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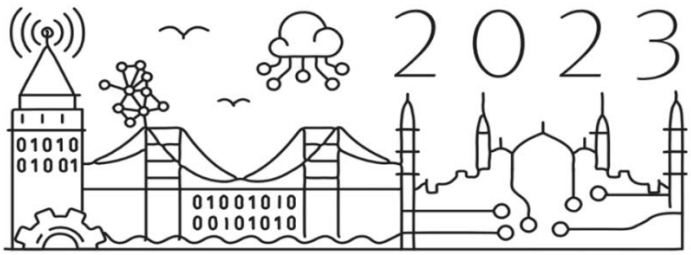

LITES

Leverage of IT for Engineering and Science

International Conference

ABSTRACT BOOK

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CONTENTS

CONTENTS i

FOREWORD iii

COMMITTEES iv

On Use of IT Technologies in Wildfire Prevention and Fighting Technologies: A Review of Current Status and Future Challenges 1

Artificial Intelligence (AI) Applications in Industry for Sustainability and Predictive Maintenance Pneumatic Cylinder Monitoring 2

Can Musculoskeletal Modeling and Simulation Provide Valid Muscle Force Estimates for Patients with Cerebral Palsy? 3

Is the Kinesiotaping Promote the Joint Torque, Muscular Activity and Cross-Activation? 5

Predicting Human Body Gait by Solving Tracking Optimization Problem 6

Prediction of Ground Reaction Forces from Joint Angles Using Machine Learning 7

How Can We Benefitted from Musculoskeletal Modeling, Simulation, and Machine Learning in Gait Analysis of Patients with Cerebral Palsy? 8

Development of a Finite Element Model of the Lumbar Spine 9

Determination of Cutting Force Components in Up and Down Milling Based on Relevant Measurements in Orthogonal Shoulder Slot Milling 10

Stress, Strain and Strain-Rate Cemented Carbide Properties Determined with a Fem Supported Evaluation of Impact Test Imprints 11

Design of an Experimental Setup for Investigating UAV Propeller Icing 12

Intrinsically Disordered Proteins and Bio-mimicked Polymers for Soft Robotics 13

Modern vs Conventional Mineral Processing Methods for Borates 14

Adaptive Heat Gain Estimation for Window Filming with Building Models and Estimation of Reduction in Carbon Emission for Turkish Cities 15

False Star Filtering and Camera Motion Estimation using an Unsupervised Learning Method with Morphological Attributes 16

Material Classification by Investigation of 3D Morphological Chip Attributes using Neural Networks 17

Nonwettable Hybrid Paper Sheets: Effect of The Coating Formulation on the Surface and Barrier Properties 18

An Operating System to Control Demand Side Management in a Microgrid 19

Site Planning for Wind Turbines: A Case Analysis from Türkiye 20

Optimum Control of Structures with Active Tendons 21

Molecular Imprinting: A Way to Fabricate Artificial Antibodies for SARS-CoV-2 Sensing 22

Effects of Boron Compounds on the Electrical Properties of Polyester Samples 24

FOREWORD

The Leverage of IT for Engineering and Science (LITES) is organized collaboratively by the Turkish-German University, TU Berlin, and Uni Potsdam. LITES aims to a platform for interdisciplinary exchange. The conference covers a broad spectrum of subjects including, Information Technology, Sustainability, Circular Economy, Logistics, Smart Cities, AI, Automation, Robotics, Energy Science, and more. It provides a platform where experts and enthusiasts from various disciplines can engage in conversations about new developments, exchange their research discoveries, and investigate the convergence of IT with engineering and science. In addition to informative presentations, the conference hosted an industry workshop aimed at connecting academic knowledge with real-world use. By means of these dialogues and interactions, LITES aims to facilitate the sharing of knowledge, encourage collaboration, and ignite progress in the domain of technology-based solutions for the intricate issues within Engineering and Science.

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The Leverage of IT for Engineering and Science, International Conference (LITES 2023)
İstanbul, Türkiye, 30-31 October - 1 November 2023

On Use of IT Technologies in Wildfire Prevention and Fighting Technologies: A Review of Current Status and Future Challenges

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ABSTRACT:
Wildfires constitute a significant field in disaster management works due to their drastical adverse effects on nature, environment and human life. Increase in the number of wildfires is observed during recent years mainly due to effects of global warming and human errors, and large amounts of forest areas have been diminished as a consequence, leading to adverse changes in the affected regions natural properties and the life of its inhabitants and also increasing the vulnerability of these regions to secondary disasters such as drought, landslides and flooding.

Today's technology enables the prediction of areas prone to wildfires easily by guidance of some simple input data such as temperature, topology, land coverage, human activities, wind and humidity. On the other hand, response process in case of a wildfire is highly dynamic and dangerous due to the rapidly varying propagation of the fire, lack of proper access in mountainous wilderness and the presence of the immense amount of fuel. Various methods are applied in fighting wildfires, however, variations in meteorological parameters, mainly wind, coupled with the additional winds caused by the fire itself lead to unpredictability in the spreading direction and speed of a wildfire. Consequently, wildfire fighting is considered as a highly dangerous work, and the occurrence of fatalities and injuries in the personnel occupied is not rare.

This paper represents a review of existing utilization of IT technologies in wildfire fighting with examples covering applications from various countries. Further improvements which may be implemented by technological advances with the main aim of a better prediction of fire spreading directions and early warning to local inhabitants and firefighting personnel are also discussed.

Keywords: Wildfires, Disaster Management

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Artificial Intelligence (AI) Applications in Industry for Sustainability and Predictive Maintenance Pneumatic Cylinder Monitoring

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ABSTRACT:
There are Mega Trends and challenges on the world. Industry 4.0 is an answer for those challenges. Ecology (Sustainability) and economy for businesses are no longer opposing goals. On the contrary, managing the interaction between these two forces in the form of climate protection measures has become one of the main tasks of enterprises. As the number of automated industrial processes continues to increase worldwide, automation technology is a sector with great potential when it comes to efficiency measures. Digitalization and Artificial Intelligence (AI) support and accelerate these studies.

For 50 years now, our machines and production facilities have been equipped with centralelectronic controllers, PLCs for short, or process control systems (PCS). Over the years, more and more sensors have been installed, but their evaluation was time-consuming, complex, and expensive and very inflexible too. So initially the focus was on having relevant data for process control and on reducing the error messages. Today, usage of Artificial Intelligence (AI) is becoming standard in Industry for "predictive maintenance", "predictive Energy", and "predictive quality". With the standardization of data interfaces between IT and OT created within the framework of Industry 4.0 and with the availability of increasingly better and cheaper memory and processor performance, modern analytical tools such as artificial intelligence (AI) can make huge advances in the evaluation of mass data and finally help predictive machine diagnostics to achieve a breakthrough.

Making decisions based on facts – This becomes standard.

The business value of AI can be proven by numbers. In its use in industrial applications, it reduced rework, increased availability and transparency and converted unplanned shutdowns into planned maintenance.

In this paper, we will explain AI in Industrial applications, as use case we will lock closer at "cylinder Monitoring" for Predictive Maintenance.

Keywords: Artificial Intelligence, AI, Sustainability, Pneumatics, Energy Efficiency, Digitization, Anomaly Detection, Health Score

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Can Musculoskeletal Modeling and Simulation Provide Valid Muscle Force Estimates for Patients with Cerebral Palsy?

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ABSTRACT:
Static optimization (SO) and computed muscle control (CMC) are two widely used optimization-based tools to estimate muscle forces. Validation best practices include joint moment and EMG-based validation due to the infeasibility of in-vivo muscle force measurement. Several studies comparing the validation performance of SO and CMC for healthy subjects have been inconclusive, but a few indicate the superiority of SO based on direct and indirect validation through limited in-vivo muscle and joint contact force measurements. It is unclear if this holds true for patients with cerebral palsy (CP) walking with the crouch gait pattern, as such a comparison has not been made for the population to date. It is also not known if crouch severity is a factor in the validation performance of SO and CMC. The muscle activity of patients with CP differs from normal as reflected in experimental EMG data and is particularly elevated in some muscles for patients with high crouch severity due to increased co-contraction between antagonistic muscle pairs. As such, this muscle activity is not expected to be predicted well by SO which uses a cost function that is known to work well for level walking in healthy subjects. Given that CMC allows the user to constrain muscle activations based on EMG measurements, it is expected that CMC-generated muscle activations would be closer to EMG profiles for patients of CP. Therefore, we aimed to compare the validation performance of SO and CMC for patients of CP walking with crouch gait. An openly available motion analysis dataset of nine subjects with CP uniformly divided into mild, moderate, and severe crouch (from simtk.org, containing marker data, ground reaction forces, and scaled models for all subjects and EMG of 6 subjects during walking) was used to perform inverse kinematics, inverse dynamics, and residual reduction in the neuromusculoskeletal simulation software OpenSim.

The results of these procedures were fed to OpenSim's SO and CMC tools to obtain muscle force and activation estimates. EMG-based validation was performed by quantitatively comparing normalized muscle activations with normalized EMG using the Pearson correlation coefficient- PCC - (for temporal similarity) and root mean square error – RMSE- (for magnitude difference). The Student's t-test was used to check the statistical significance of the difference between the RMSE results of SO and CMC. The PCC results were inconclusive, varying with both muscle group and crouch severity. The RMSE values from CMC were lower than those from SO, but this difference was not statistically significant. In terms of EMG-based validation, CMC was not superior to SO for the studied patient group despite its ability to constrain muscle activity prediction based on EMG data. The validation performance of CMC did not improve with increasing crouch severity, nor did SO's.

Keywords: Cerebral Palsy, Musculoskeletal Modeling, Musculoskeletal Simulation

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Is the Kinesiotaping Promote the Joint Torque, Muscular Activity and Cross-Activation?

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ABSTRACT:
KinesioTaping (KT) is a taping method. The mechanism of KT is explained with the hypothesis that both the skin and subcutaneous tissues can be mechanically stimulated via an elastic tape applied with a specific tension level and direction. The method is commonly used to promote muscle performance and enhance or inhibit muscle activity, and neuromuscular performance as a physiotherapy method. However, recent systematic reviews presented the lack of evidence about KT, it is extensively used in clinics and research. Therefore, the aim of our study is to show the effect of KT on joint torque, muscular activity and cross-activation. We found out that KT may influence joint torque. In addition, KT application on the contralateral limb increased the contralateral muscle activation during the unilateral isometric, concentric, and eccentric contractions.

Keywords: Kinesiotaping, Joint Torque, Muscular Activity, Cross-Activation

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Predicting Human Body Gait by Solving Tracking Optimization Problem

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ABSTRACT:
Estimating how patients having musculoskeletal disorders would walk after surgeries through predictive simulations with subject-specific musculoskeletal models could provide precious insight to clinicians in pre-operative decision-making. To do so, different optimization techniques were proposed to predict human body gait. Accordingly, we aimed to predict healthy human gait by solving a tracking optimization problem. Gait data of one healthy male aged 35 was used. All modeling and simulation process was implemented in OpenSim software. Once the generic musculoskeletal model available in OpenSim was scaled according to the marker data recorded during the static pose, inverse kinematics were applied to calculate trajectories of joint angles. The set of joint angles obtained by inverse kinematics was tracked to predict ground reaction forces and joint moments. Estimated kinetics were compared to the experimental data. The proposed optimization technique was successful in tracking the reference trajectories and the predicted kinetics are coherent with normative data. Although a promising result was obtained in predicting human gait, this attempt should be expanded to a large population and clinically validated.

Keywords: Body Gait, Optimization

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Prediction of Ground Reaction Forces from Joint Angles Using Machine Learning

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ABSTRACT:
Measuring or calculating gait kinetics requires high in-lab effort or complex musculoskeletal models. In this study, we aim to predict gait kinetics (specifically ground reaction forces) of healthy subjects using kinematic signals. One conventional machine learning model with automatically extracted features is applied for this purpose. The expected results of performance metrics will show that the model is able to predict ground reaction forces successfully, hence the model is promising for predicting gait kinetics. Successful application of this workflow will facilitate gait analysis by requiring less in-lab effort and no need for complex musculoskeletal models.

Keywords: Joint Angles, Machine Learning.

The Leverage of IT for Engineering and Science, International Conference (LITES 2023)
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How Can We Benefitted from Musculoskeletal Modeling, Simulation, and Machine Learning in Gait Analysis of Patients with Cerebral Palsy?

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ABSTRACT:
Cerebral palsy (CP) encompasses a spectrum of motor disorders profoundly impacting movement and posture. Gait analysis plays a pivotal role in comprehending and enhancing the ambulatory patterns of CP individuals. The integration of musculoskeletal modeling and simulation yields a profound understanding of gait biomechanics, fostering the creation of tailored treatment strategies, and contributing to the development of more efficacious interventions aimed at augmenting mobility and the overall quality of life for CP individuals.

Furthermore, the amalgamation of machine learning techniques into gait analysis for patients with cerebral palsy not only affords objective assessments but also amplifies the potential for early diagnosis and the formulation of individualized treatment plans, thereby elevating the caliber of care and augmenting outcomes for those afflicted by CP.

In this presentation, I will offer insights into the transformative benefits derived from the synergy of musculoskeletal modeling, simulation, and machine learning in the realm of gait analysis for patients with cerebral palsy.

Keywords: Musculoskeletal Modeling, Machine Learning, Gait Analysis

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Development of a Finite Element Model of the Lumbar Spine

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ABSTRACT:
Spinal instrumentation, which is based on the partition of the applied loads acting on the spine, is employed to keep the anatomic alignment of spinal segments from the upper body to the lower body portions. Stabilization and maintenance of curve alignment are the main goals of spinal instrumentation, especially in scoliosis. The success of the post-recovery period of the patients is related to the spinal implants used in surgeries including their material strength, stress-strain, and fatigue properties. In this study, a lumbar spine model was developed to investigate the spinal performance of a scoliotic lumbar spine under the effect of fixed and hybrid implants. The model was subjected to different compressive loads and finite element analysis was performed to present the usefulness of the spine model.

Keywords: Finite Element Model, Lumbar Spine

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Determination of Cutting Force Components in Up and Down Milling Based on Relevant Measurements in Orthogonal Shoulder Slot Milling

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ABSTRACT:
In orthogonal slot milling, dependent on the actual up or down cutting kinematic, the generated undeformed chip thickness corresponds to different active forces. This fact prevents the unconditioned application of data established via experiments in orthogonal slot milling in other cutting processes.

In the present paper, this problem is elucidated. Herein, an accurate determination of the chip thicknesses considering the trochoidal tool path and the development of analytical procedures to define cutting force components in a cutting edge reference system were performed. Measurements of deformed chip thickness along the chip length verified calculation's results by means of the developed procedures. Considering these facts, a model to predict the active force in orthogonal milling, based on cutting force measurements carried out in slot milling was established.

Keywords: Cutting Force, Milling

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Stress, Strain and Strain-Rate Cemented Carbide Properties Determined with a Fem Supported Evaluation of Impact Test Imprints

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ABSTRACT:
Tool materials like cemented carbide, high-speed steels (HSS) etc. with elevated strength and hardness possess low ductility. Therefore, it is practically not possible to attain their stress, strain and strain-rate dependent properties using established test methods since a brittle fracture develops after reaching their yield strain.

To overcome this problem, an innovative method to determine strain-rate and temperature dependent tool material data via experimental and analytical evaluation of remaining imprints after the repetitive impact test was developed. Characteristic results are introduced.

Keywords: Cemented Carbide, FEM

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Design of an Experimental Setup for Investigating UAV Propeller Icing

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ABSTRACT:
Aircraft propeller icing is a serious issue that can lead to many safety and flight performance problems. Propellers are important components that enable aircraft to move through the air. However, in cold weather conditions, especially rain, snow or sleet, water droplets hit the propellers and freeze. This frozen water can form layers of ice. Propeller icing can have a negative impact on the aerodynamic performance of the aircraft. Ice accumulation can change the shape and balance of the propellers, causing fluctuations, vibrations and even loss of control during flight. It can also reduce engine efficiency and increase fuel consumption. Design of an experimental system that will provide the meteorological conditions of a UAV's operational altitude is one of the critical stages for the study of icing effects. Measuring the icing that will form after the temperature of about -50 degrees Celsius and other required pressure and humidity balance is achieved is another critical stage. A high-speed camera is used in the literature for visual measurement of icing. However, the cost of a high-speed camera alone takes up more than half of the budget provided by many national support programs today. In order to obtain droplet images sequentially in such cases where economic conditions do not allow, in this study, 4 DSLR cameras will be used at maximum shutter speed and 4 powerful led flashlights will be used for each camera to take images one after the other. Thus, the droplet movement can be analyzed through images acquired at regular intervals. Laser circuit breakers will be placed at critical points and communication between the droplet and the camera will be ensured. In this way, the droplet will be automatically recorded as it passes through the locations that are important to be analyzed.

Keywords: Icing, High-speed Imaging, Droplet Dynamics, UAV, IT

The Leverage of IT for Engineering and Science, International Conference (LITES 2023)
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Intrinsically Disordered Proteins and Bio-mimicked Polymers for Soft Robotics

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ABSTRACT:
We discovered the roles of intrinsically disordered proteins in various diseases including neurodegenerative diseases about 20 years ago. Intrinsically disordered proteins are highly flexible and do not adopt stable three dimensional structures. These proteins can be used in smart and sustainable polymer design via bio-mimicking. Using our own intrinsically disordered protein studies in neurodegenerative diseases, we bio-mimicked new smart and soft polymers for soft robotics applications. Here, I show our new synthesis mechanisms for these new class of polymers, characterization mechanisms and production ways for synthetic intrinsically disordered polymers in soft robotics applications which were bio-mimicked by intrinsically disordered proteins in neurodegenerative diseases.

Keywords: Intrinsically Disordered Proteins, Bio-mimicked Polymers, Soft Robotics

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Modern vs Conventional Mineral Processing Methods for Borates

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ABSTRACT:
This review paper aims to outline main advantages of modern mineral processing methods which have been applied to borates in recent years against conventional methods. Modern methods cover full automation, robotics and intelligent systems and easy handling of the physical, chemical and operational parameters affecting recovery values. These unique features of the modern methods pave the way for less time consuming, less trial and error use, easy process and product quality control against the conventional methods which also require more energy, more capital and more environmental concerns.

Conventional mineral processing methods for efficient borate beneficiation cover upgrading the B2O3 grades and lowering impurity contents, such as some clays, Fe, As and etc. by using simple physical separation methods, such as primary and secondary crushing, washing, trommel screening followed by handsorting, hydrocycloning and attrition scrubbing which are known as particle size liberation oriented, huge water consuming and environmentally problematic. Those methods also cause more B2O3 % losses in pulp form with tailings and require higher capital and operating costs, while the modern mineral processing methods, such as sensor base sorting generally focus on product oriented, less water consuming, requiring less particle breakage and combined with fully automated characterization and quality control devices, such as X-ray and Scanning Electron Microscope technologies (XRD, XRF and MLA/QemSCAN/TESCAN) with lower operating costs.

As it is well-known digitalization, modelling and simulation start from mine exploration, reserve estimation, selection of an effective mining method, effective transportation, calculation of proper liberation degree for optimal comminution, selection of suitable particle size reduction and concentration technology, dewatering, tailings management, suitable storage, etc. Modern mineral processing methods are also more prone to application of novel expert systems (such as AI-Artificial Intelligence, ML-Machine Learning and DL-Deep Learning, etc.) than conventional methods.

Keywords: Mineral Processing, Borates

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Adaptive Heat Gain Estimation for Window Filming with Building Models and Estimation of Reduction in Carbon Emission for Turkish Cities

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ABSTRACT:

Recently, the world is facing many environmental issues related to climatic instabilities including floods, fire and drought, which are assumed to be originating from global warming. The excessive amount of greenhouse gasses emitted to the atmosphere results in global warming, implying a rise in the average temperature of the atmosphere, oceans and earth surface. The carbon emission is caused by extravagant use of carbon resources including fossil fuels, intensely utilized in many strategic economic activities required for national growth. The struggle to enable reduction in carbon emission has recently accelerated and gained interest of many parties including governments, institutions, sectoral companies, etc. Lately, the efforts of carbon emission are enforced by legal acts around the world through the agreements and deals within either regional or global unions. Thus, there have been many scientific research and studies performed to propose ways of carbon reduction. One approach is to minimize the activities consuming carbon resources through efficiently optimized production processes while the other approach is to design materials that efficiently curb the solar heating effect to lead a decrease in usage of services causing carbon emission. This study aims to estimate heat gain for the given building models equipped with windows coated by various types of films. The method is based on the process of Kirchoff's law of radiation, followed by the iterative steps of the Boles procedure. The adaptive calculation of the final internal temperature within a given period is ensured by using the formula of thermal energy change, in which the changes in air density and the moist percentage are involved iteratively in the process. Several types of window filming are modeled, and the results are compared for several Turkish cities with different population, geographic coordinates and elevation in different periods of the days of different months. The heat gain and final internal temperature of estimations are compared in reference to the results obtained with clear window in terms of final internal temperature and heat gain. Additionally, a cost analysis is carried out, including reduction in electric consumption, carbon emission and electric bill.

Keywords: Solar Films, Window Films, Emission Reduction, Solar Gain.

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False Star Filtering and Camera Motion Estimation using an Unsupervised Learning Method with Morphological Attributes

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ABSTRACT:

Star sensors are tools that are used in the attitude determination systems of spacecrafts. They are, recently, preferred because of high accuracy, independency from celestial bodies and inertial vector output. Increasing technological complexity of space missions necessitates higher accuracy in the attitude determination systems. In this respect, star sensors are employed in the recent advanced missions for their capabilities allowing near and far space missions. Moreover, star sensors are able to operate without a priori information, which makes it a self-contained attitude determination system. On the other hand, they are limited by a high computational cost due to the complexity of the star identification algorithms, which can be compensated with more storage and memory. This imposes more space and mass occupation and more electricity consumption, which are vital for space mission cost and achievement, and lifetime of a spacecraft. Regardless whether they use morphological methods, pattern recognition or artificial neural networks, star identification algorithms require a star catalog for a good match with a given observation star image to yield a reference inertial vector as an attitude output. However, the input to the identification algorithm, which usually comprises position vector and brightness values of star objects on the image plane as obtained from observation star image, is inevitably exposed to some sources of noise including false stars shifting stars and missing stars due to magnetic, electronic and physical interferences or limitations such as reflecting objects, solar flare, thermal deformation, optical flaws, blockage of field-of-view or dead pixels. The noise occurrences cause distortions on the input vectors transferred to the star identification algorithm, which leads to risk of poor accuracy and need for algorithms with high computational complexity to compensate the distortion effect. Thus, in prior to the execution of star identification algorithms, some denoising algorithms may be implemented on the star observation image and input body vector to reduce the need for higher-complexity algorithms and help increase accuracy. In this study, a method based unsupervised learning is proposed to filter false stars, which can help speed up the star identification process and raise accuracy. The false star filtering process depends on the density-based clustering method, a method of unsupervised learning. The feature vectors are derived morphologically using the body vector information including position and brightness. The feature vectors comprising brightness, angular distance and its slope are obtained for each pair of stars within the observation image. A disparity list is generated using the feature vectors retrieved from two consecutive images. After the implementation of the clustering method, false stars are detected. Plus, an affine transformation matrix is obtained using motion estimation, which can be used in recursive star identification algorithms for the future studies. The empirical results are shown on a case study through the implementation of the method. Twelve sets of experiments are carried out, including the simulated observation images without noise and with brightness noise, position noise and false stars added. Confusion matrixes are obtained to show the achieved accuracy, and the transformed images are generated to measure the success of the motion estimation.

Keywords: Attitude Determination, Star Sensor, False Star Filtering, Camera Motion Estimation, Unsupervised Learning.

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Material Classification by Investigation of 3D Morphological Chip Attributes using Neural Networks

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ABSTRACT:

One of the steel types commonly used for industrial practice, 316L, is expected to have varying attributes after being processed depending on the type and purpose of the process and cutting parameters. The chip residuals remaining after the process of cutting by chip removal contain valuable information that allows prediction of the parameters of cutting process and material type. This scheme can be inverted into an estimation problem by using the morphological aspects of the chip residuals. This study aims to build a classification mechanism by means of neural networks by using the features of the chip residuals obtained through depth analysis by stereo image processing and categorized with respect to the cutting parameters they are related to. The chip residuals are produced by milling 64 pieces of 316L cylinders by using 64 different triple cutting parameters. Prior to the process of feature extraction, the optic microscope images of the chip residuals are captured with different angles to satisfy the conditions for stereo image depth analysis. The 3D models of the chip residuals are generated. The features including chip compression ratio, chip segmentation degree and tooth pitch spacing are calculated for both the 2D planar image model and 3D spatial model. The relationship between the features of the chip residuals and cutting parameters are analyzed, and the dataset is used to develop a neural network with 20 layers. The dataset is divided into three parts, six feature vectors for validation, nine feature vectors for test and the rest fifty-five feature vectors for training. The regression plots are revealed for both 2D feature vectors and 3D feature vectors. By this way, a space of feature vectors is created uniquely for 316L. the future studies aim to increase the number of experiments and expand the type of materials to allow more classes of materials to be introduced by extending the estimation problem into an estimation by classification problem.

Keywords: Chip Morphology, Milling, Neural Networks, Depth Estimation, Stereo Image Processing

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Nonwettable Hybrid Paper Sheets: Effect of the Coating Formulation on the Surface and Barrier Properties

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ABSTRACT:
Hybrid paper sheets with chemically stable superhydrophobic surface coatings were prepared through immobilizing a mixture of cross-linked poly(dimethylsiloxane) (PDMS) and various inorganic particles onto Whatman Grade 1 filter paper substrates. Coating formulations were varied in terms of the PDMS molecular masses and types and sizes of inorganic particles to prepare different hybrid paper sheets. The effect of the change in the coating formulation on the (i) optical properties, (ii) surface roughness, (iii) surface chemistry and (iv) barrier properties was investigated. Moreover, model compounds were prepared to investigate the distribution behavior of the inorganic particles on the surfaces prepared with the method proposed.

Keywords: Nonwettable Hybrid Paper Sheets, Barrier Properties

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An Operating System to Control Demand Side Management in a Microgrid

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ABSTRACT:
Distribution grids will struggle with intermittency of renewable resources, if too many renewable generators feed in without resource diversification. There might be residual oversupply, even if all fossil fuel based generators cease operation.1 This abstract will present a basic option to realize demand side management locally in microgrids at reasonable cost and technical complexity, provided the microgrid has suitable loads. For this purpose an induction engine or a resistance water heater2 will be driven by an AC-frequency or DC-voltage converter, respectively. The electrical load of such a device is called an analog load3, distinguished from digital loads designed to be turned either on or off.4 The driver incorporates a PI controller to adjust the frequency of the induction engine. The power transmitted to the macrogrid is the controlled variable5, hence the output of the system. The frequency of the induction engine is the manipulated variable. A smart meter transmits the feedback signal to the driver. The feedback signal contains information about the difference between the controlled variable and the reference input, which is the requested power to be fed in to the macrogrid. The driver manipulates the frequency of the engine according to the error. If multiple analog and digital loads of a microgrid are to be controlled to provide a higher degree of flexibility with regard to power exchanged, the respective drives and relays will be submitted to a distinct computer. The software run on this computer is a microgrid operating system.

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Keywords: Demand Side Management, Microgrid.

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Site Planning for Wind Turbines: A Case Analysis from Türkiye

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ABSTRACT:
Consumption is rising rapidly due to the increasing world population and economic growth. The expansion in consumption has also led to an enlarged demand for energy. It is expected that this situation can be managed through solutions such as more energy production and more efficient energy use. However, the sustainability and environmental impacts of the energy sector should also be considered in the design of these solutions. In this direction, the use of wind energy is gradually growing worldwide. Türkiye is one of the most convenient countries in terms of wind energy potential due to its location. The aim of this study is to examine the current status of wind power plants in Türkiye. For this purpose, the location of the proposed wind power plant in Tekirdağ, one of the provinces with the highest potential in Türkiye, is discussed using multi-criteria decision support (MCDM) approaches. Ten factors that can be considered in wind farm siting were identified through a literature review and feedback from five experts, and the weights of these factors were calculated using the AHP method. Using the weights and TOPSIS, 10 different sites given in Tekirdağ were listed in terms of wind farm applicability. As a result, the site located 22 km away from Şarköy district was identified as the most suitable location. The study is anticipated to contribute to sustainable energy assessment studies in the future.

Keywords: Site Planning, Wind Turbines.

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Optimum Control of Structures with Active Tendons

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ABSTRACT:
In this study, a single-story 3D structure with active tendons are investigated analytically under the influence of earthquake. Using MATLAB and Simulink, the structural responses and the associated control forces during the earthquake, the capacity of the actuators to be placed on each facade of the three-dimensional structure and the optimum values of the PID control parameters (Kp is the proportional gain, Td is the derived gain and Ti is the integral gain) are calculated with the help of metaheuristic algorithms.

Keywords: Control of Structures, Active Tendons.

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Molecular Imprinting: A Way to Fabricate Artificial Antibodies for SARS-CoV-2 Sensing

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ABSTRACT:
Molecular imprinting is a promising technique aiming to substitute biological recognition elements like antibodies and enzymes in bioanalysis. It is pioneered by Wulff and Mosbach to create artificial antibodies or plastibodies by the polymerization of functional monomers with or without cross-linkers in the presence of a target analyte (template). Subsequent removal of the template leads to the formation of binding cavities mirroring the template's size, shape, and functionality [1,2].

Although MIPs for low-molecular-weight substances have been successfully prepared, it is still challenging for biomacromolecules like proteins or viruses. However, increasing attention has been paid to the fabrication of MIPs due to their ease of preparation, cost-effectiveness, and stability under various extreme pHs, high temperatures, or organic solvents.

Since the first reported case of COVID-19 in 2019 in China and the official declaration from the World Health Organization in March 2021 as a pandemic, fast and accurate diagnosis of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has played a significant role worldwide. Various methods have been developed, comprising reverse transcriptase-polymerase chain reaction (RT-PCR), immunoassays, clustered regularly interspaced short palindromic repeats (CRISPR), reverse transcription loop-mediated isothermal amplification (RT-LAMP), and bio(mimetic)sensors. RT-PCR is, so far, the gold standard [3].

Herein we present MIP-based sensors for SARS-CoV-2 utilizing two different transduction methods: i) Optical and ii) Electrochemical [4,5]. Both methods address the receptor binding domain (RBD) of the spike protein (S-protein) of the virus, which binds to the host cell receptor angiotensin-converting enzyme 2 (ACE2) and mediates viral cell entry. Different lengths of peptides and scopoletin were applied to a template and functional monomer, respectively. MIP sensors were fabricated in two steps. In the first step, peptides were immobilized on a gold chip or electrode. In the next step, electropolymerization was directly performed on peptide-modified chips or electrodes. The developed sensors did not only recognize the template peptides, but they also recognized RBD, S-protein, or virus-like particles. Moreover, they were specific to the target compared to other peptides, proteins, or other viruses.

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Keywords: Molecular İmprinting, Artificial Antibodies, SARS-CoV-2.

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Effects of Boron Compounds on the Electrical Properties of Polyester Samples

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ABSTRACT:
In this study, electrical insulation properties of some polyesters and three different borate samples as additives were measured by using IEC 587 Inclined Plane Tracking test method. The endurance of pure samples lasted an average of 15 to 25 minutes. The purpose was to compare pure polyesters with other polyester samples produced depending on the type and ratio of the additive materials. The selected additive materials are boric acid, boron oxide and borax pentahydrate in their pure forms. After the experiments, the most durable material type was found to be boric acid with a 2% addition. The important factors influencing durability were determined as the types, the particle size, the purity, the density and the production conditions of the additive material.

Another aim of this study was to observe the electrical effects of polyester production with large-sized materials compared to pure polyester samples. All the polyester samples were produced manually for this study. Additionally, a digital microscope was used for particle size measurement. In this case, when working with properties of large particle sizes (700μm and 860 μm), it was not always possible to expect a linear change in the average lifetime depending on the increase or decrease in the percentage contribution rates of the polyester.

Keywords: Boron Compounds, Electrical Insulation, Inclined Plane Test, Aging.