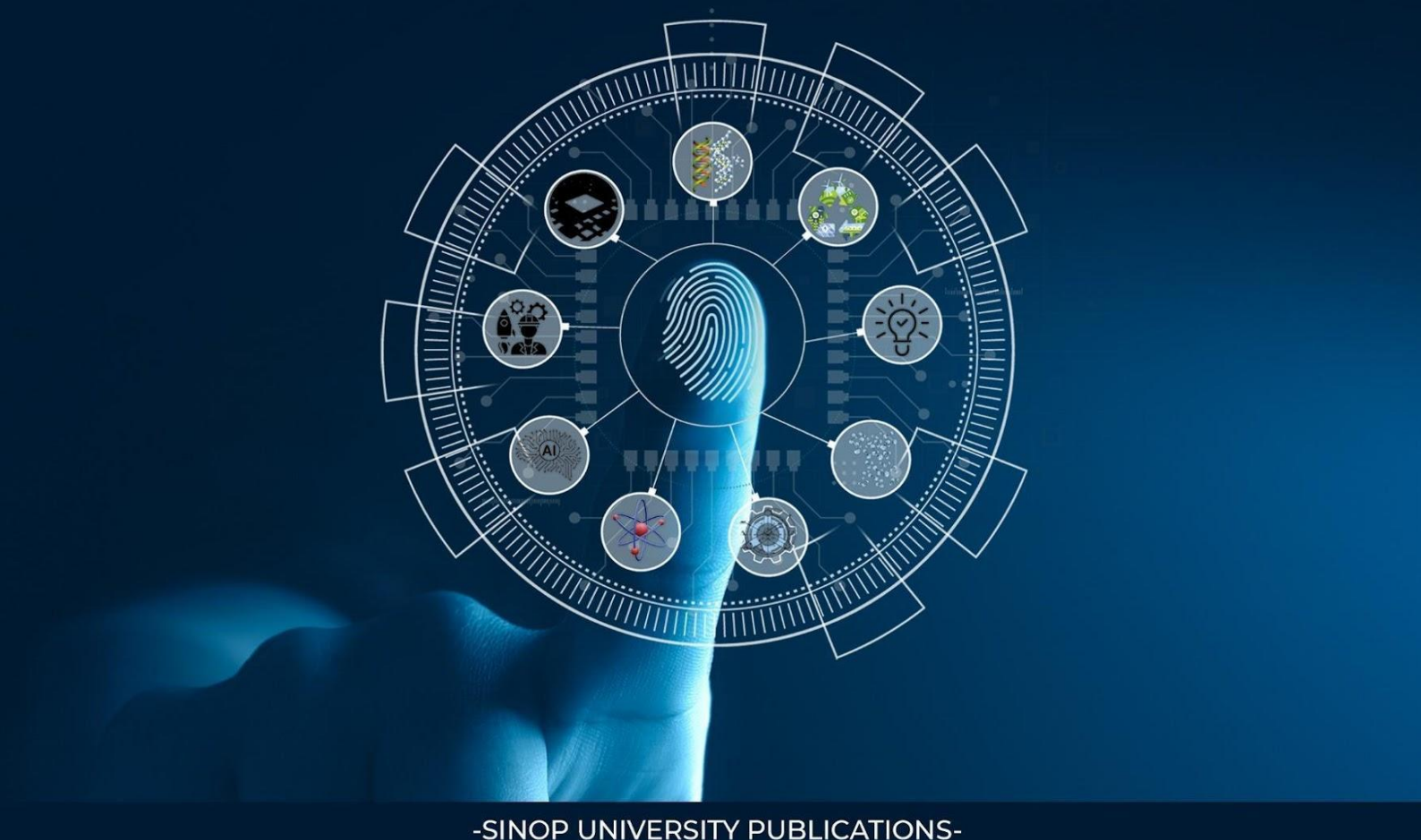
FACULTY OF ENGINEERING AND ARCHITECTURE

ISEDIR2024

1ST INTERNATIONAL SYMPOSIUM ON ENGINEERING, DESIGN AND INNOVATIVE RESEARCH 2024

ABSTRACT BOOK



-SINOP UNIVERSITY PUBLICATIONS-

SİNOP UNIVERSITY

1st INTERNATIONAL SYMPOSIUM ON ENGINEERING, DESIGN AND INNOVATIVE RESEARCH

ABSTRACT BOOK

23-24 DECEMBER 2024 / SİNOP

This book is the 66th scientific publication of Sinop University

E-ISBN: 978-625-94958-6-6

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ABSTRACT BOOK

23-24 DECEMBER 2024 / SİNOP

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PREFACE

The 1st International Symposium on Engineering, Design, and Innovative Research (ISEDIR 2024) was held on December 23-24, 2024, organized by the Faculty of Engineering and Architecture at Sinop University. This symposium aimed to provide a platform for researchers, professionals, and students to exchange ideas, discuss challenges, and explore innovative solutions in various engineering and design fields.

During the symposium, a total of 62 oral presentations were delivered, covering a wide range of disciplines including Nuclear Energy Engineering, Environmental Engineering, Computer Engineering, Metallurgical and Materials Engineering, Mechanical Engineering, Aerospace Engineering, Civil Engineering and Architecture, Energy Systems Engineering, and Fisheries Engineering. The multidisciplinary nature of the symposium encouraged cross-disciplinary collaboration and fostered an environment of knowledge-sharing and innovation.

The abstracts of the presented papers were published in this "Abstract Book," ensuring the dissemination of the valuable findings and insights shared during the symposium. Furthermore, participants have the opportunity to publish their full papers in peer-reviewed journals affiliated with Sinop University, providing a broader platform for their research contributions.

We would like to express our sincere gratitude to all authors, reviewers, session chairs, participants, and organizing committee members whose dedication and efforts have made ISEDIR 2024 a memorable and impactful event. Their contributions have been pivotal in fostering academic and professional growth through this symposium.

Dr. Mustafa Can CANOĞLU
December 2024

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Artificial Reef Applications and Legal Regulations in Türkiye

İlyas Demir BİLGİLİ[1*] and Sabri BİLGİN[1]

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Abstract

Artificial reefs (ARs) are structures intentionally placed in predetermined locations by humans to provide new habitats for aquatic organisms or to protect existing habitats, thereby increasing biodiversity and population in the area. These structures are also designed to prevent coastal erosion and to enhance tourism in the region. They are created using various materials, including concrete blocks, decommissioned ships, natural stones, rubble, or specially designed structures. These materials provide suitable surfaces for marine organisms. In the application and planning of ARs, factors such as site selection and suitability (considering wave and wind conditions), substrate suitability (mud, sand, partially rocky, etc.), material selection and appropriateness (concrete, old ships, airplanes, etc.), anthropogenic impacts, global climate change and its effects, changes in water parameters, and shifts in species diversity must all be taken into account for the effective implementation of AR projects.In Türkiye, ARs are regulated under Article 7 of the Fisheries Law No. 1380 and Article 7 of the Fisheries Regulation, which subjects artificial reef applications to licensing as outlined in Article 50/9 of the Regulation on the Organization of Commercial Fisheries. Additionally, the Ministry of Agriculture and Forestry prepared a National AR Master Plan in 2008, and in 2024, a Scientific and Technical Advisory Board was established. The first permit for AR applications in Türkiye was granted by the Ministry of Agriculture and Forestry in 1989, and by 2024, a total of 79 permits for AR applications had been issued across 21 provinces. The General Directorate of Fisheries and Aquatic Products conducted the "First AR Workshop" on December 18-19, 2018, at the Mediterranean Fisheries Research, Production, and Training Institute, resulting in the decision to develop an AR Action Plan. Subsequently, taking into account various adverse factors related to AR applications, the General Directorate of Fisheries and Aquatic Products prepared the "AR Project Disposition" in 2022 to ensure that the AR applications are conducted in a correct and planned manner.
This study evaluates the artificial reef applications in Türkiye, the legal framework governing ARs, and the existing AR projects in Sinop. It also discusses the parameters that should be considered in the planning and implementation of an AR projects.

Keywords: Artificial Reefs, Biodiversity, Fisheries, Black Sea

E-ISBN: 978-625-94958-6-6 December 23-24, 2024, Sinop, TÜRKİYE

Environmental Impacts of Biomass Resources

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Abstract

Biomass resources, which are derived from organic materials, are an important renewable energy source used in energy production. These sources include organic materials such as agricultural waste, wood and animal waste. The use of biomass as an energy source can help reduce these wastes and prevent environmental pollution and reduce pressure on landfills. It also has the potential to reduce greenhouse gas emissions by replacing fossil fuels. Since plants absorb carbon from the atmosphere through the process of photosynthesis, the carbon dioxide released when burned is balanced with the carbon needed for plant growth. Therefore, biomass can be considered a carbon-neutral energy source. However, the use of large areas of land for biomass production can lead to the destruction of natural habitats and the decrease in biodiversity. In addition, pressure on water resources and the risk of air pollution are also important problems. The use of agricultural land for biomass production can also endanger food security. There is a risk of air pollution during the installation and operation of biomass energy plants. This can have negative effects on human health. The benefits of using biomass resources are related to your capacity to properly manage environmental impacts. In this study, which was conducted as a review, what biomass resources are, were classified and their areas of use were mentioned. The potential environmental impacts of biomass use for energy production are highlighted and compared with traditional fuels. According to the review, when sustainable energy production methods are used, biomass energy production has a reducing effect on fossil fuel dependency. Dependency on imports of fossil fuels causes energy prices to fluctuate and is open to geopolitical risks. The use of biomass resources reduces fossil fuel dependency and can make energy supply more sustainable. It has been determined that lower emission levels are achieved with the use of biomass compared to fossil fuels. Moreover, considering that biomass is vegetal and therefore draws carbon dioxide from the atmosphere, the total emission in the whole process is evaluated to be significantly less compared to fossil fuels. It has been concluded that it is important to consider environmental impacts in energy production and to adopt a balanced approach.

Keywords: Biomass, Emissions, Environmental Impacts, Renewable Energy Sources

Evaluation of Performance Tests of Hard Coatings Applied on Acrylic and Polycarbonate Materials

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Abstract

Acrylic and polycarbonate materials are widely used in the aviation and defence industries due to their transparency, lightness and durability. This study aims to improve the mechanical and optical properties of these materials by strengthening them with hard coatings. Hard coatings have proven their potential to extend the life of materials by providing additional protection against abrasion, scratching, UV radiation and temperature changes. The samples were tested with and without hard coatings. They were subjected to abrasion, light transmittance, temperature variations and salt fog. As a result of the abrasion tests, it was observed that hard coating increased the surface strength of both materials and caused minimal changes in their optical properties. Uncoated specimens were more sensitive to environmental factors and showed signs of faster deterioration. In addition, in salt fog and hydrophobic characteristics tests, hard coated specimens showed higher resistance to environmental conditions. In conclusion, hard coatings applied to both acrylic and polycarbonate materials offer suitable solutions for long-term use by increasing the durability of these materials. These results show that hard coatings are an effective protection method, especially in harsh environmental conditions such as aviation.

Keywords: Acrylic, Polycarbonate, Hard Coating, Aerospace Transparencies, Environmental Tests

Campus Wastewater Treatment Plant Current Status Analysis and Evaluation of Effluent Quality

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Abstract

Wastewater management and water quality monitoring have a critical role in protecting water resources in sustainable development. Treatment of used water before discharge and monitoring and evaluation of various parameters of the outlet water after treatment are important approaches in environmental protection. Wastewater treatment plant (WTP) effluents that are not regularly monitored can lead to pollution of aquatic ecosystems through treated wastewater. The performance of the treatment plant is very important in terms of discharging the treated wastewater into the aquatic environment in accordance with the limit values specified in the relevant regulation. Therefore, the wastewater to be discharged must be analyzed and the water quality must be monitored regularly. In our country, according to the "Domestic Wastewater Discharge Standards" specified in Table 21 of the Water Pollution Control Regulation, the use of parameters such as chemical oxygen demand (COD) and biological oxygen demand (BOD), suspended solids (SS) and pH has become a standard method for monitoring the quality of wastewater. The current WTP is monitored in terms of water quality by taking samples from the wastewater at regular intervals. WTP units consist of three main parts: a grid, a balancing and a biological reactor. Additionally, the facility has additional units such as a chlorination unit and an adsorption column. After chlorination, the treated water coming out of the biological treatment unit is transferred back to the sand/active carbon adsorption column and taken to the clean water tank and made ready for discharge. In this study, the performance of a campus WTP was evaluated, and the monitored water quality parameters and values were presented. The reuse areas and criteria of treated wastewater were evaluated.

Keywords: Campus Wastewater, Wastewater Treatment Plant, Reuse

Black Sea Pollution: Ecosystem-Based Engineering Solutions

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Abstract

The Black Sea Basin is a region of strategic and ecological significance, encompassing numerous countries and diverse geographic areas due to its vast scope and extent. Located at the convergence of Europe, Asia, and the Middle East, this basin includes rivers flowing into the Black Sea and the extensive lands these rivers traverse. As one of the world's largest enclosed seas, the Black Sea is nourished by contributions from many countries across the basin. Consequently, the Black Sea Basin is intricately connected not only with the sea itself but also with the ecosystems of the regions traversed by these rivers. Although the Black Sea Basin harbors a highly dynamic ecosystem, it is also under the pressure of environmental degradation and pollution caused by agricultural, industrial, and urban activities. In this context, engineering solutions addressing Black Sea pollution emphasize the conservation and sustainability of the marine ecosystem, focusing on strategic and technological approaches such as pollution source control, water quality improvement, and ecosystem restoration.

Keywords: Black Sea Basin, Ecosystem, Pollution, Sustainability, Engineering Solutions

Genetic Modifications on Plant Cell Wall Structure for Bioethanol Production

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Abstract

Especially with the industrial developments in the last few centuries, environmental pollution has increased significantly. As a result of this pollution, an increase in environmental problems and human health problems has been inevitable. Factors such as diminishing fossil fuel resources, increasing environmental pollution and unexpected price fluctuations have increased the need for biofuels. Bioethanol is an important type of biofuel, and applications for the production and use of bioethanol in transportation vehicles have been ongoing for years. Indeed, the use of bioethanol in transportation vehicles has been determined to reduce the amount of CO_2 emissions. However, the so-called "first generation bioethanol" -bioethanol produced from crops that are directly available for human consumption, such as barley, corn, potatoes, sugar beet, sugar cane, wheat, etc.- has also raised some controversial issues, such as the potential to increase food and animal feed prices. Many of the problems associated with first-generation bioethanol can be overcome by producing bioethanol from lignocellulosic plant biomass that is not directly consumed by humans or is non-food (second generation bioethanol). Plant biomass, consisting predominantly of plant cell walls, has a high feedstock potential for second generation bioethanol. However, for bioethanol production from plant cell wall, it is crucial to hydrolyze this structure to release fermentable sugars, and one of the biggest handicaps is that the plant cell wall is naturally resistant to hydrolysis. In order to break this resistance, some expensive pre-treatments are required and some of the fermentable sugars are lost during these pre-treatments. There are many scientific applications that all these disadvantages can be overcome by genetic modifications on the plant cell wall. The aim of this study is to introduce these genetic modifications and strategies for facilitating hydrolysis and bioethanol production.

Keywords: Bioethanol, Plant Cell Wall, Genetic Modifications

Sources and Effects of Microplastics Reaching Surface Waters

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Abstract

Plastic waste management is inadequate in different areas of the world. In this framework, small debris (microplastics), formed due to the degradation of the structural forms of large plastics used in different fields, attract global attention as they reach the aquatic ecosystem through various sources. In this study, it was aimed to determine the sources and effects of microplastics reaching surface waters. By size, microplastics originate from washing clothes (12-16 μm), plastic materials (2-5 mm), vehicle tires (>0.01 mm), artificial turf (10-200 μm), fishing gear (2-5 mm) and building paints (0.5-6 mm). Its composition includes polyester, nylon, polyurethane (PU), polyethylene (PE), polyethylene terephthalate (PET), polystyrene (PS), polypropylene (PP), polyvinyl chloride (PVC), acryl-monomer (AM), and polyamide (PA). Microplastics typically reach surface waters through the use of cosmetic products, synthetic clothing, cleaning products, via domestic wastewater, and industrial discharges, either directly or after wastewater treatment systems. Conventional wastewater treatment systems are not designed to remove microplastics. Therefore, it is inevitable that a small amount of microplastics will reach the receiving environment due to the discharge of wastewater treatment plant effluent into the receiving environment. Microplastics can also be transported from land to the aquatic environment due to adverse weather conditions. Small or debris microplastics can be suspended at the water surface, while large or heavy debris accumulates at the bottom of the aquatic ecosystem. Suspended particles are carried by the water current and cause point accumulation of microplastics in specific areas, increasing ecological risks. In addition, some of the microplastics suspended in water are ingested by aquatic organisms. As a result of its negative impact on water organisms and accumulating in the body of organisms, it is introduced into the food chain. Microplastics accumulated in the bottom are deposited in the sediments. In conclusion, microplastics affect the aquatic ecosystem globally, depending on their size and shape, with different sources and composition.

Keywords: Surface Waters, Microplastic Sources, Microplastic Impacts

Monitoring of Sea Level Change with GNSS-IR Technique: A Case Study at the Co-located SNOP GNSS Station, Türkiye

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Abstract

Sea level change is an important parameter in climate scenarios, and it occurs at different rates in different regions. It is known that the rising sea levels have significant environmental, economic, and social impacts, particularly in coastal areas. Therefore, determining the changes in sea level at a regional scale is extremely important. Obtaining sea level observations through tide gauge stations is a traditional method. However, it is known that the tide gauge measurements conducted this way do not only include sea level observations but are also affected by vertical land motion. As a result, uncertainties arise in sea level observations. Global Navigation Satellite System (GNSS) signals possess certain distinctive features that can be utilized for remote sensing applications. Global Navigation Satellite System Interferometric Reflectometry (GNSS-IR) enables the determination of sea level using reflected signals. Therefore, it is considered as an alternative technique to conventional tide gauge measurements. Recently, there has been a growing interest in this innovative use of GNSS signals due to their numerous potential applications. In this study, the monitoring of sea level changes was conducted using the GNSS-IR technique at co-located SNOP GNSS station, and the results were compared with conventional tide gauge observations. Consequently, GNSS-IR-based sea level and tide gauge observations show a high correlation by 0.90.

Keywords: Sea Level, GNSS Interferometric Reflectometry, Tide Gauge

Optimum Chimney Analysis to Support Energy Performance in Residential Buildings

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Abstract

The design of buildings to improve their energy performance is influenced by the properties of the materials used in building planning as well as data such as building orientation, the climate of the region where the building is located, and the meteorological effects it is exposed to. Interventions to reduce the amount of energy used in buildings are another way to design a more energy efficient building. Today, for this purpose, it is possible to control the energy consumption of the building by using equipment and devices that work more efficiently in terms of energy consumption in the building, by providing lighting of the building with more efficient lighting systems, by controlling and monitoring the energy outputs consumed, and by making many constructive improvements and arrangements in the systems with timely interventions. Researches in many different directions have gained popularity in recent years in order to plan buildings and make more effective designs by using software produced on this subject. In this research, the chimney system with two different chimney cross-sections as circular and oval for a guest house in Samsun province, which contains a 100 000 kcal/h natural gas heating boiler, has been designed with different modelling for the building using four different materials [stainless steel, cast steel, steel coated with refractory aluminium (welded), flex steel pipe]. With the help of KesaAladin simulation software, the models created with different material combinations and different forms are comparatively evaluated in the light of software-assisted analyses to evaluate the energy consumption and environmental performance of the guest house. The results of the study are intended to guide decision makers in the building sector in the investigated region.

Keywords: Chimney System, Energy Performance, Energy Saving in Buildings, Environmental Pollution, KesaAladin Software

Energy Efficient Chimney System Analysis in Buildings

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Abstract

Today, harmful gases released into the environment during the use of energy obtained from fossil resources threaten society and ecology. For this reason, researches are continuing worldwide to reduce the use of fuels obtained from fossil resources. In recent years, according to the results of software-supported studies, the planning of systems with the help of evaluations made at early stages is used in many areas. Especially in the building sector where energy is consumed intensively, simulation-supported analyses are important in designing more energy efficient buildings to increase energy efficiency.

In this research, a library building was designed in Rize province. The heating system of the building is planned with a solid fuel (coal) boiler system with a capacity of 100 000 kcal/h. The chimney system connected to the boiler system was modelled in rectangular and square form with four different chimney materials [chamotte form stones, varnished ceramic, ceramic with varnished inside and concrete form stones]. Alternative scenarios were determined by considering the chimney system designed by taking into account the materials compatible with the climatic conditions of Rize province and considering two chimney forms. Among the alternative scenarios, the most favourable combination of flue material and flue cross-sectional form was tried to be determined in order to support the energy efficiency of the library building. It is aimed that the results of the research can be evaluated in terms of energy efficiency in buildings to be constructed in Rize province and to be a sample study.

Keywords: Energy Efficient Building, Energy Efficiency, Environmental Pollution, Chimney System, KesaAladin Software

Advanced Techniques for Jointing Closed-Cell Aluminum Foams

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Abstract

Closed-cell aluminum foams are lightweight materials with excellent energy absorption properties, making them highly suitable for structural, aerospace, defense, and automotive applications. In this study, aluminum foam samples were joined using the torch brazing method with AlSi12 flux-cored filler wire. Material analysis revealed that the foam's chemical composition is highly compatible with 6xxx-series aluminum alloys. Tensile tests conducted at TÜBİTAK laboratories showed no failure at the joint regions, demonstrating the effectiveness of torch brazing in preserving the mechanical performance of aluminum foams. Future studies will include comparisons with laser welding techniques and additional mechanical tests, such as bending and shear tests, to evaluate the performance of different joining methods.

Keywords: Closed-Cell Aluminum Foam, Torch Brazing, AlSi12 Filler Wire, Tensile Test

Design and Production of High-Durability SF6 Gas Insulated Circuit Breaker for Insulation Class up to 36 kV

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Abstract

High-voltage circuit breakers are the most important switching elements in electricity transmission and distribution networks. They not only switch under normal operating conditions but also serve to protect the network by opening within the desired timeframe in case of faults. In our country, the distribution infrastructure is not of the desired quality. Furthermore, the electricity distribution infrastructure in the Southeastern Anatolia Region, where our company operates, is in worse condition compared to the rest of Turkey. As a result, faults occur above standard levels, leading to excessive stress on the circuit breakers and shortening their lifespan. The project aims to design and manufacture high-durability SF6 gas circuit breakers. SF6 gas circuit breakers are highly preferred due to their ability to extinguish arcs quickly and effectively during opening and closing, as well as their operational ease and compact size. The design focuses on reducing components in the switching mechanism that could potentially cause faults and increasing the switching durability of the breaker. Thus, it is planned to produce a circuit breaker with a durability higher than that prescribed by standards. To achieve this, a design and production of an SF6 gas circuit breaker that can operate at voltage levels up to 36 kV and meets standards has been undertaken. The project has established a new production platform for operational purposes. The design of the circuit breaker was carried out internally, with additional measures taken compared to similar products to ensure high durability.

Keywords: SF6 Gas Breakers, High Voltage, Circuit Breaker Design, Switching Mechanism

Evaluation of Job Satisfaction Levels of Civil Aircraft Maintenance Personnel

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Abstract

The aim of the research is to examine the job satisfaction levels of civil aircraft maintenance personnel according to different variables. Within the scope of the research, the effects of demographic and occupational variables of civil aircraft maintenance personnel on job satisfaction were examined. The universe of the research consists of civil aircraft maintenance personnel working in different civil aviation companies. The sample of the research was made up of 278 civil aircraft maintenance personnel who were reached online and agreed to participate in the study. The data obtained from the participants were analyzed using the Minnesota Job Satisfaction Questionnaire (MSQ), which was developed by Weiss and his friends in 1967 and translated into Turkish by Baycan in 1985, and was approved by the Kocaeli University Science and Engineering Sciences Ethics Committee's decision dated 31/10/2024 and numbered 2024/13 and numbered E-20189260-100-675926, and the intrinsic satisfaction, extrinsic satisfaction and general satisfaction dimensions of job satisfaction were evaluated. According to the results of the research, it was found that the job satisfaction level of civil aircraft maintenance personnel who work shifts and have a civil aircraft maintenance license is higher. This study emphasizes that job satisfaction is an important factor in the civil aviation sector and that the quality of care can be improved by understanding the demographic and occupational variables that affect job satisfaction. The research results provide recommendations for the development of management practices and personnel policies in a way that supports job satisfaction.

Keywords: Civil Aviation, Civil Aircraft Maintenance, Civil Aircraft Maintenance Personnel, Job Satisfaction

Development of Premium Segment Wafer with High Pistachio Content: The Damak Ala Project

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Abstract

In the coated wafer market, cream fillings are typically placed between 3 to 6 wafer layers, and this combination is coated with chocolate. However, the amount of nuts used in fillings and outer coatings in existing products is limited, failing to fully meet consumer expectations for rich-content products. The Damak Ala project was initiated to address this need by developing a wafer product with high pistachio content, positioned in the premium segment.

Within the scope of the project, a cream filling containing a high percentage of pistachio puree was developed, and the outer coating was designed using milk chocolate combined with crushed pistachios and 25% pistachio content was achieved in the final product. The raw materials, process parameters, and production methodologies were optimized, and industrial production trials were successfully conducted. The trials demonstrated that the cream filling achieved a viscosity of 4.78 Pa.s and a particle size of 26 μm during production trials. Sensory tests confirmed the success of its texture, color, and flavor. The cream was applied to wafer layers and processed through a cooling system (20°C for 35 minutes) to achieve the desired final texture. Additionally, milk chocolate coating and pistachio particle application processes were validated, ensuring consistency with design specifications.

Shelf-life evaluations over 12 months under reference (18–20°C) and ambient (22–26°C) storage conditions revealed no deterioration in taste, texture, or stability. Accelerated shelf-life testing at 26°C also showed no issues such as oxidation, bitterness, or oil migration. The pistachio particles maintained their texture and aroma, and the cream's color stability was preserved. Furthermore, microbiological analyses remained well within standard limits, confirming the product's safety and quality throughout its shelf life. Consumer tests indicated high satisfaction with the product's content and flavor profile. Damak Ala received the highest scores in all evaluation categories and was identified as a product exceeding consumer expectations in the premium segment.

Keywords: Premium Wafer, Pistachio, Product Development, Consumer Satisfaction

Development of a Bridge Device for the Integration of KNX and Matter Protocols

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Abstract

The primary aim of this project is to develop a bridge device that enables the integration of KNX and Matter protocols. Matter is a widely adopted new standard for smart home and Internet of Things (IoT) devices, ensuring interoperability between devices. KNX, on the other hand, is a protocol used for automation in buildings, managing systems like energy management, climate control, security, and lighting. This project seeks to make KNX devices compatible with Matter, facilitating interaction among devices from different platforms.
The proposed bridge device will enable the integration of KNX devices with smart home platforms such as Apple HomeKit, Google Home, Amazon Alexa, and Samsung SmartThings via the Matter protocol. This will allow users to control various systems through a single application, thereby increasing the flexibility of KNX systems and enhancing energy efficiency. Another significant benefit of this project is that the integration of KNX and Matter protocols will enable remote monitoring and management of devices.
The project includes the development of hardware and software for a bridge device that supports both KNX and Matter protocols. The scope involves making KNX accessories compatible with the Matter protocol and developing a device that enables control and monitoring through Matter. This device will provide users the flexibility to use wired (KNX) and wireless (Matter) devices simultaneously.

Keywords: KNX, Matter, Smart Home, IoT, Automation Systems

Determination of Meteorological and Hydrological Drought Trends Using Simultaneously Observed Precipitation and Runoff Series: Konya Closed Basin-Karaman Ayrancı Akcasehir Sub-Basin Application

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Abstract

Using simultaneous observation series in studies where drought types are evaluated together can provide essential information for determining the interaction and relationship of drought types. In this context, The aim of this study conducted in the Karaman-Ayrancı-Akçaşehir sub-basin of the Konya Closed Basin was to determine the trends of meteorological and hydrological drought using different methods. The study used monthly total precipitation series from the Karaman meteorological station and monthly average runoff series from the Seyithasan streamflow gauging stations, which were simultaneously observed over the long term (1985-2022). Standardized Precipitation Index (SPI) and Streamflow Drought Index (SDI) values of precipitation and runoff series were calculated for 3 (3_1, 3_2, 3_3, 3_4), 6 (6_1, 6_2) and 12-month time scales. Mann-Kendall (MK), Sen Slope (SS) and Innovative Trend Analysis-ITA methods were applied to the SPI and SDI series obtained in the specified periods to determine the trends of the time series. When meteorological and hydrological droughts were considered separately, no difference was found between the methods in determining the trend direction. Except for the increasing trend in the SPI_32 period (MK=2.3), no significant trend was detected in the trends of SPI and SDI series. For the two drought types and 7 different periods analysed, predominantly non-significant decreasing trends were found. While the SPI and SDI trends showed a direct proportional adjustment in the decreasing direction in periods 3_1 and 3_4, an inverse relationship was observed between the other periods where the trends were not significant. Consequently, it was found that the choice of time scale and the ability of the rainfall station to represent the drainage basin is very important due to the rainfall-runoff delay in studies where SPI and SDI drought categories are evaluated together. Similar studies are recommended to be carried out in catchments with a sufficient density of rainfall observation stations representing the catchment in the drainage basin where surface runoff observations are made.

Keywords: Drainage Basin, Observation Network Density, Time Scale

The Effect of Silica Usage on Adhesive Properties in Steel Coating Compounds

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Abstract

Silica and silane reactions are widely used to improve tire tread performance by forming strong bonds between rubber and silica. These bonds improve wet grip and reduce rolling resistance, contributing to safer driving, particularly on wet surfaces, and improving fuel efficiency. Such improvements are particularly advantageous for heavy vehicles and driving in rainy conditions. Additionally, silica increases surface energy in tire compounds, which strengthens adhesion between rubber and steel cords. Strong adhesion to steel cords extends tire lifespan, especially in heavy-load applications.

In this study, the effects of increasing silica content (from 0 to 60 phr) on the adhesion performance of steel cords coating compounds were investigated. The goal was to assess how varying silica content impacts the material's mechanical, adhesive, and dynamic properties.

Results showed that higher silica content significantly improved adhesion performance after aging, reducing adhesion loss from around 20% to as low as 2% in some cases. This indicates that silica enhances aging resistance in coatings, helping to preserve adhesion over time.

However, increasing silica beyond 20 phr can negatively affect mechanical properties such as hardness, tensile strength, and elasticity, potentially compromising impact resistance and increasing deformation risks under heavy loads. At 60 phr, there is a risk of material breakdown, as high silica levels challenge material integrity. Therefore, maintaining an optimal silica content is crucial to balancing adhesion benefits with mechanical stability.

Keywords: Steel Cord, Adhesion Strength, Truck Tire

Improvement Curing Bladder For Industrial Tyres

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Abstract

In the tire manufacturing process, soft raw materials are heated and combined in different ways (filler, catalyst, etc.) to provide parts of the crosslinks. Since tire properties depend on both the crosslink density and the crosslink regions for the distribution of the best vulcanization values, great importance can be given to the use of optimum curing time, optimum temperature and optimum pressure.

In this study, it is shown how the vulcanization time in industrial tires is reduced by reducing the thickness of the curing bladder by 30%. As a result of the tests, the vulcanization time was reduced by 2 to 4 minutes depending on the tire size, material thickness, and material characterization. In this process, the temperature was kept constant and the vulcanization time was reduced.

As a summary of the study, as seen in the graph above, the difference in the time-temperature curve showed that with decreasing bladder thickness, heat transfer occurs faster and the optimum vulcanization equivalent time is reached in a shorter time. Time , efficiency and energy gains were achieved

Keywords: Vulcanization, Curing Bladder, Tire, Thickness, Time and Temperature

Evaluation of Complaints About Gaming Computers Using Web and Text Mining Methods

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Abstract

Technological devices have become an indispensable part of our day. Gaming computers, which stand out with their high performance, are highly preferred by users. However, during the use of these devices, various problems may occur both regarding the product and the services provided.

In this study, user complaints about gaming computers were examined using web and text mining methods. In the research, user complaints collected from various web pages were used as data. Data were collected between November 30, 2021, and December 30, 2024. The data obtained were evaluated in detail through RapidMiner, a popular data mining software. Within the scope of the study, a total of 9,194 words were identified from 250 different web pages, but words that did not carry any meaning or were not directly related to the complaints were removed from the analysis.

The analysis results revealed that complaints about gaming computers generally fall under two main headings. Product-related problems were among the most frequently voiced complaints by users. Among these issues, screen problems (mentioned 1,200 times), charging problems (525 times), fan performance (380 times), freezing problems (355 times), audio complaints (350 times), and battery problems (210 times) stand out. On the other hand, service-related problems were also frequently emphasized in user complaints. Service (mentioned 855 times), product replacement (355 times), lack of technical support (265 times), lack of warranty coverage (250 times), and delivery problems (128 times) are the main service-related complaints.

The study analyzes the most common problems faced by users regarding gaming computers in detail, shedding light on the deficiencies in this field. Since such studies using web and text mining methods are limited, it is thought that this research will make a significant contribution to both academic literature and the companies that produce gaming computers or provide services in this field.

Keywords: Web Mining, Text Mining, Gaming Computer, Complaint

Effects of Electromigration in Integrated Circuit Interconnects and Modeling of Median Time-to-Failure

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Abstract

In modern integrated circuits, the reliability of interconnect elements has become increasingly critical as devices scale down to nanoscale dimensions. One of the primary failure mechanisms affecting the reliability of these interconnects is electromigration, which involves the movement of metal atoms under the influence of electrical current. Over time, this phenomenon compromises the structural integrity of interconnects, leading to circuit failures.

This study models the median time to failure (MTTF) of interconnect elements by examining the processes of void and hillock formation caused by electromigration. A simulation-based approach has been employed to analyze the effects of surface diffusion and flux divergence. The model incorporates factors such as geometric curvature, material properties, and applied voltage to explore their impact on the gradient of chemical potential.

The simulation framework is built on a simplified 2D wire model with predefined surface defects to investigate the role of initial imperfections. The interactions between anisotropic diffusion and chemical potential gradients, as well as the local dynamics induced by surface curvature, are explicitly considered. Under the assumption that surface diffusion is the sole active mechanism, the study determines the surface normal velocities and examines the progression of void formation.

The findings of this research provide valuable insights for mitigating electromigration-induced failures in next-generation integrated circuits. This work aims to contribute to the development of more robust interconnect structures and reliable modeling approaches. Furthermore, it offers a practical platform for designing advanced materials and strategies to enhance the performance of nanoelectronic devices.

Keywords: Electromigration, Integrated Circuit Reliability, Interconnect Failure, Mean Time to Failure (MTTF), Surface Diffusion Modeling

Optimized Machine Learning for Risk Classification in Thyroid Cancer Patients

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Abstract

Thyroid cancer causes tens of thousands of deaths every year in the world. Treatment of this disease is possible with today's medical conditions. However, as in other types of cancer, there is a possibility of recurrence. In this study, a data set consisting of 383 patients followed for 15 years and including clinical and pathological features of thyroid cancer patients was used. Recurrence of thyroid cancer in patients was classified with machine learning algorithms SVM, Navive Bayes and Random Forest. By optimizing some parameters of the SVM algorithm, the classification success was increased to 90.33%. 88.50% classification accuracy was obtained with Naive Bayes and 86.94% with Random Forest. In this study, the SVM algorithm is a classical classification tool and higher performance levels were achieved with parameter optimization.

Keywords: Optimization, Machine Learning, Thyroid Cancer

Examination of Morphology of Combustion Chamber Deposits Formed in Gas Engine at Dilovası Facility

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Abstract

In landfill gas-to-energy (LFGtE) projects, the use of untreated landfill gas can lead to deposit formation on the inner surface of the combustion chamber of gas engines, primarily due to the accumulation of oxide nanoparticles formed as combustion by-products. In this study, the morphology of deposits on the combustion chamber components (piston head and cylinder head) of a gas engine operated at the Dilovası Facility was examined using Scanning Electron Microscopy (SEM) method. The SEM analysis revealed that the top and bottom surfaces of the deposits exhibit distinct morphological characteristics. The structural differences between these surfaces can be attributed to two factors: first, oxides with low melting points lose their shape and flatten upon impact with the hot surfaces of the combustion chamber, and second, oxides form irregular deposits by bonding with elements in the thin melted layer. Furthermore, the SEM images showed that particles smaller than 1 μm tend to agglomerate, forming larger particles with varying sizes, some of which exhibit cauliflower-like structures. The glassy structures observed in the deposits are thought to be related to nano-porous silica particles. Additionally, the internal cross-section of the deposit was also examined, and its thickness was measured. In this context, the entire internal cross-section surface of the deposit exhibited a compact structure. The deposits were found to have a uniform height, with approximately 540 μm of deposit forming on the piston head and 750 μm on the cylinder head. Based on these values, it can be stated that approximately 40% more deposits were formed on the cylinder head compared to the piston head during a single operating cycle of the engine.

Keywords: Landfill Gas, Engine Combustion, Deposit, Morphology

Investigation of Calcium in Deposits from Gas Engines Used in Energy Production from Landfill Gas

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Abstract

It is well known that deposits formed in the inner surface of the combustion chamber of gas engines utilizing landfill gas-to-energy projects predominantly contain oxide nanoparticles including silicon, calcium, and sulfur. The compounds responsible for the presence of silicon and sulfur in deposits are attributed to impurities in landfill gas, such as siloxanes, hydrogen sulfide, mercaptans, dimethylsulfide, dimethyl disulfide, and carbon disulfide. However, no data suggests that calcium in the deposits originates from landfill gas. Furthermore, previous studies have mainly indicated that the calcium found in deposits originates from the engine oil used in gas engines. In this context, the engine oil used for lubrication of the piston rings in the gas engine operated at the Odayeri Energy Production Facility was analyzed using an optical emission device to investigate the presence of calcium in the oil. The elemental analysis results of the engine oil revealed 1778 mg/kg calcium in the fresh oil and 2163 mg/kg calcium in the used oil. Based on these results, the engine oil used for the lubrication leaks into the combustion chamber to some extent, depending on the engine's operating principles, and oxidizes there, contributing to calcareous deposit formation. Additionally, some of the oxide nanoparticles formed in the engine's combustion chamber accumulate in the lubricating oil. It can be stated that the formation of anhydrite (CaSO4) crystal, as previously identified in the deposits, can be attributed to the engine oil. Thus, by modifying engine oils, it may be possible to minimize the calcium content of the deposits formed in the combustion chamber.

Keywords: Landfill Gas, Engine Oil, Deposit, Oxide Nanoparticles, Calcium

Environmental Effect of Battery Safety in Energy Storage Plant

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Abstract

The diversity of renewable energy sources is critical for both environmental sustainability and the energy security of countries. Within the scope of Türkiye's 12th Development Plan, which holds significant importance and provides guidance for achieving global targets, it is anticipated that renewable energy sources will surpass coal in electricity generation worldwide by 2025. However, due to the discrete nature of renewable energy, challenges arise in terms of grid flexibility. To address this issue, energy storage facilities are being established. These facilities store energy in batteries during periods of high production, ensuring a continuous supply to the grid. Nonetheless, mechanical impacts, overheating, and short circuits in batteries can lead to a phenomenon called thermal runaway. This issue often results in battery fires or explosions, which, in turn, release heavy metals, plastics, and organic chemicals into the environment. These pollutants pose significant threats to public health and contribute to soil, water, and air pollution. The literature offers various methods to ensure battery safety and address these challenges. One of the prominent solutions is the use of phase change composite materials to enhance the thermal safety of batteries. This approach mitigates the risk of fires and explosions, particularly in batteries used in energy storage systems. Consequently, the problem of thermal runaway is resolved, offering a critical solution to one of the most significant risks associated with battery usage in energy storage facilities. Furthermore, preventing thermal runaway also significantly reduces environmental pollution caused by batteries.

Keywords: Environmental Pollution, Energy Storage, Battery Safety, Thermal Runaway, Phase Change Materials

Effect of Laser Power Parameter on a Welded Galvanized Steel Beam

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Abstract

Today, complex geometries are needed to meet the demands of rapidly developing technology. Different welding methods are used to obtain these different and high-precision geometric features. Laser welding method is one of these types of welding methods and the most effective. The laser power parameter plays an active role on the material joining surface and causes serious changes in its physical properties. The effect of laser power parameter on the mechanical performance of the structural element is still an active field of study.

This study basically consists of 4 stages: (i) Galvanized steel beams will be grouped with four different laser power parameters (1000, 1200, 1300, 1400 and 1500 W), (ii) Modulus of Elasticity values of the each group are obtained experimentally by using modal analysis method. (iii) A numerical model is completed according to the experimental findings. (iv) Mechanical characteristics for a cantilever beam, i.e., deflection, elastic strain energy and maximum shear strength values, are computed via general purpose finite element code Ansys 2024 R2.

Results show that (i) laser power of 1200 W is suitable value high-precision geometric features, (ii) for the suitable laser power of 1200 W, linear shear stress distribution is acceptable according to Euler-Bernoulli beam theory.

Keywords: Laser Welding Power, Galvanized Steel, Modal Analysis, Finite Element, Stress Analysis

A Review of Modern and Conventional Treatment of Textile Wastewater and Water Recovery Processes

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Abstract

Proper disposal of wastewater by industries is one of the biggest challenges affecting the entire world. Wastewater containing dyes is a major environmental pollutant that also affects human health, as textile industries produce large amounts of highly colored wastewater containing various persistent pollutants. Humans and other mammals can be exposed to dyes in industrial wastes either orally or through direct skin contact. The intestinal microflora in the human intestine converts dyes into toxic amino acids that have adverse effects on various tissues in the human body. Bacteria cultured from human skin were able to degrade azo dyes and produce carcinogenic amines. Due to the large amount of wastewater, appropriate and effective management techniques are necessary to prevent pollution of ecosystems and increase sustainability.

Keywords: Textile Wastewater, Conventional Treatment Processes, Modern Treatment Processes

Catalytic Processes in Volatile Organic Compound Removal

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Abstract

Volatile Organic Compounds (VOC) are considered by the World Health Organization (WHO) as substances that endanger public health. This situation necessitates VOC removal, which has low boiling points due to high vapor pressures, is mostly carried out in the gas phase. Although adsorption is the most economical removal process for low VOC concentration, it is seen that the adsorption process cannot provide high removal efficiency when a facility using VOCs in the production chain is considered. Therefore, it is essential to develop a process that can provide high removal efficiency. At this stage, catalytic oxidation processes come into play. Catalytic oxidation is an oxygen combustion process in which a catalyst is used to reduce the activation energy of the oxidation process, and the fundamental parameter that affect the performance of the process are the catalysts used. Catalysts used for this purpose over the years; investigated and developed for catalyst activity, reusability and lifetime of the catalyst, usage and production costs, and most importantly, final oxidation products. While noble metal catalysts provide high removal efficiency and high CO_2 conversion at low temperatures, they should be upgraded due to their high costs. In this case, transition metal oxides became popular. These catalysts, which provide high removal efficiency and high CO_2 conversion, require much higher temperatures compared to noble metals. Bimetallic and even trimetallic systems are used to reduce the operating temperature by increasing the performance of transition metal oxide catalysts. It has been determined that transition metal oxide catalysts provide high oxidation efficiency at lower temperatures with the synergistic effect of more than one metal oxide.

Keywords: Volatile Organic Compound, Catalytic Oxidation, Polymetalic Catalyst Applications

Conjugate Heat Transfer in Thick-Walled Pipes with a Periodically Varying Outer Surface Temperature Boundary Condition

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Abstract

The transient conjugate heat transfer problem for thick-walled pipes under laminar flow conditions has been numerically solved. The finite difference numerical method was employed in the developed mathematical model. In a two-region tube, the upstream region is fully insulated, and the flow is hydrodynamically developed at an initially uniform temperature. In the downstream region, a periodically varying external boundary temperature condition over time is imposed. The problem was analysed considering two-dimensional wall conduction and axial fluid conduction. This study investigates the effects of parameters such as angular frequency, Biot number, Peclet number, wall thickness ratio, wall-to-fluid thermal conductivity coefficient ratio, and wall-to-fluid thermal diffusivity ratio on heat transfer characteristics. A software code was developed in the Delphi programming language to perform the numerical solution. The results revealed significant heat transfer toward the upstream region due to both wall and fluid axial conduction. It was observed that the transferred heat increased with higher angular frequency. It was concluded that variations in parametric values, such as Peclet number, Biot number, and wall thickness ratio, have substantial impacts on the heat transfer characteristics. The heat transfer characteristics were observed to vary periodically over time, resembling and being influenced by the periodic temperature change on the outer surface of the wall. The results are significantly influenced by parameter values and angular frequency.

Keywords: Periodically Varying Boundary Condition, Transient Conjugate Heat Transfer, Axial Fluid Conduction, Thick-Walled Tubes, Finite Difference Method.

Design Development and Finite Element Analysis of Heavy Coil Tilting Machine

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Abstract

The Safe transportation of steel coil sheets within a factory is a significant requirement for the machinery manufacturing sector. To facilitate this process, it is crucial to position coil sheets both horizontally and vertically as needed. In this study, the design and finite element analysis of a coil tilting machine, which can position heavy coil sheets either vertically or horizontally, with a hydraulic drive and a maximum load capacity of 10 tons, were carried out. Based on the industry's demand, design criteria were first established. Considering operational conditions and design constraints, a 3D model of the coil tilting machine was created. The operational structure of the system can be described as follows: initially, the coil sheet is placed horizontally on the machine using a forklift, and then the tilting process is performed using the hydraulic system. Once the coil reaches a vertical position, it can be lifted and removed with a C-hook. These steps can also be performed in reverse order. After the final structure of the system was developed, structural analysis was performed using the finite element method to examine potential deformations during the tilting process. Physical working conditions were referenced during the analysis. The results indicated that the maximum stress observed on the coil tilting machine was 125.5 MPa, while the maximum displacement value was 7.9 mm. These findings demonstrate that the coil tilting machine complies with the requirements of the Turkish Machinery Safety Regulation. Considering the operational conditions, it is concluded that a functional and safe solution has been achieved.

Keywords: Structural Analysis, Machine Design, Rotation Machine, Hydraulic Drive System

Conceptual Design of a Hard-Shell Rooftop Camping Tent

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Abstract

In this study, the conceptual design of Hard-Shell Rooftop Camping Tents (HSRCTs) was carried out to address the growing demands in the camping industry. HSRCTs offer an innovative solution for campers with features such as portability and durability. The study systematically addressed the conceptual stages of the design process. The fundamental steps of conceptual design included creating a list of requirements, preparing function diagrams, determining design variations, and selecting the most suitable option.

The list of requirements encompassed key features of HSRCTs, such as geometry, materials, vehicle fuel consumption, ergonomics, manufacturing, and assembly, classifying these requirements as either mandatory or optional. For example, features such as being lightweight and durable, easy to open and close, and suitable for four-season use shaped the design criteria. The function diagram identified sub-functions by associating user needs with product outcomes. During this process, criteria such as material selection, ease of production, and assembly methods were detailed.

Morphological charts were used to develop various material and assembly alternatives during the solution search. For instance, ABS material emerged as an ideal option due to its lightweight nature and cost advantages. Selection charts and evaluation tools were employed to conduct a preliminary assessment of the design alternatives. Based on these evaluations, the design variant utilizing ABS material, known for its lightweight, durable, and easy-to-manufacture characteristics, was determined to be the most suitable option.

This conceptual design phase established a robust foundation for the aerodynamic analysis of HSRCTs.

Keywords: Conceptual Design, Hard-Shell Rooftop Camping Tent, Industrial Design

Design Development and Finite Element Analysis of a Mobile Access Platform

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Abstract

Mobile access platforms are lifting systems designed to ensure personnel safety and enhance operational efficiency in professions that require working at heights. These systems can provide speed and flexibility, especially in areas such as painting, maintenance, cleaning, and warehouse operations, which require overhead access. In this study, the design development and finite element analysis of a mobile access platform were carried out. The main frame of the platform is designed to be movable and foldable, with stabilization legs that secure it in place during operation. The platform design includes a vertically movable section on the main frame and a horizontally movable suspension section attached to this part. Analyses were performed under maximum loading conditions. For the structural analysis, boundary conditions and material properties were defined based on the maximum total load to be supported by the system, excluding the cabin section of the platform. Based on the analysis results, the maximum stress on the platform was measured at 53.4 MPa, while the highest displacement observed in the structure was 15.8 mm at the sling section. Considering the working and loading conditions, the safety factor of the designed mobile lifting system was found to be 4.4, and it was concluded that the system offers a viable solution in terms of functionality.

Keywords: Lifting System, Mechanical Design, Finite Element Analysis, Mobile Access Platform

E-ISBN: 978-625-94958-6-6 December 23-24, 2024, Sinop, TÜRKİYE

Improvement of Aerodynamic Performance of the SAE Reference Vehicle Model: Dimpled Surface Modifications

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Abstract

In this study, the surface structure of a vehicle model similar to the SAE reference car model has been modified to reduce aerodynamic drag force. To investigate the vehicle's aerodynamic properities, dimples were created on surface, resulting instructure similar to the surface of a golf ball.

Detailed analyses were conducted using the ANSYS commercial software's Fluent program to examine the aerodynamic differences between the flat and dimpled surfaces of the vehicle model. The turbulence model used in the study is the k-ω SST (Shear Stress Transport) model, which more accurately models the complexity of the flow. Fluid motion and surface pressures on dimpled and flat vehicle surfaces have been investigated. It has been concluded that adding dimples to the surface improves the aerodynamics of a golf ball but does not enhance the aerodynamic performance of vehicles.

Keywords: Aerodynamic Drag, Dimples, Vehicle Aerodynamics, SAE Reference Car Model, Surface Modification

Performance Analysis of a Vehicle Bumper in Low-Speed Collisions: A Comparison of PP and ABS Materials

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Abstract

This study aims to develop material and design solutions to enhance vehicle safety and maintain structural integrity in low-speed collisions, aligning with the goals of the modern automotive industry. The performance of vehicle bumpers in low-speed impacts (4, 6, and 8 km/h) was evaluated in terms of energy absorption and deformation resistance. Two commonly used thermoplastic materials, Polypropylene (PP) and Acrylonitrile Butadiene Styrene (ABS), were compared.

Numerical simulations were conducted using LS-DYNA software to comprehensively analyze the energy absorption, deformation amount, stress distribution, and yield behavior of the materials after the collisions. The results revealed that ABS excels in high energy absorption capacity and durability, while PP offers advantages in terms of lightweight properties. Moreover, distinct mechanical behaviors of the materials at different impact speeds were observed. These findings emphasize the significance of selecting the right material and optimal bumper design for low-speed impacts.

Keywords: Impact Test, Polypropylene (PP), Acrylonitrile Butadiene Styrene (ABS), Energy Absorption, Deformation Resistance

Aerodynamic Analysis of a Formula 1 Car Using Various Turbulence Models in ANSYS Fluent

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Abstract

This study investigates the aerodynamic performance of a Formula car using ANSYS Fluent software to evaluate the impact of various turbulence models on the vehicle's aerodynamics. The turbulence models employed include $k-\epsilon$, $k-\omega$, $k-\omega$ SST. The analysis focuses on comparing the influence of these models on airflow behavior and proposes design modifications to enhance aerodynamic efficiency. Key aerodynamic parameters, such as drag coefficient, lift coefficient, and surface flow structures, were calculated and analyzed. The results reveal notable differences in performance among the turbulence models, offering insights into their suitability for Formula car design. This study provides a valuable foundation for engineering strategies aimed at optimizing the aerodynamic performance of Formula cars.

Keywords: $k-\omega$, $k-\epsilon$, $k-\omega$ SST, Drag Coefficient, Lift Coefficient

Multidisciplinary Approaches in Architecture

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Abstract

Architecture brings together many disciplines, establishes a balance between aesthetics and functionality, and organizes projects with various professional groups. On the one hand, while producing new spaces, on the other hand, it proposes innovative solutions to existing problems with a multidisciplinary approach. It is in constant communication with almost all branches of engineering such as civil, mechanical, electrical and electronic engineering. In addition, it works directly with disciplines such as sociology and psychology, which are in closer contact with society. In this case, such collaborations ensure that all spaces that are planned to be designed and put into operation are site-specific. Thus, architecture not only creates a tangible and visible physical space, but also makes it possible to address the social, cultural and environmental context of a space. Today, as environmental conditions change rapidly and frequently, sustainable architecture has come to the forefront, making it possible to design energy-efficient, environmentally friendly buildings by combining ecological knowledge with engineering methods. From a sociocultural perspective, neuroarchitecture utilizes neuroscience and psychology to create spaces that prioritize the user experience. Artificial intelligence, the most current topic of our age, is integrated into the design processes of architecture through certain parameters and data analytics in collaboration with software engineers in order to accelerate design processes. Such approaches will change the role of the architect in architecture and cause the change of course. In this context, interdisciplinary collaboration has become a fundamental requirement for contemporary architecture to evolve both creatively and responsibly.

Keywords: Architecture, Artificial Intelligence, Engineering, Multidisciplinary Approaches

A Review on Dual Fluid Reactor Concepts: Neutronic Analysis and Material Considerations

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Abstract

The Dual Fluid Reactor (DFR) is an innovative nuclear reactor that merges properties from Molten Salt Reactor and Lead Cooled Fast Reactor, having separate liquid cycles: one for liquid fuel and the other for lead coolant. Operating at approximately 1000°C and atmospheric pressure, the DFR is able to use molten chloride salts (DFR_s) and metallic fuels (DFR_m). Furthermore, the separate circuit of fuel and coolant enables design to have higher power density within a compact core volume while ensuring inherent safety through a negative temperature feedback coefficient. This study provides a comprehensive overview of both DFR concept, focusing on neutronic and material considerations. Both DFR concepts were evaluated, alongside their implications for reactor performance and safety. This study discusses core findings and potential research directions are discussed to advance the understanding and development of this promising reactor technology.

Keywords: DFR, Dual Fluid Reactor, MSR, Molten Salt Reactor, Neutronic Analysis

Utilization of Photovoltaic Systems for GSM Base Stations

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Abstract

The use of non-renewable resources in traditional energy production leads to environmental pollution and irreversible ecological damage. In contrast, renewable energy sources offer a sustainable and environmentally friendly alternative, playing a significant role in electricity generation. Among renewable energy sources, solar energy stands out due to its high potential and numerous advantages. In this study, the electricity demand of GSM base stations located in rural areas and the city center of Çorum province has been determined, and the potential electricity generation that could be achieved through photovoltaic (PV) systems has been analyzed. Especially in rural areas, the cost of extending power lines to base stations located far from the electrical grid is extremely high. This creates an economically unfeasible solution for mobile operators. The analyses clearly demonstrate the cost advantages of off-grid PV systems in rural areas. Off-grid systems provide a more economical option, and considering their payback periods, solar energy is projected to be more widely used in the future. This study highlights the importance of renewable energy utilization by demonstrating that solar energy can efficiently and sustainably meet the energy needs of GSM base stations in rural areas.

Keywords: Solar Energy, GSM Stations, Photovoltaic Panel

The Ethics and Security of Data in the Context of Artificial Intelligence: A Management Information Systems Perspective

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Abstract

The advent of Artificial Intelligence (AI) has the potential to radically alter the dynamics of the business world. It offers innovative solutions in critical areas such as decision-making, process optimization and data analytics, particularly within the context of Management Information Systems (MIS). The opportunities created by AI, along with the accompanying data security, privacy violations and ethical issues, are becoming increasingly complex. The extensive data processing capabilities of AI applications require a review of foundational concerns, including data ownership, algorithmic bias, transparency, and accountability.

This paper presents a comprehensive examination of the role of AI in data collection, processing and analysis within the context of MIS. In the first part of the study, the data processing procedures of AI systems are examined, with particular attention paid to the potential risks, particularly in the context of the utilization of personal and commercial data. In the context of data security, technical threats to data systems, such as cyber-attacks and data breaches, are discussed. The effects of bias and lack of transparency in algorithmic processes on system reliability are also considered.

Secondly, the impact of global regulations on the transformation of MIS applications is presented, such as the European Union's General Data Protection Regulation, California Consumer Privacy Act, Data Security Law of China and Personal Data Protection Law of Turkey.

Thirdly, ethical principles and security protocols proposed for AI-based MIS applications are emphasized. Basic approaches such as transparency, data minimization, user consent and algorithm control are detailed, and the applicability of these principles is supported with case studies. This paper emphasizes the need to prioritize data security and ethical principles while maintaining the innovative potential of AI in MIS. This study is expected to guide the development of sustainable AI strategies for AI-based MIS applications at both academic and applied levels.

Keywords: AI, MIS, AI-based Management Information Systems, Data Security, Ethics

Drought Assessment of Inebolu and Sinop Settlements with PNI

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Abstract

Drought is becoming an increasingly serious global problem due to the inadequacy of water resources and the effects of climate change. This situation causes great losses especially in agricultural areas, restricts access to water and threatens biodiversity by disrupting the balance of ecosystems. Drought is a disaster that affects millions of people by causing not only environmental but also economic and social crises. Therefore, it is of great importance to take effective measures and manage water resources sustainably. In this presented study, the drought status of Inebolu and Sinop, which are located on the coastline of the TR82 region and have sufficient observation length, was investigated. Drought analysis was carried out using the precipitation records for 1971-2023 and the Percentage of Normal Index (PNI). Among the years determined as drought for each settlement, it was determined that drought occurred for both settlements in 1981, 1986 and 2020.

Keywords: Drought, PNI, Sinop, Inebolu, TR82

Investigation of Conventional Processes in Boron Removal

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Abstract

As a result of many applications such as fertilizers, insecticides, corrosion inhibitors in antifreeze formulations for motor vehicles and other cooling systems, buffers in pharmaceutical and paint production, and the use of boron compounds as moderators in nuclear reactors, boron is found in wastewater in varying amounts and with a large number of compounds. Boron has potential negative effects and to prevent environmental impacts, it is imperative to carefully manage the use of boron, especially in industrial applications and waste disposal. Recognizing both the potential benefits and the need for responsible management is crucial to capitalizing on boron's positive aspects while minimizing negative consequences on human health and the environment. Boron removal has become very important after the limit concentration was recommended by the World Health Organization (WHO) in 1998. Although current technologies have been proposed and started to be used, a process that will surpass conventional methods in boron removal in both wastewater and seawater treatment has not been developed. Hybrid processes are being developed in order to increase the efficiency of conventional methods and benefit from their advantages. These hybrid processes often cannot go further than the 2-stage combination of conventional methods, but even with these methods it is possible to achieve over 90% removal efficiency.

Keywords: Boron Removal, Coagulation, Membrane Processes, Adsorption

Evaluation on Use of Biomaterials in Sustainable Building Production

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Abstract

The increasing demand for energy and the ecological challenges posed by industrialization and urbanization since the middle of the 20th century have underscored the importance of sustainability. In architecture, sustainable approaches have promoted the use of environmentally friendly materials, with biomaterials becoming an important option in the construction sector. Biomaterials are derived from natural resources, are biodegradable and environmentally friendly, ensuring both user health and structural sustainability. Their applications span various areas of the construction industry, including facades, wall panels, insulation, structural components, roofing and flooring. In addition to construction, biomaterials are also used in furniture, lighting, textiles and electronics. Biomaterials contribute to energy efficiency and reduce carbon emissions and waste. Although not always cost-effective, they often offer long-term economic benefits, depending on the type of material, production process and availability of local resources. Locally sourced biomaterials offer environmentally friendly alternatives, but custom-made or composite biomaterials can have higher costs. The integration of biomaterials with conventional materials is therefore crucial to advance sustainable building practices.

This study explores the relationship between biomaterials and sustainability, focusing on their properties, production methods and classifications. The study also evaluates their use in various construction processes, both as stand-alone materials and as composites, and highlights their ability to promote resource efficiency and environmentally sustainable designs. Biomaterials enable innovative solutions as they can be produced with low energy input, have a lower environmental impact and have the potential for hybrid applications with conventional materials. In conclusion, biomaterials represent a promising alternative for sustainable construction and harmonize modern architecture with ecological goals. Their versatile applications, combined with their ability to improve sustainability, make them an important factor in environmentally friendly and innovative architectural practice.

Keywords: Natural Construction Materials, Biomaterials, Sustainability, Sustainable Building Components

Product Recovery Techniques From Olive Oil Production Process Waste

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Abstract

Although olive oil production is a process that only involves the addition of olives and water, it is a process that causes waste production in solid and liquid phases. Due to environmental concerns, it is essential to evaluate these wastes in the light of both waste reduction strategies and product recovery strategies in the olive oil production process, as in all production processes. Pomace, which is the solid waste of the process, is a product that contains a very high amount of oil, but due to the different oil extraction techniques, the oil obtained cannot be considered as olive oil. Although this product has been used directly as animal feed for years, in recent years it has been processed with techniques that allow it to be used as both a valuable oil and energy source. The wastewater of the process is called olive mill water and contains high levels of phenolic compounds and volatile fatty acids. Due to its high organic content, it is not possible to discharge it into the environment without being processed through treathment processes. Because it contains valuable products, treatment processes have been replaced by recovery processes. Thanks to these processes, it has been possible to provide a more economical production process by reducing environmental concerns, utilizing resources more efficiently, and recycling products with commercial value.

Keywords: Olive Oil Production, Olive Pomace, Olive Mill Water

Investigation of Some Historical Buildings in Ankara Çubuk District

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Abstract

Çubuk is a settlement established during the period when the Turks dominated Anatolia and is located in the transition zone of the Black Sea region in the north-east of Ankara. The Çubuk district, which is estimated to have been established after the conquest of Ankara, has been on the King and Silk Road route since the early and middle ages. Çubuk was under the rule of Romans, Byzantines, Seljuks and Ottomans. It gained a historical importance with the Battle of Ankara. In this study; some important historical buildings such as two mansions, schools and forestry directorate in Çubuk district of Ankara province were examined. İzzet Korman Mansion and Mazhar Balcı Mansion in the center of Çubuk district are among the works of the Republican period. These two mansions were used for state affairs and are examples of civil architecture of the period. The restoration works of these two mansions, whose restoration was completed, were examined. The historical stone building, which is idle in Kapaklı Neighborhood of Çubuk district, is one of the primary schools opened in the northern regions of Ankara in the first years of the Republic. Used for 50 years for primary education activities, the building is abandoned and inactive. There is no cultural asset protection or restoration work by state institutions related to this building. Another building for which there is no decision for the protection or restoration of cultural property is the former forestry directorate building located in Yukarı Çavundur Neighborhood of Çubuk District. The building is estimated to be about 100 years old and was used in the 1930s to accommodate the employees of the watchtower for the forested areas in and around Aydos Mountain. This historical building, which served the Forestry Directorate for many years, was abandoned 20 years ago. Apart from simple renovations, no restoration work or comprehensive renovation work has been carried out on this building. The building is idle and the ownership right belongs to the Çubuk Regional Directorate of Forestry. As a result of these researches, the restored historical buildings that are active in public activities today are İzzet Korman Mansion and Mazhar Balcı Mansion. The Kapaklı Village School and the Upper Çavundur Forestry Management Supervisor's Lodging are idle and not in use. It is important that these two historical buildings are urgently restored and brought into public activity.

Keywords: Çubuk, Restoration, Material, Izzet Korman Mansion, Mazhar Balcı Mansion

An Overview of The Additive Manufacturing Ecosystem and Current Technologies

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Abstract

Additive manufacturing stands out as a technology that has been frequently used in industrial applications in recent years and offers innovations to production processes. Unlike traditional manufacturing methods, additive manufacturing is a process where products are produced by combining materials layer by layer. Thanks to this technology, parts with very complex structures can be produced with minimal material usage. In addition, the production of complex geometries can be done in a simple and fast way that would not be possible with traditional methods. The additive manufacturing ecosystem includes various CAD/CAM programs (SolidWorks, CATIA, etc.), a wide range of materials (polymers, metals, ceramics) and 3D printer technologies with different functionalities. Current technologies include methods such as SLA, FDM, SLS and EBM. These technologies vary according to different materials and application areas. Additive manufacturing is widely used in many sectors such as automotive, aerospace, defense and medicine. Today, additive manufacturing technologies have gained more power with rapidly developing software and hardware solutions. In this context, the integration of artificial intelligence, machine learning and data analysis into additive manufacturing technologies increases efficiency in production processes. Additive manufacturing will offer more efficient, sustainable and customized production solutions for manufacturing processes in the future with developing technologies.

Keywords: Additive Manufacturing, CAD/CAM, 3D Printer, Materials

A Comparative Analysis of Deep Learning Models for Mammography Classification

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Abstract

Classification of mammography images is a challenging problem that plays a critical role in breast cancer diagnosis. Breast cancer is one of the most common cancers in women worldwide, and early detection and accurate classification can significantly increase patient survival rates. Today, deep learning models have achieved impressive results in the field of medical imaging, allowing the development of automatic diagnostic systems. This study aims to compare the performance of different deep learning architectures in mammography image classification and to determine the best model. Commonly used models such as ResNet152, EfficientNet (B0 and V2 B0), DenseNet201 and MobileNetV2 were evaluated on various success metrics. The classification process focused on the ability to correctly distinguish different classes such as glioma tumor, meningioma tumor, normal tissue and pituitary tumor.

Keywords: Deep Learning, Transfer Learning, Brain Tumor

Renewing of Urban Environments by Green Infrastructure Planning and Implementation

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Abstract

Green infrastructure has been proposed as a mechanism for the promotion of an integrated system of sustainable resource management and land use management, as well as for positive, productive environmental change and urban sustainability. A number of the fundamental principles of sustainability are promoted by green infrastructure, including fostering a healthy community, enhancing quality of life, reducing the negative effects of climate change, facilitating sustainable urban development, encouraging economic growth, fostering urban resilience, and addressing social equity issues. The key principles for Green infrastructure planning and implementation are: integration, multifunctionality, connectivity, multiscale planning approach, multiobject approach, strategic, cooperative and socially inclusive planning process. In recent years, The GI concept has been closely linked to the notions of multifunctionality, climate change, and green growth. This has resulted in a highly diverse research and policy agenda that targets many audiences and themes.

In order to negotiate and prioritize the essential green components without focusing on just one, it is essential to have an equitable distribution of space while building green infrastructures for cities that take synergies and tradeoffs into account. The desired outcomes should be maximized by employing strategic techniques for site selection, consistent allocation, and handling multi-functionality. A series of criteria can be applied in accordance with the requirements to select the site, and each criterion is assigned the proper weight to identify and prioritize the regions that are considered severe hotspots. Multicriteria decision analysis (MCDA) is a widely used technique in UGI spatial planning, which is beneficial for GI prioritization and decision making. The results of this study will aid developing the knowledge of UGI spatial planning and be useful to academics and practitioners who plan and create sustainable, livable cities and urban environments.

Keywords: Green Infrastructure, Spatial Planning, Urban Environment

Enhancing Operational Efficiency and Customer Satisfaction Through the OTS Cargo Module

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Abstract

The increasing customer expectations in today's retail sector have necessitated faster, more efficient, and traceable management of delivery processes. One of the major challenges in supply chain management is the slowness of manual business processes and high error rates. The OTS Cargo Module developed in this study aims to digitize delivery and return processes, thereby enhancing operational efficiency for businesses and elevating customer satisfaction to the highest level.

The OTS Cargo Module is a system that optimizes end-to-end delivery processes among suppliers, logistics companies, and customers. With this module, the process of transferring products purchased by customers to supplier warehouses, receiving them by logistics companies, and delivering them to customers is carried out entirely in a digital environment.

The system provides customers with instant access to information, enabling them to monitor the status of their purchased products. At the same time, it offers suppliers the ability to analyze and report on delivery processes. The module reduces manual workload, minimizes error rates, and accelerates delivery processes.

By increasing the transparency of delivery processes, the system ensures that all stakeholders have real-time access to the information they need. Additionally, it contributes to reducing operational costs for businesses and improving the efficiency of workflows.

The OTS Cargo Module exemplifies successful digital transformation in the retail sector by enhancing the traceability and efficiency of delivery processes. This innovative system not only boosts customer satisfaction but also provides businesses with time and cost advantages, strengthening their competitive position in the industry. The project underscores the importance of digitalization in the retail sector and serves as a reference point for future similar initiatives.

Keywords: Cargo Integration, Digital Transformation, Operational Efficiency

CFD-Based Study of Ground Effect on Formula One Car Front Wing

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Abstract

Aerodynamics is a critical factor that directly impacts vehicle performance in motorsports. It plays a significant role, particularly in enhancing cornering capability and straight-line speeds, which contribute to achieving better lap times. This study focuses on aerodynamic analyses conducted on the front wing of a Formula 1 car, considering the ground effect.

To evaluate the impact of ground effect on aerodynamic performance, two separate analysis scenarios were created at different ride heights. Initial analyses were conducted using a coarse mesh, and mesh refinement was applied to regions with high turbulence intensity using a mesh generation technique to obtain more accurate results in these areas. Considering the speed range of Formula 1 cars on straights (78–95 m/s), the analyses were performed at 90 m/s.

A fluid simulation was carried out using Cradle CFD to determine aerodynamic loads, with the realizable k-epsilon turbulence model employed. Additionally, a mesh independence study was conducted to ensure the accuracy of the analysis results.

The study revealed the effects of ground effect on the drag and downforce generated by the front wing, providing a detailed evaluation of these impacts. The findings underscore the necessity of accounting for ground effect in the aerodynamic optimization of Formula 1 cars.

Keywords: Formula-1, Aerodynamic Loads, Ground Effect, Cradle CFD

Radiation Shielding Analyses of 3D Printed Capsules Filled with Gadolinium Oxide-Enhanced Paraffin

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Abstract

Radiation shielding is a crucial application in order to protect both humans and sensitive equipment from undesired impacts of radiation. This study aims to analyze the potential use of paraffin-based shielding materials, often employed for their neutron-absorbing properties, in combination with rare earth oxides, known for their high atomic numbers and superior photon shielding capabilities. With the use of 3D printing technology, the 3D printed capsules are designed, and the capsules are filled with Gadolinium Oxide-Enhanced Paraffin. Therefore, a multilayer shielding design is created. The capsule is made of PLA polymer. The multilayer design, incorporating these materials, is analyzed for its effectiveness in gamma or neutron radiation environments. The results indicate that the combination of paraffin with Gadolinium Oxide significantly improves the shielding performance, offering a promising solution for advanced radiation protection in medical, industrial, and space applications.

Keywords: Radiation Shielding, Multilayer Radiation Shielding, Paraffin, Rare Earth Oxides

Sensitivity and Uncertainty Analysis for Fast Molten Salt Reactor

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Abstract

In this study, it is aimed to investigate the effect of feedback parameters on the effective multiplication coefficient (k-eff) value in the Fast Molten Salt Reactor (MSR) system, to calculate the effects of feedback parameters on k-eff and to calculate the cumulative contribution of these parameters to uncertainty. The fact that there is no comprehensive study on sensitivity and uncertainty analysis for Fast MSR in the literature is a strong motivation and I aim to reach sensitivity and uncertainty analysis results with realistic simulations using SCALE code, an advanced code system for neutronic analysis, and thus contribute to the literature. This study involves expert nuclear power engineers, domestic and international companies and institutions working on the licensing of MSR.

TSUNAMI-3D (Tools for Sensitivity and Uncertainty Analysis Methodology Implementation) module in SCALE code is used for sensitivity and uncertainty analysis. In the code, the information of the nuclear reactor is defined and its effect on the k-eff value is calculated. The covariance between the reference data in the defined neutron cross section library and the neutron cross sections of the designed system with different temperature and material density, the degree of similarity between the two systems is determined by TSUNAMI-IP (Tools for Sensitivity and Uncertainty Analysis Methodology Implementation-Indices and Parameters) using the sensitivity data produced by TSUNAMI-3D and the data in the cross section library, and the uncertainty value is obtained.

As a result of the analysis, the sensitivity coefficients of U-333(n,fission), Th-232(n,n), Th-232(n,n'), Li-7(n,total), B-11(n,total), Ni-58(n,n) reactions are significantly higher compared to other nuclear reactions. The uncertainty value based on the neutron cross section data resulted in (% delta-k/k) 3.1076 +/- 0.0055.

Looking at the output results, it is seen that the uncertainty value is high. Since the MSR has not yet been commercially produced, the material properties suitable for licensing have not yet been clarified and detailed studies on this subject have not been available before. With this study, one of the main objectives is to minimize the uncertainty value, identify the nuclear reactions that affect k-eff and recognize the neutronic system of the reactor, making it reliable and suitable for licensing.

Keywords: Molten Salt Reactor, Sensitivity and Uncertainty Analysis, SCALE, k-eff, TSUNAMI-3D

Finite Element Analysis of 800 MPa High Strength Steels with Roll Forming Method

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Abstract

The sheet metal forming process with the roll form method is a technology that allows the production of products with higher strength compared to traditional forming methods. In this method, the sheet or coil metal material is bent with rollers of different sizes and arranged in a row until it reaches the final section. In addition to its advantages, the complexity of the production process and the difficulty of determining process parameters are shown as limitations of the sheet metal forming process with rollers.

In this study, the analysis of DP800 high strength sheet metal material was performed using the roll form method with the COPRA FEA finite element software. It was aimed to examine the behavior of the sheet material during the forming of the sheet material with rollers, to determine and improve the errors that may occur in advance. In line with this goal, a "C" sectioned perforated profile was selected from the DP800 material. Modeling of multiple bending operations has been carried out with finite element software. These operations include parameters such as roll diameters, distances between stations, and shaft diameters. Before the actual production line is established, errors that may occur in production are prevented with finite element analysis, thus reducing costs and achieving economical production.

Keywords: Sheet Metal Forming, DP800, Production Process

Free Vibration Analysis of Clamped-Free Stepped Beam with Rigid and Elastic Segment

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Abstract

In the present study, the natural frequency values and mode shapes of a cantilever beam with a rigid or elastic segment placed at the free end are obtained analytically, taking into account various attachment models. These beams are frequently used in machine construction studies such as shafts with gear wheels or pulleys. In this context, the segment of the beams or shafts becomes rigid due to the attached rigid part. In vibration analysis, that segment of the clamped beam along with any mass on it is sometimes considered rigid and at other times elastic. In some cases, the mass on the beam is treated as a concentrated mass. Additionally, due to construction requirements, there may be a short elastic segment at the end following the rigid segment. There may also be two concentrated masses on the beam. The kinetic and potential energy terms of the beam have been derived according to Euler-Bernoulli beam theory. The equations of motion and boundary conditions have been derived by means of using Hamilton's principle. After separating variables, dimensionless transverse displacement functions and boundary conditions have been obtained. The frequency equation has been established by setting the determinant of the coefficients matrix equal to zero. The natural frequencies and first three mode shapes of the beam have been presented for all cases analyzed. The analytical results have been compared with those obtained from FEM-based ANSYS Workbench simulations. This study indicates that attachment models significantly affect both natural frequencies and mode shapes of beams; therefore, an appropriate model must be established based on these attachments. The analytical method revealed in this work can be utilized to calculate natural frequencies and mode shapes for all types of beam models.

Keywords: Natural Frequencies, Stepped Beam, Euler-Bernoulli Beam, Beam with Attachment, Rigid Segment

Dose Rate Analysis of Fuel Salt in Spent Nuclear Fuel Casks for Molten Salt Reactors

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Abstract

Molten salt reactors (MSRs), utilizing liquid forms of fluoride or chloride salts as fuel, offer high efficiency and the advantage of operating at low pressure. Spent nuclear fuels are stored or transported within containers designed with considerations for corrosion resistance, sealing integrity, and shielding. Decay heat and dose rates are critical parameters for the safe storage and transportation of spent fuels.

Currently, there is no design in the literature for storage and transportation containers specifically tailored to spent nuclear fuel from MSRs. To address this gap, container systems used in the storage and transportation of nuclear fuels are being investigated. Depletion analyses of the fresh fuel salt, LiF-ThF_4-UF_4, from a molten salt reactor were conducted using the MCNP code. The isotopes obtained from the depletion analysis were placed into nuclear fuel transport containers and simulated. Dose rate measurements were performed using the MAVRIC module of SCALE 6.2.3. The results were compared with values reported in the literature.

It was found that the activity levels of some isotopes remained constant over time, while the activities of others were initially low but increased over time. Furthermore, changes in neutron source activities were examined across different time intervals.

Based on the findings for spent fuel from molten salt reactors, it was observed that when steel and Hastelloy materials were used in the construction of the spent fuel transport container, the dose rate values exceeded the allowable limits significantly. These results indicate that the design is not suitable. To enhance the shielding effectiveness of materials against neutron and gamma radiation, it is recommended to introduce additional protective materials. Furthermore, modifications to the geometry and the development of an alternative container design are also proposed.

Keywords: Molten Salt Reactor, Spent Nuclear Fuel Cask, Decay Heat, Dose Rate, Transportation and Storage

Investigation of Gamma Radiation Shielding Properties of Boric Acid and Ethylene Propylene Diene Monomer (EPDM) Composites

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Abstract

Radiation adversely affects the human body and the environment, necessitating protective materials to mitigate its harmful effects. In the search for cost-effective, environmentally friendly, and non-toxic materials that provide effective protection against radiation, the use of alternative materials instead of lead has attracted significant attention. Polymers have emerged as primary materials for radiation shielding applications due to their lightweight, flexible, and moldable nature, and they are the focus of this investigation. Non-toxic boron compounds added to polymers contribute to enhancing their radiation shielding capabilities. These composite materials make polymers more effective as shielding materials against various types of radiation. In this study, the gamma-ray shielding capability of boric acid-reinforced Ethylene Propylene Diene Monomer (EPDM) polymer was investigated. EPDM is known for its durability across a wide temperature range and its elastic structure, which prevents deformation over extended periods. Boric acid, being a boron compound, is recognized in the literature for its effectiveness against radiation. The composite material produced from the mixture of EPDM and boric acid can be utilized in challenging environments such as the nuclear industry, space technology, and medical applications. Within the scope of this study, the gamma-ray shielding parameters of the boric acidreinforced composite material were examined. These shielding parameters include the total mass attenuation coefficient (μ/ρ), linear attenuation coefficients (μ), half-value layer (HVL), mean free path (MFP), effective atomic numbers (ZEff), energy absorption buildup factors (EABF) and exposure buildup factors (EBF). The investigated parameters were theoretically analyzed for various photon energies in the range of 59.5–1332.5 keV. The measured μ/ρ values were validated against the WinXCOM database results. Additionally, the compatibility of the WinXCOM database results with simulation codes was examined using GEANT4 simulation codes.

Keywords: EPDM, Radiation Shielding, Boric Acid

Estimation Some Specific Lengths of Fish from Picture

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Abstract

In laboratory settings, fish length is commonly measured using high-precision instruments like vernier calipers. However, manual measurement methods may introduce errors despite their precision. This study presents a more accurate, image-based method for measuring fish length through pixel calibration, achieved by photographing the fish on a monochromatic sheet of paper with a fixed horizontal reference line. The reference line, positioned above the fish, provides a known length that facilitates pixel-to-length calibration within the photograph, enabling precise calculations of the fish's length. This approach has the potential to reduce manual measurement inaccuracies and streamline the measurement process for laboratory and field applications, enhancing accuracy and repeatability in fish morphometrics.

Keywords: Fish Morphometrics, Pixel Calibration, Image-Based Measurement

Investigating Multidecadal Data Drift in Central Asian Ground Observations

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Abstract

Analysis of long-term meteorological data quality and homogeneity is crucial for understanding climate patterns and changes, particularly in regions with complex terrain and sparse observation networks like Central Asia. This study proposes to investigate systematic data drift patterns in the Global Summary of the Day (GSOD) dataset across Central Asia, encompassing Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan, from 1932 to 2023. The study starts with a total number of 402 (median start date 1959, installed before 1992), and continues with 469 stations (after 1992).

The research employs a comprehensive multi-metric approach to examine temporal shifts in daily total precipitation. The methodology incorporates absolute homogeneity tests, including the Standard Normal Homogeneity Test, and Buishand Range test, to identify potential breakpoints and systematic biases in individual time series. Special attention is given to the impact of the transition period following the dissolution of the Soviet Union in the early 1990s. The study analyzes temporal inhomogeneities in individual station records, focusing on breakpoint detection and drift patterns within each time series. It examines the completeness of individual station records and their quality characteristics, with particular attention to statistical changes that may have occurred. This investigation will contribute to the broader understanding of data quality challenges in long-term climate records and aims to establish guidelines for similar analyses in other regions with complex political and technological transitions. The findings will help evaluate the reliability of historical trends derived from GSOD data and inform future climate studies in Central Asia.

Keywords: Temporal Data Drift, Precipitation, Ground Observations

Safe Management of Fission Gases in Molten Salt Reactors

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Abstract

Molten Salt Reactors (MSRs) offer innovative approaches to radioactive waste management and the safe removal of fission gas products. Unlike conventional solid-fuel reactors, the liquid fuel salts used in MSRs prevent the accumulation of fission gases within the reactor and enable their continuous removal from the system. This process not only enhances reactor safety but also reduces the risk of radioactive gases being released into the environment.

The primary technical challenge in the removal process of fission gas products is evaluating the performance of online gas separation systems. Although methods such as gamma spectroscopy are employed in MSR designs for monitoring and capturing radioactive gases, the high levels of background radiation reduce the effectiveness of these analyses. Alternatively, online sampling methods using optical spectroscopy are being developed.

Materials such as Metal-Organic Frameworks (MOF) provide an effective solution for capturing fission gases like xenon (Xe) and krypton (Kr). Additionally, the use of silica aerogels is being explored for the immobilization of long-lived radioisotopes, such as I-129. These technologies not only ensure environmental safety but also contribute to the economical and reliable operation of MSRs.

In conclusion, MSRs offer advanced technological solutions for the efficient management and safe immobilization of fission gas products. The development of these systems will enhance the sustainability of the nuclear energy sector and significantly reduce the challenges associated with waste management.

Keywords: Molten Salt Reactors, Fission Gas Management, Radioactive Waste Management

Usability of Atmospheric Plasma Systems in Industry and Health: Potential, Applications and Future Perspectives

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Abstract

Atmospheric plasma systems are increasingly preferred in industrial applications due to their low energy consumption and environmentally friendly features. These systems play an important role in optimizing various industrial processes such as surface modification, cleaning, adhesion technologies, textile processing and food safety with plasma generated at atmospheric pressure. The advantages offered by atmospheric plasma technologies include improving surface properties, disinfecting microorganisms and increasing the efficiency of various industrial processes without using chemical substances. In the field of health, atmospheric plasma enables critical applications such as sterilization of microorganisms, acceleration of wound healing and promotion of tissue regeneration. Plasma can be used as an alternative to chemical methods in processes such as sterilization of surgical instruments, disinfection of wound surfaces and cleaning of medical devices. In addition, plasma technology is being investigated as a potential method for targeting and treating tumor cells in cancer treatment. In this report, the working principles of atmospheric plasma systems, current industrial application areas and potential use in the field of health are discussed. In addition, research requirements for miniaturization of plasma systems, new areas of use and commercialization processes are discussed. As a result, the environmentally friendly and energy-efficient properties of atmospheric plasma technologies enable these systems to play an important role in the future not only in industrial production processes but also in the field of healthcare.

Keywords: Atmospheric Plasma, Surface Energy, Adhesion Technology, Sterilization, Tissue Regeneration

Radiological Evaluation with Possible Accident Scenario of Akkuyu Nuclear Power Plant

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Abstract

Nuclear power plants are designed with a series of safety measures to minimize potential risks during the design phase and to prevent accidents during operation. The most significant advancements in these designs have been driven by investigations into the causes of major past nuclear power plant accidents, leading to substantial changes in the design of nuclear facilities. The selection of sites for nuclear power plants involves evaluating the meteorological and climatic characteristics of candidate locations. Key factors such as wind speed, wind direction, humidity, precipitation rates, air quality, and temperature data play a crucial role in site selection. Additionally, the environmental and geological conditions of the site are of significant importance. Action plans are developed to address potential accidents and their consequences, including informing the local population around the proposed site and determining the most effective evacuation routes in case of an emergency. To prepare for actions to be taken during and after an accident, annual simulations and calculations are conducted prior to the construction of a nuclear power plant using data on meteorological conditions, transportation infrastructure, seismic activity, and natural events in the region. Based on the data obtained from these simulations and calculations, a roadmap for responding to potential accidents is developed. In this study, the direction and impact area of a radioactive cloud that could be released into the atmosphere in the event of a nuclear accident at the Akkuyu Nuclear Power Plant currently under construction and set to become Turkey's first nuclear power plant were analyzed. The meteorological data used for the analysis were obtained from the meteorological station closest to the nuclear power plant (NPP) site, and the relevant analyses were conducted using the HotSpot program. The results demonstrate the direction of the radioactive cloud that could emerge in the event of a hypothetical nuclear accident at the Akkuyu NPP, as well as the radiation dose levels that plant workers and the local population would be exposed to along this trajectory.

Keywords: Akkuyu Nuclear Power Plant, Nuclear Accident, Atmospheric Dispersion Model, Gaussian Plume Model, HotSpot

Roof and Terrace Gardens: Singapore Examples

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Abstract

In the 21st century, especially European and American countries, as well as Far Eastern countries that attract attention with their sustainable and ecological design approaches; Roof and terrace gardens are included in the design approaches of architectural structures, especially in large cities with dense population. Along with densely populated cities from Far Eastern countries such as China, Japan and Indonesia, the country of Singapore attracts attention with its design approaches and examples of architectural structures. The population concentrated in the big cities of Singapore reflects the new urbanization phenomenon to its buildings and finds a solution with roof-terrace gardens, which is one of the alternative solution approaches of functional architectural structures built instead of decreasing green and empty areas. The developing technology, new materials and new solution approaches for these functional architectural structures (residences, offices, hotels, etc.) offer. In addition, by addressing ecological and sustainable topics in line with the needs and demands of the users, it reveals application approaches that contribute to the city-user-environment context.

With design approaches, solutions are being sought for the need for green areas so that functional architectural structures can adapt to the living environment and offer a high quality of life to other generations in the future. These approaches can also offer many alternative spaces for users in open and semi-open spaces. In architectural buildings according to the roof type examples to be applied; It paves the way for the formation of many places such as recreation, sports-activity, social, food and beverage.

The purpose of this study; The aim is to examine the space approaches of multi-functional architectural buildings and roof-terrace gardens with examples from Singapore. Although there are many studies on the subject in the literature, it has been determined that there are not enough studies within the framework of the architectural structure with roof-terrace garden in Singapore. The study was conducted using descriptive situation analysis, one of the qualitative research methods. In the study, spatial approaches were examined by comparing architectural structures with roof and terrace gardens in Singapore.

Keywords. Roof and Terrace Gardens, Singapore, Design Approaches

Effect of Soil Conditions on Foundation Design Under Extreme Loading Conditions for Solar Energy Panels

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Abstract

Today, the demand for energy is increasing due to factors such as population growth, industrialization, urbanization, technological advancements, and globalization. To meet this rising demand, alternative energy sources such as wind, solar, and wave energy are being utilized in addition to traditional energy sources. Among these, solar energy stands out as a superior option, as it is an entirely limitless resource. Currently, there are numerous applications for solar energy production systems, and their prevalence continues to grow steadily. As the number of such systems increases, the demand for information regarding the development of solar panel components and the considerations for field installation is also rising.

Solar panels can be deployed on building rooftops, facades, or open land, depending on topographical and geographical conditions, such as the land's slope, orientation, prevailing winds, and the angle and intensity of solar radiation in the region. A solar panel system consists of photovoltaic panels and a supporting framework (foundations and mounting elements). The design and material selection for the load-bearing system take into account factors such as cost, soil characteristics, local snow and wind loads, variations in land slope, and the selection of appropriate equipment for the site.

Although the structural loads imposed on solar panel systems are relatively small compared to other structures, it remains crucial to examine how these loads are transferred to the ground, with appropriate foundation design being of particular importance from a geotechnical engineering perspective. This study reviews the relevant regulations and explores the factors influencing the geotechnical design of solar panels in the field. Additionally, various foundation solutions developed for different site conditions are examined through an extensive review of the existing literature.

Keywords: Renewable Energy, Solar Panels, Foundation Applications, Geotechnical Design

The Role of Material Selection in Stent Production

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Abstract

Stents help restore proper blood flow in blocked arteries and are essential in treating cardiovascular issues. The choice of materials used in stent fabrication has a direct impact on their mechanical stability, compatibility with bodily tissues, and long-term reliability. Several factors guide material selection, including biocompatibility, corrosion resistance, strength, imaging compatibility, and ease of manufacturing.

Among commonly used materials, 316L stainless steel stands out for its reliable corrosion resistance and favorable biocompatibility. It provides enough strength to maintain arterial patency without harming the vessel wall. While it may present some drawbacks in MRI settings and does not possess shape memory characteristics, it remains cost-effective and relatively simple to work with.

Nitinol, a nickel-titanium alloy, offers shape memory and superelastic qualities. This makes it ideal for stents placed in narrower, curved vessels. Its exceptional flexibility allows it to adapt to natural arterial movements. However, careful monitoring of nickel ion release is necessary due to possible biocompatibility concerns.

Cobalt-chromium alloys excel in scenarios demanding high mechanical strength and durable, thin-walled configurations. They exhibit outstanding corrosion resistance and long-term stability. On the downside, their complex manufacturing process and higher expense limit broader use.

Polymers have gained attention for bioresorbable stents that eventually dissolve within the body. This approach may reduce the risk of complications like restenosis and help support the vessel's natural healing process. Still, polymer-based stents lag behind metal options in terms of mechanical strength.

Overall, selecting the right material is critical not only for ensuring safe implantation and reliable performance but also for shaping the implant's ability to adapt to the patient's vascular environment. In the future, advancements in biomaterials will enable the production of technically superior stents with enhanced mechanical strength, improved corrosion resistance, better biocompatibility, and greater flexibility.

Keywords: Stent, Stainless Steel, Nitinol, Cobalt-Chromium, Polymer

Address Osmaniye District, Selanik Street, No:52N - City Centre - Sinop / TURKIYE
E-ISBN **978-625-94958-6-6**