılmasıdır. Sırt sırta dönüştürücüler voltaj beslemeli veya akım beslemeli, yarım köprü veya tam köprü olabilir. Şekil 2.5’de transformatörün her iki yanında iki tam köprü topolojisi kullanan DAB dönüştürücünü temel topolojisini göstermektedir. Çift yönlü dönüştürücülerin güç aktarımı anahtar sayısı ile orantılıdır (Krismer ve Kolar, 2009). Dolayısıyla bu topolojide galvanik izolasyonla birlikte sekiz güç anahtarının bulunması, onu otomotiv sistemleri gibi yüksek voltaj kazanç oranına sahip yüksek güçlü uygulamalar için uygun hale getirir (Zhao ve diğ., 2013). Bu dönüştürücünün enerji aktarımı, transformatörün birincil/ikincil sargılarının AC voltaj dalga biçimleri arasındaki faz kaymasının ayarlanmasıyla kontrol edilir. Etkin bir kontrol şeması, bu dönüştürücünün kontrol şemalarının incelenmesini cesaretlendiren verimlilik optimizasyonuna yol açabilir. DAB topolojileri en popüler yalıtılmış çift yönlü topolojilerden biri olduğundan, DAB’den türetilmiş topolojiler üzerine kapsamlı incelemeler gerçekleştirilmiştir . Kısaca DAB’den türetilen bir çok dönüştürücü bulunmaktadır DAB’da birinci aşamada, istenen uygulamaya bağlı olarak, DC-AC dönüşümünü ya voltaj beslemeli ya da akım beslemeli bir tam köprü gerçekleştirir; ikinci aşamada, yüksek frekanslı bir transformatör AC voltajı yükseltir ve galvanik izolasyon sağlar.



Şekil 2.5. Çift Aktif Köprü (DAB) Çift Yönlü DC-DC Dönüştürücü

ZVS/ZCS'yi elde etmek ve dolayısıyla verimliliği artırmak için transformatörle birlikte bir rezonans tankı kullanılabilir (Bai ve diğ., 2008; Li ve Bhat 2009) c) Üçüncü aşamada, istenilen uygulamaya bağlı olarak, gerilim beslemeli veya akım beslemeli tam köprü, AC-DC doğrultma işlemini gerçekleştirir (Gorji ve diğ., 2019). DAB ile karşılaştırıldığında yarım köprü topolojisi, dönüştürücünün daha düşük güçlü uygulamalarda uygulandığı ve güç anahtarlarının sayısının sekizden dörde indirilebildiği durumlarda faydalı olabilir. Şekil 2.6'da transformatörün her iki tarafında voltaj beslemeli yarım köprü topolojileri kullanan çift yönlü izole bir dönüştürücüyü göstermektedir (Gorji ve diğ., 2019).

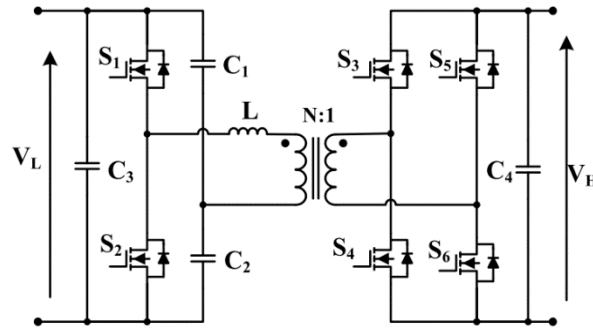


Şekil 2.6. Çift Yarım Köprü Çift Yönlü DC-DC Dönüştürücü

Dönüştürücü, ilk olarak birincil tarafta akım beslemeli yarım köprü topolojisi ve ikincil tarafta voltaj beslemeli yarım köprü topolojisi kullanan ikili yarım köprü dönüştürücüye dayalı olarak önerilmiştir (Peng ve diğ., 2004). Çift yarım köprü dönüştürücünün, transformatörün birincil tarafında voltaj beslemeli topoloji ve ikincil tarafında akım beslemeli topoloji kullanan başka bir çeşidi vardır (Li ve diğ., 2001). Akım beslemeli bir topolojinin kullanılması, belirli uygulamalarda istenebilecek sürekli akım dalga biçimini mümkün kılacaktır. Gerilim yükseltme

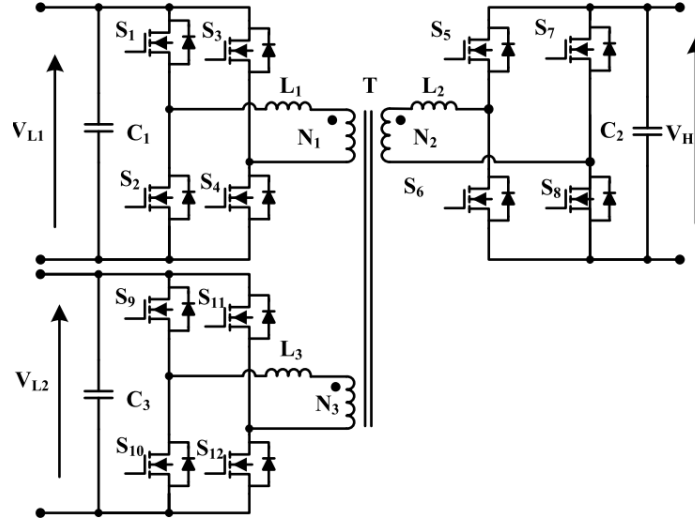
kabiliyetini arttırmak ve transformatör oranını ve akım stresini azaltmak amacıyla interleaved çift yarım köprü topolojisi gibi çift yarım köprü dönüştürücüler üzerinde daha fazla çalışma yapılmıştır (Park, 2011; Gorji ve diğ., 2019)

DAB göz önüne alındığında, bir kesintisiz güç kaynağı tasarımı durumunda, birincil tarafta voltaj beslemeli yarım köprü topolojisi ve ikincil tarafta voltaj beslemeli tam köprü topolojisi kullanan izole edilmiş çift yönlü DC-DC dönüştürücü kullanılabilir (Şekil 2.7). Daha az sayıda anahtara sahip olması nedeniyle DAB'ye göre daha basit kontrol gereksinimlerine olanak tanır. Özellikle, tam bir UPS topolojisi elde etmek için yarım köprü tarafındaki iki anahtarlı düşürücü-yükseltici dönüştürücünün entegrasyonu için uygundur. Bu konfigürasyonun, daha iyi performans elde etmek için empedans ağılarıyla birleştirilmiş tam köprü yarım köprü çift yönlü DC-DC dönüştürücü gibi başka varyantları da vardır. (Gorji ve diğ., 2019). Çok girişli dönüştürücüler, yenilenebilir enerji sistemlerinde ve hibrit elektrikli araçlarda birden fazla giriş voltaj kaynağının entegre edilmesi durumunda iyi bir seçimdir.



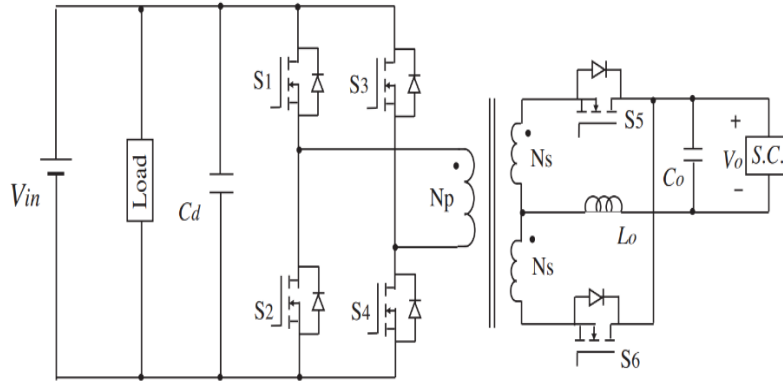
Şekil 2.7. Yarım Köprü-Tam Köprü Çift Yönlü DC-DC Dönüştürücü

Çok sargılı transformatör kullanan Çift Aktif Köprüye dayanan izole edilmiş çok girişli çift yönlü bir DC-DC dönüştürücü, Şekil 2.8'de görülmektedir. (Gorji ve diğ., 2019)



Şekil 2.8. Çok Bağlantı Noktalı Dab Çift Yönlü DC-DC Dönüştürücü

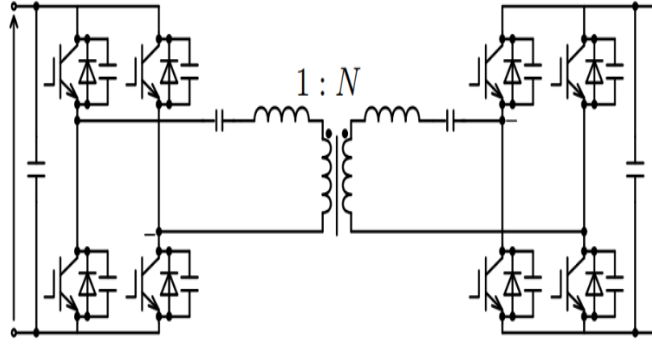
Şekil 2.9’da EV’ler için alçak gerilim tarafında tam köprü yapısını, yüksek gerilim tarafında ise itme-çekme yapısını kullanan çift yönlü bir DC-DC dönüştürücü önerilmektedir (Mishima, ve Hiraki, 2005).



Şekil 2.9. Batarya / SC hibrit sistemler için çift yönlü DC-DC dönüştürücü

Şekil 2.10, EV’lerde düşük gerilimli bir veri yolu ile yüksek gerilimli bir veri yolu arasında bir arayüz olarak düşünülen bir seri rezonans dönüştürücüyü temel alan çift yönlü izole edilmiş DC-DC dönüştürücüyü sunmaktadır (Krismer ve diğ., 2005). Dönüştürücünün dezavantajı, seri kapasitörün tam yük akımını idare etmek zorunda kalmasıdır, bu da artan hacim ve maliyete yol açar. Yüksek güç uygulamalarında, kaynaklar ve yük arasında izolasyonun gerekli olduğu durumlarda izole topolojiler, elektriksel izolasyon, yüksek güvenilirlik, yumuşak anahtarlama kontrolünün kolay gerçekleştirilmesi, çift yönlü enerji akışı ve güvenlik nedeniyle ekipmanın ve

operatörlerin korunması gibi avantajlar sağlar. Bu avantajlar genellikle yüksek frekanslarda çalışan transformatörlerin kullanılmasından kaynaklanmaktadır.



Şekil 2.10. Seri rezonansa dayalı çift yönlü izole edilmiş DC-DC dönüştürücü

Çift yönlü DC-DC dönüştürücüler için topoloji seçiminin yanı sıra, bu dönüştürücüler için yüksek verimlilik ve birleşik bir kontrol stratejisi gerekmektedir. Yalıtımlı çift yönlü DC-DC dönüştürücülerde ortaya çıkan çeşitli kontrol problemlerini çözmek için farklı uygulamalara yönelik olarak kontrol stratejileri önerilmektedir. Bu kontrol stratejilerine PID kontrol, kayan kipli kontrol, Dinamik Gelişim Kontrolü, Model Tahminli Kontrol, Bulanık Mantık Kontrol örnek verilebilir. Anahtarlama stratejisi olarak PWM, Tek Faz Kaydırma (SPS), Faz Kaydırma Artı PWM (PSP), Çift Fazlı Kaydırma (DPS), Üç Faz Kayması (TPS) tercih edilebilir. Bu yöntemlerden PWM'in uygulaması basit ancak dinamik performansı zayıftır. SPS'de görev saykılının 0-50 arasında ve birbirleriyle 180 derece faz dışında geçiş yapacak şekilde seçilebilir. Güç anahtarlarının ne zaman açılıp kapanması gerektiğine karar verir. Esnek güç akışı ve sıfır voltajda anahtarlama hedeflerine ulaşmak için farklı tipte faz kaymaları önerilmektedir. Hem üst hemde alt anahtar için görev döngüsü ayarlanmalıdır. SPS, yalıtılmış dönüştürücülerde en yaygın kullanılan kontrol şeması olmasına rağmen, esnek değildir, bu kararlı durum çalışması sırasında dönüştürücüde kullanılan cihazlara ek stres getirir. Ayrıca tek faz kaydırmalı kontrolün verimli çalışması ancak gerilim dönüşüm oranının bire eşit olması ve devre akımının çok daha büyük olması durumunda mümkün olur ve transformatörün iki tarafının gerilim genlikleri eşleşmediğinde verim düşer. Bu nedenle, SPS kontrolü yalnızca azaltılmış bir çalışma aralığında yumuşak anahtarlama altında çalışabilir. SPS, giriş ve çıkış gerilim genlikleri eşleşmediğinde artan reaktif güç sonucu anahtarlama elemanlarında yüksek akım stresi ve iletim kaybı oluşur bu

durumlarda sıfır gerilimde anahtarlama sağlar. Dinamik performansı yüksektir. PSP, akım stresini ve iletim kayıplarını azaltır, verimi artırır, sıfır gerilimde anahtarlama genişletir. DPS, pik akımları ve iletim kayıplarını azaltırken güç kapasitesini ve verimi artırır, daha fazla güç transfer edilebilmesini sağlar, başlangıç akımlarını azaltır. TPS, sıfır gerilimde anahtarlama aralığını genişletir, toplam kayıpları azaltır SPS ve DPS'den daha esneklerdir.

3. SONUÇ

- Çift yönlü izoleli dönüştürücülerde galvanik izolasyon trafosu dönüştürme oranı voltaj kazancını artırır. Aynı zamanda giriş ve çıkış arasında izolasyon sağlar. İzoleli Çift Yönlü DC-DC Dönüştürücülerde en popüler dönüştürücü yüksek güçlü uygulamalar için uygun olan ve transformatörün her iki tarafında iki tam köprü topolojisi kullanan çift aktif köprü dönüştürücüdür.
- Tek fazlı kaydırmalı kontrol yönteminin dolaşım akımını, akım stresini, iletim kaybını azaltması ve ZVS aralığını genişletmesi özellikleri PWM'nin uygulama basitliği ile birleştirildiğinde en kullanışlı anahtarlama strateji olarak ortaya çıkmaktadır.
- Devre topolojisi açısından bakıldığında, mevcut araştırmaların odak noktası ağırlık, hacim, kayıplar ve maliyet ve güvenilirlik ve güç yoğunluğudur. Çift yönlü DC-DC dönüştürücülerin geniş bant uygulaması, elektromanyetik uyumluluk ve arıza teşhis stratejileri perspektifinden optimizasyonu araştırma konuları arasındadır.

KAYNAKÇA

Bai, H., Mi, C. C., & Gargies, S. (2008). The short-time-scale transient processes in high-voltage and high-power isolated bidirectional DC-DC converters. *IEEE Transactions on Power Electronics*, 23(6), 2648-2656.

<https://doi.org/10.1109/TPEL.2008.2005106>

Farzamkia, S., Farhangi, S., & Iman-Eini, H. (2020, February). Utilization of Soft-Switched Boost Converter for MPPT Application in Photovoltaic Single-Phase Grid-Connected Inverter. In *2020 11th Power Electronics, Drive Systems, and Technologies Conference (PEDSTC)* (pp. 1-6).

<https://doi.org/10.1109/PEDSTC49159.2020.9088432>

Gorji, S. A., Sahebi, H. G., Ektesabi, M., & Rad, A. B. (2019). Topologies and control schemes of bidirectional DC-DC power converters: An overview. *IEEE Access*, 7, 117997-118019.

<https://doi.org/10.1109/ACCESS.2019.2937239>

Hosseini, S. H., Ghazi, R., Farzamkia, S., & Bahari, M. (2020, February). A novel high gain extendable DC-DC bidirectional boost-Buck converter. In *2020 11th Power Electronics, Drive Systems, and Technologies Conference (PEDSTC)* (pp. 1-6).

<https://doi.org/10.1109/PEDSTC49159.2020.9088370>

- Krismer, F., Biela, J., & Kolar, J. W. (2005, October). A comparative evaluation of isolated bi-directional DC/DC converters with wide input and output voltage range. In *Fortieth IAS Annual Meeting. Conference Record of the 2005 Industry Applications Conference, 2005*. (Vol. 1, pp. 599-606).
[https://doi.org/ 10.1109/IAS.2005.1518368](https://doi.org/10.1109/IAS.2005.1518368)
- Krismer, F., & Kolar, J. W. (2009). Accurate power loss model derivation of a high-current dual active bridge converter for an automotive application. *IEEE Transactions on Industrial Electronics*, 57(3), 881-891.
[https://doi.org/ 10.1109/TIE.2009.2025284](https://doi.org/10.1109/TIE.2009.2025284)
- Li, X., & Bhat, A. K. (2009). Analysis and design of high-frequency isolated dual-bridge series resonant DC/DC converter. *IEEE Transactions on Power Electronics*, 25(4), 850-862.
[https://doi.org/ 10.1109/TPEL.2009.2034662](https://doi.org/10.1109/TPEL.2009.2034662)
- Li, H., Peng, F. Z., & Lawler, J. S. (2001, September). A natural ZVS high-power bi-directional DC-DC converter with minimum number of devices. In *Conference Record of the 2001 IEEE Industry Applications Conference. 36th IAS Annual Meeting (Cat. No. 01CH37248)* (Vol. 3, pp. 1874-1881).
[https://doi.org/ 10.1109/IAS.2001.955786](https://doi.org/10.1109/IAS.2001.955786)
- Mishima, T., & Hiraki, E. (2005, June). A dual voltage power system by battery/supercapacitors hybrid configuration. In *2005 IEEE 36th Power Electronics Specialists Conference* (pp. 1845-1850).
[https://doi.org/ 10.1109/PESC.2005.1581882](https://doi.org/10.1109/PESC.2005.1581882)
- Park, S., & Song, Y. (2011, May). An interleaved half-bridge bidirectional dc-dc converter for energy storage system applications. In *8th International Conference on Power Electronics-ECCE Asia* (pp. 2029-2034).
[https://doi.org/ 10.1109/ICPE.2011.5944485](https://doi.org/10.1109/ICPE.2011.5944485)
- Peng, F. Z., Li, H., Su, G. J., & Lawler, J. S. (2004). A new ZVS bidirectional DC-DC converter for fuel cell and battery application. *IEEE Transactions on power electronics*, 19(1), 54-65.
[https://doi.org/ 10.1109/TPEL.2003.820550](https://doi.org/10.1109/TPEL.2003.820550)
- Sedaghati, F., Salehian, S. M., Shayeghi, H., & Asl, E. S. (2018, February). A configuration for double input Z-source DC-DC converters. In *2018 9th Annual Power Electronics, Drives Systems and Technologies Conference (PEDSTC)* (pp. 449-455).
[https://doi.org/ 10.1109/PEDSTC.2018.8343839](https://doi.org/10.1109/PEDSTC.2018.8343839)
- Tang, Y., Lu, J., Wu, B., Zou, S., Ding, W., & Khaligh, A. (2017). An integrated dual-output isolated converter for plug-in electric vehicles. *IEEE Transactions on Vehicular Technology*, 67(2), 966-976.
<https://doi.org/10.1109/TVT.2017.2750076>
- Yahyazadeh, S., Khaleghi, M., Farzamkia, S., & Khoshkbar-Sadigh, A. (2020, February). A new structure of bidirectional dc-dc converter for electric vehicle applications. In *2020 11th Power Electronics, Drive Systems, and Technologies Conference (PEDSTC)* (pp. 1-6).
[https://doi.org/ 10.1109/PEDSTC49159.2020.9088414](https://doi.org/10.1109/PEDSTC49159.2020.9088414)
- Yu, G., & Choi, S. (2021). An effective integration of APM and OBC with simultaneous operation and entire ZVS range for electric vehicle. *IEEE Transactions on Power Electronics*, 36(9), 10343-10354.
<https://doi.org/10.1109/TPEL.2021.3063931>
- Zhao, B., Song, Q., Liu, W., & Sun, Y. (2013). Overview of dual-active-bridge isolated bidirectional DC-DC converter for high-frequency-link power-conversion system. *IEEE Transactions on power electronics*, 29(8), 4091-4106.
<https://doi.org/10.1109/TPEL.2013.2289913>

HAVADAN GÖRÜNTÜLEME UYGULAMALARINDA YOLOv9 ALGORİTMASI İLE NESNE TESPİTİ

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ÖZET

Uydu teknolojisi ve insansız hava araçlarının gelişmesi ile havadan görüntüleme süreci ilerlemiştir. Bu görüntüler coğrafi analiz, kentleşmenin incelenmesi vb. çalışmaların yaygınlaşmasına katkıda bulunmuştur. Yapay zekâ, insansız/insanlı hava araçlarından elde edilen görüntülerin analizinde sıkça kullanılmaktadır. Bilgisayar donanım teknolojilerinin gelişmesi yapay zekâ çalışmalarını kolaylaştırmış ve kullanımını yaygınlaştırmıştır. Görüntüleme teknolojisinin gelişimi ve geniş alanların taranması ihtiyacı yüksek çözünürlüklü görüntüler elde edilmesine sebep olmaktadır. Küçük nesnelerin algılanması yapay zekâ modelleri için nesne tespit sürecini zorlaştıran bir görevdir. Görüntülerdeki çözünürlüğün artması nesnelerin görüntülerde temsil edildiği piksellerin oranının düşmesine neden olmuş bu da nesne tespitini dahada zor hale getirmiştir. Bununla birlikte bu zorlukların üstesinden gelmek ve başarımı artırmak amacıyla nesne tespit algoritmaları üzerinde birçok çalışma gerçekleştirilmektedir. YOLO algoritması, gerçek zamanlı nesne tespitindeki hız ve ortalama kesinlik değerindeki yüksek başarısı nedeniyle havadan görüntülerle yapılan nesne tespiti çalışmalarında sıkça kullanılmaktadır. Bu çalışmada hava araçlarından toplanan görüntülerde bulunan nesnelerin tespiti sırasında karşılaşılan zorlukların üstesinden gelmek ve başarımı artırmak için YOLO algoritmasının en yeni üyesi olan YOLOv9 mimarisi için araştırma yapılmıştır. Özellikle

YOLOv9 algoritmasının VisDrone veri seti üzerinde YOLO algoritmasının önceki versiyonlarına göre çok sınıflı nesne algılama performansı detaylı olarak incelenmiştir. Deneysel sonuçlar, YOLOv9 algoritmasının diğer YOLO versiyonlarına göre daha optimum düzeyde çalıştığını ve nesne tespitindeki ortalama kesinlik değerini önemli ölçüde iyileştirdiğini göstermektedir. Bu deneysel bulgular, gelecekte hava araçlarından elde edilen görüntülerde YOLOv9 algoritmasının kullanılmasının uygun olduğunu göstermektedir.

Anahtar Kelimeler: VisDrone, YOLOv9, Nesne Tespiti

OBJECT DETECTION WITH YOLOv9 ALGORITHM IN AERIAL IMAGING APPLICATIONS

ABSTRACT

The aerial imaging process has progressed with the development of satellite technology and unmanned aerial vehicles. These images can be used for geographical analysis, study of urbanization, etc. contributed to disseminating the studies. Artificial intelligence is frequently used to analyze unmanned/manned aerial vehicle images. The development of computer hardware technologies has facilitated artificial intelligence studies and made its use widespread. The development of imaging technology and the need to scan large areas lead to high-resolution images. Detecting small objects is a task that makes the object detection process difficult for artificial intelligence models. Increasing image resolution has caused the proportion of pixels in which objects are represented in images to decrease, making object detection even more difficult. However, many studies are carried out on object detection algorithms to overcome these difficulties and increase performance. YOLO algorithm is frequently used in object detection studies with aerial imaging due to its high success in real-time object detection speed and average accuracy. In this study, research was conducted for the YOLOv9 architecture, the newest member of the YOLO algorithm, to overcome the difficulties encountered when detecting objects in images collected from aircraft and to increase the performance. In particular, the multi-class object detection performance of the YOLOv9 algorithm on the VisDrone dataset compared to previous versions of the YOLO algorithm was examined in detail. Experimental results show that the YOLOv9 algorithm works more optimally than other YOLO versions, significantly improving the average accuracy value in object detection. These experimental findings show that it is appropriate to use the YOLOv9 algorithm in future images obtained from aerial vehicles.

Keywords: VisDrone, YOLOv9, Object Detection

YAPAY ZEKA DESTEKLİ YAYA VE ARAÇ TRAFİĞİNİN ANALİZİ

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ÖZET

Trafik yoğunluğunun takip edilmesi, modern şehirlerde hayati bir öneme sahiptir. Yoğunluğunun doğru ve hızlı analiz edilmesi, sürücülere ve yayalara güvenli ve verimli bir yolculuk sağlamak için kritiktir. Yol ve kaldırımların planlanması, trafik yoğunluğunu dikkate alarak yapılmalıdır. Doğru planlama ile trafik sıkışıklıkları azaltabilir ve yayalar ile araçların güvenliğini artırabilir. Trafikteki araç ve yayaların tespitinin güvenlik kameralarından veya hava araçlarından gerçek zamanlı olarak yapılabilmesi trafik ışıklarının doğru şekilde zamanlamasına önemli katkıda bulunacaktır. Yapay zekâ tabanlı sistemlerin gelişmesi ile trafik analizi gibi birçok alanda yaygın olarak kullanılmasına olanak tanımaktadır. Yapay zekâ için görüntü analizi ve nesne tespiti önemli çalışma alanlarıdır. Nesne tespiti için birçok algoritma olsa da gerçek zamanlı nesne tespitinde YOLO algoritması oldukça popülerdir. Bu çalışmada trafikteki araç ve yayaların gerçek zamanlı olarak tespit edilmesi için YOLO algoritması ailesinin en yeni üyesi YOLOv9 algoritması kullanıldı. Çalışmalar Sakarya şehrinin farklı lokasyonlarında drone çekimlerinden toplanarak etiketlenmiş görüntüler üzerinde gerçekleştirildi. Oluşturulan veri seti % 80 eğitim ve % 20 test verisi olarak ayrıldı. Test verileri üzerinde YOLOv9 algoritmasının sınıflara göre

ortalama kesinlik değerleri incelendi. Deneylerde YOLOv9 algoritması nesnelerin tespiti konusunda oldukça başarılı sonuçlar elde etti. Bundan dolayı trafik analizinde, araç ve yayaların tespiti için YOLOv9 kullanılmasının uygun olacağı düşünülmektedir.

Anahtar Kelimeler: Trafik Analizi, YOLOv9, Nesne Tespiti

ANALYSIS OF PEDESTRIAN AND VEHICLE TRAFFIC WITH ARTIFICIAL INTELLIGENCE

ABSTRACT

Monitoring traffic density is of vital importance in modern cities. Accurate and rapid density analysis is critical to providing drivers and pedestrians with a safe and efficient journey. Planning of roads and sidewalks should be done taking into account traffic density. With proper planning, traffic congestion can be reduced, and safety for pedestrians and vehicles can be increased. Real-time detection of vehicles and pedestrians in traffic from security cameras or aerial vehicles will significantly contribute to the correct timing of traffic lights. The development of artificial intelligence-based systems enables widespread use in many areas, such as traffic analysis. Image analysis and object detection are essential areas of work for artificial intelligence. Although there are many algorithms for object detection, the YOLO algorithm is viral in real-time object detection. In this study, the YOLOv9 algorithm, the newest member of the YOLO algorithm family, was used to detect vehicles and pedestrians in traffic in real-time. The studies were conducted on labeled images collected from drone footage in different locations in Sakarya. The created data set was divided into 80% training and 20% test data. According to the classes, the average precision values of the YOLOv9 algorithm were examined using the test data. In the experiments, the YOLOv9 algorithm achieved very successful results in detecting objects. Therefore, it is thought that using YOLOv9 to detect vehicles and pedestrians in traffic analysis would be appropriate.

Keywords: VisDrone, YOLOv9, Object Detection

BİR ÇİMENTO FABRİKASINDA ATIK ISI GERİ KAZANIMINA YÖNELİK HELYUM BRAYTON ÇEVİRİMİ ÜZERİNE ÇALIŞMA

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ÖZET

Bu çalışmada Helyum Brayton Çevriminin (HBC) çimento fabrikalarında atık ısıdan yararlanılarak enerji verimliliğinin artırılması amacıyla kullanımı araştırılmıştır. Çimento üretim süreci, önemli miktarda enerji tüketimi ve buna bağlı sera gazı emisyonları ile biliniyor ve bu da onu yenilikçi atık ısı geri kazanım çözümleri için başlıca aday haline getiriyor. İncelenmekte olan HBC sistemi, çimento üretim sürecinin çeşitli aşamalarından gelen yüksek sıcaklıktaki atık ısıyı yakalayıp ve bunu helyum bazlı bir Brayton döngüsünü çalıştırmak için kullanarak, böylece ek güç üreterek çalışıyor. Kapsamlı bir analiz aracılığıyla HBC sisteminin çimento fabrikaları bağlamında uygulanmasının performans özellikleri incelenmiştir. Termal verimlilik ve güç çıkışı gibi temel performans ölçümleri, çeşitli çalışma koşulları altında değerlendirilir. Ayrıca türbin giriş ve çıkış basıncının, helyum kütle akış hızının ve referans sıcaklığının sistem performansı üzerindeki etkileri incelenmiştir. Analiz sonuçlarına göre sistemden elde edilen net güç 6296.6 kW olarak hesaplanmıştır. Ayrıca sistemdeki toplam ekserji yıkımı 10248 kW olup, en yüksek tersinmezlik 2172.5 kW ile gaz soğutucudur. Bu çalışmanın bulguları, çimento fabrikalarında atık ısının geri kazanımı için HBC sistemlerinin uygulanabilir bir çözüm olarak umut verici potansiyeline ışık tutmaktadır.

Anahtar Kelimeler: Helyum Brayton Çevrimi, Atık Isı Geri Kazanımı, Çimento Fabrikası, Performans Değerlendirmesi, Enerji Verimliliği.

STUDY ON HELIUM BRAYTON CYCLE FOR WASTE HEAT RECOVERY IN A CEMENT PLANT

ABSTRACT

In this study, the use of the Helium Brayton cycle as a means of utilizing waste heat in cement plants to increase energy efficiency was investigated. The cement manufacturing process is known for its substantial energy consumption and associated greenhouse gas emissions, making it a prime candidate for innovative waste heat recovery solutions. The Helium Brayton cycle

under investigation operates by capturing high-temperature waste heat from various stages of the cement production process and using it to drive a helium-based Brayton cycle, thereby generating additional power. Through a comprehensive analysis, the performance characteristics of the application of the Helium Brayton cycle system in the context of cement plants were examined. Key performance metrics such as thermal efficiency, and power output are evaluated under a range of operating conditions. Additionally, the effects of turbine inlet and outlet pressure, helium mass flow rate and reference temperature on system performance were examined. According to the analysis results, the net power obtained from the system was calculated as 6296.6 kW. In addition, the total exergy destruction in the system is 10248 kW, and the highest irreversibility is in the gas cooler with 2172.5 kW. The findings of this study shed light on the promising potential of Helium Brayton cycles as a viable solution for waste heat recovery in cement plants.

Keywords: Helium Brayton Cycle, Waste Heat Recovery, Cement Factory, Performance Evaluation, Energy Efficiency.

1. INTRODUCTION

The cement manufacturing sector significantly contributes to climate change due to the substantial release of CO₂ during production processes. Within the European Union, it ranks as the third largest industrial emitter, accounting for approximately 4.1% of total CO₂ emissions (Mikulcic et al,2013). Additionally, cement production is highly energy-intensive, with clinker production alone consuming over 90% of the industry's total energy (Dogan et al,2018). The production of one ton of cement requires an energy consumption of 4 to 5 GJ, equivalent to about 150 to 200 kg of coal (Madloul et al, 2012) and resulting in nearly a ton of CO₂ emissions. Given its significant environmental impact and societal importance, there is a critical need to mitigate these effects and adopt more energy-efficient technologies (Oral and Saygin, 2019).

The energy consumption in the cement industry is predominantly sourced from thermal energy supplied by fossil fuels, constituting about 75% of the total energy input in a typical cement plant. Major energy consumers include raw mills, preheaters, clinker coolers, and rotary kilns. However, a considerable portion, approximately 35% to 39% of the total energy input, is lost through exhaust gas, cooler, and radiation heat transfer. This waste thermal energy presents an

opportunity for recovery and utilization, potentially meeting heating demands within the plant or generating electricity (Boldyryev et al,2016).

Waste heat recovery systems offer a solution by recovering and utilizing this waste thermal energy, thereby reducing the overall energy consumption of a cement plant. Waste heat recovery systems can provide up to 30% of a cement plant's electricity needs, while also decreasing greenhouse gas emissions and improving the overall efficiency of the cement production process. Waste heat recovery systems provide a compelling avenue for harnessing and transforming surplus heat from diverse industrial operations into valuable energy, leading to decreased energy usage and emissions of greenhouse gases. The Helium Brayton Cycle emerges as a desirable choice for such recovery endeavors in industrial environments due to its recognized high efficiency in heat utilization and minimal environmental footprint. Employing helium as the operational fluid within a closed-loop cycle, this technology excels in recuperating waste heat at elevated temperatures, rendering it especially fitting for implementation within cement plants where high temperatures are prevalent (Karellas et al, 2013).

In recent years, there has been increasing interest in utilizing waste heat for energy production in cement plants. Table 1 shows a brief summary of the recent literature on the Waste heat recovery power generation systems in cement plants. As seen from the table, several cycle configurations such as steam Rankine cycle, organic Rankine cycle, and Kalina cycle have been investigated using different working fluids. In the studies, the exhaust gas temperature of the Waste heat recovery system in the cement plants varies between 215°C and 440°C, which is quite sufficient for electricity generation from thermal power. However, there is a noticeable gap in the literature regarding comprehensive energy and exergy analyses of Helium Brayton cycle integrated waste heat recovery systems in the cement industry. Therefore, the primary objective of this study is to assess the performance of an actual waste heat recovery power generation system in a cement plant and evaluate its adaptation with Helium Brayton cycle. This involves conducting energy and exergy analyses on an existing waste heat recovery integrated Helium Brayton cycle to evaluate its performance. Next, the analyses are carried out for the Helium-based closed Brayton cycle using the actual data of the waste heat recovery system in order to assess the feasibility. Parametric analyses will then be conducted to understand the impact of different operating parameters on system performance, contributing to the optimization of waste heat recovery systems in the cement industry.

Table 1. Literature overview about studies on WHR integrated power generation cycles in cement plants

Reference	Exhaust Gas Temperature (°C)	Cycle	Working Fluid	Net Power Generation, (kW)	Energy Efficiency (%)	Exergy Efficiency (%)
Moreira and Arrieta	310~440	ORC	R11	5614	22.85	50.59
			R141b	5547	22.49	50.19
			R123	4975	20.51	45.52
Olumayegun and Wang	380	Brayton Cycle	sCO ₂	5000	33	-
Naeimi et al.	270~340	Rankine Cycle	Water	5224.39	23.53	73.46
Han et al.	380	Rankine Cycle	Water	4231	-	-
Ahmed et al.	200	ORC	R134a	941	18	58.2

2. SYSTEM DESCRIPTION

Figure 2.1 shows the schematic diagram of the proposed system for waste heat recovery in a cement factory. The designed system uses the Helium Brayton Cycle (HBC) to capture excess heat resulting from various high-temperature processes within the facility and convert it into usable energy. The system aims to improve energy efficiency, reduce greenhouse gas emissions, and optimize resource utilization in the cement manufacturing process. The primary heat sources targeted for waste heat recovery include clinker production in kilns, raw mills, preheaters, clinker coolers, and rotary kilns within the cement plant. These processes generate substantial amounts of waste heat at elevated temperatures, which can be effectively harnessed for energy recovery. The Helium Brayton Cycle is selected as the preferred thermodynamic cycle for waste heat recovery due to its high thermal efficiency and low environmental impact. Helium, known for its excellent heat transfer properties and non-reactive nature, serves as the working fluid in a closed-loop cycle. The Brayton Cycle comprises four main components: a compressor, a recuperator, a turbine, and a heat exchanger. The compressor pressurizes the helium gas, which is then heated in the recuperator using waste heat from the cement plant processes. The heated helium expands

through the turbine, driving it and producing mechanical energy. Finally, the helium passes through a heat exchanger to transfer its remaining heat to a secondary fluid or directly to the cement plant processes before being compressed again in the cycle. The Helium Brayton Cycle system is integrated into the existing infrastructure of the cement plant to capture waste heat from identified sources. Heat exchangers are strategically placed within the plant to extract heat from hot gases or surfaces and transfer it to the helium working fluid. The recovered energy can be utilized for various purposes within the cement plant, including preheating raw materials, generating electricity, or providing process heat.

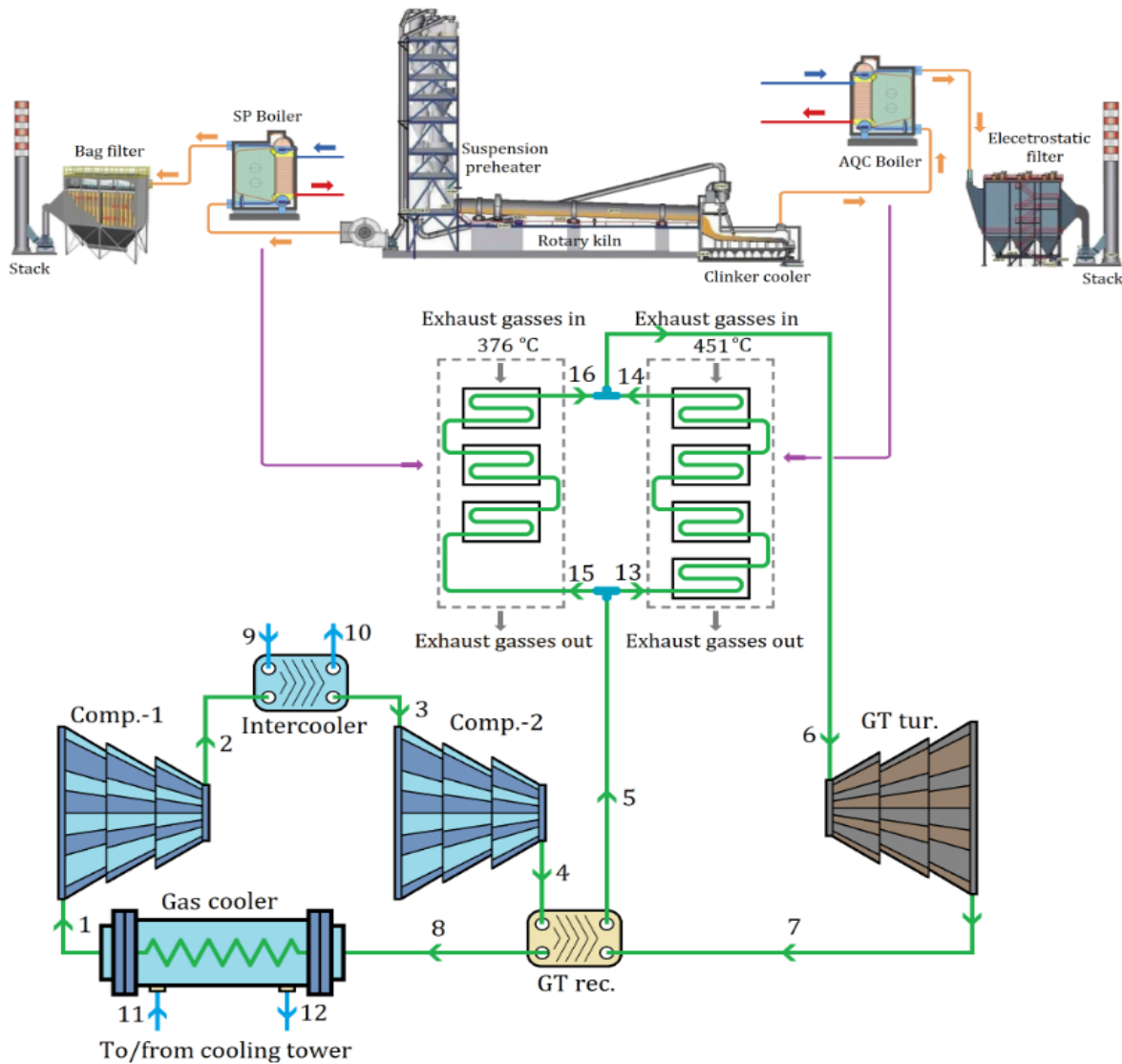


Figure 2.1. Schematic representation of the helium brayton cycle for waste heat recovery in a cement plant

3. THERMODYNAMIC ANALYSIS

In this subchapter, a detailed definition of the thermodynamic methodology utilized in this paper is introduced. Energy and exergy analyses are performed using the MATLAB software for the performance evaluation of the system. In this paper, the thermodynamic analysis is made under the following assumptions:

- The steady-state and steady-flow conditions are chosen for all system elements.
- The energetic change for kinetic and potential energies are neglected.
- The heat losses from compressors and turbine are neglected.
- The pressure drops through the pipelines and heat exchangers are neglected.
- The reference state properties are 22°C and 101.325 kPa.

The mass balance equation for steady-state and steady-flow processes can be written as (Cengel and Boles, 2006):

$$\sum \dot{m}_{in} = \sum \dot{m}_{out} \quad (1)$$

Here, \dot{m} is the mass flow rate, and the subscript in denotes inlet and out denotes outlet. The energy balance is expressed as:

$$\dot{Q} + \sum \dot{m}_{in}h_{in} = \dot{W} + \sum \dot{m}_{out}h_{out} \quad (2)$$

where \dot{Q} is the heat transfer rate, \dot{W} is the work, and h is the specific enthalpy. For the exergy analysis, the balance equation is defined as (Dincer and Rosen, 2007):

$$\dot{E}x_Q - \dot{E}x_W = \sum \dot{E}x_{in} - \sum \dot{E}x_{out} + T_0\dot{S}_{gen} \quad (3)$$

where the first and the second terms are exergy of heat and work respectively, $\dot{E}x$ is the rate of flow exergy, T_0 is the reference state temperature, and the last term is entropy generation. In the above equation, each term is defined as follows:

$$\dot{E}x_{\text{dest}} = T_0 \dot{S}_{\text{gen}} \tag{4}$$

$$\dot{E}x_Q = \dot{Q} \left(\frac{T-T_0}{T} \right) \tag{5}$$

$$\dot{E}x_W = \dot{W} \tag{6}$$

$$\dot{E}x_W = \dot{m} \text{ ex} \tag{7}$$

In Equation (7), *ex* is the specific flow exergy and can be calculated using the equation below:

$$\text{ex} = (h - h_0) - T_0(s - s_0) \tag{8}$$

4. RESULTS

This study aims to conduct comprehensive thermodynamic analyzes and parametric studies to evaluate the performance of the Helium Brayton cycle, including energy and exergy efficiency, power production and exergy destruction. Figure 4.1 shows the total exergy destruction occurring in the components that make up the system. The total exergy destruction occurring in the system was calculated as 10248 kW. As seen in the figure, the highest exergy destruction is in the gas cooler with 21% (2172.5 kW) and in the intercooler with 21% (2124.6 kW). The lowest exergy destruction is in the recuperator with 3.808 kW.

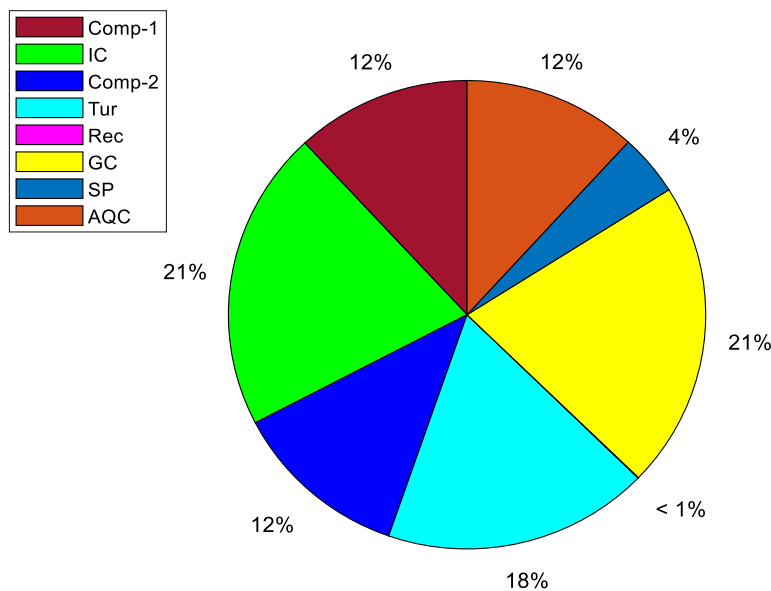


Figure 4.1. Exergy destruction of system components

Figure 4.2 shows the effect of turbine inlet pressure on the net power and energy efficiency obtained from the system. As seen in the figure, when the turbine inlet pressure increases from 7000 kPa to 10000 kPa, the net power and energy efficiency obtained from the system decreases.

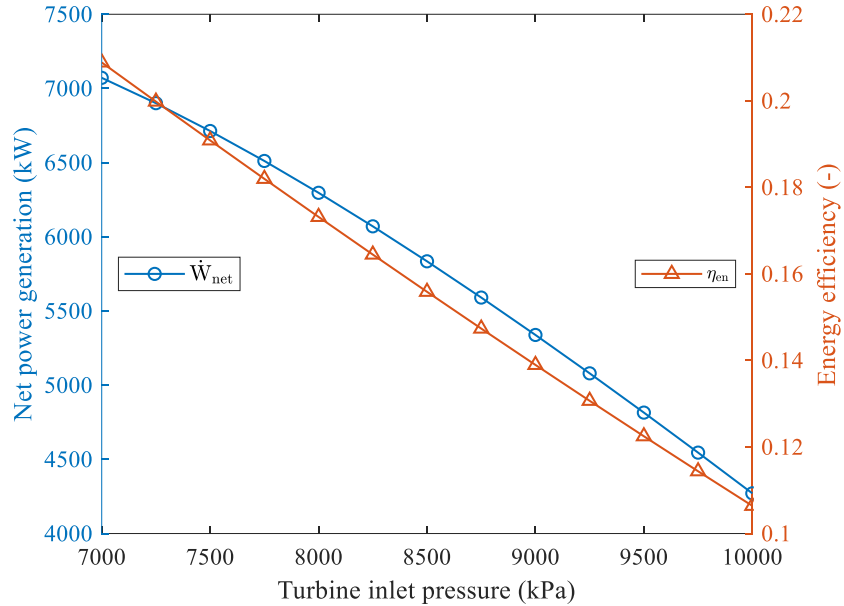


Figure 4.2. Variation of net power generation and energy efficiency according to the change of turbine inlet pressure

As seen in the Figure 4.3, when the turbine inlet pressure increases from 7000 kPa to 10000 kPa, the total exergy destruction increases, and the exergy efficiency decreases.

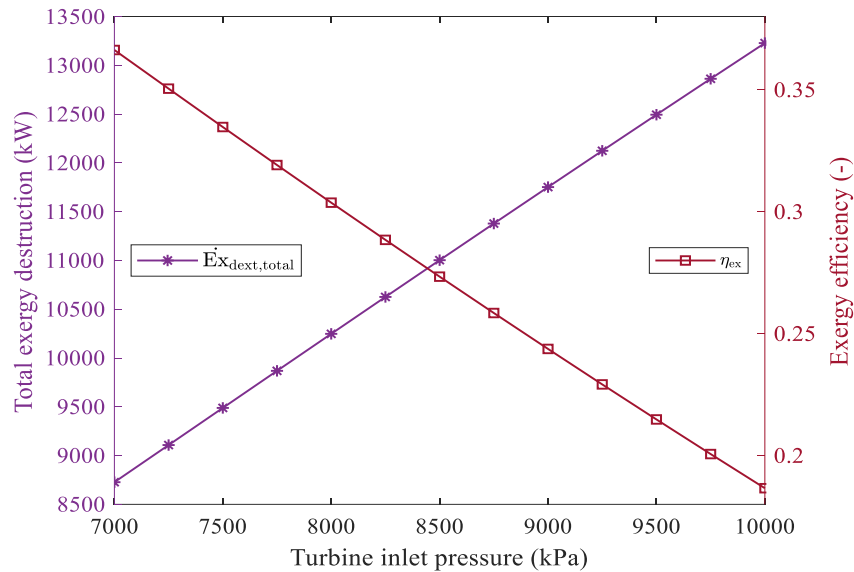


Figure 4.3. Variation of total exergy destruction and exergy efficiency according to the change of turbine inlet pressure

Figure 4.4 indicates the effect of the turbine outlet pressure on the net power and energy efficiency obtained from the system. As seen in the figure, when the turbine outlet pressure is increased from 1500 kPa to 3000 kPa, the net power obtained from the system increases from approximately 500 kW to 7000 kW. Additionally, as seen in the figure, as the turbine outlet pressure increases, energy efficiency increases in proportion to the net power.

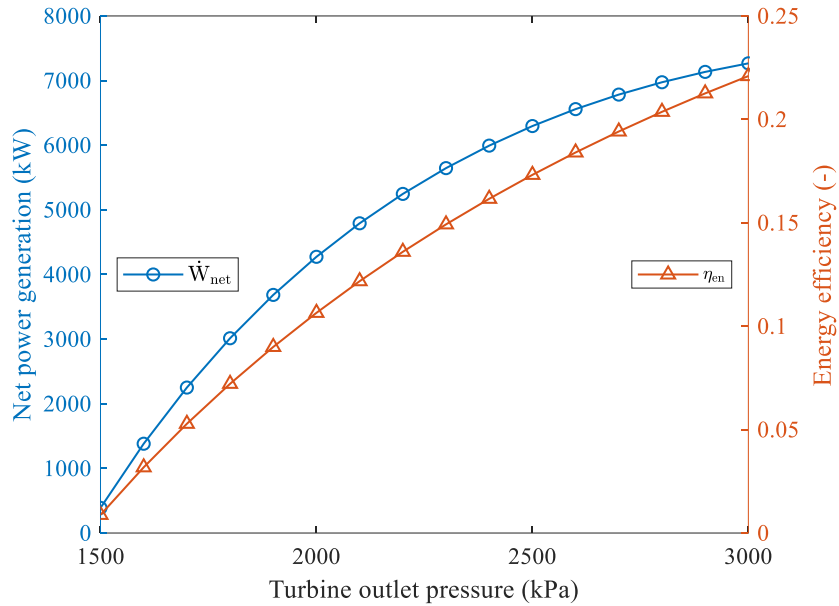


Figure 4.4. Variation of net power generation and energy efficiency according to the change of turbine outlet pressure

Figure 4.5 shows the effect of turbine outlet pressure on total exergy destruction and exergy efficiency. As seen in the figure, when the turbine outlet pressure increases from 1500 kPa to 3000 kPa, total exergy destruction decreases and exergy efficiency increases.

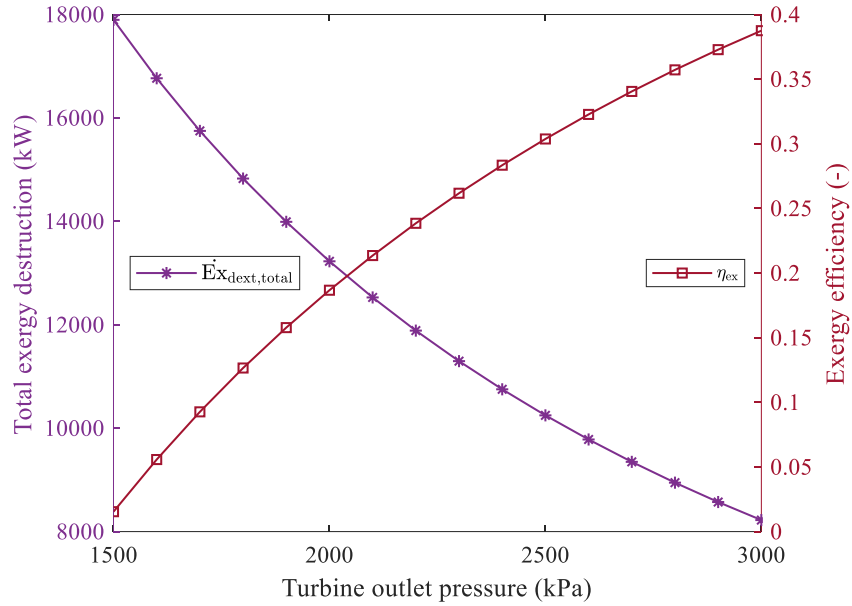


Figure 4.5. Variation of total exergy destruction and exergy efficiency according to the change of turbine outlet pressure

Figure 4.6 shows the effect of helium mass flow rate on net power production and energy efficiency. As seen in the figure, when the mass flow rate of helium increases from 25 kg/s to 40 kg/s, net power production and energy efficiency decrease.

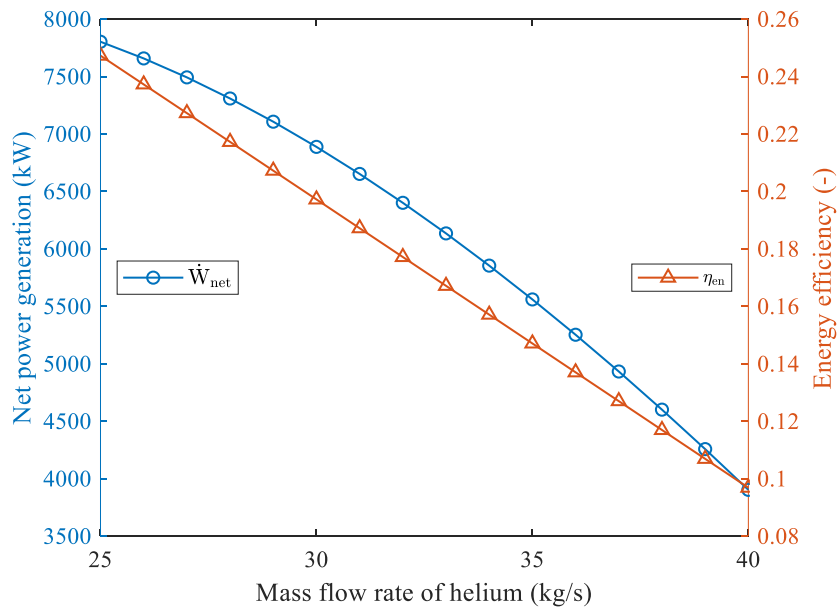


Figure 4.6. Variation of net power generation and energy efficiency according to the change of mass flow rate of helium

Figure 4.7 shows the effect of helium mass flow rate on total exergy destruction and exergy efficiency. As seen in the figure, when the mass flow rate of helium increases from 25 kg/s to 40 kg/s, total exergy destruction increases and exergy efficiency decreases.

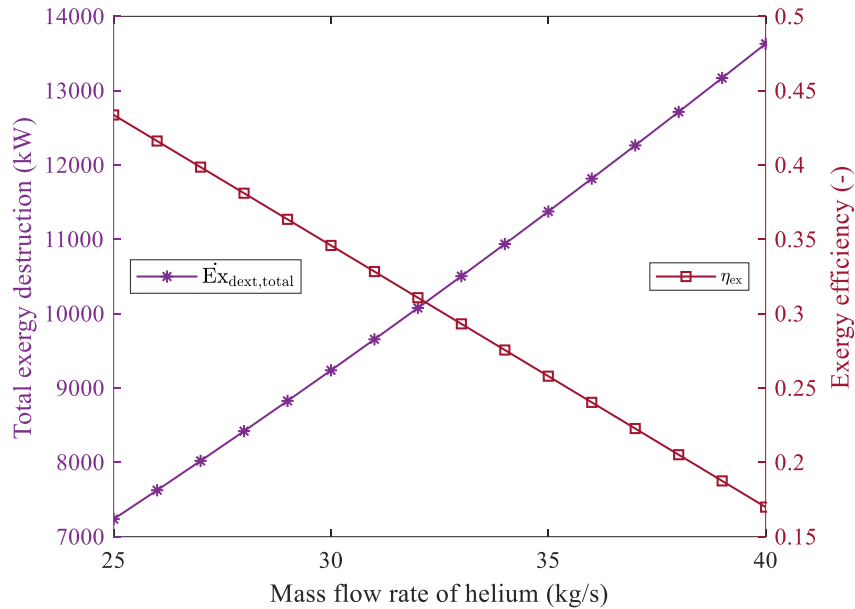


Figure 4.7. Variation of total exergy destruction and exergy efficiency according to the change of mass flow rate of helium

Figure 4.8 exhibits the effect of reference temperature on total exergy destruction and exergy efficiency. As seen in the figure, when the reference temperature increases from 15 C to 25 C, total exergy destruction decreases and exergy efficiency increases.

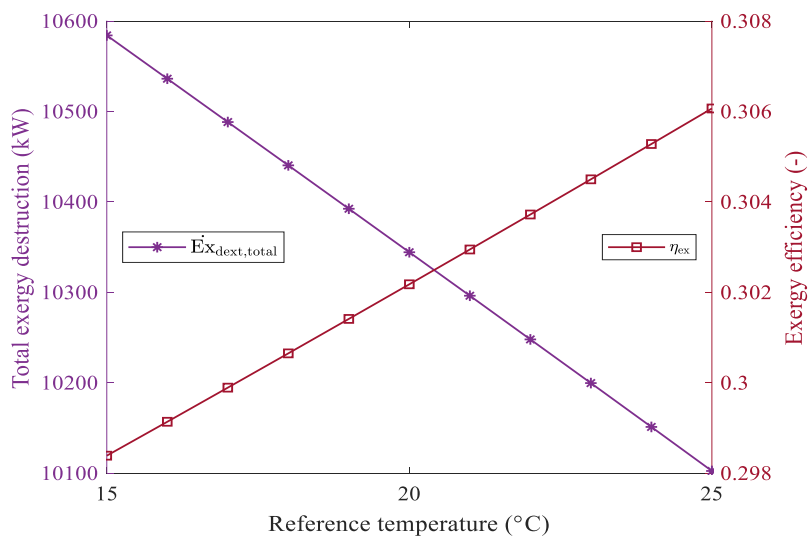


Figure 4.8. Variation of total exergy destruction and exergy efficiency according to the change of reference temperature

5. CONCLUSIONS

The main purpose of this study is to evaluate the performance of a waste heat recovery energy production system in a cement factory. To achieve this aim, energy and exergy analyzes were performed on an existing integrated Helium Brayton cycle with waste heat recovery. Parametric analyzes were then performed to understand the effect of different operating parameters on system performance. According to the analysis results, the net power obtained from the system is 6296.6 kW. In addition, the energy and exergy efficiencies of the system were calculated as 17.31% and 30.37%, respectively. According to the parametric analysis results, as the turbine inlet pressure increases, net power production, energy and exergy efficiency decrease, and total exergy destruction increases. Additionally, when the effect of turbine outlet pressure on system performance was examined, it was seen that as the turbine outlet pressure increased, net power production, energy and exergy efficiency increased, and exergy destruction decreased. In addition, as helium mass flow rate increases, net power production, energy and exergy efficiency decrease, and total exergy destruction increases. Finally, it was observed that as the reference temperature increased, total exergy destruction decreased, and exergy efficiency increased.

REFERENCES

- Ahmed, A., Esmaeil, KK., Irfan, MA., & Al-Mufadi, FA. (2018). Design methodology of organic Rankine cycle for waste heat recovery in cement plants. *Appl Therm Eng.* 129:421-430.
- Boldyryev, S., Mikulcic, H., Mohorovic, Z., Vujanovic, M., Krajacic, G., & Duic, N. (2016). The improved heat integration of cement production under limited process conditions: a case study for Croatia. *Appl Therm Eng.* 105:839-848.
- Cengel, Y.A., & Boles, M.A. (2006). *Thermodynamics: an engineering approach*. McGraw-Hill, New York.
- Dincer, I., & Rosen, M.A. (2007). *Exergy: Energy, Environment and Sustainable Development*. Elsevier Science.
- Dogan, A., Bodnarova, B., & Hedman, BA. (2018). *Waste Heat Recovery in Turkish Cement Industry, Review of Existing Installations and Assessment of Remaining Potential*. Washington, DC: World Bank Group.
- Han, T., Wang, C., Zhu, C., & Che, D. (2018). Optimization of waste heat recovery power generation system for cement plant by combining pinch and exergy analysis methods. *Appl Therm Eng.* 140:334-340.
- Karellas, S., Leontaritis, AD., Panousis, G., Bellos, E., & Kakaras, E. (2013). Energetic and exergetic analysis of waste heat recovery systems in the cement industry. *Energy.* 58:147-156.
- Madloul, NA., Saidur, R., Rahim, NA., Islam, MR., & Hossian, MS. (2012). An exergy analysis for cement industries: an overview. *Renew Sustain Energy Rev.* 16:921-932.
- Mikulcic, H., Vujanovic, M., & Duic, N. (2013). Reducing the CO₂ emissions in Croatian cement industry. *Appl Energy.* 101:41-48.
- Moreira, LF., & Arrieta, FRP. (2019). Thermal and economic assessment of organic Rankine cycles for waste heat recovery in cement plants. *Renew Sustain Energy Rev.* 114:109315.

- Naeimi, A., Bidi, M., Ahmadi, MH., Kumar, R., Sadeghzadeh, M., & Nazari, MA. (2019). Design and exergy analysis of waste heat recovery system and gas engine for power generation in Tehran cement factory. *Thermal Sci Eng Prog.* 299-307.
- Olumayegun, O., & Wang, M. (2019). Dynamic modelling and control of supercritical CO₂ power cycle using waste heat from industrial processes. *Fuel.* 249:89-102.
- Oral, HV., & Saygin, H. (2019). Simulating the future energy consumption and greenhouse gas emissions of Turkish cement industry up to 2030 in a global context. *Mitig Adapt Strat Glob Chang.* 24:1461-1482.

GÜNEŞ ÇANAĞI KOLLEKTÖRÜ KULLANILAN KAPALI BRAYTON ÇEVİRİMİ UYGULAMALARI: HAVA, HELYUM VE AZOT İÇİN KARŞILAŞTIRMALI BİR DEĞERLENDİRME

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ÖZET

Bu çalışma, çalışma akışkanları olarak hava, helyum ve nitrojen kullanıldığındaki performans farklılıklarına odaklanarak, güneş çanağı toplayıcıları kullanan Kapalı Brayton Çevrimi (CBC) uygulamalarının karşılaştırmalı bir değerlendirmesini sunmaktadır. Güç üretim sistemlerinde yaygın olarak kullanılan bir termodinamik döngü olan CBC, çanak toplayıcılar aracılığıyla güneş enerjisinden yararlanma bağlamında araştırılmaktadır. Bu çalışma, hava, helyum ve nitrojen gibi farklı çalışma akışkanlarını kullanan CBC sistemlerinin verimliliğini ve operasyonel özelliklerini analiz ederek, bunların güneş enerjisi üretimindeki uygunlukları ve potansiyel uygulamaları hakkında fikir vermeyi amaçlamaktadır. Termodinamik modellemeyi de içeren ayrıntılı bir karşılaştırmalı analiz aracılığıyla Performans simülasyonları ve performans simülasyonları sayesinde, her çalışma sıvısı için termal verimlilik, güç çıkışı ve sistem güvenilirliği gibi temel parametreler değerlendirilir. Karşılaştırmalı değerlendirme, güneş çanağı toplayıcılarıyla CBC uygulamalarında hava, helyum ve nitrojen kullanmanın avantajlarını ve sınırlamalarını açıklamak için ısı transfer özellikleri, akışkan özellikleri ve sistem tasarımı hususları gibi faktörleri dikkate alır. Analiz sonuçlarına göre nitrojen kullanıldığında sistemden elde edilen maksimum net güç 138.9737 kW olmaktadır. Ayrıca türbin giriş ve çıkış basıncı ile güneş ışınımının sistem performansı üzerindeki etkilerini incelemek amacıyla parametrik çalışmalar yapılmıştır. Parametrik analiz sonuçlarına göre güneş ışınımı arttıkça sistemden elde edilen net güç, enerji ve ekserji verimi tüm çalışma akışkanları için artmıştır.

Anahtar Kelimeler: Güneş Çanağı, Kapalı Brayton Çevrimi, Hava, Helyum, Azot, Enerji, Ekserji.

CLOSED BRAYTON CYCLE APPLICATIONS USING SOLAR DISH COLLECTOR: A COMPARATIVE EVALUATION FOR AIR, HELIUM AND NITROGEN

ABSTRACT

This study presents a comparative evaluation of Closed Brayton Cycle (CBC) applications utilizing solar dish collectors, focusing on the performance differences when using air, helium, and nitrogen as working fluids. The CBC, a thermodynamic cycle commonly used in power generation systems, is explored in the context of solar energy harnessing through dish collectors. By analyzing the efficiency and operational characteristics of CBC systems employing different working fluids, namely air, helium, and nitrogen, this study aims to provide insights into their respective suitability and potential applications in solar power generation. Through a detailed comparative analysis, including thermodynamic modeling and performance simulations, key parameters such as thermal efficiency, power output, and system reliability are assessed for each working fluid. The comparative evaluation considers factors such as heat transfer characteristics, fluid properties, and system design considerations to elucidate the advantages and limitations of utilizing air, helium, and nitrogen in CBC applications with solar dish collectors. According to the analysis results, the maximum net power obtained from the system is 138.9737 kW when nitrogen is used. Additionally, parametric studies were conducted to examine the effects of turbine inlet and outlet pressure and solar radiation on system performance. According to the parametric analysis results, as solar radiation increased, the net power, energy and exergy efficiency obtained from the system increased for all working fluids.

Keywords: Solar Dish, Closed Brayton Cycle, Air, Helium, Nitrogen, Energy, Exergy.

1. INTRODUCTION

In recent decades, the depletion of fossil fuels and growing environmental concerns have emerged as primary drivers shaping the global energy landscape. The imperative to address environmental contamination, ensure secure energy generation, and promote sustainability has become increasingly pressing (Smaisim et al., 2023). Despite past efforts and evolving scientific insights, it has become evident that relying solely on fossil-based fuels is not a sustainable solution to meet future energy demands. Consequently, there is a growing recognition of the need to transition towards cleaner, more efficient, and sustainable power generation systems by leveraging renewable resources (Khanmohammadi et al., 2015).

In this context, the utilization of renewable resources, particularly solar energy, has gained prominence (Saini et al., 2020; Keshvarparast et al., 2020; Chen et al., 2023). Solar energy, characterized by its unlimited and pollution-free nature, has emerged as a viable alternative to meet the escalating global energy demand (Khanmohammadi et al., 2021; Kizilkan et al., 2021). It is increasingly recognized as a crucial solution to address the world's energy needs sustainably. Solar energy can be harnessed for various power generation processes, including co-generation and tri-generation systems (Dabwan and Pei, 2020; Yan et al., 2020).

Among the diverse applications of solar energy (Mozafarifard et al., 2022; Hai et al., 2022; Wang et al., 2023), solar concentrating systems have garnered significant attention due to their effective integration, particularly in power generation systems. Among these systems, parabolic trough solar collectors (PTSC) have emerged as a practical solution for harnessing solar thermal power for electricity generation. PTSCs are recognized as a clean and promising modern technique for both large-scale sustainable energy generation and small-scale co-generation applications (Zayed et al., 2020). Their efficient utilization of solar energy makes them an attractive option for addressing the challenges of energy sustainability and environmental protection in today's world.

Solar dish collectors represent a prominent solar concentration technology, harnessing the immense energy potential of sunlight to generate high-temperature thermal energy. By concentrating solar radiation onto a receiver, these collectors provide an abundant and renewable heat source for power generation systems. Coupling solar dish collectors with the Closed Brayton Cycle offers a sustainable solution for electricity generation, industrial processes, and other energy-intensive applications. The comparative evaluation of different working fluids - air, helium, and nitrogen - within the Closed Brayton Cycle framework is crucial for optimizing system performance and efficiency. Each working fluid possesses unique thermodynamic properties that influence the overall operation of the CBC system. Factors such as efficiency, power output, operating temperature range, cost-effectiveness, and environmental impact play pivotal roles in determining the suitability of a particular working fluid for solar dish collector applications.

This paper aims to analyze and compare the performance of CBC systems utilizing air, helium, and nitrogen as working fluids within the context of solar dish collector applications. Through a comprehensive evaluation, insights into the advantages, limitations, and optimal operating

conditions of each working fluid will be gained. By elucidating the comparative merits of these working fluids, this study aims to contribute to the advancement of sustainable and efficient energy generation technologies, paving the way for broader adoption of solar dish collector-based Closed Brayton Cycle systems in diverse industrial and commercial settings.

2. SYSTEM DESCRIPTION

Figure 2.1 shows the schematic diagram of the closed Brayton cycle using a solar dish collector. In this system, different working fluids (air, helium and nitrogen) were used and how they affected the system performance was examined. The system consists of a solar dish collector that concentrates solar radiation on a receiver. It consists of a collector, a parabolic dish reflector and a receiver positioned at the focal point. Solar radiation incident on the reflector is focused on the receiver, where it heats the working fluid to high temperatures. This concentrated solar thermal energy serves as the primary heat source for the closed Brayton cycle. The closed Brayton cycle is a thermodynamic cycle characterized by four main processes: compression, heating, expansion, and cooling. It operates on a closed-loop system in which a working fluid, typically a gas, is continuously circulated through the loop. The compressor increases the pressure of the working fluid by compressing it. This also increases its temperature, preparing it for the next heating process. The high temperature working fluid from the solar receiver passes through a heat exchanger, where it transfers its thermal energy to the working fluid in the power generation cycle. This process occurs at constant pressure and causes an increase in the specific enthalpy of the working fluid. Heated and pressurized, the working fluid expands through an expander, typically a turbine. This expansion converts the thermal energy of the fluid into mechanical work, which is then used to drive a generator to produce electricity. After work is done in the expander, the working fluid is cooled, or heat rejected to complete the cycle. This cooling process typically occurs at constant pressure and allows the working fluid to return to its initial state before entering the compressor.

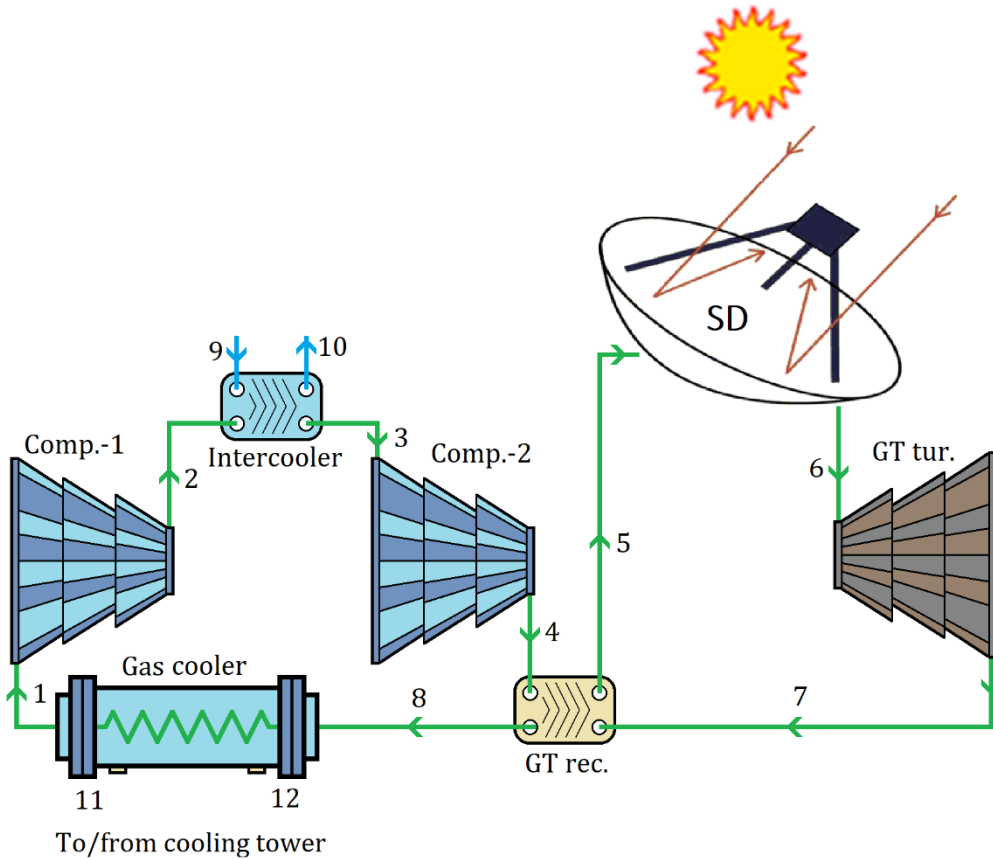


Figure 2.1. Schematic representation of solar dish collector based closed Brayton cycle

3. THERMODYNAMIC ANALYSIS

Energy and exergy analyses are performed using the MATLAB software for the performance evaluation of the system. In this paper, the thermodynamic analysis is made under the following assumptions:

- The steady-state and steady-flow conditions are chosen for all system elements.
- The energetic and exergetic changes for kinetic and potential energies are neglected.
- The heat losses from the compressors and turbine are neglected.
- The pressure drops through the pipelines, and heat exchangers are neglected.

For the performance assessment of the solar dish-based system, the first and second laws of thermodynamics and the principles of conservation of mass are applied to each system element. The mass and energy balance equations for steady-state and steady-flow processes are written as (Cengel and Boles, 2015):

$$\sum \dot{m}_{in} = \sum \dot{m}_{out} \quad (1)$$

Here, \dot{m} is the mass flow rate and subscripts "in" and "out" are the input and output states. Energy balance equality in a general method is written as (Bejan and Moran, 1996):

$$\sum \dot{m}_{in} \left(h + \frac{v^2}{2} + gz \right)_{in} + \sum \dot{Q}_{in} + \sum \dot{W}_{in} = \sum \dot{m}_{out} \left(h + \frac{v^2}{2} + gz \right)_{out} + \sum \dot{Q}_{out} + \sum \dot{W}_{out} \quad (2)$$

Here, \dot{Q} is the heat energy transfer rate, \dot{W} is the power transfer rate, h is the specific enthalpy, v is the velocity, z is the elevation, and g is the gravitational acceleration. Entropy balance equality is given as:

$$\sum \dot{m}_{in} s_{in} + \sum \frac{\dot{Q}}{T} + \dot{S}_{gen} = \sum \dot{m}_{out} s_{out} \quad (3)$$

Here, s is the specific entropy, and \dot{S}_{gen} stands for entropy generation rate. An exergy balance equality of any system can be described as (Dincer and Rosen, 2013):

$$\sum \dot{m}_{in} \dot{e}x_{flow} + \sum \dot{E}x_{in}^Q + \sum \dot{E}x_{in}^W = \sum \dot{m}_{out} \dot{e}x_{flow} + \sum \dot{E}x_{out}^Q + \sum \dot{E}x_{out}^W + \dot{E}x_{dest} \quad (4)$$

Where $\dot{e}x_{flow}$ is the flow exergy, $\dot{E}x_{in}^Q$ is the exergy associated with heat flow across the control volume of the process, $\dot{E}x_{in}^W$ is the exergy associated with work and $\dot{E}x_{dest}$ is the exergy destruction. In the above equation, each term is defined as follows:

$$\dot{e}x_{flow} = (h - h_0) - T_0(s - s_0) \quad (5)$$

$$\dot{E}x^Q = \dot{Q} \left(\frac{T - T_0}{T} \right) \quad (6)$$

$$\dot{E}x^W = \dot{W} \quad (7)$$

$$\dot{E}x_{dest} = T_0 \dot{S}_{gen} \quad (8)$$

4. RESULTS

In this study, it was aimed to evaluate the performance of the solar dish supported closed Brayton cycle for different working fluids. For this purpose, zero-dimensional analyzes were carried out in the MATLAB software program. Figure 4.1. shows the exergy destruction that occurs in system components when different working fluids are used. As seen in the figure, the highest exergy destruction for three different fluids is in the solar dish. The solar dish is followed by the gas cooler with a rate of 5%.

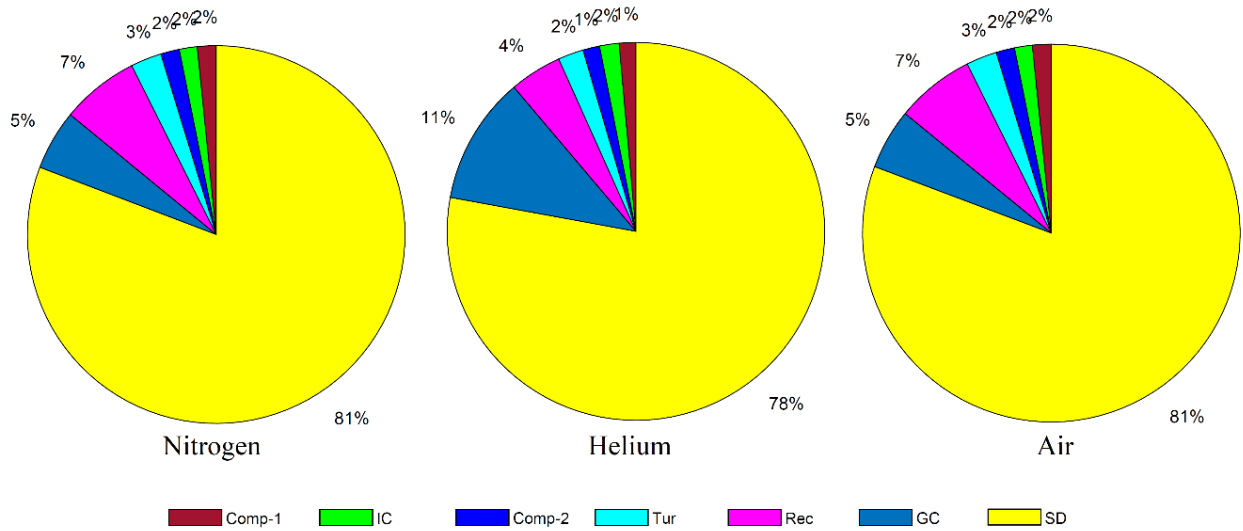


Figure 4.1. Exergy destruction for system components for different working fluids

In the parametric analysis section, which is the second stage of the study, the effect of turbine inlet pressure on net power production and energy efficiency was examined for three different working fluids. As seen in the Figure 4.2, when the turbine inlet pressure increases from 700 kPa to 1300 kPa, net power production for all fluids and energy efficiency increases in direct proportion.

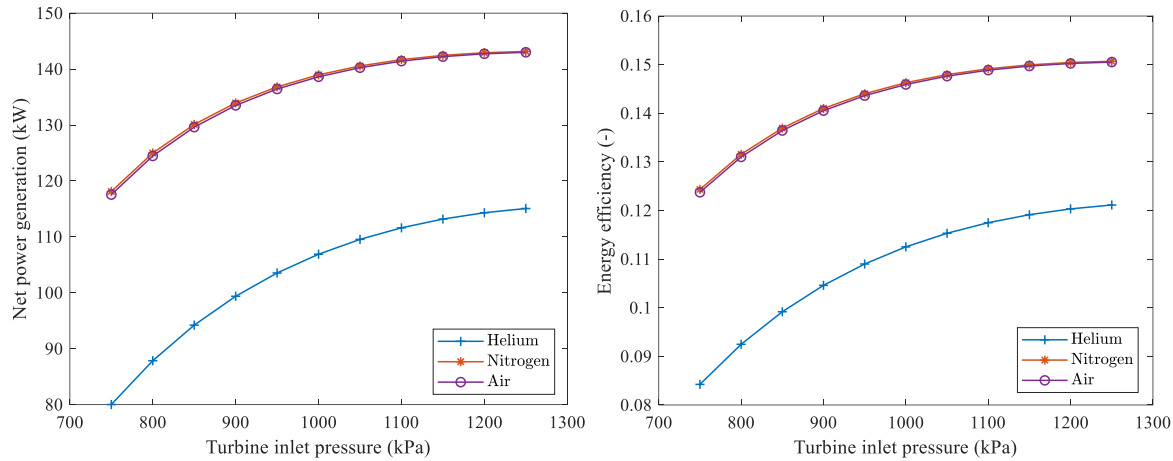


Figure 4.2. Variation of net power generation and energy efficiency according to the change of turbine inlet pressure

The effect of turbine inlet pressure on exergy destruction and exergy efficiency is seen in Figure 4.3 for three different working fluids. As seen in the figure, when the turbine inlet pressure is increased, exergy destruction decreases for all fluids and exergy efficiency increases.

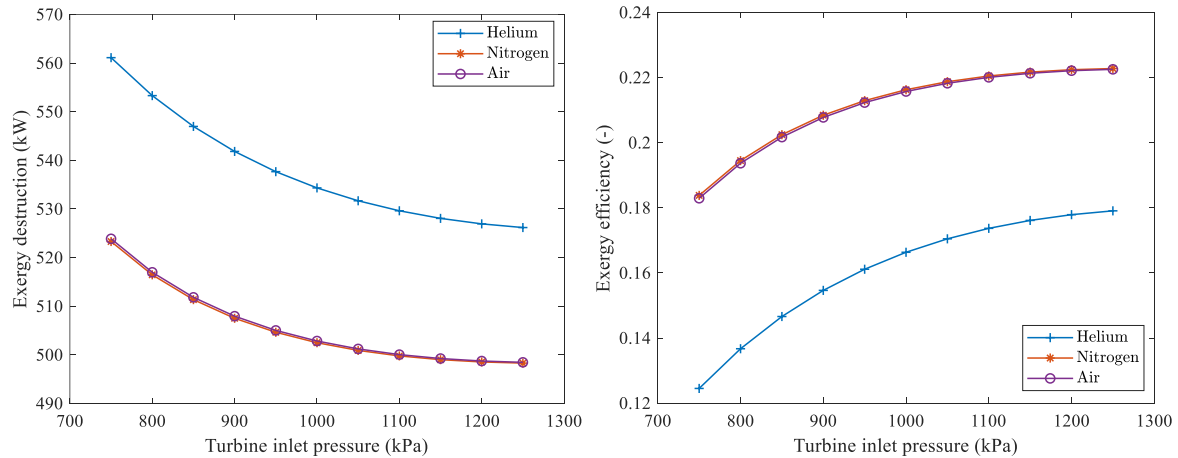


Figure 4.3. Variation of exergy destruction and exergy efficiency according to the change of turbine inlet pressure

The effect of turbine outlet pressure on net power production and energy efficiency is seen in Figure 4.4 for three different working fluids. As seen in the figure, when the turbine outlet

pressure is increased from 350 kPa to 650 kPa, net power production and energy efficiency decrease for all fluids.

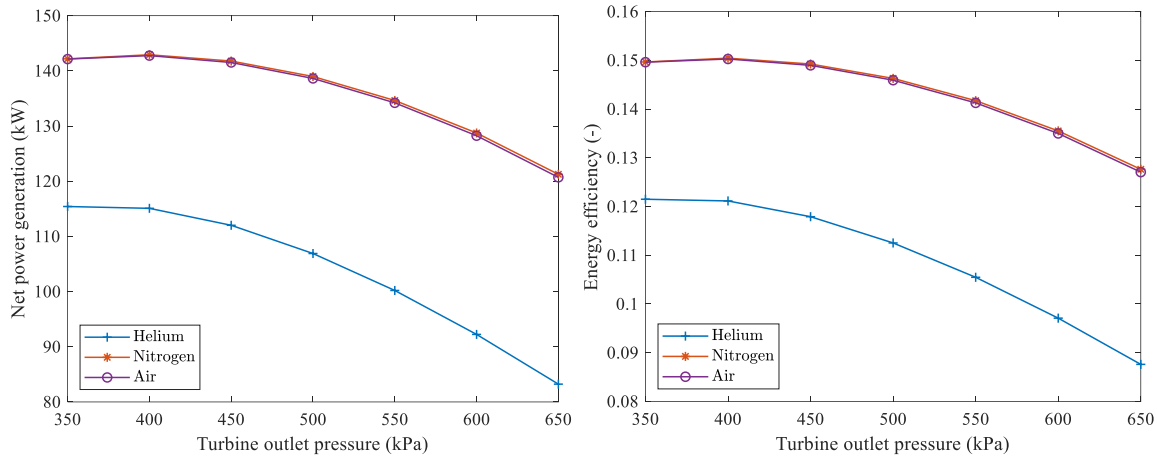


Figure 4.4. Variation of net power generation and energy efficiency according to the change of turbine outlet pressure

Figure 4.5 shows the effect of turbine outlet pressure on exergy destruction and exergy efficiency. As seen in the figure, as the turbine outlet pressure increases, exergy destruction increases for all fluids and exergy efficiency decreases.

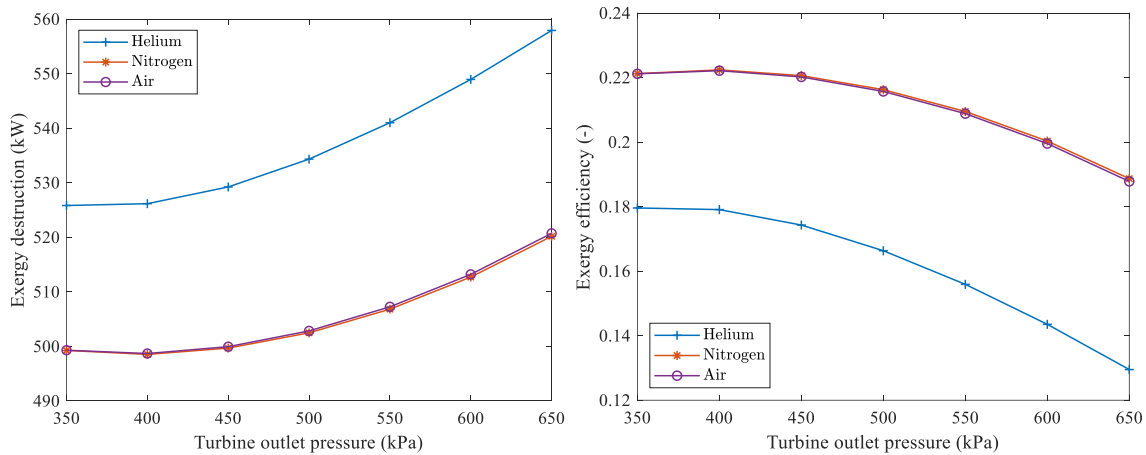


Figure 4.5. Variation of exergy destruction and exergy efficiency according to the change of turbine outlet pressure

Parametric studies have been conducted to examine the effect of solar radiation on system performance. As seen in Figure 4.6, as solar radiation increased, the net power obtained from the

system for the entire fluid increased. As the net power obtained from the system increases, the energy efficiency of the system also increases in direct proportion.

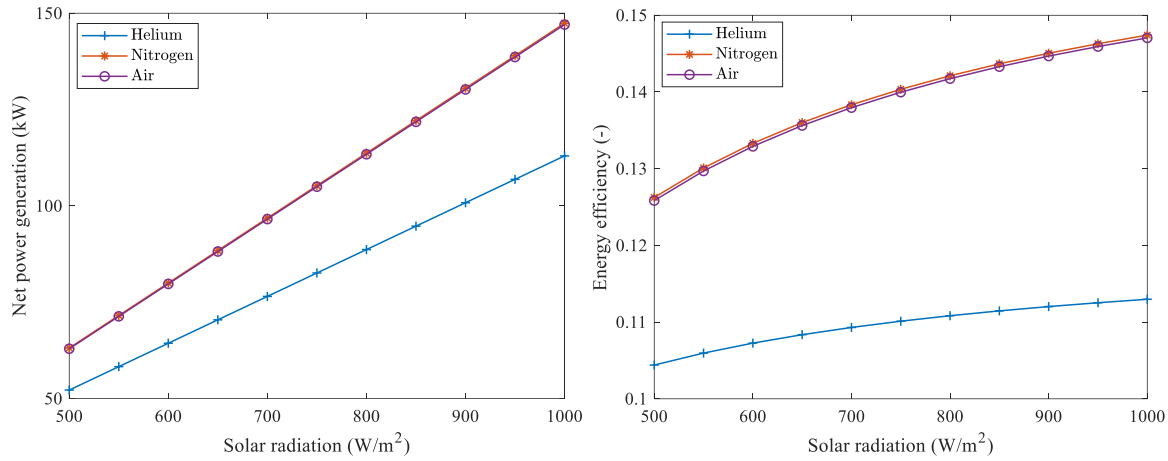


Figure 4.6. Variation of net power generation and energy efficiency according to the change of solar radiation

Finally, the effect of solar radiation on exergy destruction and exergy efficiency is seen in Figure 4.7. As seen in the figure, as solar radiation increases, exergy destruction and exergy efficiency increase.

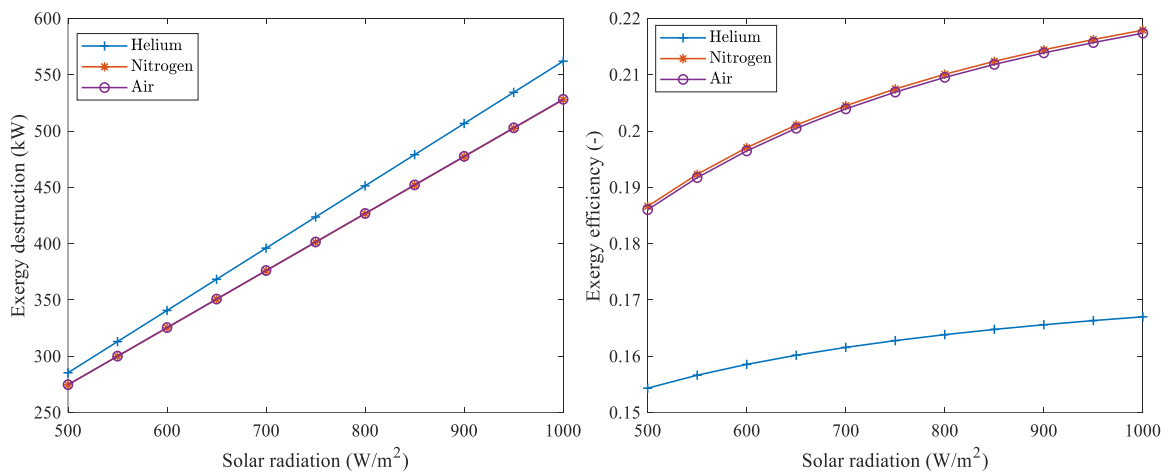


Figure 4.7. Variation of exergy destruction and exergy efficiency according to the change of solar radiation

5. CONCLUSIONS

The main purpose of this study is to evaluate the performance of the solar dish supported closed Brayton cycle for different working fluids. For this purpose, air, nitrogen and helium were chosen as working fluids. Net power, energy and exergy efficiency and exergy destruction obtained from the system were calculated for three different working fluids. Additionally, parametric studies were conducted to examine the effects of turbine inlet/exit pressure and solar radiation on system performance. According to the analysis results, when air, nitrogen and helium are used, the net power obtained from the system is calculated as 138.6241 kW, 138.9737 kW and 106.8973 kW, respectively, and the energy efficiency is calculated as 14.59%, 14.62% and 11.25%, respectively. Additionally, exergy efficiencies were calculated as 21.57%, 21.62% and 16.63%, respectively. When the exergy destruction was calculated, it was determined that the highest exergy destruction was 534.33 kW when air was used. The least exergy destruction was calculated as 502.48 kW when nitrogen was used. According to the parametric analysis results; As the turbine inlet pressure increases, net power production, energy efficiency and exergy efficiency increase for all fluids, while exergy destruction decreases. It has been determined that when the turbine outlet pressure is increased, net power production, energy efficiency and exergy efficiency decrease and exergy destruction increases. Finally, when the effect of solar radiation on the system performance was examined, it was seen that as solar radiation increased, the net power obtained from the system, energy and exergy efficiency, and exergy destruction increased.

REFERENCES

- Bejan, A., & Moran, M.J. (1996). *Thermal Design and Optimization*, New York: John Wiley & Sons.
- Cengel, Y.A., & Boles, M.A., (2015). *Thermodynamics: An Engineering Approach* 8th Edition.
- Chen, Y., Abed, A.M., Faisal Raheem, A.-B., Altamimi, A.S., Yasin, Y., & Abdi Sheekhoo, W., et al. (2023). Current advancements towards the use of nanofluids in the reduction of CO₂ emission to the atmosphere. *J. Mol. Liq.* 371, 121077.
- Dabwan, Y.N., & Pei, G. (2020). A novel integrated solar gas turbine trigeneration system for production of power, heat and cooling: thermodynamic-economic-environmental analysis. *Renew. Energy* 152, 925–941.
- Hai, T., Abidi, A., Wang, L., Abed, A.M., Mahmoud, M.Z., Tag El, M., & Din, E, et al. (2022). Simulation of solar thermal panel systems with nanofluid flow and PCM for energy consumption management of buildings. *J. Build. Eng.* 58, 104981.
- Keshvarparast, A., Ajarostaghi, S.S.M., & Delavar, M.A. (2020). Thermodynamic analysis the performance of hybrid solar-geothermal power plant equipped with air-cooled condenser. *Appl. Therm. Eng.* 172, 115160.
- Khan, M.S., Abid, M., Bashir, M.A., Amber, K.P., Khanmohammadi, S., & Yan, M. (2021). Thermodynamic and exergoeconomic analysis of a novel solar-assisted multigenerational system

- utilizing high temperature phase change material and hybrid nanofluid. *Energy Convers. Manag.* 236, 113948.
- Khanmohammadi, S., Atashkari, K., & Kouhikamali, R. (2015). Exergoeconomic multiobjective optimization of an externally fired gas turbine integrated with a biomass gasifier. *Appl. Therm. Eng.* 91, 848–859.
- Kizilkan, O., Khanmohammadi, S., & Yamaguchi, H. (2021). Two-objective optimization of a transcritical carbon dioxide based Rankine cycle integrated with evacuated tube solar collector for power and heat generation. *Appl. Therm. Eng.* 182, 116079.
- Mozafarifard, M., Azimi, A., Sobhani, H., Smaism, G.F., Toghraie, D., & Rahmani, M. (2022). Numerical study of anomalous heat conduction in absorber plate of a solar collector using time-fractional single-phase-lag model. *Case Stud. Therm. Eng.* 34, 102071.
- Saini, P., Singh, J., & Sarkar, J. (2020.) Thermodynamic, economic and environmental analyses of a novel solar energy driven small-scale combined cooling, heating and power system. *Energy Convers. Manag.* 226, 113542.
- Smaism, G.F., Abed, A.M., & Alavi, H. (2023). Analysis of pollutant emission reduction in a coal power plant using renewable energy. *Int. J. Low Carbon Technol.* 18, 38–48.
- Yan, R., Wang, J., Cheng, Y., Ma, C., & Yu, T. (2020). Thermodynamic analysis of fuel cell combined cooling heating and power system integrated with solar reforming of natural gas. *Sol. Energy* 206, 396–412.
- Zayed, M.E., Zhao, J., Elsheikh, A.H., Li, W., & Elaziz, M.A. (2020). Optimal design parameters and performance optimization of thermodynamically balanced dish/ Stirling concentrated solar power system using multi-objective particle swarm optimization. *Appl. Therm. Eng.* 178, 115539.
- Wang, Y., Nasajpour-Esfahani, N., Alizadeh, A., Smaism, G.F., Abed, A.M., & Hadrawi, S. K., et al. (2023). Numerical simulation of the melting of solid paraffin in a solar water heater and the effect of the number of fins and the height of the fins. *Case Stud. Therm. Eng.* 41, 102653.

ON PRIME IDEALS AND MULTIPLICATIVE GENERALIZATION DERIVATIONS IN IDEALS

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ABSTRACT

Derivation definition on rings was first made in the literature by Posner in 1957. This definition, discussed by Posner, has revealed different derivation concepts. A map $F: R \rightarrow R$ is called a multiplicative generalized derivation if there exists a map $d: R \rightarrow R$ such that $F(xy) = F(x)y + xd(y)$, for all $x, y \in R$. Accordingly, let R be a ring, P a prime ideal of R , I a nonzero ideal of R . Then, R/P is a commutative integral domain or $d(I) \subseteq P$, if R admits a multiplicative generalized derivation F associated with a nonzero map d such that: (i) $F([x,y]) \in P$, (ii) $F([x,y]) \pm [x,y] \in P$, (iii) $F([x,y]) \pm (xoy) \in P$, (iv) $F(xoy) \in P$, (v) $F(xoy) \pm (xoy) \in P$, (vi) $F(xoy) \pm [x,y] \in P$, (vii) $F([x,y]) \pm [F(x),y] \in P$, (viii) $[F(x),y] \pm [x,F(y)] \in P$, $\forall x, y \in I$.

Keywords: prime ring, ideal, derivation, multiplicative generalization derivation.

1. INTRODUCTION

Let R be an associative ring with center Z . For any $x, y \in R$, the symbol $[x, y]$ stands for the commutator $xy - yx$ and the symbol $x \circ y$ denotes for the anti-commutator $xy + yx$. Recall that a ring R is prime if $xRy = 0$ implies $x = 0$ or $y = 0$. An additive mapping $d: R \rightarrow R$ is called a derivation if $d(xy) = d(x)y + xd(y)$ holds for all $x, y \in R$. Let R will be an associative ring with center Z . For a fixed $a \in R$, the mapping $I_a: R \rightarrow R$ given by $I_a(x) = [a, x]$ is a derivation which is said to be an inner derivation. An additive function $F: R \rightarrow R$ is called a generalized inner derivation if $F(x) = ax + xb$ for fixed $a, b \in R$. For such a mapping F , it is easy to see that

$$F(xy) = F(x)y + x[y, b] = f(x)y + xI_b(y) \text{ for all } x, y \in R.$$

This observation leads to the following definition given by Bresar: An additive mapping $F: R \rightarrow R$ is called a generalized derivation if there exists a derivation $d: R \rightarrow R$ such that

$$F(xy) = F(x)y + xd(y), \text{ for all } x, y \in R.$$

Familiar examples of generalized derivations are derivations and generalized inner derivations, and the later include left multipliers and right multipliers (i.e., $F(xy)=F(x)y$ for all $x,y \in R$).

The commutativity of prime or semiprime rings with derivation was initiated by Posner. Thereafter, several authors have proved commutativity theorems of prime or semiprime rings with derivations. The notion of multiplicative derivation was introduced by Daif motivated by Martindale. $d: R \rightarrow R$ is called a multiplicative derivation if $d(xy) = d(x)y + xd(y)$ holds for all $x, y \in R$. These maps are not additive. Goldman and Semrl gave the complete description of these maps. We have $R = C[0,1]$, the ring of all continuous (real or complex valued) functions and define a map $d: R \rightarrow R$ such as

$$d(f)(x) = \begin{cases} f(x)\log|f(x)|, & f(x) \neq 0 \\ 0, & otherwise \end{cases}$$

It is clear that d is multiplicative derivation, but d is not additive. Inspired by the definition multiplicative derivation, the notion of multiplicative generalized derivation was extended by Daif and Tamman El-Sayiad as follows:

$F:R \rightarrow R$ is called a multiplicative generalized derivation if there exists a derivation $d:R \rightarrow R$ such that $F(xy) = F(x)y + xd(y)$, for all $x, y \in R$. Dhara and Ali gave a slight generalization of this definition taking g is any map (not necessarily an additive map or a derivation). Every generalized derivation is a multiplicative generalized derivation. But the converse is not true in general. Hence, one may observe that the concept of multiplicative generalized derivations includes the concept of derivations, multiplicative derivation and the left multipliers. So, it should be interesting to extend some results concerning these notions to multiplicative generalized derivations. But there are only few papers about this subject.

Daif and Bell proved that R is semiprime ring, I is a nonzero ideal of R and d is a derivation of R such that $d([x, y]) = \pm[x, y]$, for all $x, y \in U$, then $U \subseteq Z$. This theorem considered for generalized derivations by Quadri et al. and extended by Dhara proving $F([x, y]) \pm [x, y] \in Z$, for all $x, y \in U$, when F is a generalized derivation of R . This result was examined by Argaç. Gölbaşı generalized the same result for the generalized derivation in a semi-prime ring. The above conditions were studied on Lie ideals by Gölbaşı and Koç. Hongan proved that if a 2-torsion free semiprime ring R admits a derivation d such that $d([x, y]) \pm [x, y] \in Z(R)$ for all x, y

$\in R$, then R is commutative. Ashraf and Rehman prove that if R is a 2-torsion free prime ring and L a nonzero Lie ideal of R such that $u^2 \in L$ for all $u \in L$ and d a derivation which satisfies $d(u \circ v) - u \circ v$ for all $u, v \in L$, then $L \subseteq Z(R)$.

In order to extend the standard theory of “derivations in rings” recently, Almahdi et al. initiated the study of derivations of an arbitrary ring R satisfying some P -valued conditions, where P is a prime ideal of R . Specifically, they improved the well-known Posner’s Second Theorem as follows: If P is a prime ideal of a ring R and d a derivation of R such that $[[d(x), x], y] \in P, \forall x, y \in R$, then $d(R) \subseteq P$ or R/P is a commutative ring. Further Mamouni et al. investigated many P -valued differential identities such as: (i) $[d(x), g(y)] \in P$, (ii) $d(x) \circ g(y) \in P$, (iii) $[d(x), y] + [x, g(y)] \in P$, (iv) $[d(x), y] + [x, g(y)] - [x, y] \in P$, (v) $[d(x), y] + [x, g(y)] - [y, d(x)] \in P$ for all x, y in a prime ring R and d, g are the derivations of R . The authors also examined some particular cases of these identities in semi-prime rings. In the successive paper Mamouni et al. extended this theory to the class of generalized derivations and obtained the commutativity of the quotient rings.

We aim to investigate the commutativity of quotient ring R/P where R any ring, I a nonzero ideal and P is prime ideal of R which admits a multiplicative generalized derivations associated with an map d of R are satisfying some identities acting on prime ideal P .

Results

We will make some extensive use of the basic commutator identities:

$$[x, yz] = y[x, z] + [x, y]z$$

$$[xy, z] = [x, z]y + x[y, z]$$

$$x \circ (yz) = (x \circ y)z - y[x, z] = y(x \circ z) + [x, y]z$$

$$(xy) \circ z = x(y \circ z) - [x, z]y = (x \circ z)y + x[y, z].$$

Fact: Let R be a ring, I a nonzero ideal of R and P a prime ideal of R such that $P \subsetneq I$. If $aIb \subseteq P$, with $a, b \in R$, then $a \in P$ or $b \in P$.

Theorem: Let R be a 2-torsion free ring with P a prime ideal of R and I a nonzero ideal of R such that $P \subsetneq I$. Suppose that R admits a multiplicative generalized derivation F associated with a nonzero map d . If any of the following conditions is satisfied for all $x, y \in I$, then R/P is a commutative integral domain or $d(I) \subseteq P$:

- (i) $F([x, y]) \in P$,
- (ii) $F([x, y]) \pm [x, y] \in P$,
- (iii) $F([x, y]) \pm (xoy) \in P$,
- (iv) $F(xoy) \in P$,
- (v) $F(xoy) \pm (xoy) \in P$,
- (vi) $F(xoy) \pm [x, y] \in P$,
- (vii) $F([x, y]) \pm [F(x), y] \in P$,
- (viii) $[F(x), y] \pm [x, F(y)] \in P$.

Proof.

(i) **By the hypothesis, we have**

$$F([x, y]) \in P, \text{ for all } x, y \in I.$$

Replacing yx by y in the above expression and using this expression, we get

$$[x, y]d(x) \in P, \text{ for all } x, y \in I. \tag{1}$$

Taking yz , $z \in R$ for y in (1) and using (1), we get

$$[x, y]Rd(x) \subseteq P, \text{ for all } x, y \in I. \tag{2}$$

Since P is prime, we get

$$[x, y] \in P \text{ or } d(x) \in P, \text{ for all } x, y \in I.$$

Let $L = \{x \in I \mid [x, y] \in P, \text{ for all } y \in I\}$ and $K = \{x \in I \mid d(x) \in P\}$. Clearly each of L and K is additive subgroup of R such that $I = L \cup K$. But, a group can not be the set-theoretic union of its two proper subgroups. Hence $L = R$ or $K = R$. In the first case, we have $[x, y] \in P$, for all $x, y \in I$. Replacing y by ry , $r \in R$ in this expression, we have $[x, r]y \in P$, for all $x, y \in I$. That is, $[x, r] \in P$, for all $x \in I, r \in R$ by Fact. Replacing x by xz , $z \in R$, we have $[z, r] \in P$ for all $r, z \in R$. Let $R = R/P$, then $\overline{[z, r]} = \overline{0}$ and so $[\bar{z}, \bar{r}] = \bar{0}$. Hence R/P is a commutative, and since P is a prime ideal of R , then R/P is an integral domain. Thus R/P is a commutative integral domain. In the second case, we get $d(I) \subseteq P$. This completes the proof.

(ii) Suppose that

$$F([x, y]) \neq [x, y] \in P, \text{ for all } x, y \in I.$$

Replacing y by yx in this expression and using this expression, we arrive that

$$[x, y]d(x) \in P, \text{ for all } x, y \in I.$$

Using the same arguments after (1) in the proof of Theorem (i), we get the required result.

(iii) Assume that

$$F([x, y]) \neq (xoy) \in P, \text{ for all } x, y \in I.$$

Replacing yx by y in the last expression and using this expression, we get

$$[x, y]d(x) \in P, \text{ for all } x, y \in I.$$

This expression is same as (1) in the proof of Theorem (i). Hence, using the same arguments in there, we get the required result.

iv) Assume that

$$F(xoy) \in P, \text{ for all } x, y \in I.$$

Writing yx for y in this expression and using this expression, we have

$$(xoy)d(x) \in P, \text{ for all } x, y \in I. \tag{3}$$

Substituting $zy, z \in R$ for y in (3) and using this expression, we arrive at

$[x,z]Rd(x) \subseteq P$, for all $x,z \in I$.

Using the same arguments after (2) in the proof of Theorem (i), we get the required result.

(v) We have

$F(xoy) \pm (xoy) \in P$, for all $x,y \in I$.

Replacing y by yx in this expression and using this, we arrive that

$(xoy)d(x) \in P$, for all $x,y \in I$.

Using the same arguments after (3) in the proof of Theorem (iv), we conclude the required result.

(vi) Suppose that

$F(xoy) \pm [x,y] \in P$, for all $x,y \in I$.

Replacing yx by y in this expression and using this, we get

$(xoy)d(x) \in P$, for all $x,y \in R$.

This expression is same as (3) in the proof of Theorem (iv).

(vii) By our hypothesis, we get

$F([x,y]) \pm [F(x),y] \in P$, for all $x,y \in I$.

Replacing y by yx in this expression and using this expression, we arrive that

$[x,y]d(x) \pm y[F(x),x] \in P$, for all $x,y \in I$. (4)

Replacing y by x in the hypothesis, we get

$F([x,x]) \pm [F(x),x] \in P$, for all $x,y \in I$.

That is,

$[F(x),x] \in P$, for all $x \in I$.

Using this expression in (4), we get

$[x,y]d(x) \in P$, for all $x,y \in I$.

Using the same arguments after expression (1) in the proof of Theorem (i), we get the required results.

iii) By the hypothesis, we have

$[F(x),y] \pm [x,F(y)] \in P$, for all $x,y \in I$.

Replacing y by yx in the hypothesis, we have

$y[F(x),x] + [F(x),y]x \pm [x,F(y)]x \pm [x,y]d(y) \pm y[x,d(x)] \in P$.

Application the hypothesis, we get

$y[F(x),x] \pm [x,y]d(x) \pm y[x,d(x)] \in P$.

Writing y by zy in this expression and using this expression, we get

$[x,z]yd(x) \in P$, for all $x,y,z \in I$.

This expression is the same as in (2). The proof is completed using similar techniques.

REFERENCES

- F.A.A. Almahdi, A. Mamouni, M. Tamekkante, A generalization of Posner's theorem on derivations in rings, *Indian J. Pure Appl. Math.*, 51(1), 187–194, 2020.
- N. Argaç, On prime and semiprime rings with derivations: *Algebra Coll.*, 13 (3), 371-380, 2006.
- M. Bresar, On the distance of the compositions of two derivations to the generalized derivations, *Glasgow Math. J.*, 33 (1), 89-93, 1991.
- M. N. Daif, When is a multiplicative derivation additive, *Int. J. Math. Math. Sci.*, 14(3), 615-618, 1991.
- M. N. Daif, H. E. Bell, Remarks on derivations on semiprime rings, *Int. J. Math. Math. Sci.*, 15(1), 205-206, 1992.
- M. N. Daif, M. S. Tamman El-Sayiad, Multiplicative generalized derivation which are additive, *East-West J. Math.*, 9(1), 31-37, 1997.
- B. Dhara, S. Ali, On multiplicative (generalized) derivation in prime and semiprime rings, *Aequat. Math.*, 86, 65-79, 2013.
- H. Goldman, P. Semrl, Multiplicative derivations on $C(X)$, *Monatsh Math.*, 121(3), 189-197, 1969.
- Ö. Gölbaşı, E. Koç, Generalized derivations on Lie ideals in prime rings: *Turk. J. Math.*, 35, 23-28, 2011.
- Ö. Gölbaşı, On commutativity of semiprime rings with generalized derivation: *Indian Journal of Pure and Appl. Math.*, 40 (3), 191-199, 2009.
- A. Mamouni, B. Nejjar, L. Oukhtite, Differential identities on prime rings with involution, *J. Algebra & Appl.*, 17(9), 11, 2011.
- A. Mamouni, L. Oukhtite, M. Zerra, Prime ideals and generalized derivations with central values on rings, *Rendiconti del Circolo Matematico di Palermo Series 2*. doi: 10.1007/s12215-020-00578-3.
- W. S. Martindale III, When are multiplicative maps additive, *Proc. Amer. Math. Soc.*, 21, 695-698, 1969.

- E. C. Posner, Derivations in prime rings, Proc Amer.Math.Soc., 8, 1093-1100, 1957.
- N, Rehman, M. Hongan, Generalized Jordan derivations on Lie ideals associate with child 2-cocycles of rings, Rend. Circ. Mat. Palermo, 60(3), 437-444, 2011.
- M. A. Quadri, M. S. Khan, N. Rehman, Generalized derivations and commutativity of prime rings, Indian J. Pure Appl. Math., 34(9), 1393-1396, 2003.

MULTIPLICATIVE GENERALIZATION DERIVATIONS IN PRIME IDEALS**Emine KOÇ SÖGÜTCÜ**

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ORCID ID: 0000-0002-8328-4293**ABSTRACT**

Let R be any an arbitrary associative ring, P a prime ideal and I a nonzero ideal of R . In this study, using multiplicative (generalized) derivations, we explore the behaviour of prime ideals that satisfy certain algebraic identities. Suppose that F is a multiplicative (generalized)-derivations of R associated with the map d on R . Throughout this paper we study the following situations:

- (i) $F(x)x \pm xF(x) \in P$,
- (ii) $F([x,y]) \pm (F(x)oy) \in P$,
- (iii) $F(xoy) \pm [F(x),y] \in P$,
- (iv) $F(x)oy \pm xoG(y) \in P$,
- (v) $F([x,y]) \pm x^m[x,y] x^n \in P$,
- (vi) $F(x \circ y) \pm x^m(x \circ y) x^n \in P$, for all $x,y \in I$.

Keywords: prime ring, ideal, multiplicative generalization derivation.

1. INTRODUCTION

Let R will be an associative ring with center Z . For any $x,y \in R$, as usual $[x,y]=xy-yx$ and $xoy=xy+yx$ will denote the well-known Lie and Jordan products respectively. Recall that a ring R is prime if for $x,y \in R$, $xRy=0$ implies either $x=0$ or $y=0$. An additive mapping $d:R \rightarrow R$ is called a derivation if $d(xy)=d(x)y+xd(y)$ holds for all $x,y \in R$. An additive mapping $F:R \rightarrow R$ is called a generalized derivation if there exists a derivation $d:R \rightarrow R$ such that

$$F(xy)=F(x)y+xd(y), \text{ for all } x,y \in R.$$

Following, a multiplicative derivation is a map $d:R \rightarrow R$ which satisfies $d(xy)=d(x)y+xd(y)$, for all $x,y \in R$. The concept of multiplicative derivation was introduced by Daif. Of course these

maps are not additive. Motivated by this work, the definition of a multiplicative generalized derivation was extended by Daif and Tamman El-Saiyad as follows:

$F:R \rightarrow R$ is called a multiplicative generalized derivation if there exists a derivation $d:R \rightarrow R$ such that $F(xy) = F(x)y + xd(y)$, for all $x, y \in R$. Dhara and Ali gave a slight generalization of this definition taking d is any map (not necessarily an additive map or a derivation). Hence, one may observe that the concept of multiplicative generalized derivations includes the concept of derivations, multiplicative derivation and the left multipliers (i.e., $F(xy) = F(x)y$ for all $x, y \in R$). So, it should be interesting to extend some results concerning these notions to multiplicative generalized derivations. Every generalized derivation is a multiplicative generalized derivation. But the converse is not true in general.

During the past few years several authors have proved commutativity theorems for prime rings or semiprime rings admitting automorphisms or derivations on appropriate subsets of R . Shang proved that if N is a 3-prime near ring and D is a derivation of N such that $D([x, y]) = \pm x^m [x, y] x^n$ or $D(x \circ y) = \pm x^m (x \circ y) x^n$ for all $x, y \in N$, then N is commutative ring. Koç and Gölbaşı have been studied for the multiplicative generalized derivations by generalizing these conditions on the semiprime ring.

Let S be a nonempty subset of R . A mapping F from R to R is called centralizing on S if $[F(x), x] \in Z$, for all $x \in S$ and is called commuting on S if $[F(x), x] = 0$, for all $x \in S$. Posner showed that if a prime ring has a nontrivial derivation which is centralizing on the entire ring, then the ring must be commutative. Awtar considered centralizing derivations on Lie and Jordan ideals. For prime rings Awtar showed that a nontrivial derivation which is centralizing on Lie ideal implies that the ideal is contained in the center if the ring is not of characteristic two or three. Lee and Lee obtained the same result while removing the restriction of characteristic not three. By Rehman, if R is a prime ring whose characteristic is different from two, U is a square-closed Lie ideal of the ring R and (f, d) is the generalized derivation of R , for every $u \in U$ $[f(u), u] = 0$, then $U \subset Z$. This theorem was proven by Gölbaşı and E. Koç by removing the $u^2 \in U$ condition. It was studied by Argaç and Albaş by taking generalized derivation in the prime ring. Rehman et.al. discussed this in prime ideals that affect the derivation.

We investigate algebraic identities with multiplicative (generalized) derivation involving prime ideal in this article without making any assumptions about primeness on the ring in discussion.

2.RESULTS

We will make some extensive use of the basic commutator identities:

$$[x,yz]=y[x,z]+[x,y]z$$

$$[xy,z]=[x,z]y+x[y,z]$$

$$x\circ(yz)=(x\circ y)z-y[x,z]=y(x\circ z)+[x,y]z$$

$$(xy)\circ z=x(y\circ z)-[x,z]y=(x\circ z)y+x[y,z].$$

Fact: Let R be a ring, I a nonzero ideal of R and P a prime ideal of R such that $P \subsetneq I$. If $aIb \subseteq P$, with $a, b \in R$, then $a \in P$ or $b \in P$.

Theorem: Let R be a 2-torsion free ring with P a prime ideal of R and I a nonzero ideal of R such that $P \subsetneq I$. Suppose that R admits a multiplicative generalized derivation F associated with a nonzero map d . If any of the following conditions is satisfied for all $x,y \in I$, then R/P is a commutative integral domain or $d(I) \subseteq P$:

(i) $F(x)x \pm xF(x) \in P$,

(ii) $F([x,y]) \pm (F(x)\circ y) \in P$,

(iii) $F(x\circ y) \pm [F(x),y] \in P$,

(iv) $F(x)\circ y \pm x\circ F(y) \in P$,

(v) $F([x,y]) \pm x^m[x,y]x^n \in P$,

(vi) $F(x\circ y) \pm x^m(x\circ y)x^n \in P$.

Proof.

(i) **By the hypothesis, we have**

$$F(x)x - xF(x) \in P \text{ for all } x \in I. \tag{1}$$

By linearizing this expression, we have

$$F(x)y + F(y)x - xF(y) - yF(x) \in P \text{ for all } x, y \in I. \quad (2)$$

Replacing y by yx in this expression, we get

$$F(x)yx + F(y)x^2 + yd(x)x - xF(y)x - xyd(x) - yxF(x) \in P \text{ for all } x, y \in I. \quad (3)$$

Right multiplying (2) by x , we obtain

$$F(x)yx + F(y)x^2 - xF(y)x - yF(x)x \in P. \quad (4)$$

Subtracting (4) from (3), this gives

$$yd(x)x - xyd(x) - yxF(x) + yF(x)x \in P. \quad (5)$$

Replacing y by zy , $z \in I$ in (5), we have

$$zyd(x)x - xzyd(x) - zyxF(x) + zyF(x)x \in P. \quad (6)$$

Left multiplying (5) by x , we get

$$zyd(x)x - xzyd(x) - zyxF(x) + zyF(x)x \in P. \quad (7)$$

Comparing (6) and (7), we obtain

$$[x, z]yd(x) \in P. \quad (8)$$

That is

$$[x, z]Rd(x) \subseteq P.$$

Since P is a prime ideal of R , we get $[x, z] \in P$ or $d(x) \in P$. Let $L = \{x \in I \mid [x, z] \in P, \text{ for all } z \in I\}$ and $K = \{x \in I \mid d(x) \in P\}$. Clearly each of L and K is additive subgroup of R such that $I = L \cup K$. But, a group can not be the set-theoretic union of its two proper subgroups. Hence $L = R$ or $K = R$. In the first case, we have $[x, z] \in P$, for all $x, y \in I$. Replacing y by rz , $r \in R$ in this expression, we have $[x, r]z \in P$, for all $x, y \in I$. That is, $[x, r] \in P$, for all $x \in I$, $r \in R$ by Fact. Replacing x by xz , $z \in R$, we have $[z, r] \in P$ for all $r, z \in R$. Let $\bar{R} = R/P$, then $\overline{[z, r]} = \bar{0}$ and so $[\bar{z}, \bar{r}] = \bar{0}$. Hence R/P is a commutative, and since P is a prime ideal of R , then R/P is an integral domain. Thus R/P is a commutative integral domain. In the second case, we get $d(I) \subseteq P$. This completes the proof.

Suppose that $F(x)x+xF(x) \in P$ for all $x, y \in R$, then using the similar arguments as in the above with suitable slight modification, we get the required result.

(ii) By the hypothesis, we get

$$F([x,y]) \pm (F(x)oy) \in P, \text{ for all } x,y \in I.$$

Replacing y by yx in the hypothesis, we have

$$F([x,y])x + [x,y]d(x) \pm (F(x)oy)x \pm y[F(x),x] \in P.$$

Application the hypothesis, we get

$$[x,y]d(x) \pm y[F(x),x] \in P. \tag{9}$$

Writing y by zy in this expression and using this expression, we get

$$z[x,y]d(x) + [x,z]yd(x) \pm zy[F(x),x] \in P, \text{ for all } x,y,z \in I.$$

Using (9) in this expression, we get

$$[x,z]yd(x) \in P, \text{ for all } x,y,z \in I.$$

This expression is the same as in (8). The proof is completed using similar techniques.

(iii) By the hypothesis, we have

$$F(xoy) \pm [F(x),y] \in P,$$

Replacing y by yx in the hypothesis, we have

$$F(xoy)x + (xoy)d(x) \pm [F(x),y]x \pm y[F(x),x] \in P.$$

Application the hypothesis, we get

$$(xoy)d(x) \pm y[F(x),x] \in P. \tag{10}$$

Writing y by zy in this expression and using this expression, we get

$$z(xoy)d(x) + [x,z]yd(x) \pm zy[F(x),x] \in P, \text{ for all } x,y,z \in I.$$

Using (10) in this expression, we get

$$[x,z]y d(x) \in P, \text{ for all } x,y,z \in I.$$

This expression is the same as in (8). The proof is completed using similar techniques.

(iv) By the hypothesis, we have

$$F(x) \circ y \pm x \circ F(y) \in P.$$

Replacing y by yx in the hypothesis, we have

$$y[F(x),x] + (F(x) \circ y) \pm (x \circ F(y)) \pm [x,y]d(y) \pm y[x,d(x)] \in P.$$

Application the hypothesis, we get

$$y[F(x),x] \pm [x,y]d(x) \pm y[x,d(x)] \in P.$$

Writing y by zy in this expression and using this expression, we get

$$[x,z]y d(x) \in P, \text{ for all } x,y,z \in I.$$

This expression is the same as in (8). The proof is completed using similar techniques.

(v) By the hypothesis, we have

$$F([x,y]) \pm x^m [x,y] x^n \in P, \text{ for all } x,y \in I.$$

Replacing y by yx in this expression, we get

$$F([x,y]x) \pm x^m [x,y] x^{n+1} \in P$$

and so

$$F([x,y]x) \pm [x,y]d(x) \pm x^m [x,y] x^{n+1} \in P, \text{ for all } x,y \in I.$$

Using the hypothesis, we obtain that

$$[x,y]d(x) \in P, \text{ for all } x,y \in I.$$

Taking $zy, z \in R$ for y in this expression and using this, we have

$[x,z]y d(x) \in P$, for all $x,y,z \in I$.

Using the same arguments after (8) in the proof of Theorem, we get the required result.

(vi) We assume that

$F(x \circ y) \pm x^m(x \circ y) x^n \in P$, for all $x,y \in I$.

Replacing y by yx in this expression, we obtain

$F(x \circ yx) \pm x^m(x \circ y) x^{n+1} \in P$

and so

$F(x \circ y)x + (x \circ y)d(x) \pm x^m(x \circ y) x^{n+1} \in P$.

Using the hypothesis, we get

$(x \circ y)d(x) \in P$, for all $x,y,z \in R$.

Substituting $zy, z \in R$ for y in this expression and using this, we find that

$[x,z]y d(x) \in P$, for all $x,y,z \in R$.

Arguing the same methods after (8) in the proof of Theorem, we obtain the required result.

REFERENCES

- N. Argaç ve E. Albaş, Generalized derivations of prime rings: Algebra Coll., 11 (3), 2004, 399-410.
 R. Awtar, Lie structure in prime rings with derivations, Publ. Math. Debrecen, 31, 209-215, 1984.
 M. N. Daif, When is a multiplicative derivation additive, Int. J. Math. Math. Sci., 14(3), 615-618, 1991.
 M. N. Daif, M. S. Tamman El-Sayiad, Multiplicative generalized derivation which are additive, East-West J. Math., 9(1), 31-37, 1997.
 B. Dhara, S. Ali, On multiplicative (generalized) derivation in prime and semiprime rings, Aequat. Math., 86, 65-79, 2013.
 Ö. Gölbaşı, E. Koç, Generalized derivations on Lie ideals in prime rings: Turk. J. Math., 35, 2011, 23-28.
 E. Koç, Ö. Gölbaşı, Some Results on Ideals of Semiprime Rings with Multiplicative Generalized Derivations, Communication in Algebra 46 (11) (2018) 4905–4913.
 E. C. Posner, Derivations in prime rings, Proc Amer.Math.Soc., 8, 1093-1100, 1957.
 N. U. Rehman, On commutativity of rings with generalized derivations: Math. J. of Okayama Univ., 44, 2002, 43-49.
 N. Rehman, H. Alnohashi, and A. Boua, Identities in a Prime Ideal of a Ring Involving Generalized Derivations, Kyungpook Math. J., 61, 727-735, 2021.
 Y. Shang, A study of derivations in prime near-rings, Math. Balkanica, 25, fasc.4, 2011.

FLUKA KODU İLE TAM ENERJİ TEPE VERİMLİLİĞİNİN HESAPLANMASINA ETKİ EDEN SİMÜLASYON PARAMETRELERİNİN ARAŞTIRILMASI

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ÖZET

Gama algılama sistemlerinin Monte Carlo simülasyon kodları kullanılarak modellenmesi son yıllarda oldukça sık çalışılmaktadır. Simülasyon kodları sayesinde, deney ortamını oluşturmadan önce simülasyon ortamında bunu gerçekleştirerek bilgi sahibi olmak mümkündür. Deneysel olarak araştırma imkanı maliyetli ve uzun zaman alabilecek parametreleri simülasyon kodlarıyla incelemek avantajlı olabilmektedir. Simülasyon sonuçları ile deneysel sonuçların kıyaslanması hem yöntemlerin doğrulanması hem de çalışmanın içeriğinin daha detaylı incelenmesi açısından önemlidir. Simülasyon çalışmalarında kodun iyi anlaşılması ve parametrelerin dikkatli seçilmesi, sonuçların doğruluğu açısından büyük önem taşımaktadır. Çoğu zaman deney ile simülasyon sonuçları arasındaki farklılıklar, deneysel ortamın simülasyon kodunda tam olarak tanımlanamaması ya da kullanıcı tanımlı simülasyon parametrelerinin uygun seçilmemesinden kaynaklanmaktadır. Bu çalışmada, FLUKA simülasyon kodu ile 3"x3" NaI(Tl) dedektörünün tam enerji tepe verimliliğinin hesaplanmasında seçilen simülasyon parametrelerinin verimlilik sonuçlarına etkisi araştırılmıştır. Çalışma boyunca dedektör bölgesinde skorlanan minimum ve maksimum enerjiler, kanal sayısı, fotonlar için kesilim enerjisi, birincil foton sayıları parametreleri ele alınarak tam enerji pik verimi sonuçlar üzerine etkilerini görmek için simülasyonlar gerçekleştirilmiştir. Her parametre için belli kombinasyonlar belirlenip kod çalıştırılmıştır. Simülasyonların sonucunda, değişen her parametre değerleri için foton puls yükseklik dağılımları da çizdirilmiştir ve foton spektrumlarına etkisi de incelenmiştir. Ayrıca seçilen parametrelerin simülasyon hızına da etki edebileceğinden her parametre için simülasyon hızı da değerlendirilmiştir.

Anahtar Kelimeler: NaI(Tl) detektörü, FLUKA, Tam Enerji Pik Verimi, Simülasyon Parametreleri

INVESTIGATION OF SIMULATION PARAMETERS AFFECTING THE CALCULATION OF FULL ENERGY PEAK EFFICIENCY WITH THE FLUKA CODE

ABSTRACT

Modeling of gamma detection systems using Monte Carlo simulation codes has been studied quite frequently in recent years. Thanks to simulation codes, it is possible to gain knowledge by performing this in the simulation environment before creating the experimental environment. It may be advantageous to examine parameters that can be expensive and take a long time to investigate experimentally, with simulation codes. Comparing simulation results with experimental results is important for both validating the methods and examining the content of the study in more detail. In simulation studies, a good understanding of the code and careful selection of parameters are of great importance for the accuracy of the results. Most of the time, differences between experiment and simulation results are due to the experimental environment not being fully defined in the simulation code or user-defined simulation parameters not being chosen appropriately. In this study, the effect of the selected simulation parameters on the efficiency results in calculating the full energy peak efficiency of 3"x3" NaI(Tl) detector with the FLUKA simulation code was investigated. Throughout the study, simulations were carried out to see the effects of the full energy peak efficiency results by considering the parameters of the minimum and maximum energies scored in the detector region, the number of channels, the cut-off energy for photons and the number of primary photons. Certain combinations were determined for each parameter and the code was run. As a result of the simulations, photon pulse height distributions were drawn for each changing parameter values and their effects on the photon spectra were also examined. Additionally, since the selected parameters may also affect the simulation speed, the simulation speed was also evaluated for each parameter.

Keywords: NaI(Tl) Detector, FLUKA, Full Energy Peak Efficiency, Simulation Parameters.

NATURAL MODULATION OF THE MICROBIOTA IN PATIENTS WITH ATOPIC DERMATITIS

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ABSTRACT

Background Atopic dermatitis is a long-standing inflammatory skin disease that is highly prevalent worldwide. The immune mechanisms involved in atopic dermatitis are complex and little is known about the possible role of the gut microbiota in the aetiopathogenesis of atopic dermatitis. Advancing knowledge of the cutaneous microbiome and its function in modulating the course of atopic dermatitis, might result in novel therapeutic strategies.

Objective Antidermatite tea could modulate the immune system through gut microbiota in atopic dermatitis.

Materials and methods The evaluation of the patients was based on history and physical examination. We investigated the effect Antidermatite tea in patients with atopic dermatitis.

Results It is not clear whether microbial change in atopic dermatitis is an outcome of barrier defect or the cause of barrier dysfunction and inflammation. Manipulation of the intestinal microbiota as a method for modifying atopy, may be attempted in many ways including avoidance of certain foods, supplementation with probiotics and prebiotics, optimising nutrient intake, minimising stress, antimicrobial therapy, correction and prevention of low stomach acid, and faecal microbiota transplantation. Antidermatite tea had a positive effect on the severity of atopic dermatitis.

Conclusion The resident microbiota is important in maintaining structural and functional integrity of the gut and in immune system regulation. There was an increase of the intestinal permeability reported in patients with atopic dermatitis and a reduction of the cutaneous microbiome diversity. Modifying skin and gut microbiome by applying probiotic supplementation during early years may be a preventive and therapeutic option in high risk groups.

Keywords: atopic dermatitis, host-microbiome interaction; immune regulation; Antidermatite tea

SYNERGISTIC EFFECT OF INCORPORATION METHOD ON Fe-Co BASED CATALYST FOR CO₂ VALORIZATION

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ABSTRACT

Carbon dioxide has been described as the most dominant greenhouse gas and most problematic climate pollutant over the decades. The continuous development of high CO₂ gas field forces the paradigm shift from Carbon Capture Sequestrian (CCS) to carbon capture utilization (CCU). CO₂ hydrogenation to value-added chemicals is highly sought and were mainly influenced by H₂ and C-O bond activation through adsorption-desorption process on catalyst active sites.. The adsorption energy of CO₂ on the catalyst surface is the limiting factor; hence, the metal–support interaction is key in formulating a catalyst with superior performance. Two different supports nature were investigated; Titania (mesoporous) and HZSM-5 (microporous) were synthesised using four different methods; impregnation, ultrasonication, powder mixing and granular mixing for optimization of Surface Metal support Interaction. Elemental and morphological analysis from XRD Diffractograms reveals pure phases of magnetite and Co₃O₄ were attained with 5% K loading. HZSM5 supported catalyst had the highest acidic strength though these dropped when Fe is incorporated in contrast to Titania supported catalyst whereby the acidity is increased when Fe is added. Early Screening of Fe-Co-K catalyst on supported on Titania synthesised via powder mixing provides the highest CO₂ conversion though mainly produces CO. However, Fe-Co-K catalyst on supported on Zeolite via granular mixing produces the highest percentage of liquid fuels (C₅-C₁₀).

Keywords: CO₂ Valorization; Fischer Tropsch Synthesis; Liquid fuels; Support-Metal Interaction, Catalyst Synthesis

UPDATE ON THE MANAGEMENT OF UPPER GASTRODUODENAL BLEEDING IN THE POSTKOVID PERIOD

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Introduction. The solution of problems of effective treatment of gastroduodenal hemorrhage observed during the use of anticoagulants in the complex treatment of Covid-19 virus infection is one of the current topics of discussion in modern surgery. At present, the incidence of gastroduodenal hemorrhage in the postkovid period remains high at 7.4-16%. Such a high percentage requires new research in the field of treatment and prevention of gastroduodenal hemorrhage in the postkovid period.

The aim of the study was to improve the outcome of postcovidal gastroduodenal hemorrhage by improving complex treatment and prevention methods.

Materials and methods: Between 2020-2023, 47 patients treated with the diagnosis of gastroduodenal bleeding of ulcer origin observed after Covid-19 virus disease were under our control on the Department of Surgical Diseases AMU. Of the patients, 32 were women and 15 were men. The age range of patients was 20-80. Bleeding from gastric ulcer in 11 patients, bleeding from ulcer of 12 fingers in 36 patients. In these patients, the diagnosis was made by emergency fibroesophagogastroduodenoscopy. In the complex treatment were used hemostatic(aminocaproic acid 100ml x 3 times intravenously, disinon 2ml x 4 times intramuscularly, transamine 5ml x 2 times intravenously, kleston 5ml x2 times), antisecretory(histamine, H-histamine blockers - ranitidine 50 mg x 3 times, kvamatel 20 mg x 2 times or proton pump inhibitor (pantoprazole - 30 mg intravenously x 1 time), infusion-transfusion (erythrocyte mass, plasma, protein preparations, etc.), antihelicobacterial (clarithromycin 0, 5 x 2 times, amoxicillin 1.0 x 2 times).

Outcome: In the majority of patients receiving this treatment regimen, the acute period was eliminated, and the bleeding was stopped quickly. In 10 patients, endoscopic hemostasis (coagulation + sclerotherapy) was performed because the bleeding continued and conservative treatment was ineffective, thus stopping the bleeding. In 2 patients, due to the continuation of profuse bleeding, even if endoscopic hemostasis is performed, there is a high probability of recurrence of bleeding, emergency surgery was performed, and the bleeding vessel was closed.

Conclusion: According to our observations, in the case of gastroduodenal hemorrhage after Covid-19 virus disease, complex treatment with modern drugs is a convenient method, which allows to quickly eliminate the bleeding, quickly stop the acute period, and discharge patients

from the hospital as soon as possible. In addition to the diagnosis of gastroduodenal hemorrhage, FEQDS examination also stops the bleeding by endoscopic hemostasis for therapeutic purposes, thus significantly reducing the risk of surgery. Also, the use of gastric lavage in the complex treatment of Covid-19 virus infection is of great importance in the prevention of postoperative bleeding.

Key words: postkovid, bleeding, treatment

RELATIONSHIP BETWEEN FIBROBLAST GROWTH FACTOR-23 AND VASCULAR CALCIFICATION IN HEMODIALYSIS PATIENTS

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Relevance: FGF-23 synthesis is increased in osteocytes and osteoblasts to overcome hyperphosphatemia caused by decreased glomerular filtration rate (GFR) in chronic kidney disease (CKD). Increased FGF-23 decreases vitamin D synthesis, eliminating its inhibitory effect on PTH secretion and causing secondary hyperparathyroidism. The resulting hypercalcemia and hyperphosphatemia lead to complications such as vascular calcification in CKD and HD patients. Factors associated with vascular calcification were classified as traditional (age, diabetes, male sex, tobacco use, inflammation, more frequent warfarin treatment and peripheral vascular and heart disease) and non-traditional. Considering FGF-23 metabolism disorders, we have studied the effect of FGF-23 on vascular calcification in diabetic and non-diabetic hemodialysis patients.

Methods and materials: 124 patients, 64 women and 60 men, who received hemodialysis (HD) up to the last 12 years, were included in the study. Patients were divided into 2 groups depending on the etiology of terminal CKD. Group I included 68 patients with Diabetic Nephropathy (DN) causing CKD, Group II included 56 patients with non-diabetic end-stage CKD. Immediately before the hemodialysis session, the blood samples of all patients were taken either from the arteriovenous fistula or from the catheter, basic biochemical tests (P, creatinine, hs CRP) were performed and FGF-23 (C-Terminal) plasma concentration was measured by the 2nd generation two-side immunosorbent assay. The normal range of FGF-23 used was mean \pm SD, 129 \pm 34RU/ml. ECG, Echo-CG, R-scopy, USM were performed in all patients.

Result: FGF-23 in the blood of patients with diabetic nephropathy was 3674.3 \pm 406 pg/ml, and in non-diabetic HD patients it was 2572.7 \pm 471 pg/ml, they differed from each other with statistical integrity ($p < 0.001$). There was no significant difference in FGF-23 level between men and women ($p > 0.05$). Aortic calcification index was determined that it is also related to the duration of hemodialysis. In patients receiving HD for more than 5 years, aortic calcification was detected in 92% of patients. Abdominal aortic calcification was detected in

98 of 124 patients. It was determined that there is a positive correlation between aortic calcification index (ACI) and hs-CRP ($R = 0.68$, $p < 0.01$), FGF-23 ($R = 0.42$, $p < 0.001$).

Conclusion: FGF-23 is associated with various markers of inflammation and oxidative stress in hemodialysis patients. It may positively influence the relationship between FGF-23 and vascular calcification by normalizing inflammatory markers.

Key words: fibroblast growth factor-23, vascular calcification, diabetic nephropathy

MULTIFACTORIAL PATHOGENESIS OF CALCIPHYLAXIS**Narmin EYVAZOVA**

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Introduction: Calciphylaxis is a serious, rare disease in which calcium accumulates in the small blood vessels of fat and skin tissues. This disease can cause blood clots, painful skin ulcers, and serious infections that can even lead to death. This disease can be found both in those with kidney failure (uremic form) and in those without it (non-uremic form). According to recent studies, the factors that can cause the disease can be mentioned - blood coagulation factors, disorder of calcium metabolims, etc. This disease, of unknown etiology, is more common in women, occurs in obesity, diabetes, kidney transplant and dialysis patients, and can also be seen as a result of certain medications.

The aim was to demonstrate the importance of recognizing calciphylaxis and to characterize features of calciphylaxis or components of treatment that may lead to improved outcome.

Clinical case: A 73-year-old male patient is admitted to the Cardiology Department with a diagnosis of aortic dissection. He underwent CABG surgery 15 years ago due to vascular occlusion. Kidney injury had been developed after surgery and he has been receiving hemodialysis for the past 8 years. Also, the patient continuously took warfarin after the operation. According to the patient's anamnesis, even if skin necrosis caused by warfarin was not considered in the foreground, warfarin was stopped, until the INR reached the appropriate range, the drug "Clexane" was started at the appropriate dose for the patient, protein C and protein S levels were determined, and Protein C activity was 118%, Protein S activity was 58%. ANA positive; ANCA negative; Anti Cardiolipin antibody, IgM, IgG negative; PTH-204 pg/ml; P-4.6 mg/dl Laboratory examination revealed hyperparathyroidism and incisional skin biopsy suspected calciphylaxis.

Discussion: Because calciphylaxis is a very painful and debilitating disease, specific pain management should be provided in addition to nutritional and psychological support. Treatment should focus on local wound care and metabolic control. It is appropriate to prescribe enzymatic cleaning agents and antibiotics against local and systemic infections.

Also, the effect of currently used sodium thiosulfate application on pain and inflammation is significant. In this case, hemodialysis therapy should be continued and palliative measures should be implemented without surgical intervention.

Conclusion: Diagnosis can be based on clinical, supported by histological analysis when possible. Laboratory examination should include all possible findings of chronic kidney disease, special attention should be focused on Ca^+ and P^+ values, evidence of presence of skin or systemic infection. Calciphylaxis should be monitored by a dermatologist, as early diagnosis and proper treatment can be crucial for a better prognosis.

Keywords: calciphylaxis; skin ulcers; systemic infection; hyperparathyroidism; hemodialysis; kidney failure

MEANING, OBJECTIVES AND FUNCTIONS OF MONETARY POLICY**Navila Bunga SAFIRA****ORCID ID:** 0009-0001-0218-7046**Olga VALENTINA****ORCID ID:** 0009-0004-2529-6001**Lailah Nur AZIZAH****ORCID ID:** 0009-0004-6017-9302**Eva Zulmi MEILAWATI****ORCID ID:** 0009-0009-3688-3814**Muhammad Sultan MUBAROK****ORCID ID:** 0000-0002-6168-0439

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ABSTRACT

This paper aims to explain the meaning, objectives and functions of monetary policy questions: First, what is the meaning of monetary policy? Second, the purpose of monetary policy? Third, the function of monetary policy? Fourth, what is the influence of the parameters in determining the success of monetary policy?. This paper uses a qualitative approach, because data sources and research results in library research, inductive data analysis, grounded theory (towards the direction of theory building based on data). Findings First, Monetary policy is a policy issued by the central bank in the form of regulating the money supply to achieve certain goals. The party that can provide monetary policy is the government of a country or the monetary authority. In its implementation, monetary operations are carried out with various monetary operations which aim to influence monetary targets through the money market to influence economic liquidity and are transmitted through several channels called monetary transmission channels such as credit interest rates, asset prices, expectations, and so on. Second, the aim of monetary policy is to support the achievement of macroeconomic targets, namely high economic growth, price stability, equitable development and balanced balance of payments. Third, the function of monetary policy is to maintain the investment climate in a country, increase economic stability and growth, overcome the unemployment rate and open up a number of job opportunities, help to improve the balance of payments, maintain the stability of the currency exchange rate. Finally, the influence of parameters to determine the success of monetary policy is influenced by 3 indicators: (1) Money supply, (2) Control of exchange rate movements, (3) Inflation target.

Keywords: Monetary Policy, Credit Interest, Parameters, Inflation Target.

EVALUATION OF FRUIT GROWTH ON A BIFEROUS FIG TREE: MONITORING OF MORPHOMETRIC PARAMETERS

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ABSTRACT

Characterizing the growth of a tree's fruit, shoots and leaves is an extremely useful step in reasoning about its hydromineral nutrition. Indeed, periods of rapid growth indicate high water and nutrient requirements and vice-versa for periods of slower growth. To this end, the evolution of fruit weight and dimensions on a late biforous fig tree was studied throughout the season, at one-week intervals. The results highlighted the existence of periods of slowed fruit growth, which could be considered less critical for the tree's yield development and thus constitute optimal periods for applying deficit irrigation and/or reducing fertilizer inputs. These are spread out over a total of 6 weeks for the flowering fig (Bakor), the first of which begins when the fruit has reached 64% of its final size, followed by a second period when ripening approaches (98% of the flowering fig's final size). For the autumn fig, a single period of slower growth was recorded, extending over 4 weeks, after reaching a fruit size of 43%.

Key words: fruit growth kinetics, critical periods, water requirements, *Ficus carica L.*

A STUDY ON FACTORS AFFECTING CONSUMERS' CHOICES OF OVER THE-COUNTER MEDICATIONS

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ABSTRACT

The primary objective of this article is to examine how consumers' attitudes and decisions affect the availability of various OTC drugs. The data used in this study came from secondary sources. A critical area of research is that of consumer behavior. Regulatory agencies in many countries randomly choose medicine for testing to guarantee that over-the-counter medications include only safe and practical components. The active pharmaceutical ingredient (API) rather than the finished product regulates over-the-counter medications. There was a significant correlation between age, gender, income, education, price, and brand confidence when purchasing over-the-counter medications. The demographic, behavioral, psychographic, and geographical aspects that influence consumers' OTC-buying decisions are the primary focus of this research.

Keywords : Perception, Brand Loyalty, OTC Products, and Consumer Behavior

TALLOW LAUREL (*Litsea Glutinosa*) AS NOVAL BIO-MATERIAL FOR ECO-FRIENDLY COLORATION OF COTTON

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ABSTRACT

The current study have been designed to observe the coloring efficacy of tallow (*Litsea Glutinosa*) based natural color for cotton dyeing under microwave (MW) treatment. The colorant has been isolated in aqueous and acidic media before and after microwave (MW) treatment up to 10 minutes. Shades have been developed using 0.5-2.5g/100mL of sustainable anchors chemical and bio mordents before and after during dyeing. All dyed and mordanted samples have been subjected to spectra flash SF 600 for evaluation of color strength (K/S) and color coordinates (L^* , a^* & b^*). The colorfastness properties of selected mordanted samples have been evaluated as per ISO standards. The results show that if acidic tallow extract and cotton fabric is irradiated for 2 min., than excellent colour strength is obtained. For shade development, using chemical mordant, 1%) of Al mordant before dyeing (pre-chemical mordant) using optimal extraction conditions and (2%) of Al after dyeing (post chemical mordant) applied onto fabric under extraction optimal conditions have given colorfast shades. Similalry application of 1.5% orange peel as a pre-bio mordant, and the employment of 1.5% orange peel as a post-bio mordant has given color fast shades onto cotton fabric.

Keywords: Aluminum-salt, Bio-materials Cotton, Colorfastness, Sustainability, Orange Peel, Tallow Laurel,

WATER PURIFICATION BY GOLD NANOPARTICLES – A MINI REVIEW

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ABSTRACT

Pollutants in the form of heavy metals, fertilizers, detergents, and pesticides have seriously reduced the supply of pure drinking water and usable water. Due to the exceptional characteristics which resulted from nanoscale size, such as improved catalysis and adsorption properties as well as high reactivity, nanomaterials have been the subject of active research and development worldwide in recent years. Numerous studies have shown that nanomaterials can effectively remove various pollutants in water and thus have been successfully applied in water and wastewater treatment.

Gold metal has intriguing potential to deal with the water pollution problem, as recent research on several fronts is advancing the concept of nanoscale gold as the basis for cost-effective nanotechnology-based water treatment. Nano-gold has special properties, such as enhanced catalytic activity, visible surface plasmon resonance color changes, and chemical stability, that make it more useful than other materials. The gold nanoparticles help in the efficient removal and the selective and sensitive detection of a variety of pollutants in water. The challenges in further developing nano-gold to address water contamination are discussed, which should stimulate future research into improved removal and detection of undesirable chemical compounds.

Keywords

Pure drinking water: Gold nanoparticles; detection of a variety of pollutants

HYDROPONIC PLANT GROWTH SYSTEM - ANALYSIS

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ABSTRACT

Hydroponic plant growth is a method of growing plants without soil, with the main benefits of environmental and nutrient control, water conservation, and reduction of labour . This technique relies on a number of technologies that the principles of automation can be applied in order to improve yield and consistency. An optimal amount of nutrients can be supplied directly to plant roots in an immediately-usable form. Plants can be grown in areas with poor soil or limited space, or grown vertically to maximize plant density. Water waste is reduced by recirculating it back into the system. There's also no need to worry about weeds.

Hydroponic system applies principles of automation to monitor and regulate it. This is meant primarily to demonstrate the process of applying automation techniques, which can be adapted to many other systems.

Keywords: Hydroponic plant growth: automation to monitor

INFLUENCE OF PRECURSOR SELECTION ON SURFACE WETTABILITY TUNING IN ZNO THIN FILMS

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ABSTRACT

Chemical bath deposition (CBD), a simple and cost-effective solution-based technique, has emerged as a prominent method for fabricating zinc oxide (ZnO) thin films. However, the properties of ZnO thin films are significantly influenced by the choice of salt precursors employed during CBD. This research delves into the intricate relationship between salt precursors and the morphological and wetting characteristics of ZnO thin films grown on glass substrates via CBD. Four distinct zinc salts – zinc chloride (ZnCl_2), zinc acetate (ZnAc_2), zinc nitrate ($\text{Zn}(\text{NO}_3)_2$), and zinc sulfate (ZnSO_4) – are employed as precursors to investigate their diverse effects. X-ray diffraction (XRD) analysis reveals the crystallinity of the deposited films, confirming the presence of a hexagonal wurtzite structure with high crystalline purity. Field emission scanning electron microscopy (FESEM) images unveil ZnO particles with sizes below 500 nanometers, each exhibiting unique morphology and feature sizes. Wettability assessment using contact angle (CA) measurements demonstrates a significant decrease in wettability for ZnCl_2 -deposited films (CA of 127.1°) compared to ZnAc_2 (CA of 129.5°), $\text{Zn}(\text{NO}_3)_2$ (CA of 130.9°), and ZnSO_4 (CA of 142.3°), highlighting the substantial influence of salt precursor selection on surface roughness and, consequently, ZnO film wetting behavior. This study provides a comprehensive understanding of the interplay between salt precursors and ZnO thin film properties, offering valuable insights into the controlled manipulation of surface wettability for diverse applications.

Keywords: surface area; metal oxide salts; hydrophobic; surface roughness, chemical bath deposition.

COMPARATIVE CHARACTERISTIC OF INTRODUCED REPRESENTATIVES OF THE GENUS *ROSA* L. IN THE UKRAINIAN STEPPE ZONE

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ABSTRACT

Among the plants that are widely used as food and traditional medicine, there are representatives of the genus *Rosa* L. The purpose of the work was to analyze the state of 18 representatives of the genus *Rosa* L., introduced in the Ukrainian steppe zone.

The analysis of the ascorbic acid content in rose hips grown in conditions of the steppe zone of the Dnipro River revealed a significant content of ascorbic acid (from 1489.44 mg% to 4591.52 mg%). During the drying of fruits, the loss of ascorbic acid content is noted, depending on the species characteristics. In particular, vitamin C is best preserved in the fruits of *R. rugosa* and *R. hugonis* (58 % and 55 %, respectively). This makes it possible to use *R. rugosa* and *R. hugonis*, which retain 1013.18–1198.38 mg% of ascorbic acid during storage, as vitamin raw materials. The rose hips are used as a source of multivitamins to produce medicines and processed foods with a high content of vitamin C. In the food industry, rose hips are used to produce juices, jams, pastilles, and compotes, and as a vitamin C supplement to functional foods.

Thus, representatives of the genus *Rosa* L. are characterized by high resistance in the conditions of the steppe zone of the Dnipro River (the experimental site – the DNU Botanical Garden) and good taste properties and can be recommended for inclusion in functional foods, as well as for wider introduction in the system of the landscaping of the Ukrainian steppe zone.

Keywords: functional foods, Ukrainian steppe zone, Dnipro

PERFORMANCE OF SOYBEAN UNDER DIFFERENT PHOSPHORUS CONCENTRATION AND SOYBEAN POPULATION IN SOUTH WESTERN NIGERIA

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ABSTRACT

Environmental factors determine crops adaptation to various climatic zones. Field experiments were conducted at Ibadan and Ikenne, South Western Nigeria in the 2015/2016 cropping season to determine the effect of varied environmental conditions on the performance of maize—soybean sequential cropping in the Rainforest Region of Nigeria. Experimental design was randomized complete block design (RCBD) with split plot arrangement replicated thrice. Main plots were four phosphorus levels (0, 20, 40 and 60 kg/ha) while four soybean populations (666700, 333333, 222200 and 166700) were sub plots. Growth and yield parameters of components crops were assessed. Results showed that number of branches and number of pod per plant were higher in Ibadan in 2015 than Ikenne. In 2016, Ikenne showed superiority of 48.82 and 44.28% compared to Ibadan for the two traits respectively. The yield of soybean also differed significantly with a difference of 185.02kg/ha in favor of Ibadan in 2015 while Ikenne had significantly ($p < 0.05$) higher yield than Ibadan in 2016 with a difference of 570.79_kg/ha. The study concluded that, soil acidity impedes release of P. Steady rainfall during pod filling stage of soybean is required for optimum performance of the crop. Phosphorus at 60kg/ha and 20kg/ha is recommended for potassium and magnesium release for more N fixation by soybean.

Key words: Grain yield; location; seed weight; shelling percentage; soybean

**THE ITERATIVE APPROXIMATING OF MULTIVALUED
NONEXPANSIVE MAPPINGS IN METRIC SPACES****Ali FARAJZADEH****Mahtab DELFANI**

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ABSTRACT

In this talk we are going to study endpoints of multivalued mappings in metric spaces by using abstract convexity. The weak and strong convergence Theorems of proposed iterative schemes under weak assumptions appeared in the literature.

Keywords: Multivalued mappings, Iterative schemes, Weak convergence

CLEAN AND GREEN ENVIRONMENT BY USING NATURAL SURFACTANTS WITH BETTER SURFACTANT PROPERTIES THAN SYNTHETIC ONES

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ABSTRACT

The plant extract was found to be rich with surfactant properties. The comparative study between synthetic and natural surfactant was carried out using spectrophotometry, and conductometric measurement. The natural surfactant plant gave CMC values $4.4 \times 10^{-4} M$. It is the point where their monomer aggregates to form micelles, which are far below the CMC point of most of the synthetic surfactants. The role of temperature was also monitored in comparison to the synthetic surfactants. The pH was used to find the nature of surfactants and number of replaceable protons in the system. The surfactant interaction properties were monitored against a variety of dyes cationic (CTAB), and anionic (methylene blue and neutral red). The interactions were monitored from pre- to post micellar concentrations of both natural and synthetic surfactants. The change in concentration of the surfactant led to the change in interaction behaviour. Wide range of temperatures were selected to monitor the behaviour and interactions of the natural and synthetic surfactants as these interactions are temperature dependent and found to be favourable at lower temperatures.

The self-degradation was observed at ambient temperature and in the dark both in aerobic and anaerobic conditions. Based on its behavior and degradation properties, the proposed natural surfactant is a cheap and good alternative to the synthetic surfactants. These natural surfactants were found to have surfactant properties and even efficient from synthetic counterparts and biodegradable thus environmentally friendly.

Moreover, the natural surfactant helps to degrade many environmentally toxin dyes which are even non degradable in fenton presence.

INSIGHTS INTO GASTROTRICHS FAUNA FROM BIZERTE, TUNISIA COASTLINES

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ABSTRACT

Gastrotrichs is a group of microscopic organisms (body length range from 60 μm to 3.5 mm) carrying out a free life style, they are found on the sedimentary surface, between the interstices and between the vegetation of marine and fresh waters (lake, lagoon and sea).

This group is cosmopolitan and counts at least 860 species, it is subdivided into 2 orders: Chaetonotidae (Remane, 1924) known to be tenpin body shaped and Macrodasidydae (Remane, 1924) with a strap shaped body.

These micro-invertebrates are component of the microphagous benthic population, performing a vital ecological role in aquatic ecosystems.

Even with their ecological importance, studies held on these organisms are scarce.

The present study aims to enrich the knowledge about the marine Gastrotrichs fauna from the region of Bizerte, Tunisia with taxonomic identification.

During the summer of 2022, sampling was held at Bizerte (North Tunisia) beaches, where sand sediment was collected at different depth. Transported to the laboratory then processed within the next 3 days, to extract and identify living specimens using the anesthetization–decantation technique and optical microscopy.

Following these different sampling trips held at Bizerte coastlines, and based on morphological criteria observed on live specimens, a total of 4 genera were recorded for the first time: *Acanthodasys* (Macrodasyida, Thaumastodermatidae), *Paraturbanella* (Macrodasyida, Turbanellidae), *Xenotrichula* (Chaetonotida, Xenotrichulidae) and *Chaetonotus* (Chaetonotida, Chaetonotidae).

Key words: Gastrotricha, Tunisia, Macrodasyida, Chaetonotida

BIFUNCTIONAL CANCER CELL–BASED VACCINE CONCOMITANTLY DRIVES DIRECT TUMOR KILLING AND ANTITUMOR IMMUNITY

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ABSTRACT

The administration of inactivated tumor cells is known to induce a potent antitumor immune response; however, the efficacy of such an approach is limited by its inability to kill tumor cells before inducing the immune responses. Unlike inactivated tumor cells, living tumor cells have the ability to track and target tumors. There is developed bifunctional whole cancer cell–based therapeutic with direct tumor killing and immunostimulatory roles. We repurposed the tumor cells from interferon- β (IFN- β) sensitive to resistant using CRISPR-Cas9 by knocking out the IFN- β –specific receptor and subsequently engineered them to release immunomodulatory agents IFN- β and granulocyte-macrophage colony-stimulating factor. These engineered therapeutic tumor cells (ThTCs) eliminated established glioblastoma tumors in mice by inducing caspase-mediated cancer cell apoptosis, down-regulating cancer-associated fibroblast-expressed platelet-derived growth factor receptor β , and activating antitumor immune cell trafficking and antigen-specific T cell activation signalling. This mechanism-based efficacy of ThTCs translated into a survival benefit and long-term immunity in primary, recurrent, and metastatic cancer models in immunocompetent and humanized mice. The incorporation of a double kill-switch comprising herpes simplex virus–1 thymidine kinase and rapamycin-activated caspase 9 in ThTCs ensured the safety of our approach. Arming naturally neoantigen-rich tumor cells with bifunctional therapeutics represents a promising cell-based immunotherapy for solid tumors and establishes a road map toward clinical translation.

Keywords: Bifunctional cancer cell, CRISPR-Cas9, therapeutic tumor cells (ThTCs), cell-based immunotherapy

STUDY OF OXIDATIVE STRESS BIOMARKERS CAUSED BY FUNGICIDE: MYCLOBUTANIL ON NILE TILAPIA (OREOCHROMIS NILOTICUS) GILLS

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ABSTRACT

Myclobutanil is a systemic fungicide that belongs to the triazole group of chemicals. It is widely used in agriculture to control fungal diseases in a range of crops, including fruits, vegetables, cereals, and ornamentals. Myclobutanil works by inhibiting the biosynthesis of ergosterol, a key component of fungal cell membranes, thereby disrupting the growth and reproduction of fungi. However, the use of myclobutanil in agriculture has raised concerns about its potential impact on non-target organisms, including fish, which can be exposed to myclobutanil through runoff, leaching, or direct application to aquatic systems. Aquaculture is an important and rapidly growing sector of global food production, providing a significant source of animal protein for human consumption. However, aquaculture practices can also pose significant environmental risks, including the release of chemicals such as antibiotics, pesticides, and fungicides into aquatic ecosystems. One such chemical of concern is myclobutanil, which has been detected in water and sediment samples from aquaculture systems around the world (Mao et al., 2018; Xu et al., 2020).

The potential impact of myclobutanil on fish in aquaculture systems has received relatively little attention, despite the potential risks. Few studies have investigated the effects of myclobutanil on fish biomarkers (Jin et al., 2018; Li et al., 2020), and there is limited information on the ecological consequences of myclobutanil exposure in aquatic environments. This knowledge gap is particularly concerning given the important role of fish in aquatic ecosystems, as well as their value as a food source for humans.

Therefore, there is a need for research to better understand the potential effects of myclobutanil on fish and to inform regulatory decisions regarding its use in aquaculture. In this study, we investigated the effect of myclobutanil on several biomarkers in gills of adult Nile Tilapia (*Oreochromis niloticus*). Fish were exposed to three concentrations of

myclobutanil (0.1, 1, and 10 $\mu\text{g/L}$) for 11 days, and biomarkers were measured in both exposed and control groups.

Our results show that myclobutanil exposure led to significant changes in several biomarkers in a dose-dependent manner. Specifically, we observed an increase in oxidative stress levels (measured as malondialdehyde), as well as alterations in antioxidant enzymes (superoxide dismutase and catalase) in gills.

Overall, our findings suggest that myclobutanil exposure can have significant effects on fish biomarkers, potentially indicating adverse impacts on fish health. Further research is needed to better understand the potential ecological consequences of myclobutanil exposure, and to inform regulatory decisions regarding its use in agriculture.

Keywords: Myclobutanil, Fungicide, Biomarkers, Nile Tilapia, Exposition, Agriculture.

STUDIES ON ANTIMICROBIAL AND ANTI-BIOFILM POTENTIAL OF SELECTED MEDICINAL PLANTS AGAINST *Proteus mirabilis*

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ABSTRACT

Struvite (magnesium ammonium phosphate) stones are formed due to UTIs with urease-producing pathogens, often referred to as triple phosphate or infectious stones. Infectious urolithiasis is an outcome of prolonged or recurrent urinary tract infections caused by urease-producing bacteria *e.g.*, *Proteus mirabilis*. The enzyme urease promoted the production of ammonia and hydroxide from urea. This leads to an alkaline urinary environment with high ammonia concentration and heavy phosphate and magnesium in urine. This condition leads to the crystallization of magnesium ammonium phosphate into a large, branched struvite stone. *P. mirabilis* forms biofilm in various environments, with those created in the human host playing a crucial part in the infection and virulence. Disrupting biofilms and down-regulating virulence factors are crucial in treating *P. mirabilis* infections. Plant-based natural molecules, nowadays attaining prime importance as alternative therapeutic agents in the context of the emerging problem of antibiotic resistance. The plant, *Acrotrema agastyamalayanum* E.S.S. Kumar, Dan & G.M. Nair, of Dilleniaceae family is endemic to Southern Western Ghats. The present study tested the anti-bacterial and anti-biofilm properties of *A. agastyamalayanum* leaf extracts against *P. mirabilis* (MTCC-425). The minimum inhibitory concentration (MIC) of petroleum ether extract concentrations ranged between 20mg/ml-50mg/ml, and the ethyl acetate extract concentration ranged between 25mg/ml-50mg/ml against *P. mirabilis*. A concentration-dependent reduction in biofilm formation was observed at 11mg/ml giving 79.5% inhibition.

Keywords: Struvite stone, *Proteus mirabilis*, Anti-urease, Anti-biofilm, MIC

References

- Torzewska, A., et al., (2003) *Journal of medical microbiology*, 52(6), 471-477.
Torzewska, A., & Rozalski, A. (2014). *Microbiological Research*, 169(7-8), 579-584.

FIRST-PRINCIPLES CALCULATIONS TO INVESTIGATE STRUCTURAL, ELASTIC, OPTICAL AND ELECTRONIC PROPERTIES of NaCaBr₃ COMPOUND USING DFT FRAMEWORK

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ABSTRACT

This study presents the investigations of structural, elastic, optical and electronic properties of the NaCaBr₃ compound for the first time. we used the ab –initio method with a pseudo potential and plane waves (PP-PW) with the density functional theory (DFT) implemented in the CASTEP code. Were calculated using the Generalized Gradient Approximation (GGA) correlation exchange. The calculated structural properties, as the equilibrium mesh parameter, the compressive modulus and its derivative are in good agreement with the available data. From the calculated elastic constants, we studied the mechanical stability for this material as well as their ductile/fragile behavior and their anisotropy, we explored the elastic properties for this material studied in polycrystalline state: the isotropic moduli of elasticity (module of compressibility, shear modulus, Young's modulus and Poisson's ratio and elastic wave velocity and Debye temperature), using Voigt, Russ and Hill approximations. The electronic band structure calculations reveal that NaCaBr₃ has an indirect band gap. The finding of band gap is agreed well with the data that is already available. The degree of localized electrons in different bands is confirmed by partial density of states (PDOS) and total density of states (TDOS). Through the quasiharmonic Debye model, which takes into account the phonon effects. The spectral curves of various parameters of optical properties incident photon energies are observed and it is found that NaCaBr₃ are optically active having a high absorption coefficient, optical conductivity, optical reflectivity.

Keywords: CASTEP, NaCaBr₃, structural properties, elastic properties, optical and electronic properties.

NUMERICAL SIMULATION OF ROTARY FRICTION WELDING OF SIMILAR MATERIALS

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ABSTRACT

In this research project, we focused on investigating the thermal aspects of rotary friction welding in similar metals. Our main goal was to propose a novel approach for estimating the temperature distribution within the workpiece during the welding process. To achieve this, we employed a combination of theoretical analysis and numerical simulations. Firstly, we analytically solved the heat transfer model equations for rotary friction welding using the variable separation method. This analytical solution provided insights into the temperature distribution in the workpiece under various welding conditions. To further validate and explore the findings from the analytical approach, we conducted a 3D heat conduction thermal analysis using COMSOL Multiphysics software. This numerical simulation allowed us to simulate the welding process and obtain more detailed temperature profiles.

Next, we focused on studying the influence of different welding parameters, specifically the rotation speed and friction pressure, over time. By systematically varying these parameters in the simulations, we were able to analyze their impact on the temperature distribution within the workpiece.

Finally, we compared our temperature profile results with those obtained from a reference study by Abu Bakar Dawood et al. This comparison helped us validate our approach and understand any differences or similarities between the two studies.

Overall, our work presents a new feature for estimating the temperature profile during rotary friction welding in similar metals. By combining theoretical analysis and numerical simulations, we gained valuable insights into the thermal behavior of the welding process and investigated the influence of welding parameters on the temperature distribution.

POWER GRAPHS OF GYROGROUPS DETERMINED BY THEIR GENERALIZED SPECTRA

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ABSTRACT

Graphs are discrete structures having nodes and edges. Many graphs vary based on either directions of edges or number of edges. They may have connected identical nodes where loops are mostly permitted. Graph models have wide applications in almost all branches of Sciences and Engineering technologies. Graphs demonstrate, for example, the competition between distinct ecological classes that influences an institution and the outcomes of round-robin tournaments. The graphs might be used to replicate personal friendships, telephone talks between telephone numbers, research collaboration, website linkages, road maps, and the tasks allocated to organization staff. Graph spectra contain a significant amount of combinatorial knowledge regarding the provided graphs. Several directions have been studied in recent years. So far, the power graph is the latest study. The power graph $P(G)$ of a finite group G is the graph where G is its node-set. Two different nodes are being connected in $P(G)$ if and only if one is an integer power of the other. This thesis discusses specific spectral properties of graphs, that is, the power graphs of gyrogroups. This paper presents the characteristic polynomials and spectral radii of the power graphs. In this paper, we also examine the Laplacian, signless Laplacian, and normalized Laplacian spectrums of the graphs. Moreover, we discuss the newly established spectra, such as the $A\alpha$ -spectrum and the $A\alpha$ -Laplacian spectrum of the power graphs over the mentioned groups.

Keywords: Graph Theory, Power Graph, Gyrogroup and Laplacian spectrum

COMPARATIVE STUDY OF PROPERTIES OF CONCRETE MADE WITH PIT SAND AND GRANITE DUST

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ABSTRACT

This study intends to explore whether granite dust can be used as fine aggregate in concrete production by comparing the properties of concrete made with it with that of Pit sand. Samples of both Pit sand and granite dust were obtained from commercial dealer in Ilaro. Samples of the two materials were subjected to the following tests: sieve analysis, water absorption (WA), specific gravity (SG), percentage silt content (SC), and moisture content (MC). Concrete cubes were made from the samples. Slump values of wet concrete of both materials were determined, while compressive strength and water absorption of the concrete cubes were also determined for the hardened concrete. Results of the various tests indicate that the WA, SG, SC, MC, and B for Pit sand are 2.31%, 2.67, 4.69%, 10.08%, and 16.23% respectively. While that of granite are 4.31%, 2.46, 14.3%, 1.3%, and 4.65%. Slump values water absorption and compressive values for concrete made with Pit sand are 12mm, 2.55% and 19.12N/mm² respectively. While that of granite dust are 10mm, 2.81% and 21.34N/mm² respectively. It can thus be concluded that granite dust can be used as fine aggregate in the producing concrete.

Key Words: Comparative, Properties, Concrete, Pit – sand, Granite – dust

Introduction:

1.0 INTRODUCTION

In construction industry, concrete is a major component and it mostly used for all types of construction works. Concrete a non-homogeneous compound material made up of cement (binding material), fine aggregates, coarse aggregates, water and sometimes admixtures in suitable ratio.

Aggregates can be described as an inert material which account for 50-80% of the concrete. It is an important material as it aids the durability, stiffness as well as the compressive strength of the concrete. A large number of the aggregates source is from quarries or river.

According to Omopariola 2020, Concrete is an important component in building construction. Its performance in service has great effect on the stability and durability of the various

components of which the building is made. It is versatile and can be moulded to different shapes. It is produced by thoroughly mixing the various constituents (water, cement, fine and coarse aggregates) in the appropriate proportion (Apebo, Iorwuab and Aguwamba, 2013), it is plastic and workable when wet Zerdi (2014). It is hard impermeable strong and durable in its hardened state.

Pit sand is the most commonly used fine aggregate in many parts of Ogun State. Due to the increasing rate of building construction going on as a result of the pursuit of the sustainable development goal of provision of housing for all. The extensive use of concrete for this purpose has resulted in the high demand for pit sand which has resulted in rising cost of the material. Additionally, its extensive use has equally resulted in a lot of environmental degradation. Therefore, an alternative to pit sand has become very necessary. On the other hand granite dusts are abundantly available in quarries where rocks are being crushed to produce granite that are used as coarse aggregates. The materials are in heaps as waste constituting environmental hazard at the various quarries. Its use of in place of pit sand will conserve the natural resources for the sustainable development of the concrete in construction industry.

The quality of concrete is a function of its raw materials. It has been proven from study that the strength of concrete depends mainly on many factors among which are the properties of the aggregates. Such properties include the gradation, specific gravity, percentage silt content, and water absorption. It is therefore needful to investigate the properties (physical and mechanical) of the raw materials and how they react chemically and physically with other construction materials, if they will be suitable for construction works.

The purpose and significance of this research work is to provide alternative to the commonly used fine sand (river sand) because it is not readily available due to the scarcity of big river within the country. Also it will lead to the fall in price of aggregates being sold at quarries and will reduce the environmental degradation being caused by the pit sand.

2.0 MATERIALS AND METHODS

2.1. Materials: Cement, water pit sand, granite dust and granite are the materials used in the research.

2.1.1. Cement: Dangote cement of grade 42.5 obtained from a local dealer in Ilaro was used in the study.

2.1.2. Fine Aggregate: Two types of fine aggregate (pit sand and ranite dust were used in separate mixes in the study. They were purchased from a local dealer in Ilaro.

2.1.3. Coase Aggregate: The coase aggregate used I the study is granite with maximum size of 19.5mm. It was also purchased from a local dealer in Ilaro.

2.1.4. Water: Water was fetched from the Civil Engineering Departmental laboratory of the Federal Polytechnic, Ilaro where the study was carried out.

2.2. Laboratory Tests: Laboratory tests were carried out on the the two materials used as fie aggregate. This was done to determine their properties and compare it with relevant standards so as to determmine their suitability for use I concreting works. The tests icudes sieve analysis, specific gravity, water absorption, moisture content, percentage silt cotent, and bulking. They were carried out as specified in BS EN 933-1:1997, BS EN 1097-6:2020, BS 812-109:1990 respectively.

2.3. Cube Production: Constituent materials of concrete comprising of cement as binder, pit sand and granite dust as fine aggregates and granite as coarse aggregates were mmixed in the proportion of 1:2:4. The water/cement ratio used was 0.5. The drymixing, wet mixing, casting of cubes, demoulding and curing were done according to specificatiois in BS EN 12390-2:2009. The workability of the the wet concrete mix was determined with slump test as stated in BS EN 12390-2:2009. The demoulded cubes were cured foor 7, 14, 21, and 28 days and the 7, 14, 21 and 28 days strength were determined according to BS EN 12390-3:2009. After curing the concrete cubes for 28 days, the water absorption was determined.

3.0. Results and Discussion

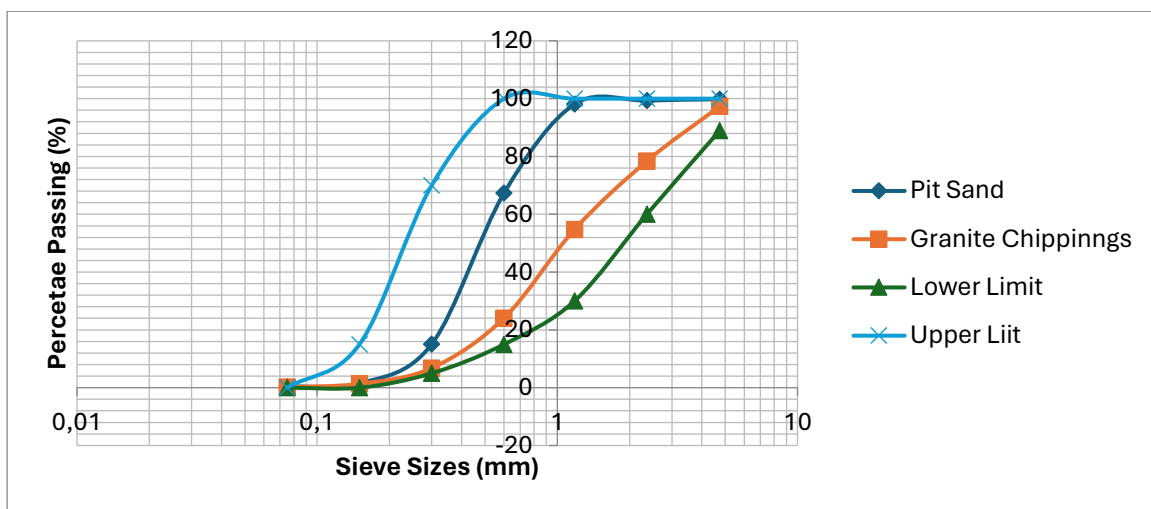


Figure 1: Sieve Analysis curve of Pit Sand ad Granite

3.1. Gradation: From the sieve analysis curve presented in Figure 1, the curve of the two materials were within the lower and upper limits of the specifications contained in Table 4 of BS 882:1992. However, while granite dust fall within the class C (coarse sand), pit sand is in class M (medium sand). The Fineness modulus of both materials fall within the range of 2.2 – 3.2 stated as range of values of fineness modulus of fine aggregate Anupoju (2016). Further classifications stated that 2.2 to 2.6 is fine sand, 2.6 – 2.9 is medium and 2.9 – 3.2 is coarse sand. This further affirms that the sample of the granite dust is coarse material while the pit sand sample is fine material.

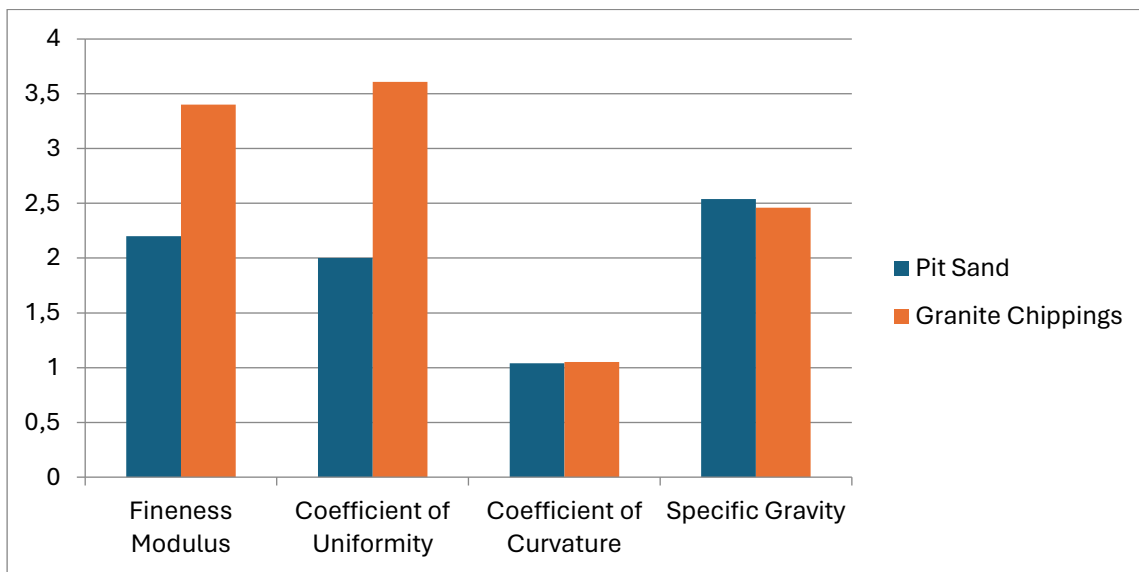


Figure 2: Bar chart of values of Coefficient of Uniformity, Coefficient of Curvature and Specific Gravity

From Figure 2, the values of Coefficient of Uniformity for both pit sand and granite dust are 2.0 and 3.61 respectively, while that of coefficient of curvature is 1.04 and 1.05 respectively. The result indicates that both materials are uniformly graded since the values of Cu of both materials are between 1 and 3 and less than 4 while that of Cc are both slightly above 1.

3.2. Specific Gravity: The values of the specific gravity of both materials as presented in Figure 2 are 2.54 and 2.46 respectively. This indicates that both materials have specific gravities within the range of 2.4 – 3.0 stipulated in various literatures (Neville 2010, Shetty 2010, Arumugam 2013 ad Nemati 2015). However, the value of pit sand is slightly higher indication a slightly higher strength than granite dust.

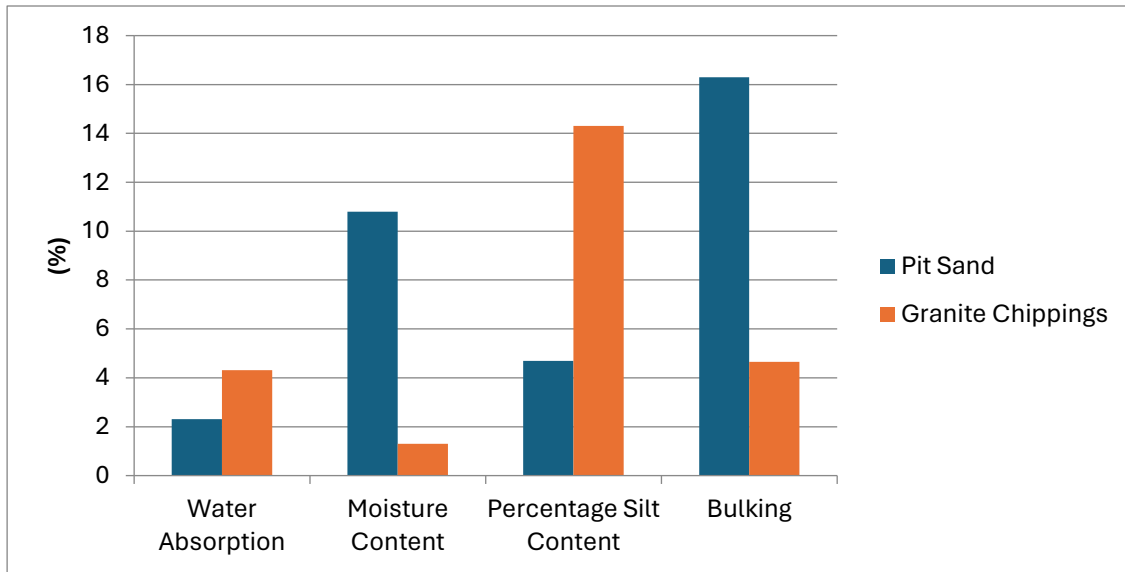


Figure 3: Bar chart of Water Absorption, Moisture Content, Percentage Silt content and Bulking of Samples

3.3. Water Absorption: From Figure 3, the value of the water absorption for pit sand and granite dust are 2.31% and 4.31% respectively. While the value of water absorption for pit sand is below the specified value of 3% as stated in BS 80007:1987, that of granite dust is higher. This implies that concrete made from granite dust are more liable to absorb water than that of pit sand. It is therefore not suitable for concreting works in swampy areas.

3.4. Moisture Content: In figure 3, the values of the moisture content for both materials are 10.8% and 1.3% respectively. Pit sand has a higher value than the specified values of 3% according to BS 8007: 1987, while that of granite dust is below the specified value. However, the high value of moisture content of aggregates does not affect the properties of hardened concrete. The purpose of the determination of the moisture content of sand is to know the amount of moisture present so that it can be provided for when determining the water/cement ratio of the concrete mix.

3.5. Bulking: The results of the bulking of both materials are presented in Figure 3. From the figure, it indicates that values of bulking of pit sand and granite dust are 16.3% and 4.65% respectively. Although relevant codes and literature does not specify any limit for bulking, however, BS 1881-102 (1983) specifies that aggregates with bulking values greater than 15% are classified as fine while those with lower value are classified as coarse. This implies that pit sand is a fine material and more liable to bulk than granite dust that is a coarse material. Bulking is the tendency for sand to increase in volume as a result of the presence of moisture. It gives a false mix proportion of the constituent materials of concrete when batching is

carried out by volume. In order to eliminate this occurrence, it is recommended that batching should be carried out by weight.

3.6. SLUMP TEST

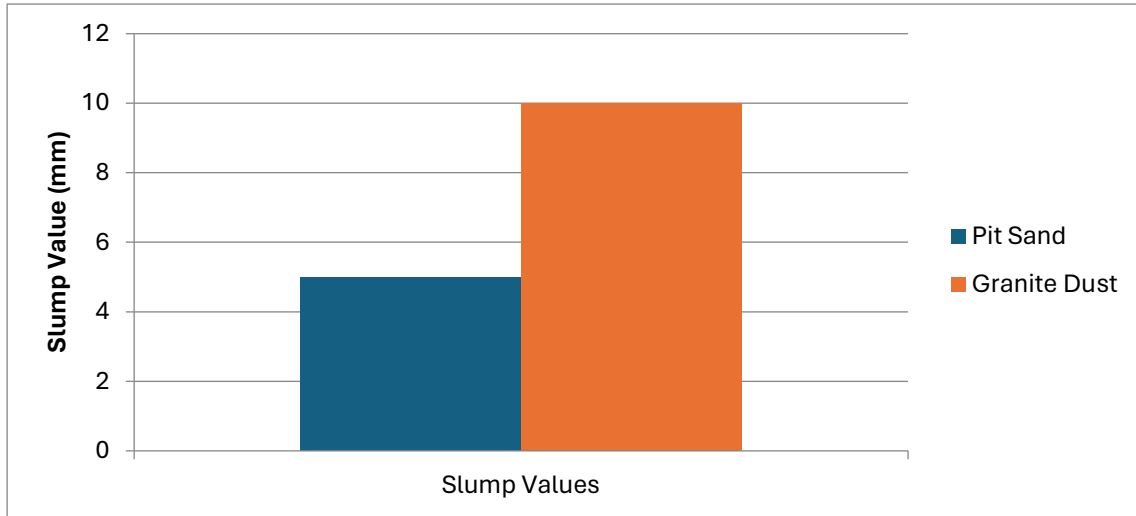


Figure 4: Slump Values for Pit Sand and Granite Dust

The result of the slump test as presented in Figure 4 indicates that pit sand has a slump value of 5mm while that of granite dust is 10mm. Both materials exhibit true slump. However, the result further indicates that granite dust is more workable than pit sand.

WATER ABSORPTION

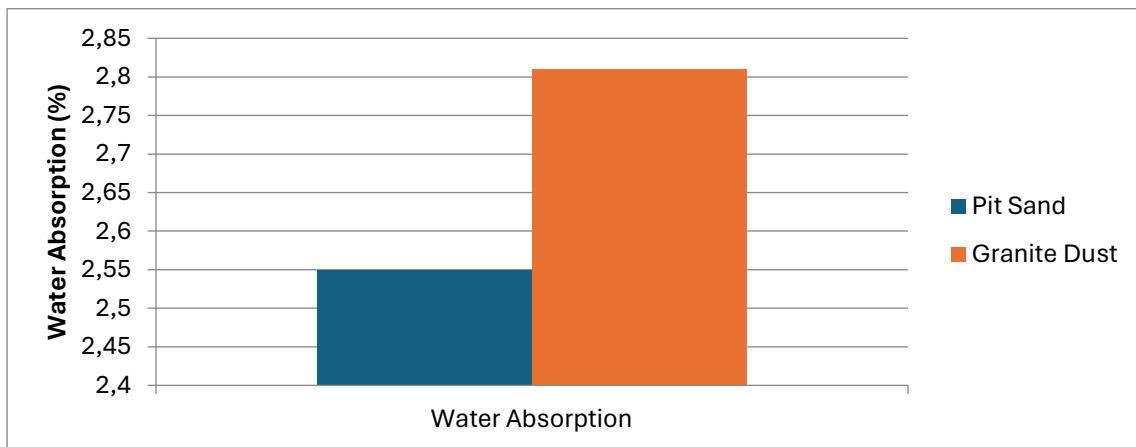


Figure 4: Bar Chart of Water Absorption of Pit Sand and Granite Dust

The water absorption of concrete cubes at the end of 28 days for pit sand and granite dust are 2.55% and 2.81% respectively. Pit sand has a lower value than granite dust. This implies that concrete produced with granite dust is more prone to water absorption than pit sand.

COMPRESSIVE STRENGTH

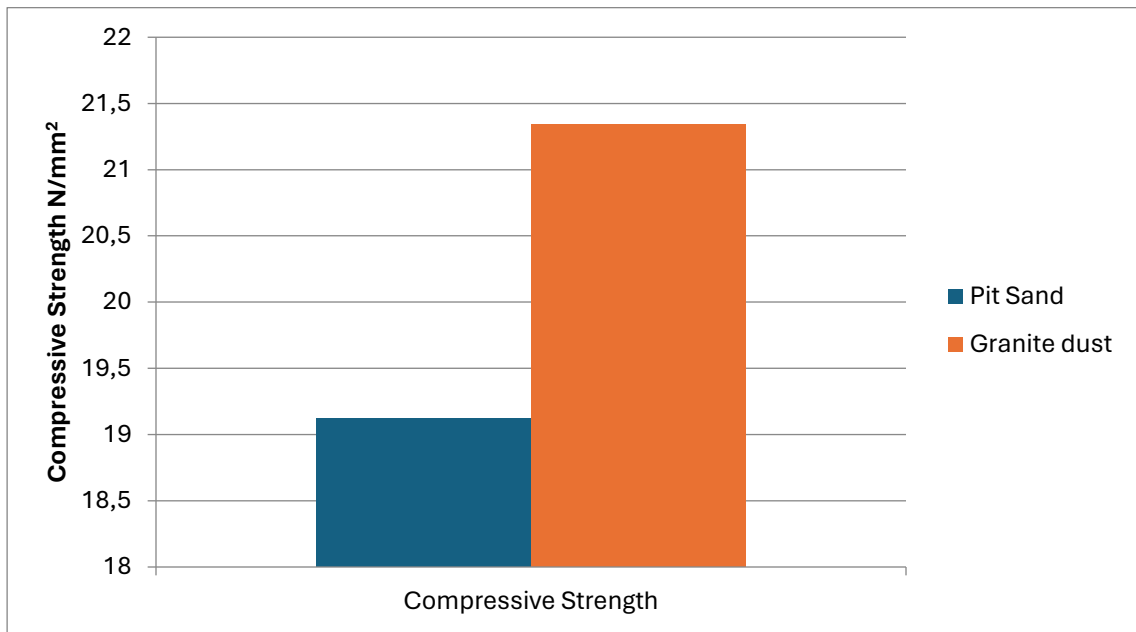


Figure 5: Bar Chart of the 28 Days Compressive Strength of Pit Sand and Granite Dust

From Figure 5: the compressive strength of concrete cubes at the end of 28 days for pit sand and granite dust is 19.12N/mm² and 21.34 N/mm² respectively. This shows that concrete made with granite dust is stronger than that of pit sand. The result of 7, 14, 21, and 28 days strength as presented in figure 6.

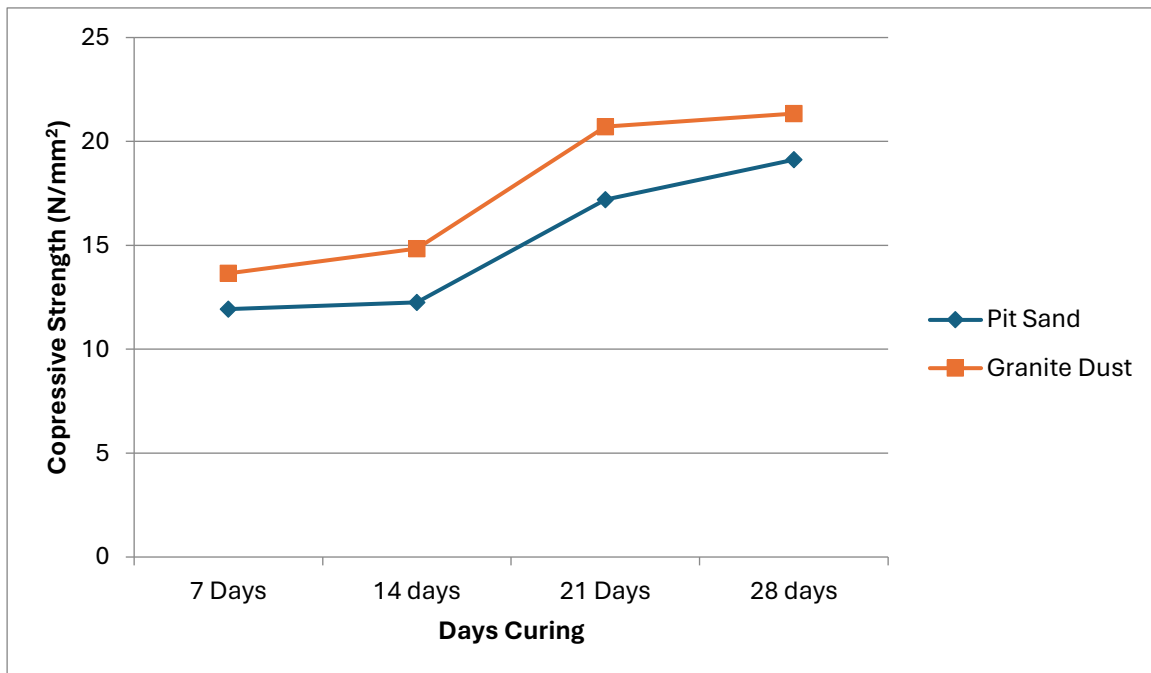


Figure 6: 7, 14, 21 and 28 Days Compressive Strength of Concrete made with Pit sand and granite Dust.

CONCLUSION: In conclusion, the result of the sieve analysis from which grading parameters such as the coefficient of uniformity and coefficient of curvature indicates that both samples uniformly graded. While the specific gravity of both materials are in line with specification in relevant codes, the percentage silt content and water absorption of granite dust are not in accordance with specification in relevant codes. Although concrete produced with granite dust is stronger, the water absorption rate is high and above the specified value in the relevant code.

References:

- Anupoju Sadanandam, (2016), <https://theconstructor.org.finenessmodulus> Accessed on 08/05/2023
- Apebo N. S., Iorwuab M. B. and Agunwamba J. C. (2013). Comparative Analysis of the Compressive Strength of Concrete with Gravel and Crushed Over Burnt Bricks as Coarse Aggregates. Nigerian Journal of Technology (NIJOTECH) 32 (1), 7–12.
- Arumugam., (2013) “Effect of Specific Gravity on Aggregate Varies the Weight of Concrete Cube” SSRG International Journal of Civil Engineering (SSRG-IJCE) – Volume 1 Issue3 August 2014, pp 1 – 8.
- BS 812: Part 109: 1990 Methods for determination of moisture content, BSI British Standards
- BS 882: Specification for Aggregates from Natural Sources for Concrete, 1992.
- BS 8007:1987, *Code of Practice for the Design of concrete structures for retaining aqueous liquids*,
- BS EN 933 – 1:1997, Test for Geometrical Properties of Aggregates “Determination of Particle Size Distribution – Sieving Method”, British Standards Institution London.
- BS EN 1097-6:2000, *Tests for mechanical and physical properties of aggregates. Determination of particle density and water absorption*, **British Standard Institution, London.**
- Nemati, K.M., Concrete Technology, Aggregates for Concrete 2015, pp 1-16,
- Neville A. M., 2011, Properties of Concrete, 5th edition. Pearson Education Limited 2011
- Omopariola S. S. (2020). Assessment of the Suitability of Pit Sand in Ilaro and Environ for Concreting Work, NSE Ilaro Branch, 1st National Conference, Ilaro, October, 2020.
- Shetty M.S. Concrete Technology Theory and Practice S. Chand & Company Ltd. Ram Nagar, New Delhi - 110 055, 2005
- Zerdi A.T. (2014). Strength Exhibition of M25 Grade Concrete with Limestone Quarry Dust Utilization for Fine Aggregates, Global Journal of Research Analysis International, 5(1).

**PERFORMANCE ASSESSMENT OF SOLAR PV-DRIVEN HYBRID RO
DESALINATION SYSTEM: THE FUTURE OF ENERGY EFFICIENT
DESALINATION**

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ABSTRACT

The Middle East and North Africa (MENA) countries are rapidly growing in population with very limited access to freshwater resources. To overcome this challenge, seawater desalination is proposed as an effective solution, as most MENA countries have easy access to saline water. However, desalination processes have massive demand of energy, which is mostly met by fossil fuel-driven power plants. The rapid technological advancements in renewable energy technologies, along with their gradually decreasing cost place renewable energy-driven power plants and processes as a promising alternative to conventional fuel-powered plants. The feasibility and potential of solar desalination technology have been demonstrated by several projects that have been implemented or planned in the MENA region. For instance, the Al Khafji solar seawater RO plant in Saudi Arabia, which has a capacity of 60,000 m³/day, is the largest solar-powered desalination plant in the world. It employs PV modules to produce electricity and to reduce carbon emissions by 19,000 tons per year. Utilization of a hybrid system of PV and renewable energy to operate the desalination process could decrease energy consumption and resultant external costs by 25% compared to conventional RO plants. The present project indicates that solar desalination can offer a sustainable and cost-effective solution for water scarcity in the MENA region.

Keywords: Environmental damages, Reverse osmosis, Water supply, Renewable energies

EMISSION TAXATION AND SUSTAINABILITY IN THE SELECTED CIS COUNTRIES

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ABSTRACT

The mainline of this research is to analyze the association between emission tax and mineral resources efficiency in the Commonwealth of Independent States from 2000 to 2021 by employing the panel co-integration estimator, namely the continuously updated full modified. The output of the empirical estimations showed that mineral resource efficiency is accelerated by emission taxation policy, green finance, and industrial green technological index, while carbon dioxide emissions and waste generation are two critical obstacles to boost mineral resources efficiency in CIS region. Moreover, the efficiency of mineral resources is more sensitive to green monetary policy (sustainable finance) than the sensitivity of efficiency of mineral resources to green fiscal policy (emission tax). To boost the mineral resources efficiency, the CIS can pay more attention to improvement of national emissions trading scheme (ETS) system, development of sustainable power generation plants, and the development of the digital green financial market based on cryptocurrencies.

Keywords: Mineral resources; emission taxation; renewable resources; green fiscal policy; the CIS

JEL classification: N51; L72; H71.

ON QUASI-EQUILIBRIUM PROBLEM AND ITS APPLICATION**Ali FARAJZADEH**

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ABSTRACT

In this paper, quasi-equilibrium problem is defined over Hausdorff topological vector spaces and deduce sufficient conditions for en-suring solutions to such a problem under the upper semicontinuity and pseudomonotonicity assumptions on the map defining the problem. The special structure of quasi-equilibrium problem enables us to show the occurrence of solutions for such inequalities based on the classical existence theorem for equilibrium problem. This special type of quasi-equilibrium problem is motivated by the pure exchange economic problems and Radner equilibrium problems for sequential trading game. Further, we study the solvability of the specific class of quasi-equilibrium on Banach spaces in which the constraint map may admit unbounded values. Finally, we demonstrate the occurrence of dynamic competitive equilibrium for a time-dependent pure exchange economy as an application.

Keywords: equilibrium problem; Dynamic competitive equilibrium; Pseudomonotone map; Constraint map; Quasi-equilibrium problem.

Mathematics Subject Classification: 37N40, 58E35, 90C2

BEHAVIOR STUDENT TO FEMINISM WOMAN DISABILITY IN A HADITH PERSPECTIVE AT UIN KH ABDURRAHMAN WAHID PEKALONGAN

Ananda Aprilia Aulia SYAHNA

Laelatul FAUZIAH

study program Knowledge Hadith UIN KH Abdurrahman Wow Pekalongan

ABSTRACT

Women with disabilities have always been considered weak and underappreciated in various ways, resulting in the denial of their rights to education, health, employment, and justice. The viewpoint of feminism emanating from the west is not a strange entity for the east. This is actually considered good in good, we can even see in the behavior of the Prophet who showed humanist characteristics in women by respecting gender equality in various fields. This research is located at UIN KH Abdurrahman Wahid Pekalongan by describing issues of disability feminism behavior in women with disabilities. The stages of research through data collection (observation, interviews, and documentation) are continued with data analysis and finally drawing conclusions. The results of this study show that feminist behavior that occurs in women with disabilities does not all see them as weak, some even admire their determination so that the existence of feminism does not limit women with disabilities in developing their talents. However, sometimes with his limitations, he has no friends. One of the women with disabilities is always patient and enthusiastic in living her life. Closely related to the hadith of the Prophet Muhammad (peace be upon him), about respecting women on behalf of their wives and Muslim women in the early days of Islam with their rights in economic, social, position and others. Based on the analysis, it can be concluded that the Holy Prophetsa is a profile of a prophet who is feminist, non-discriminatory, humanist and universal.

Keyword : Feminism, Disability, Hadith

INTRODUCTION

Women with disabilities always experience discrimination by both men and women. Woman non disability. Even disability on man more get attention than disability in women. Condition This apprehensive, so that disability on women make them neglected in all aspects of life such as, information, education, employment, and health. This condition affects their limitations in do activities. According to Dante Rigmalia, chairman of the National Commission on Disabilities, most persons with disabilities have not been recorded. According to estimates by

the Health Organization According to the World Health Organization (WHO), the percentage of people with disabilities in Indonesia is 10 percent of the total amount resident.

Along with the times, increasingly advanced technology in various fields, news about violence against women is also increasingly widespread through social media or directly. The facts that appear in the community environment are never over so it brings up concerns especially violence that happened to good girls in a manner physique or verbal. Every conversation Which involve topic religious related women experience pros and cons. This is related to the arguments of the Qur'an and hadith in explaining behavior towards women. Contextually the Al-Qur'an and Hadith contain about women being under men so that it makes women must be submissive and obedient to men. Women today are in a system that discriminatory, treated unfairly, therefore not in accordance with internal justice Islam. With the existence of these problems then raises The term feminism is synonymous with female nature.

Feminism appear Because something movement And awareness para clan feminist or women who experience discrimination and efforts to stop this discrimination. Matter This appear background 'Why' always clan Woman Which experience discrimination And treated No fair? Especially para clan Woman disabled disabilities so that they do not have rights in the field of education, work and justice. The basic concept of feminism to analyze society is gender. kindly etymological, say 'gender' originate from Language English Which means 'type sex'.

Gender is something Which attached on characteristic masculine (masculinity) And feminine (femininity) based on social construction culture (Moh. Anwar ramli, 2012: 141-142).

Issues related to persons with disabilities have been extensively studied in Islam based on Al-Qur'an And Hadith as source in behave, Prophet Mohammed SAW as *uswatun khasanah* has explained about behavior towards women. It is then draws real attention to how to treat women regardless of physique even look down on him. Islam Alone teach about justice as Lots contained in the verses of the holy Al-Qur'an and hadith which describe it contextually nor meaning just so that We Can imitating it. As servant God And people Prophet Mohammed Already should behavior And morals We in accordance with what _ order.

It is mentioned in one of the narrations that once a friend of Umar bin Khattab ra. Smiled and soon cried . The friends were surprised and thought there was the awkwardness that happened to Umar himself. So one of them asked Umar, then he explained that he laughed because he remembered every moment and what he did when he still in disbelief. When traveling he brought a statue made of bread then it pray in the journey, will but moment it feel hungry and

no there is food then he will eat the bread that is considered to be his God. While it crying because moment his wife give birth child girl, it take child the said and bury him alive because considered shame on times that. As it is sayyidinaOmar bin Khattab once said:

It means: "Demi God, Formerly when period Jahiliyah. We No Once consider women as they should until Allah sends down verses that speak about them andswear for them." (Ahmad 'Abd al-Aziz al-Husain, 2016: 11).

Consistent by hadith on top, including hadith Prophet which narrated by Ibnu Omar ra:

It means: "Whoever Which own child Woman, Then He No hurt him (buried him alive) and humiliated him and did not distinguish him from the boys he said so God right enter it to in heaven."

This was explained by the Prophet SAW as narrated by Al-Bukhari and Muslim from Abu

Hurairah:

It means: "Whoever believes in God and from then on, let him say good when he sees something or he is silent, and ask for a will for the women because indeed they were created from bent ribs. And indeed something which most crooked is which most above. When you want to straighten it out -by force- then you will break it, but if you leave it then it will fixed crooked Make a will -asking for bequeath- against women by benefit". (Narrated by al-Bukhari, Muslim, and Ibnu Majah).

That's a number of hadith Which tell How role Woman And must respect it as explained and exemplified by the Prophet Muhammad SAW. Even the Prophet himself has taught the attitudes and behavior of feminism towards his wives. his wife, he does not hesitate to do women's work such as sweeping, sewing torn clothes, or milking goats . He even sometimes babysit their children and grandchildren. As his people, of course we have to imitate and emulate what is there in a sunnah him, especially in the hadiths.

Study This discuss around behavior student to feminism on Woman disabled disability, Where discussion about behavior the will associated with hadith as source second in Islam after Al-Qur'an. Woman disabled disability always experience discrimination Good from circles man nor fellow women. Therefore, the author wants to examine the behavior of a person in treat Woman disabled disability as Which should, withuse theory feminism so that writer want to researching so far where knowledge student related feminism, How they apply behavior feminism to disabled disability Which dominant clan feminist, How hadith in looked matter This And How a feminist disabled disability in operate activity a day-day.

METHOD STUDY

Research on student behavior towards the feminism of women with disabilities in the perspective of hadith is a research that uses a qualitative descriptive method. A qualitative approach is a research procedure that produces descriptive data in the form of words written or spoken words of people and observed behavior (J, 2021). Qualitative research as a tradition certain in knowledge knowledge social Which in a manner fundamentals depend on observing humans in their own area and in contact with these people (Fadli, 2021). Therefore this method is in accordance with research that will do. The research data was conducted by interviewing directly toten sources with status as students and one of them is a woman with a disability disability.

In study This, Where eight source the is student active UIN

KH Abdurrahman Wahid Pekalongan or called UIN Gusdur who became friends from Woman disabled disability And One person student disabled disability. This study discusses how their understanding and behavior is related to feminism in Woman disability Which happen in UIN Gusdur the. Besides That study This Also discuss How feeling Woman disabled disability in operate everyday in campus Also means and infrastructure specially provided for them.

STUDY THEORY

A.Feminism

Feminism is a theory that expresses personal worth and self worth all women. With such an understanding, a woman will believe in herself themselves (Susanto, 2013). Women in the view of feminism have activity and own initiative to fight for these rights and interests in the movement for demand right as man in a manner full (Hasriani, 2018). Feminism born For oppose patriarchy Which make man always dominate who knows in political, education, institutions . Feminism is awareness of oppression and exploitation towards women in society, at work and within the family, as well something action aware by Woman nor man For change condition the. Feminism in the perspective of gender analysis is included in the scientific discipline of sociology wider. Feminism is a movement and awareness starting from assumptions that women experience discrimination and efforts to stop discrimination the.

Feminism is movement Which Already old, However new year 1960s_ movement is reborn. The beginning of this feminist movement emerged in America as part of culture rights civil (*civil rights*) And freedom sexual (*sexual liberation*). Objective from feminism This that is fight for fate clan Woman fulfil need practical such as, childcare, (*childcare*), health,

education, abortion, and so on. According to Anne Oakley, the use of the word gender in feminism was first coined by her. She started invites citizens of the world to understand that there are two terms that are similar, but not the same, namely sex and gender. So far, people have considered the two terms to be the same, viz as something that must be taken *for granted* so). Second term the is derivation from Language English which now has Lots used by the public Indonesia (Ade Marhamah, 2019).

Term feminism often called with equality gender. Gender No means biological difference (gender) which is the nature of God. Gender is differences in behavior between men and women in various fields of life. kindly Broadly speaking, feminism contains two meanings. *First*, feminism is understanding Which fight for gender-just social transformation. *Second*, feminism is a theory which analyzes and explains the root causes, dynamics and structures of oppression Woman. This issue arises to answer the question 'why' women discriminated against or treated nope fair? From here it is appear four class as following.

first, class feminist liberal. Feminism This is feminism oldest, feminism liberal argue that root oppression And backwardness Woman is exists tradition And law Which limit Woman For reach success public. Therefore, women must be given the same right to have a career in everything aspect life.

Second, Marxist feminism, this type of feminism emerged because of industrialization resulting in an unfair sexual division of labor so that women are not get rewarded and excluded from economic activities, then according to feminism Marxist women should be involved in these activities economy.

Third, radical feminism, emerged around the 1960s. This feminism voiced women's liberation. Radical feminism argues that the root of women's oppression is system patriarchal, domination man on Woman. Movement feminism This has building differences between men and women with gender symbols. In this feminism Woman must take action Alone For change style life, experience, And connection they Alone.

Fourth, psychoanalytic feminism, this flow originates from the oppression of women of his soul, and his way of thinking. Pratiarchal society has presented a dogma, that men are leaders who regulate and look after women, so women feel inferior and can't get out from the clutches of men (Hulu, 2021)

Fifth, Islamic feminism, namely the understanding that views the oppression of people women in public life is not only caused by a social system that is not fair, but caused by factors of interpretation of religious teachings that are biased towards the foundation normative, Al-Qur'an and Hadith. So according to this feminism, there is a need for

reinterpretation efforts towards religious teachings or doctrines based on the principle of gender equality that exist, both in the Qur'an and Hadith and other sources. From the fifth explanation From the flow of feminism above, it can be concluded that feminism arises because of attitudes discrimination against women as the main object even though each of them has reason And method view Which different in fighting for gender justice.

From a number of understanding on, can We take conclusion that feminism is movement or a theory born again due to discrimination against Woman And awareness will matter the However matter This more attached on Woman actually as characteristic feminine although in the practice discrimination Also happen on man- man . Feminism is closely related to gender. Theory and practice are almost the same as gender, However the movement more lead to protection on rights Woman. birth This movement is not only fighting for women's rights, but also the rights of men For against discrimination Which often happen.

B.Disabilities

Disability is a limitation on a person's body that makes them unable normal in social life. Persons with disabilities are an engineering or the result of social injustice that is deliberately built because of the existence of a power in a structural or cultural form, thus forcing them to admit that he has a physical disability. With this, it makes people with disabilities is an individual who needs to be pitied or a helpless human being. This thought still tightly among the people so they ostracized (Masduqi, matter. 26).

The condition of women with disabilities is more concerning than that of men disabled man. They are marginalized in all aspects of life like, access information, education, work, And health especially in a country develop like Indonesia. They experience discrimination Because reason gender Woman, disabled disability, and poor. Even among women they are often not seen as such causing them to be hidden and left alone and their needs and rights neglected and No equivalent with man disability. Man disabled disability more Lots get chance work Which earn tall. Consequence inequality This, Economically, women with disabilities are a burden to their families. This thing which makes them not dare to do an activity because of a lack of encouragement from Friend, public even his family himself (Turmusani in islamiyatur, 2021).

Struggle defense to Woman disabled disability split world anywhere Still Not yet find results Which expected. Matter the caused Still there is opposition to the defense movement by feminist activists and disability activists in doing their defense. Feminists with disabilities such as Jenny Morris (1991, 1993, 1996) And Thomas (1999) criticize movement feminism mainstream Which considered marginalize the voices and needs of women with disabilities.

According to Thomas para feminist often time take distance with you they Which own disability Because they considered 'weak' And 'depends', And condition This contrary with draft Feminism is a strong and independent woman. Although at this time the feminist movement Already confess diversity Woman And Already put Woman disability in it, but the process of marginalization is still often regarded only as a symbol that he call as exclusion by nominal inclusion.

Persons with disabilities in an Islamic perspective are closely related to the Al-Qur'an and hadith as source law Islam. In book Fiqh Strengthening Persons disability, peel five reason disabled disability not enough noticed their rights: *first* , perspective problems, namely magical, naive, and critical; *second* , the attitude and treatment of the persons with disabilities; *third* , limited disability-friendly public services; *fourth* , limitations opportunity Work for disabled disability; *fifth* , obstacle implementation religious obligations. Persons with disabilities in the Qur'an are a form for us not to condescend, to provide assistance to meet their needs, to support deep activity social Which measurable, structured And planned as form strengthening And empowerment to disabled disability (Sri Handayani, 2016: 267-284).

Based on various statement on, can concluded that disability is limitations on a person's body both physically and mentally that make them must noticed in a manner special. Woman disabled disability experience underdevelopment that is more concerning than men with disabilities. This matter Because lack of understanding public in treat they, Which where should the environment, family, and friends support their wishes so that they will not be oppressed and feel inferior to others. The importance of related understanding movement feminism This, should emphasized on Woman disabled disability because they are vulnerable to experiencing discrimination by men and by each other. With Thus, it is hoped that the existence of this feminist movement can eliminate discrimination happen during This.

C.Behavior

Behavior comes from the word "fairy" and "behavior". Fairy is a way of doing, and behavior means deed or behavior. Behavior is closely related to the terms morals, ethics and morals. Behavior shared to in two type, *first* , behavior Which brought from born (*innate behavior*), and *second* , operand behavior is what obtained from the learning process (*operants behavior*). Behavior originate from What Which He form, He get, And What Which controlled by the center of consciousness or the brain. Behavior caused will cause a person tends to repeat a pleasant experience and tends to avoid it experience Which not good (Marzuqi, 2015).

Behavior is also interpreted as behavior or in Islam known as morals. Morals in a manner Language is Act in demand, temperament or character. Whereas according to term is knowledge that explains good and bad, regulates human association and Determine the ultimate goal of the business and work. Morals unite in a person, united in behavior and deeds. If the behavior is good, then it is called behavior commendable or called *morals mahmudah* . While bad behavior is called disgraceful behavior or called *mazmumah morals*.

Behavior is also known as ethics. Ethics comes from the Greek word "ethes" which means customs. Ethics is the study of good and bad in actions human beings as far as the mind knows. There should be a meaning between ethics and morals and the same goal , but the principles underlying the two are different. Morals are based by Islamic teachings from Allah and His Messenger. While ethics refers to the human mind. Moral comes from the word "mores" which means custom. Morals are human actions based on good and reasonable general ideas (society). Morals and ethics have equality in terms of good and bad. The term ethics is in the theoretical and moral area in practical area.

Based on description on, that behavior is something Act in demand or deed attached to someone about the good and bad they do in everyday life. Behavior can also be called morals, ethics, character and morals. Behavior somebody very influential on view person other to We. Behavior usually motivated by a desire to achieve a certain goal. Sometimes someone's behavior Also influenced by environment. In matter This, researcher use theory behavior feminism of women with disabilities. Where researchers emphasize women with disabilities as object study and how para student behave with exists movement This.

RESULTS AND DISCUSSION

Subjects numbered eight people, which consisted of seven students and one students with disabilities. They are all students from the University KH Abdurrahman Wahid Pekalongan State Islam or known as UIN Gusdur, Where they consists from student active semester One until three in various study program especially at the Faculty of Ushuluddin Adab and Da'wah. First, the researcher asked the source person about opinion they are related meaning and form feminism which exist in UIN Gusdur and their answers almost the same, that:

Praja: " *As far as I know, Fenimism itself is a movement that aims to enforce rights Woman, if in UIN Gusdur Alone right obligation a women are equal so that UIN Gusdur itself has created students Which own characteristic fenimism* ", **Citrol:** " *Feminism That behavior Where bunch person defend women who are considered unable to fight for their own rights as a human or a woman who is considered weak*

*and she does not get rights Which should he get. For example right For Work in Constitution about citizens to live their own lives. But in ancient times women not allowed to work so, with this feminism to help women which at that time was considered not to have 100% respect for human rights and citizen rights whether the country is disabled or not, at UIN Gusdur women's rights are fulfilled well ”, Risma: “ Feminism is also about women's rights with our goal as women are seen as the same, have a role like men, at UIN Gusdur related to these rights has been implemented ”, Syahdan: “ Feminism that I read in the article is A say characteristic Which means "womanhood" or show characteristic Woman. Feminism is Genre or movement woman Which fight for rights Woman. Movement And ideology Which aim For reach level gender Which shelter in human rights, And the example of feminism itself is equalizing playing field between men as well as women by ensuring that women have the same life opportunity to choose their roles and rights as men At UIN Gusdur feminism has happened a lot ”, **Fadhila:** “ I think it's feminism difference between man And Woman as construct social, economical And culture rather than as the result of some eternal biology. So they emphasized the need for equality chance for Woman in all field. In UIN Gusdur Already apply equality between men and women ”, Sofi: “ In my opinion Feminism is social action that focuses on gender equality between women and men goals eliminate injustice to women in life, for example at UIN Gusdur itself has eradicated this injustice ”, **Farid:** “ Feminism in my opinion is a kind of groups or social movements related to those who strive to be socially related to ideology of thought for gender equality of women and men alike rights and obligations in society in various fields between women and men, UIN Gusdur in general and in particular There has been a feminist movement the "" .*

All of the answers from the sources stated that Feminism itself is a movement in defending women's rights as the object of which these rights includes equality between women and men as a form of justice, especially in UIN Gusdur itself is a place of study and has applied a feminist attitude to its students. After that, the researcher asked the students about their opinion about feminism Woman disability And How behavior they to Woman disability, that:

“Risma: “ *We have to know more about the rights of women with disabilities. That they are just like us and have the right to equality and non-discrimination. and already there the rules Also from country about employment that If there is*

discrimination in workplace for example, because people with disabilities also need decent jobs as well as other women who can compete with men. Here we can see that the government is very concerned about disability to realize equal rights and opportunities for persons with disabilities to lead a life that is prosperous, independent, and without discrimination. Regarding how to treat them, we as human beings must respect one another honor each other, value And each other love. Likewise to person disabled disability, they Also The same like We only just they have shortcomings that we should be able to view as privileges that God has given. SameAs with us, we also have strengths and weaknesses. There is little experience in Fuad There are persons with disabilities themselves , 2nd semester students. To be honest, the first time I saw it, I thought that is why the child wants to go to college with deficiencies and in his family How He educated For always come on stage give thanks on What Which God give.

*We can assure you that his family will be very supportive. And mba Risma herself often sees How come there are so many people who love this child or our friends. Her friends still invite communicate And help For go out class, if O'clock lecturesAlready finished, Possible accompany wait picked up by her mother. And time Also Alhamdulillah given the opportunity to be able to communicate, even the one who started from si his son. And mba Risma felt that maybe at that time mba Risma still didn't think so capable For invite communicate. With exists experience invited first communicate Finally mba Risma feel aware will something matter, they Also need communication from We all, And say Embarrassed That No become reason child the. And Alhamdulillah on moment That mba Risma Also da lead come back For ask. We each other communicate, and had Also joking with friends the other ” **Farid:** “ There are two cases related to feminism are equality between genderization between men and women whereas disability may be among persons with disabilities either physically or mentally with normal people it's very good when equalized means equalized not only only in terms of gender but also in terms of humanity we see the same meaning even though they have disabilities, they still get the same treatment socially in various fields. Personally to treat things the same with respect to things they must understand each other first, for example we have a friend who happens to be included in persons with disabilities physically or mentally. If physically For example, if someone is disabled or paralyzed, we have to be normal friends, don't treat them*

like that something weakness Which make it No Can do like We do. We treat The same only when he Later difficulty as Which normal We must help him. Be kind to anyone regardless of whether he is from ethnicity, race, religion, or from group certain although different view or thinking And background but when we look at God's creatures as one unit, it means us As humans, it is our duty to be kind to anyone and to persons with disabilities as well as persons who are physically or mentally disabled No perfect ” **Citrol:** “ Feminism on disability That We fight for rights Woman especially Which disability Because they need special And We must defend it with my own point of view or the point of view of being a feminist. my way if So feminist in defend clan disabilities , 1) I will embrace And ensure clan disability That No feel Alone. 2) I will help And accompanyhe in restore health mentally. 3) Merge it And interesting he to a healthier and more accepting environment. 4) I will invite him move on and move from being a victim to being a volunteer ” **Syahdan:** “ Feminism itself is to equalize between men and women by ensuring that women have the same life opportunity to choose their roles and rights as men Moreover, those with disabilities must have the same rights. How to treat girls with disabilities, don't discriminate against one another , we embrace it together if something goes wrong we remind you, don't discriminate, especially those with disabilities, don't make fun of them. If example We mock Which disability so soul her femininity will down, trust selfand his lectures will be disrupted and even drop out of lectures ” **Fadhila:** “ Gives insight to the community about how to behave towards people with disabilities. As fellow creatures of the earth, we must be able to coexist with living things other. Physical differences, race, gender, and religion are commonplace. Difference it makes us as living beings look more colorful and not monotone. A person with an intellectual disability can be treated as we are want to treated, give patience more when sufferer want to speak nor do something, and of course pay more attention to someone who has it disability because the sufferer struggles when he wants to interact with other people. For example, when interacting with persons with disabilities, watch your words and actions friends. Say and show good manners and don't make fun of it ” **Sofi:** “ Deliver support Which needed For reach rights they (with disabilities) in order to have the same opportunities to access life as we do. Don't assume limitations Because every person disability own level different limitations. Talk to them the same way you would talk to them with person normal ” **Praja:** “ Like Which I explain earlier related feminism Womanwith disabilities we help without having to be asked if someone with

a disability experiences it trouble without the need for us to ask we immediately swiftly help him, let's just say they like normal without see lack they with so appear flavor brotherhood that is so good” .”

Based on from interview on, that feminism to Woman disability is very important for us to do. Because as God's creatures we are true have the same position , only they require special attention. From various answer source person, method For treat they different from corner view each person and their point of view as a feminist. At our core as God's creatures, we must respect, appreciate, help each other, and not discriminate whether they are disabled or not. Moreover, we who are normal should be able to help they Because man actually creature Which social. Don't Because they own limitations make We apply arbitrarily even mock they. As taught by religion. In addition, researchers also interviewed a women with disabilities from Al-Qur'an and Interpretation Study Program or abbreviated as IAT, how does he feel studying at UIN Gusdur, is he treated well by the studentsstudent, he even told a little about his experiences during life daily.

“Ragil: *“ Thank God I feel comfortable with lectures at the Ushuluddin Faculty Adab and Da'wah with comfortable facilities by moving classes on the first floor and provide a special bathroom for people like me. All students and female students treat me well and I feel what happiness means in friendship, Once when there's an event on floor two, my friends shoulder to shoulder shoulder to shoulder I climbed the stairs because there is no lift at FUAD. A little past experience at MTS As - Syaifi'iyah, I have never felt what happiness is and what good friends and even me are experienced bullying for three years. I know that Allah gives a test and later will given happiness that I haven't gotten either at MTS or the environment. I moment in college, I applied for an LPDP scholarship , but I didn't qualify, even though I thought the conditions were the conditions are complete, but I don't know why it didn't pass. I like insecure because in my class there are many graduates who are fluent in Arabic, temporarily lodged place I was never taught so I could ”.*”

Results from interview study nor observation show that understanding someone related to feminism is not just a text but individual action Alone related issues or discrimination Which dominant happen on Woman Good Which disability nor non disability. Somebody Which apply behavior to feminism

Woman disability can done with various method For fight for And defend their rights. Some results also show that they support the existence this feminist movement because they

consider it very important to fight for. as who have been taught in religion to respect and respect each other between people without looked their status.

Islam as a religion that is rahmatanlilalamin, namely a religion that spreads mercy to natural universe, has called out a number of recommendation For each other honor specifically respect women, as the hadith narrated by Umar bin Khattab emphasized about that Islam very notice And glorify as creature God And give equal status to the opposite sex. And the hadith from Abu Hurairah that narrated by Abu Daud, Imam Ahmad, Imam Bukhari, Imam Muslim, and Ibn Majah contains the importance of improving kinship relations with women. the Hadith confirm that how big attention Islam to woman as creature Which glorified by Allah and they deserve equality and position with opponents kind. The respect and appreciation of Islam is described in the sunnah of the Prophet, Rasulullah give example with do construction, push they on kind, happy as well as broaden chest they on limitations Which allowed God.

In accordance with the hadith above, many narrators of hadith also narrate about this matter like hadith history Messenger of Allah bye, "*Whoever pay attention child his girl then educate him, and be patient and fear God (in the process of fulfillment his rights and obligations), then his reward is heaven .*" (HR Muslim, Abu Daud and Ahmed). In the book *Ma'a ar-Rasul fi Hajjati al-Wada* (with the Messenger of God, on the Hajj farewell) sheikh Athya Muhammad Salim, head teacher at the Nabawi mosque noted that among the sermons delivered by the Prophet when he performed Hajj Wada he ordered: "*I bequeath you to be kind to women*". By therefore, based on theological and historical studies we can draw the conclusion that at the time of the Prophet, Islam had upheld the value and dignity of a woman even they are experts in the fields of knowledge and experience of religion, language, da'wah, politics or in military like biography Aisha, Fatima, Umm Anger ra., and anotheretc.

Results study Also explain that they Also apply behavior related feminism in women with disabilities where they help, honor, appreciate, And No discriminate Woman disability in all field like What Which described in the hadith of the Prophet. As for the results of this study that the behavior of feminism in women with disabilities it is very important to do and apply not because of them has limitations, makes us stay away from and make fun of it. As has been explained in the hadiths of the Prophet, because we as his people are an obligation for us For understand, practice, and imitating the behavior of the Prophet Muhammad, PBUH.

CONCLUSION AND SUGGESTION

Can concluded from study This, that behavior feminism to women with disabilities are very important to do as a form of fighting for their rights them to create a peaceful and harmonious

life. Hadith as a source of law after Al-Qur'an has a moral message in respecting and upholding the principles of feminism in all aspect life. Suggestion researcher to Woman disabled disability, Don't Once feel low self And insecure to person other Because man Certain have advantages and disadvantages of each. Limitations are not a reason not to carve achievement. Precisely when people with disabilities are able to prove their achievements will motivating everyone that life requires patience, struggle, optimism to achieve something.

REFERENCES

- A, Hasriani. (2018). *Gender Violence Against Women in a Collection of Voice Short Stories Independent (Critics Feminism Literature)*. Macassar: University Makassar State.
- BF, Masduqi. (tt) "Disability: From Tragedy Personal Going to Movement Social", *Journal female* , 20.
- Bukhari, Muslim and Ibn Majah. *Al-Bukhari, Sahih al-Bukhari* , Juz III (Beirut: Dar al Pole al Scientific, h. 212. Muslims. *Sahih Muslim* , Juz. IV, Riyad: Dar Kalam al-Kutub, p. 178. Ibn majah. *Sunan Ibn majah* , Juz. I, Semarang: Works After all Son. h. 594.
- Daud, Abu and Ahmad each from Ibnu Abbas ra. See Abu Daud, *Sunan Abi Daud* , Juice. II, p. 759, and Ahmad, al-Musnad, Juice. I, p. 223.
- Dwi , Susanto. (2013). *A Critical Study of the Roots of Theology And Ideology Feminism Amina Wadud Muhsin* Kediri: IAIN Kediri.
- Marzuqi. (2015). *Behavior dress Student UIN Ar-Raniry Band aceh (Studies Phenomenology of the Practice of Dressing in Feminist Subjects)*. UIN Ar-Raniry Bandaaceh.
- Ramli, Anwar Mohd. (2012). "Genders Analysis in Islamic Jurisprudence", *Journals of Fiqh*, No. 9.
- J, M.L (2021). Qualitative research methodology .
<http://jurnal.sttsundermann.Ac.Id./Index.Php?Sunderman?article/view/46/30>
- Fadli, M. R. (2021). Understand design Method study qualitative. *HUMANICS* , 21(1).
<https://doi.org/10.21831/hum.v21i1.38075>
- Hasriani, A. (2018). *Gender Violence Against Women in a Collection of Voice Short Stories Independent (Literary Criticism Feminism)* . Macassar: University Makassar State.
- Susanto, Dwi . (2013). *Study Critical About Root Theology And ideology Feminism Amen Wadud Muhsin* . Kediri: IAIN Kediri.
- marhamah, Ade. (2019). "Hadith Misogynistic Perspective Gender And Feminism", *At-Tibyan Journals Of Qur'an and Hadith Studies* Vol. 2 No. 2, IAIN Salatiga.
- Hulu, Juwita M. (2021). *Gender Equality in Student Organizations of the Faculty of Social Sciences And Political science Sumatra University North* . Medan: University of Sumatra North.
- Rokhmah, Islamiyatur. (2021). "Access Education Woman Persons Disabilities In Yogyakarta Special Region: Islam, Gender and Politics". *Thesis* . Yogyakarta: UIN Sunan Kalidjaga Yogyakarta.
- Handayani, Sri. (2016). "Disabilities in the Qur'an" , *INCLUSION :Jurnal of Disability Studies*, Vol 3no 2 July-December 2016.

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ABSTRACT

Purpose: This paper aims to explain how management ethics and economic ethics in Islamic business ethics? And what is Monopoly and oligopoly in Islamic business ethics?

Design/methodology/approach: This paper uses a qualitative approach, because data sources and research results in library research, inductive data analysis, grounded theory (towards the direction of theory building based on data).

Findings: Pertama, landasan etika syariah dalam etika bisnis Islam terdiri dari struktur analitik berikut: (Etymologically, the word "ethics" comes from the Greek language which consists of two words, Ethos and ethikos. Ethos means nature, habitual character, usual place. Ethikos means morals, civilization, good behavior and actions. Kreitner reminds us that management ethics furthermore talks about the values embraced by the organization in connection with the business activities it carries out. Personal values, terminal values and instrumental values as Ethical Standards Personal values and norms are important in management. Some benefits can also be obtained such as can increase the credibility of a company and can increase the competitiveness (competitive advantage) of the company. Economic and business ethics is a way to conduct business activities, which includes all aspects related to individuals, companies and society, the principles of Economic Ethics in general are one of the principles of autonomy, autonomous business people are fully aware of what their obligations are in the business world. Here we take monopoly and oligopoly as examples of violations in economic ethics and management ethics, namely: 1. Monopoly is a state of business that is fully held by one company. Oligopoly is collusion between entrepreneurs and rulers. Oligopoly lies between a free and open market on the one hand and a monopoly on the other.

Originality/value: This paper comprehensively describes economic ethics, management ethics, monopoly and oligopoly in Islamic business ethics.

Keywords: Sharia Ethics, Ethical Ontology, Ethical Epistemology, Ethical Axiology, Islamic Business Ethics

THE CONCEPTS OF 'FIRE AND FURY' IN MARY SHELLEY'S *Frankenstein***Don-De Dieu Pacifique BAKALA****Armel MBON****Benjamin EVAYOULOU**

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ABSTRACT

This paper aims to show that 'fire', a symbol of creation, when misused, has often created fury as in Greek mythology from which Mary Shelley drew her inspiration of *Frankenstein or the Modern Prometheus*. In doing so, it purports to show how in Victorian period shaken by the Industrial Revolution, Shelley warns scientists about the negative impacts of a thoughtless science. Considering the high death rate caused by the recent Covid-19 outbreak, one notices that the concepts of fire and fury are really portrayed through the story of scientist Victor Frankenstein who misuses science and then creates a monster that revolts against him and kills his kinsfolk. To do this, recourse to myth-critical approach is needed in that it uncovers or identifies manifestations of mythology in a literary work--whether as the creation of an original myth, as the appropriation of a traditional mythological figure, story, or place, or in the form of allusions--and uses these mythological elements to aid interpretation of the work under scrutiny.

Key words: Fire, Fury, Science, Misuse, Monster.

Résumé: Cet article vise à montrer que le « feu », symbole de la création, lorsqu'il est utilisé à mauvais escient, a souvent créé la fureur comme dans la mythologie grecque d'où Mary Shelley a tiré son inspiration de *Frankenstein ou le Prométhée moderne*. Ce faisant, ce travail prétend montrer comment dans la période victorienne ébranlée par la révolution industrielle, Shelley met en garde les scientifiques contre les effets négatifs d'une science irréfléchie. Compte tenu du taux élevé de mortalité causé par la récente pandémie de Covid-19, on remarque que les concepts de feu et de fureur sont vraiment dépeints à travers l'histoire du scientifique Victor Frankenstein qui abuse de la science, puis crée un monstre qui se révolte contre lui et tue ses parents. Pour ce faire, il faut recourir à une approche critique du mythe en ce sens qu'elle permet de découvrir ou d'identifier des manifestations de la mythologie dans une œuvre littéraire - qu'il s'agisse de la création d'un mythe original, de l'appropriation d'une figure, d'une histoire ou d'un lieu mythologique traditionnel, ou sous forme d'allusions - et d'utiliser ces éléments mythologiques pour faciliter l'interprétation de l'œuvre examinée.

Mots clés : Feu, Furie, Science, Abus, Monstre.

INTRODUCTION

In 2008, journalist Michael Wolff published *Fire and Fury: Inside the Trump White House*, a book which details the behaviour of U.S. President Donald Trump, the staff of his 2016 presidential campaign, and the White House staff. This phrase was even used by Trump during his verbal escalation with North Korea, which expresses tensions. Similarly in Mary Shelley *Frankenstein*, ‘Fire and Fury’ can be read as the most outstanding issue raised throughout this novel. Before delving into this issue, it would be opportune to clarify first the concepts of “Fire and Fury” which may seem obscure to some readers. In Genesis (The Bible), the Latin phrase ‘fiat lux’ for the English ‘Let light be made’ is one of the expressions of God’s creation. As there is no smoke without fire, there is also no light without fire. There is, in fact, an interplay between fire and light, but what matters most in this is that both are closely related to creation, a creation which may result in fury once mismanaged.

Likewise, in the Greek methodology, the titan Prometheus bestowed upon mankind the gift of knowledge by stealing fire from Mount Olympus and giving the secret of life to humanity. Drawing inspiration from this, Shelley fictionalizes Victor Frankenstein who, through this dangerous electrical force, creates and revives his hideous monster. The second concept ‘Fury’, refers to sufferings and punishments endured by the latter after the monster’s creation, that is to say, the killing of his kinsfolk.

This theme needs revisiting since even with the related literature, it has not yet received the critical attention it deserves. Over the last decade, *Frankenstein* criticism has been much interested in the status of Shelley’s science, for some critics as Harold Bloom; Ellen Moers etc. had broadened our understanding about the novel. In “*Frankenstein and the New Prometheus*” (1965), Harold Bloom claims that Mary Shelley may have inadvertently written this novel to portray the struggle between human and God, as Prometheus did when he defied God, and we see him that creation is deemed to failure, since it brings about the death and downfall of human beings, who, in their attempt to be like God, just destroy themselves. In the same connection, Ellen Moers (1976) in “Female Gothic” strengthens the Gothic elements present in the novel. She mainly refers to the gloomy moments, full of agony and suffering, mainly related with life of a lonely doctor locked up in his lab, determined to create life, and defied God, which afterwards brings to terrible consequences to himself and his loved ones.

However, even though this novel has been under the scrutiny of many researches, this topic has formulated has not yet received the critical attention it deserves. As a matter of fact, what we would like to bring as novelty is to endeavour not only to pinpoint the drawbacks of

Science in Mary Shelley's *Frankenstein*, but also to remind scientists that unconscious quest for knowledge oftentimes results to dreadful consequences.

The aim of this research work which comes under the scope of English Literature is thus to show how Fire and Fury are intertwined to various extents. The interrogation that strikes our mind in this research work is the following: to what extent does Fire result in Fury in Mary Shelley's *Frankenstein*?

Bad things may happen with a thoughtless desire to make fire as evidenced through the protagonist Victor Frankenstein who desires to create a human being through a perpetual search of knowledge. Unfortunately, that daring experiment resulted to a total failure, and leads to irreparable consequences.

We were not restrictive in this research work, for relying on one approach means showing weakness. To point out the weakness of an approach if used exclusively, Wilbur Scott (1962:11) states:

(...) it is equally foolish to suppose that any critic deserving of continued attention will of a single approach. On the contrary, he is likely to employ that method-better, those methods in combination-which best suit his knowledge, his particular critical sensitives, and the work of art before him.

As it can be seen, three approaches will come in handy in this research work namely: the new historicism, mythical, and psychological approaches. New historicism will help us establish the interplay between fiction and history in Mary Shelley's *Frankenstein*, for a work of literature, whatever it is, is influenced by the author's historical background and environment. Similarly, Prafulla Kar (1995:76) argues "New historicism is a literary theory which concerns with the analysis of the relationship between the historical circumstances and our own". This means that the new historicism considers works of literature as a text grounded on history, that is, we always look at the text studied in a wider historical context, examining how the work reflects the writer's time. As for the mythical approach, mythological elements aid interpretation of works of art in general, and of literature in particular. The psychological approach which is the application of Freudian theories to the literary process helps not only examine the psychological pains endured by Victor Frankenstein, but also the motives that urged the monster to commit crimes.

Structurally, this paper comprises two main sections including two subsections each. The first subsections are 'Fire as creation' and 'Desire to usurp God' included the main section entitled "Fire in the Bible and Greek methodology". In this section, we will demonstrate how

Fire contributes to create the monster. Also, to show the reason that urged Victor Frankenstein to create the latter. The second leg of this research discusses “Fury”. It is divided into two subsections entitled: ‘Frankenstein’s fate’ and ‘The monster’s serial killings.’ Here, our main task is to show the motives that pushed the monster to kill Frankenstein’s kinsfolk.

A-Fire in the Bible and Greek Mythology

1- Fire as creation

The thorough reading of the Bible reveals that Fire was in the centre of the creation, that enigmatic force of the four elements of matter that appears in the Bible no less than 400 hundred times(according to the theological dictionary) is linked to the religious context and viewed in different angles, for instance ,the calling of Moses by God through the burning bush to his future mission (Ex.3:3-4),Israelites ‘guidance during the journey in the desert (Ex.13:12,22), Elijah is taken to heaven in a chariot of fire(2kings 2:12),to quote only a few. However, in the Old Testament, the primordial image of Fire is that of the shaping of the world, as states in Genesis (1:1, 2, 3):

In the beginning, when God created the universe, the earth was formless and desolate. The raging ocean that covered everything was engulfed in total darkness, and the spirit of God was moving over water. Then God commanded, “Let there be light”-and light appeared.

Assuredly, this extract shows that God creates life through Fire, this miraculous force symbolizes God himself, his power, and glory, for he remains a mysterious creature that ever exists. Likewise, Fire also remains a mystery that Alchemists endeavour to study. Unfortunately, they do not truly comprehend how this electrical force came true, for there are no proven evidences that demonstrate its origin. Fire is the secret of life; God keeps the latter for himself, and knows that if he puts it at the disposal of mankind, life could be possible. It is indeed the Greek methodology of Prometheus paraphrases the Bible when the titan Prometheus discovered the secret of life from the Olympian God Zeus, and gave it to mankind. This means that both the Bible and the Greek mythology side each other concerning the conceptions of Fire as the origin of life, for Prometheus is also viewed as a creator of human beings. Similarly, Victor Frankenstein who is considered as the new Prometheus, the latter can be also seen as a literary response to the Vitalism debate which prevailed between from 1816 until 1820 between physician and surgeon John Bernethy and his learner William Lawrence (Holmes, 2008:310).

2- Desire to usurp God

A close reading of Shelley's *Frankenstein* serves to highlight that Victor Frankenstein is a scientist who aspires to glory that is to say to resemble God. He wants to make a mark on history that people will never forget. In this connection, the following passage tells evidence:

It may appear very strange, that a disciple of Albertus Magnus should arise in eighteenth century, but our family was not scientific, and I had not attended any of the lectures given at the schools of Geneva. My dreams were therefore undisturbed by reality, and I entered with the greatest diligence into the search of the philosopher's stone and the elixir of life. (p.22)

This passage demonstrates that Frankenstein seeks greatness, for he claims to be a disciple of Albertus Magnus. One must bear in mind that Magnus was a Dominican friar and master of alchemy of the thirteenth century. He remains among the most intellectually compelling magical theologians and natural philosophers. Here, Victor wants to be renowned as Albertus Magnus? And the expression "our family was not scientific" is also a perfect illustration of Victor's anxiety to quench his thirst for glory. Through this utterance, one understands that the young student prides himself on being the first scientist of the family. This means he wants to be the emblem for the entire family, as illustrated in these words: "But the latter obtained my most undivided attention: wealth was an inferior object; but what glory would attend the discovery, if I could banish disease from the human frame, and render man invulnerable to any but a violent death" (p.23).

The above quotation assuredly testifies that the young ambitious Victor is motivated by the search for glory and public renown reserved only to God almighty, for he wants to make a name for himself, and also not only to be successful but brilliantly, notoriously successful. And he seeks that glorious reputation through modern philosophy. The sentence "what glory would attend the discovery, if I could banish disease from human frame, and render man invulnerable to any violent death" shows that Victor aspires to immortality and assumes a god-like role possessing the power to eradicate death on the earth, as he states:

No one can conceive the variety of feelings which before onwards, like a hurricane, in the first enthusiasm of success. Life and death appeared to me ideal bounds, which I should first break through, and pour a torrent of light into our dark world. A new species would bless me as its creator and source; many happy and excellent natures would owe their being to me. No father could claim the gratitude of child so completely as I should deserve theirs. (p.37)

This extract reveals that Victor is an arrogant scientist who desires to usurp God. He wants to create life beyond the limits of human procreation. The sentence "Life and death appeared to me ideal bounds, which I should first break through, and pour a torrent of light into our

dark world” demonstrates his pride, for he portrays the world in which he lives as a dark world and claims to be the only one to bring light. This means that he underestimates the former scientists who paved the way to alchemy and the use of the personal pronoun “I” also testifies that Victor wants to make a mark on history, and claims to be the first pioneer to understand the mystery of death and life. The sentence “A new species would bless me as its creator and source; many happy and excellent natures would owe their being to me” evidences that Victor plays God, that is to say he wants to imitate God who is always adored by his creator. Through this sentence, the author depicts Victor as an arrogant scientist who seeks glory without any conscience, as illustrated in the following passage: “After days and nights of incredible labour and fatigue, I succeed in discovering the cause of generation and life; nay, more, I became myself capable of bestowing animation upon lifeless matter” (p.34). Here again, Victor can seem godlike in his research, for he claims to have invented a way to instill life. The expression “I became myself capable” proves his perpetual lust of greatness, and the author double uses two pronouns “I” and “myself” to illustrate that Victor is selfishly motivated by glory, he does not value the consequences because bestowing animation upon lifeless matter is too risky and dangerous. Using this method, one can create a hideous which cannot be under any control. Hence Davis (2008:2) states: “Frankenstein conveys a rather cynical view of science and progress, warning us to usurp God’s place”.

As it can be seen, Victor Frankenstein goes beyond his physical limitations and wants to become closer to God. He aims to reach divine qualities through science, and eventually to conquer the throne reserved for God and become the creator of life. According to Davis, Victor is a rebel; he rejects the prohibitions and takes the position of God. His urge to create life by himself shows his titanism, his longing to do something never before attempted by man and needs to rule a new race of beings. About the monster came to the world; it is obvious to notice that Victor provokes to destroy the conventional image of mother-father parentage and promotes a new type of single-family, excluding a mother. It is also noticeable that Victor’s desire to usurp God is also linked to the fact he wants to change the social status, as evidenced by Lars Lunsford (2010:174), when he argues:

Victor Frankenstein does not value life in the absolute. Instead, he places a higher worth on his reputation. He wants to join the new class of learned men that has replaced the learned gentry as the upper society in Europe.

This passage attests that Victor Frankenstein needs to earn reputation in the new-found intellectual upper-class of European society that emerged during the Enlightenment. However, with such an extreme emphasis on gaining personal validation through social

standing, Victor's concept of the value of the human life becomes dangerously altered, eventually resulting in the creation of a hideous creature who, in a fury, kills his family.

B-Fury

1- Frankenstein's fate

Failures and successes in life have led people to believe that fate plays an important role in one's future outcome. Some argue that it is an invisible or a hidden power of what will happen in the future, it is also unavoidable and describes how one will live their life. Regardless in some cases, one may be able to change their fate by their own efforts during their lifetime. In Mary Shelley's *Frankenstein*, fate denotes negative consequences in Frankenstein's life, for through his action, he changed his destiny, sadly, his deeds led to negative effects that destiny had prepared for him. He ignores the 'hidden power' fate holds when he sought to make nature accommodate to his superfluous creation. By not considering the negative effects of providing life to a lifeless creature. So, his pursuit of knowledge brazes a trail to timeless hardships, as concedes by the narrator:

If, instead of remark, my father had taken the pains to explain to me, that the principles of Agrippa had been entirely exploded, and that a modern system of science had been introduced, which possessed much greater powers of the latter were chimera, while but those of the former were real and practical; under such circumstances, I should certainly have thrown aside, and with my imagination warned as it was, should already probably have applied myself to the more rational theory of chemistry which has resulted from modern discoveries. It is even possible, that the train of my ideas would never have received the fatal impulse that led my ruin. But the cursory glance my father had taken of my volume by no means assured that he was acquainted with its contents; and continued to read with greatest avidity. (p.21)

The above quotation reveals that Frankenstein is the master of his own destiny; no one can be responsible for his actions. For, his excessive desire of knowledge is tangible evidence, even though his father advises him to abandon Agrippa's book which seems to be outmoded and dangerous in his forthcoming life as the following sentence evidences "my father had taken the pains to explain to me that principles of Agrippa had been introduced" 'but Victor disagrees. Through this sentence, one understands that Victor's is not worth reading to be read by Victor since it has an old information about science and requests him to read the modern science, but Victor refuses until it becomes his obsession to reveal the secret of life, which he does not know the future consequences.

2- The Monster's serial killings

According to Merriam Webster's dictionary, "killing" is defined as the deprivation of a person, animal's life, etc. In Mary Shelley's *Frankenstein*, some features of the monster's criminality is the fact that the monster suffers from injustice. His career as a criminal is the result of injustice he has to face and that is plainly based on his appearance. His desperation rises from his creator which leads him to first murder William, Victor's young brother, as evidenced in the following passage:

I wish to prepare you for the wonderful news, but know it is impossible; even now your eye skims over the page, to seek the words which are to convey to you the horrible tidings." William is dead! - that sweet child, whose smiles delighted and warmed my heart, who was so gentle, yet so gay. Victor, he is murdered! I will not attempt to console you (...) "Come dearest Victor, you only can console Elizabeth. She weeps continually, and accuses herself unjustly as the cause of his death; her words pierce my heart. We are unhappy". We have no trace of him at present, although our exertions to discover him are unremitted; but they will not restore my beloved William. (pp.54-55)

This quotation shows the monster's revenge towards Frankenstein, for he realizes that his creator is also vulnerable and may undergo the same terrible misery. The monster feels injustice and the only idea of satisfaction that comes in mind is to destroy Victor's hope of happy life with his family. Through William's murderer, one understands that the monster wants Victor Frankenstein to experience the same loneliness and desolation by separating him to his family. So, he decides to kill William Victor's lovely young brother because he realizes that by killing him, he is going to torment Victor's family. Through sentences "Come, dearest Victor, you alone can console Elizabeth. She weeps continually, and accuses herself unjustly as the cause of his death; her words pierce my heart. We are all unhappy", the author shows that before William's death, Victor family has a peaceful happiness life based on love and harmony. Unfortunately, William's death brings desolation and confusion by murdering Frankenstein's sweet brother. The whole family is troubled and accuses each other, as illustrated in the following sentence: "We have no trace of him at present, although our exertions to discover him are unremitted; but they will not restore my beloved.

Additionally, after William's death, Victor Frankenstein's life resembles that of the monster; he becomes an outcast wandering here and there, as shown in the following in the passage below:

My journey was very melancholy. At first, I wished to hurry on, for I longed to console and sympathize with my loved and sorrowing friends; but when I drew near my native town, I

slackened my progress (...) I remained two days at Lausanne, in this painful state of mind. I contemplated the lake: the waters were placid; all around was calm, and the snowy mountains, “the places of nature”, were not changed (...). I wept like a child: “Dear mountains! My own beautiful lake! How do you welcome your wanderer? Your summits are clear; the sky and lake are blue and placid. Is this to prognosticate peace, or mock at my unhappiness? (p.56)

This passage attests the negative impacts of William’s death on Frankenstein’s life, for one understands that he is psychology traumatized. Through the expression “very melancholy”, the author shows the moribund state of Frankenstein’s mind because “melancholy” is a deep feeling of sadness that lasts for a long time and often cannot be explained. That deep feeling of sadness leads him to remain two days at Lausanne, as evidenced in the following sentence “I remain two days at Lausanne, in this painful state of mind. I contemplated: waters were placid; all around was calm, and the snowy mountains, “the place of nature, were not changed”.

In fact, believing that the creature will kill him, as well as his wife, he prepares the arrangements for his marriage with Elizabeth. Despite the first creature’s previous warnings “I will be with you on your wedding night”, and Elizabeth’s foreshadowing “something whispers to me not to depend too much on the prospect that is opened to us” (p.147), but Victor goes forward with the ceremony and gets married. However, in a twist of events, the creature does not attack him but goes after Elizabeth, and kills her in a horrific manner in order to taunt Victor. Through the death of Elizabeth, Victor is now deprived of every human connection and affection. As matter of fact, depriving Victor from Elizabeth may be regarded as a direct response to Victor’s refusal of providing him a female companion. This murder is what leads Victor to pursue the monster to the North Pole and later dies.

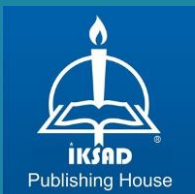
Conclusion

This work was premised on shedding light on the relationships between Fire and Fury in Mary Shelley’s *Frankenstein*. In the foregoing lines, there has been an endeavour to demonstrate how fire contributes to the acquisition of the forbidden knowledge desired by Victor Frankenstein. Prometheus was sentenced by the Olympian Gods. So is Victor Frankenstein through his insatiable desire of human creation. It is a bolt of fire which gives Victor Frankenstein reason to discuss the new and astonishing ideas of the subject of electricity and galvanism. One notices that as Prometheus uses Zeus’ lightning to spark the fire of knowledge within man, Frankenstein uses a lightning bolt to spark his quest towards creation. In doing so, this eponymous hero assumes the role of the creator, and like

Prometheus, is unaware of the damage and aftermath which his attempts to become like God will produce.

References

- Bloom, H. (1965). *Frankenstein, or the Prometheus*. *Partisan Review*. New York.
- Davis, P. (2008). *Frankenstein, Science Fiction and Poetry of Science*. Florida Atlantic University.
- Kar, P. C. (1995). *New Historicism and Interpretation of the Text*. India: University of Baroda.
- Lawrence, O. R. (1985). *New International of Encyclopaedia of Bible Words*. Zondervan
- Lunsford, L. (2010). The Devaluing of Life in Shelley's *Frankenstein*. *Explicator Academic Search Premier* 68(3),174-176
- Moers, E. (1976). *Female Gothic. Literary women: The Great Writers*. New York: Doubleday.
- Scott, W. (1962). *Five Approaches of Literary Criticism: An Arrangement of Contemporary Critical Essays*. New-York: The Macmillan Company.
- Shelley, M. W. (1831). *Frankenstein, or, The modern Prometheus*. First published in 1818. London: Colburn & Bentley.
- Webster's Dictionary (Retrieved April 13th 2023).



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