ICAT'20
9th International Conference on Advanced Technologies

ABSTRACT BOOK
ISBN: 978-625-44427-0-4

10-12 August 2020
ISTANBUL / TURKEY
International Conference on Advanced Technologies

9th International Conference, ICAT’20
Istanbul, TURKEY, August 10-12, 2020

Abstract Book

Editors
Omer Faruk BAY
Ismail SARITAS
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E-ISBN: 978-625-44427-0-4

SN Bilgi Teknolojileri
Temizciler Sk. No:5 Meram / KONYA
Tel: 0.332 323 07 39
www.snbt.com.tr

August – 2020
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PREFACE

9th International Conference on Advanced Technologies (ICAT’20) has been organized with success in Istanbul, TURKEY on August 10-12, 2020.

The main objective of this conference is to provide a platform for researchers and academicians from all over the world to present their researches and professional development activities. This conference provides opportunities for the delegates from the electrical and computer engineering areas to exchange new ideas and to establish business or research relations and to find global partners for future collaboration.

All paper submissions have been double blind and peer reviewed and evaluated based on originality, technical and/or research content/depth, correctness, relevance to conference, contributions, and readability. Selected papers presented in the conference that match with the topics of the journals will be published in the following journals:

- International Journal of Intelligent Systems and Applications in Engineering (IJISAE)
- International Journal of Applied Mathematics, Electronics and Computers (IJAMEC)
- International Journal of Energy Applications and Technology (IJEAT)
- Selcuk-Teknik Journal (SUTOD)
- International Journal of Automotive Engineering and Technologies (IJAET)

At this conference, there were 310 paper submissions. Each paper proposal was evaluated by two reviewers. And finally, 160 papers were presented at the conference from 22 different countries (Albania, Azerbaijan, Bulgaria, Canada, China, France, India, Iraq, Islamic Republic of Iran, Libyan Arab Jamahiriya, Mexico, Myanmar, Pakistan, Palestinian Territory, Portugal, Republic of Korea, Russian Federation, South Africa, Taiwan, Turkey, United Kingdom, United States).

This conference has been supported by Selcuk University and Bahcesehir University. In particular, we would like to thank Prof. Dr. Metin AKSOY, Rector of Selcuk University, and Prof. Dr. Sirin KARADENIZ, Rector of Bahcesehir University. We also thank to SN Bilgi Teknolojileri and colleagues in our conference office. They have made a crucial contribution towards the success of this conference.

Looking forward to see you in next ICAT.

Omer Faruk BAY - Ismail SARITAS
Editors
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DESIGN AND PROTOTYPE OF THE TRANSFORMABLE UNMANNED GROUND VEHICLE

SULEYMAN VALIYEV, MUSTAFA YAGCI
ABSTRACT

Mathematical modelling of the biological processes, diseases and organs are important for the model based control of diseases. Due to unmodeled dynamics, unknown and external disturbances, the performance of controllers based on these models are degraded for the accurate control. Therefore, robust controllers are need especially for the applications on patients. Inflammation, the cause of many complex biological phenomena and diseases, is a nonlinear process that is difficult to control. In this paper, continuous-time sliding-mode controller has been designed for the control of acute inflammation response (AIR) and antibacterial drug infusion under external disturbances both for septic and aseptic cases. Sliding-mode controller (SMC) is mostly used to control nonlinear systems against external disturbances and parametric uncertainties. Beside the control signal generation, we propose constraints on the control signals based on the clinical experiences such that the applied control signal is suitable for the health and improves the performance of the controller. Due to the multiple equilibrium point on the behavior of the acute inflammation response, it is difficult to design such model-based controllers without input constraints. In the numerical applications, septic death case and aseptic death case with disturbances are controlled and acceptable performances are obtained for future clinical applications.

KEYWORDS - Inflammation Response, Sliding-Mode Control, Aseptic and Septic Cases, Disturbance.
DETECTION OF CONSUMER PREFERENCES USING EEG SIGNALS

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ABSTRACT

In this study, a liking estimation system based on electroencephalogram (EEG) signals is developed for neuromarketing applications. The determination of the degree of appreciation of a product by consumers has become an important research topic using machine learning methods. Biological data is recorded while viewing product pictures or videos, then processed by signal processing methods. In this study, 32 channel EEG signals are recorded from subjects who watched two different car advertisement videos and the liking status is determined. After watching the advertisement videos, the participants were asked to vote for the rating of the different images (front view, dashboard, side view, rear view, taillight, logo and grille) of the products. The signals corresponding to these different video regions from the EEG recordings were segmented and analyzed by the Empirical Mode Decomposition (EMD) and Ensemble Empirical Mode Decomposition (EEMD). The statistical features were extracted from Intrinsic Mode Functions (IMF) and the liking status classifications were performed. The results obtained with Support Vector Machines (SVM) show that the proposed EEG-based method may be used in neuromarketing studies.

KEYWORDS - Neuromarketing, Liking Status Detection, EEG Signals, Empirical Mode Decomposition, EEMD
INVESTIGATION OF TRIBOCORROSION BEHAVIOUR OF 316L COATED H BN WITH ELECTROPHORETIC DEPOSITION TECHNIQUE

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ABSTRACT

The corrosion and wear resistance is of great importance for biometals in terms of biocompatibility and biomechanical interaction within the human body. Due to the nature of metals, their active structures cause their biodegradation within a certain period of time. Body fluids produced by living organism create highly effective corrosive damage on metallic surfaces. In addition, metallic surfaces that can be worn mechanically spread in the form of particles in the body, creating a toxic effect. These problems can be overcome by accumulating passive films on the surface of metallic implants. There are many studies related to different methods in the literature for the production of these films. One of these methods is electrophoretic deposition (EPD). The coatings made using the electrophoretic deposition method play a role in increasing wear and corrosion resistance, especially for implants used in the biomedical field. By producing ceramic-derived coatings, non-bioactive structures can be obtained by applying them on metallic biomaterials. Corrosion and wear resistance of the metal-based implant material is increased with thin films containing metal oxides, nitrides, borides and similar nonmetallic structures. Osseointegration can be improved by covering spinal implants, bone plates and screws with EPD used in the field of orthopedics. In addition, high tribo-corrosion resistance can be developed, which is a very important feature for most implant groups. In this study, it was coated with 316L stainless steel used in the field of orthopedics by using the hexagonal boron nitride (h-BN) EPD method, which does not show any biodegradable properties, and the tribocorrosion resistance is increased. For this purpose; 316L base material is coated with solutions prepared at different concentrations, and the resistance of tribocorrosion in the simulated body fluid was investigated. Tribocorrosion process was carried out under 2 N load and was completed with open circuit potential (OCP) and potentiodynamic polarization scan. Maximum performance is obtained in thin film produced with optimum coating conditions.

KEYWORDS - Electrophoretic Deposition, 316L, Hexagonal Boron Nitride (H-BN)
THE EFFECT OF WEAR MECHANISM FOR PLASMA OXIDISED CP Ti AND ITS ALLOYS ON TRIBOCORROSION PERFORMANCE

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ABSTRACT

Commercially pure titanium (cp-Ti) and its alloys (Ti6Al4V, Ti45Nb, Ti6Al7Nb etc.) have an important use among biometalllic materials. Recently developed alloying techniques and production methods have enabled many different titanium alloys to be used as biomaterials. Although harder and higher corrosion resistance than iron and its alloys, it is used as an invasive implant by applying various surface modifications to improve biodegradability performance. One of these processes is plasma oxidation process. With this process, corrosion resistance can be improved by obtaining more passive surfaces. There are many studies on these performance measurements in the literature. In this study, the effects of wear and corrosion mechanisms on the material in one cycle were investigated. Cp-Ti, Ti6Al4V and Ti45Nb were chosen as base materials. Samples were subjected to plasma oxidation for 600˚C-3 hours. Within the scope of this investigation, the adhesive wear mechanism on oxidized surfaces was compared with different types of abrasives, and its effect on corrosion performance was measured with the tribocorrosion test apparatus. Abrasion tests were carried out with two abrasive balls: tungsten carbide (WC) and silicon nitride (SiN) under 3 N load. Processes were carried out in two different media, dry and simulated body fluid (SBF). Potentiodynamic polarization scans were carried out using the scanning range of -0.28 V - 2 V in the presence of wear tests for tribocorrosion measurements. While abrasive wear mechanism is dominant in untreated samples, adhesive wear is at the forefront in coated samples. The effects that increase the corrosion resistance positively affected the performance of tribocorrosion. The high oxidation resistance of Ti and its alloys increased adhesive wear performance, and because of the higher corrosion resistance of Ti6Al4V and Ti45Nb, which were alloyed from these three material groups, their corrosion performance was higher than Cp-Ti.

KEYWORDS - Cp-Ti, Ti6Al4V, Ti45Nb, Plasma oxidation, Tribocorrosion.
ADJUSTABLE NEURAL STIMULATOR SYSTEM WITH ANDROID APPLICATION

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ABSTRACT

Low current electrical stimulation of neural tissue is beneficial for some diseases such as chronic pain and Parkinson disease where surgery is not preferred or does not give good results. Thus, various electrical stimulation studies have been carried out in recent years. With the development of electronic technology, wired excitation systems are replaced by wireless and portable systems. Mobile phones, which provide ease of use and allow to control many devices from a single environment, have become the core of such systems in recent years. In this study, a portable nerve stimulation system that can be able to make 0-10mA stimulation, and controlled via android-based mobile phone application has been developed. Mobile phones, which provide ease of use and allow to control many devices from a single environment, have become the core of such systems in recent years. In this study, a portable nerve stimulation system that can be able to make 0-10mA stimulation, and controlled via android-based mobile phone application has been developed. Mobile phones, which provide ease of use and allow to control many devices from a single environment, have become the core of such systems in recent years. In this study, a portable nerve stimulation system that can be able to make 0-10mA stimulation, and controlled via android-based mobile phone application has been developed.

KEYWORDS - Electrical Nerve Stimulation, Electrically Nerve Stimulation, Embedded System, Bluetooth Communication, Biomedical Systems.
CLASSIFICATION OF LEFT AND RIGHT HAND MOTOR IMAGERY EEG SIGNALS BY USING DEEP NEURAL NETWORKS

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ABSTRACT

The brain-computer interface (BCI) is one of the most promising technologies that allows us to establish a relationship between brain and devices. In this study, three-channel EEG signals collected from nine subjects performing two motor imagery tasks are classified using two different deep neural network (DNN) based approaches called framework 1 (FW1) and framework 2 (FW2). The proposed frameworks were evaluated using BCI Competition IV-IIb dataset. In FW1, the raw EEG data is directly presented to the deep neural network without performing any pre-processing. In FW2, the EEG data is first filtered with five band pass filters with fifth order (Butterworth), then the common spatial patterns (CSP) method, which introduces additional pseudo channels, is applied to the filtered signals. Two experiments were conducted for each framework. In the first experiment, a unique DNN is trained for each subject, and in the second experiment only one DNN is trained with the combination of training sets of all subjects. The performance of the two experiments are then compared in terms of average accuracy. According to the simulation results, we did not observe a significant difference between the average classification accuracies obtained with the first and the second experiments. Therefore, we concluded that, by the use of DNNs we do not need to train several subject-specific networks which requires high computational loads. On the other hand, we observed that the average classification performance significantly improves by the filtering and extracting features with CSP pre-processes.

KEYWORDS - EEG, Motor Imagery, Deep Learning, Convolutional Neural Network, Common Spatial Patterns
FRAMINGHAM RISK SCORE BY DATA MINING METHOD

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ABSTRACT

There are cleaning, integration, reduction, conversion, algorithm implementation and evaluation stages in data mining meaning finding necessary data from a wide variety of variables and data. It is important to create a data warehouse to realize these steps. Data randomly selected from data warehouse is evaluated with certain algorithms. While deaths resulting from heart diseases in our country are 37% according to 2016 data, 420-440 thousand people are diagnosed as heart patients each year and the number of deaths per year can reach 340 thousand people. These values correspond to approximately three times of Europe. In this study, risk of heart attack is calculated by data mining method by taking advantage of Framingham risk score. In order to determine this risk factor; 10-year risk is calculated by looking at sex, age, total cholesterol, HDL cholesterol, blood pressure, diabetes and smoking. Framingham risk score reveals different risk results for men and women. There are risk values ranging from 1% to 30%. These values vary according to scores between 0-17 and over in men, and scores between 0-25 and over in women. As a result of scoring the values that possible patients will get from routine blood tests results and daily measurements, the risk factor of heart attack is revealed in percent. This system is also included in e-pulse application.

KEYWORDS - Data Mining, Heart attack risk, Framingham Risk Score, ECG
MULTI CLASS ACTIVITY CLASSIFICATION BY USING ONE VS REST STRATEGY

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ABSTRACT

Human activity classification is an issue that more and more researchers are working on day by day. In this study, human activity classification was done using an open source dataset. Dataset was created using 4 subjects. 6 kinds of daily life activities were tried to be classified by using the data obtained from accelerometers placed in different parts of the subjects’ body. 11 features, which are frequently used in activity classification, have been determined. First of all, the data divided in two parts as 70% training and 30% test. The classification was made with SVM, k-NN and DT algorithms by using the train data and these results were examined comparatively. Next, the confusion matrix of the most successful classifier was examined and the one-vs.-rest strategy was determined. The activity to be allocated at each step and the algorithm variations to be used in classification were determined by empirical experiments. Thus, the most successful strategy has been determined. By using the test data, the novel one-vs.-rest strategy is tested. The results of the study were examined comparatively in terms of machine learning performance parameters. The results showed that the classification made with the one-vs.-rest strategy is superior to all normal classifiers in terms of accuracy and F-score.

KEYWORDS - Machine Learning, Activity Classification, Multi-Class, One-Vs.-Rest, Accelerometer
COMPARISON OF PHYSICAL CHANGES IN 7 KV CM AND 12 KV CM ELECTRIC FIELD VALUES OF PS BASED STRUCTURES IN LIQUIDS CONTAINING FIXED CONCENTRATION E COLI BACTERIA

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ABSTRACT

The ability to detect the presence of certain biomolecules is crucial for many areas. Porous Silicon (PS) is used as a promising material for biosensor applications due to its large internal surface area, adjustable pore size, porosity and ease of production. PS-based structures were obtained by applying electrochemical anodization method to the n-type single crystal silicon material used in this study. These structures were submerged in liquids containing 4x10⁷ cfu fixed concentration live E. coli bacteria and were exposed to 7 kV/cm and 12 kV/cm electric field, in separate experiment sets for 0.5-3 hours. The aim of this study is to compare the change in frequency-dependent impedance values of the approaching and removal of bacteria to the pores formed in PS-based structures as a result of forward and reverse application of different electric field values of E. coli bacteria with negative electric charge. The same experiments were repeated on dead bacterial cells. PS-based structures are immersed in liquids containing autoclaved 4x10⁷ cfu E. coli constant bacteria concentration for 20 minutes at a pressure of 1.5 atm at 121 0C for a period of 0.5-3 hours, and 7 kV/cm and 12 kV/cm electric fields in separate experiment sets values were examined.

KEYWORDS - E. Coli, Electric Field, Porous Silicon
THREE DIMENSIONAL MODELLING TRANSIENT ANALYSIS OF SURFACE ACOUSTIC WAVE DELAY LINE DEVICE USING COMSOL MULTIPHYSICS

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ABSTRACT

This paper represents the simulation and modelling of three dimensional (3D) surface acoustic wave (SAW) delay line device using finite element method in COMSOL Multiphysics platform. This device is made of thin film of aluminium nitrate (AlN) material with two pairs of aluminium interdigital transducers (IDTs). The SAW device delay line is studied in time transient analysis to examine the mechanical and electrical performance of delay line SAW. The results are showed the difference for both electrical and mechanical performance between the beginning of oscillation of SAW device and the end of oscillation, the performance of mechanical is showed high responses amplitudes at the end of SAW oscillation compared with the beginning of oscillation. The electrical performance is obtained in time analysis while electrical characterization of SAW device is obtained from using fast Fourier transform (FFT) at input and output of IDTs such as admittance, scatter parameters, insertion loss. As for mechanical characterization of SAW device the quality factor is obtained by using FFT. SAW device is simulated using COMSOL Multiphysics to investigate the theoretical performance of mechanical and electrical characterizations with center frequency equal to 15.8 MHz and comparing them with experimental characterizations.

KEYWORDS - 3D Simulation, AlN Thin Film, COMSOL Multiphysics Program, Quality Factor, SAW Device, S-Parameters
DETERMINATION OF RISK OF DEATH CAUSED BY HEART FAILURE BY RANDOM FOREST METHOD

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ABSTRACT
The aim of this study is to create a decision support system by kneading clinical information of heart failure patients with artificial intelligence techniques. Heart failure is when the heart muscle weakens and the heart needs to work harder to keep blood flowing through the body. Heart failure occurs after problems such as a heart attack, long-term high blood pressure or damage from an abnormality of one of the heart valves cause damage to the heart. Heart failure is often defined as a further stage of heart failure, called congestive heart failure (CHF), in which fluid can seep into the lungs, feet and in some cases into the liver or abdominal cavity. At this point it is important to perform early diagnosis of the disease and to identify the disease before irreversible consequences occur. In order to make decisions in medicine, in-depth research, analysis statistics, up-to-date information on the subject, test results and the patient's medical history are needed. Support systems are being developed for selecting the correct diagnosis and appropriate procedures to assist the doctors decided to formulate. Computer-based systems involving artificial intelligence techniques help doctors make decisions about their patients' treatments. At this point, by using artificial intelligence techniques in medical decisions, doctor's error rates and stress can be removed by producing mathematical models to assist in critical decision moments. This study analyzed a dataset of 299 heart failure patients collected in 2015. Various machine learning classifiers have been applied both to predict the survival of patients and to rank characteristics corresponding to the most important risk factors. The Random Forest method, which has the highest accuracy among these artificial intelligence techniques, achieves 84.2809% accuracy.

KEYWORDS - Heart Failure, Computer-Based Systems, Random Forest Method, Artificial Intelligence Techniques
THE BIOMECHANICAL ANALYSIS FOR BIODEGRADABLE PURE MAGNESIUM BONE SCREWS UNDER THREE POINT BENDING AND TORSIONAL TEST

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ABSTRACT

Recently, magnesium and its alloys have been used as the raw material of degradable implants. In the orthopedic implant group, it is used in the production of medical tools due to its close modulus of elasticity and mechanical behavior suitable for bone tissue. In addition, magnesium is completely biodegradable both in biocompatible and living organisms. The purpose of using a degradable implant within the living organism is both to perform biomedical functions. It has become even more attractive to use the biodegradable magnesium screws due to the use of the temporary (non-biodegradable) implant in the living organism, the need for a secondary surgical operation to remove it from the body, and the increased risk of complications for the patient. However, the degradation times of magnesium screws; It is difficult to control the biological environment, the age and gender of the patients and the implant geometry Determination of the degradation stage is important for mechanical performance due to loss of mass and volume in the implant. Furthermore, loss of adhesion performance due to deterioration of bone screws weakens the mechanical properties of the implant system. Considering this feature of magnesium screws, pure magnesium screws of different origin were kept in phosphate buffer solution (pH = 7.4) for 1 day, 1,4,12 and 26 weeks. Then, three-point bending and torsion tests were performed according to ASTM F2502-11 standard to examine the mechanical properties of the screws. In the mechanical tests applied for both groups, when the three-point bending test and force-displacement curves were examined, it was observed that the mechanical properties of the 26th week decreased by about half compared to the 1st day. In the same way, when the torsion-torsion angle curves were examined in the torsion test, it was observed that the mechanical properties of the 26th week decreased for both groups.

KEYWORDS - Pure Magnesium, Biodegradation, Bone Screws, Three-Point Bending Test, Torsion Test
A COMPARISON OF CONVOLUTIONAL AND RECURRENT NETWORK ALGORITHMS ON HUMAN ACTIVITY RECOGNITION

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ABSTRACT

Lately, and by using the models of deep learning, it became easier to recognize the human activity with more accuracy than before by categorizing the activities that people are doing daily, especially the old people. In these days, and with the modern smart phones that have sensors, it became easier to save the data in raw format that has the details and values of three dimensions (X-Y-Z). In this paper, we utilized the open source W!reless Sensor Data Mining (WISDM) dataset which has six activities that are walking, jogging, standing, sitting, upstairs and downstairs. Every activity of those activities has values in terms of (X, Y and Z) axes. We performed two types of deep learning algorithms that are Convolutional Neural Network (CNN) and Recurrent Neural Network - Long Short-Term Memory (RNN-LSTM). Our paper’s aim is to make a comparison between accuracy and loss after implementing the two models. We discovered that, when using the Convolutional Neural Network (CNN), the accuracy was 81%. However, the accuracy was 91% when using Recurrent Neural Network - Long Short-Term Memory (RNN-LSTM) and applying it on same database. As a result, Recurrent Neural Network - Long Short-Term Memory (RNN-LSTM) model outperforms Convolutional Neural Network (CNN) model.

KEYWORDS - Human Activity Recognition, Activity Type, CNN, RNN-LSTM, WISDM
TIME SERIES PREDICTION BASED ON FACEBOOK PROPHET
A CASE STUDY TEMPERATURE FORECASTING IN
MYINTKYINA

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ABSTRACT

Temperature forecasting is a progressive and time series analysis process to forecast the state of the temperature for a certain location in coming time. Nowadays, agriculture and manufacturing sectors are mostly dependent on temperature so forecasting is important to be precise because temperature warnings can save life and property. In this work, the Prophet Forecasting Model is used for Myitkyina's annual temperature forecasting using historical (2010 to 2017) time series data. Myitkyina is the capital city of the northernmost state (Kachin) in Myanmar, located 1480 kilometers from Yangon. Prophet is a modular regression model for time series predictions with high accuracy by using simple interpretable parameters that consider the effect of custom seasonality and holidays. In this study, the temperature forecasting model is proposed by using weather dataset provided by an International institution, National Oceanic and Atmospheric Administration (NOAA). This work implements the multi-step univariate time series prediction model and compare the forecasted value against the actual data. Such findings check that the proposed forecasting model provides an efficient and accurate prediction for temperature in Myitkyina.

KEYWORDS - Time Series Data, Time Series Prediction, Facebook Prophet Model
GENDER DETERMINATION USING VOICE DATA

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ABSTRACT

Today, with the rapid advancement of technology, the systems are tried to be facilitated by utilizing the voice features of the users, making use of voice features such as person recognition and speech recognition. In this case, the service provider needs less manpower and facilitates the operation by helping users faster. The decision making process using voice features is a very difficult process. With gender recognition, which is one of these steps, the opportunity to appeal to the user with their gender can be obtained. In this study, it is aimed to define gender from the voice, which is also important in terms of forensic computing. The dataset used consists of 3168 male and female voice samples. Sound samples were pre-analyzed by acoustic analysis in R using seewave and tuneR packages. Logistic regression, the statistical method used to determine a result using one or more independent variables, was used in the classification phase. In order to increase the classification accuracy, dataset has been divided into 10 parts and each part has been excluded from training for the test and used for the test. The average classification success was found by taking the arithmetic average of the obtained results. In the classification made using the logistic regression method, male and female voices could be distinguished from each other with 91.3\% success.

KEYWORDS - Voice, Gender Recognition, Regression, Machine Learning
IDENTIFICATION OF ENGLISH ACCORDING WITH K NEAREST NEIGHBOR TALKED IN DIFFERENT COUNTRIES

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ABSTRACT

Sound is the pressure wave created by an object vibrating with a certain frequency. 3 organs are needed for the formation of voice in humans. These are lungs, vocal cords and mouth. Due to the structure of these organs and the similarity of the person with their current language, they can speak another language with different accent. A language can be spoken in different parts of the same country and in different countries. English, the official language in the world, has numerous accents around the world. In this study, it is aimed to determine which country the English accent spoken in different regions belongs to. In the dataset used, there are 330 sound samples including English accents spoken in Spain, France, Germany, Italy, England and America. 165 of these sound samples belong to American accents and the rest to other accents. For this reason, the classification rate of other accents other than American accents is low. Feature extraction from sound samples has been done before and dataset was created in this way. Classification has been made with 12 features obtained by Mel Frequency Cepstrum Coefficients feature extraction method. In classification, k-Nearest Neighbor algorithm was used and 87.2% success was achieved.

KEYWORDS - Language, Accent, Neural Network, English
BINOCULAR MACHINE ACTIVE VISION SYSTEM FOR ROBOTS NAVIGATION ENVIRONMENT RECONSTRUCTION

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ABSTRACT

Computer Vision or Machine Vision is the computer implementation of the vision process that allows machines to understand the surrounding environment. Employing machine vision system in robots gives it more powerful and advanced operation in real life application such as exploration of environments. Binocular machine active vision system has been implemented to reconstruct unknown / partially-known navigation map of robots. The system is composed of four processing stages namely: frame capturing, pre-processing, matching and depth recovery is applied to determine the distance between the system and the object and then stored in relative depth matrix and finally navigation map update. Computer Vision or Machine Vision is the computer implementation of the vision process that allows machines to understand the surrounding environment. Employing machine vision system in robots gives it more powerful and advanced operation in real life application such as exploration of environments. Binocular machine active vision system has been implemented to reconstruct unknown / partially-known navigation map of robots. The system is composed of four processing stages namely: frame capturing, pre-processing, matching and depth recovery is applied to determine the distance between the system and the object and then stored in relative depth matrix and finally navigation map update.

KEYWORDS - Machine Vision, Active, Stereo, Navigation Map, Robot
AUTOMATIC CATEGORIZATION OF TEXTILE PATTERNS USING CONVOLUTION KERNELS

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ABSTRACT

Due to the rapid advancement of textile technologies, textile images have reached a huge amount, and they cannot be classified efficiently by hand. The classification of these textile images with different patterns is a time-consuming and hard process. To reach the textile images fast, automatic classification is a necessary process. In this study, textile classification systems have been designed and implemented by Support Vector Machine, Multi-Layer Perceptron, Naive Bayes, and K-Nearest Neighbors classifiers. The systems consist of Preprocessing, Feature Extraction, Train, and Test operations. In the preprocessing stage, after each image is converted to grayscale. After that, the edges of the images have been detected with four edge detection operators. Furthermore, skeletonization process is performed. After computing the frequencies of nxn convolution kernels in the image, the convolution kernel vectors are normalized and the feature vectors for the textile images are generated in the feature extraction stage. In the train stage, according to some techniques, the models of all categories have been constructed by training all feature vectors in every category. The dataset includes seven categories as “Horizontal Striped”, “Speckled”, “45-Degree Striped”, “Flowery”, “Vertical Striped”, “Plaided” and “135-Degree Striped”. Using the training dataset, the systems are trained with the categorization methods. In test stage, the systems have been evaluated by using the textile images in the test dataset, and each class model has been generated in the train stage. F-measure and Accuracy scores have been obtained with calculating the system’s results. According to accuracy and F-measure, the best success values of the systems, which are evaluated with k-fold-cross-validation technique, are attained with Support Vector Machines. The best accuracy and F-measure results are 95.3% and 95.1% respectively. The best values of the systems have been found with 4x4 convolution kernel and Sobel edge detector.

KEYWORDS - Textile Image, K-Nearest Neighbor, Multi Layer Perceptron, Support Vector Machines, Naive Bayes
DISSIMILARITY WEIGHTING FOR GRAPH BASED POINT CLOUD SEGMENTATION USING LOCAL SURFACE GRADIENTS

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ABSTRACT

Processing of 3D point cloud data is seen as a problem due to the difficulties of processing millions of unstructured points. The point cloud segmentation process is a crucial pre-classification stage such that it reduces the high processing time required to extract meaningful information from raw data and produces some distinctive features for the classification stage. Local surface inclinations of objects are the most effective features of 3D point clouds to provide meaningful information about the objects. Sampling the points into sub-volumes (voxels) is a technique commonly used in the literature to obtain the required neighboring point groups to calculate local surface directions (with normal vectors). The graph-based segmentation approaches are widely used for the surface segmentation using the attributes of the local surface orientations and continuities. In this study, only two geometrical primitives which are normal vectors and barycenters of point groups (for obtaining a tangent vector of fitting co-plane of two adjacent local planes) for the weight values of the connections that connect the adjacent voxels (vertices), 14 possible dissimilarity calculations of three angular values getting from the primitives are experimented and evaluated on five sample datasets that have reference data for segmentation. Finally, the results of the measures are compared in terms of accuracy and F1 score.

KEYWORDS - Point Cloud Segmentation, Graph-Based Segmentation, Normal Vector, Weighting, Surface Gradients
DETECTION AND DIFFERENTIATION OF COVID 19 USING DEEP LEARNING APPROACH FED BY X RAYS

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ABSTRACT

The coronavirus, which appeared in China in late 2019, spread over the world and became an epidemic. Although the mortality rate is not very high, it has hampered the lives of people around the world due to the high rate of spread. Moreover, compared to other individuals in the society, the mortality rate in elderly individuals and people with chronic disease is high. The early detection of infected individuals is one of the most effective ways to both fight disease and slow the outbreak. In this study, a deep learning approach, which is alternative and supportive of traditional diagnostic tools and fed with chest x-rays, has been developed. The purpose of this deep learning approach, which has the convolutional neural networks (CNNs) architecture, is (1) to diagnose pneumonia caused by a coronavirus, (2) to find out if a patient with symptoms of pneumonia on chest X-ray is caused by bacteria or coronavirus. For this purpose, a new database has been brought together from various publicly available sources. This dataset includes 50 chest X-rays from people diagnosed with pneumonia caused by a coronavirus, 50 chest X-rays from healthy individuals belonging to the control group, and 50 chest X-rays from people diagnosed with bacterium from pneumonia. Our approach succeeded in terms of accuracy of 92% for coronavirus-based pneumonia diagnosis tasks (1) and 81% for the task of finding the origin of pneumonia (2). Besides, achievements for Area Under the ROC Curve (ROC AUC), Precision, Recall, F1-score, Specificity, and Negative Predictive Value (NPV) metrics are specified in this paper.

KEYWORDS - Covid-19, AlexNet, CNN, Pneumonia, X-ray
A DEEP LEARNING APPROACH FED BY CT SCANS FOR DIAGNOSIS OF COVID 19

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ABSTRACT

Since the beginning of 2020 Covid-19 disease has widely spread around the world. To both fight disease and slow the outbreak, early detection of infected individuals is one of the most effective ways. Although the coronavirus has many symptoms, the fatal one is the damage to the lung. One of the methods used to detect this damage is computed tomography (CT). Convolutional Neural Networks (CNNs), which is a highly effective deep learning algorithm on multidimensional data, is used on different types of medical images such as CT scan, MRI, and X-ray. In this study, we aim to develop a deep learning approach and thus detect/diagnose COVID-19 by using chest CT scans. For this purpose, a public resource consisting of 349 CT scans of 216 patients with COVID-19 clinical findings and CT scans of 397 healthy individuals was used. Diagnostic performance was assessed by accuracy, precision, recall, Matthews’s coefficient correlation (MCC), and F-measure criteria. The validity of the approach was tested using a 10-fold cross-validation technique. The results showed that CNN achieves an average accuracy of 92.63%, precision 92.95%, recall 93.18%, MCC 85.20, and F1-measure 93.06%. Considering the results obtained with this approach developed within the scope of this study, the mentioned approach may be an alternative or supportive of classical diagnostic approaches in coronavirus outbreak.

KEYWORDS - COVID-19, Deep Learning, Diagnosis, CT-Scan, Classification
DISCOVERING THE SAME JOB ADS EXPRESSED WITH THE DIFFERENT SENTENCES BY USING HYBRID CLUSTERING ALGORITHMS

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ABSTRACT

Job advertisement analysis studies have become widespread in recent years to determine the necessary qualifications for different professions. It can be said that the researches made for Turkish are limited while a large resource pool is encountered for the English language. Kariyer.net is the biggest company for the job ads in TURKEY and 99% of the ads are Turkish. Therefore, there is a necessity to develop novel Natural Language Processing (NLP) models in Turkish for analysis this big database. In this study, the job ads of Kariyer.Net have been analysed, and by using a hybrid clustering algorithm, the hidden associations in this dataset as the big data have been discovered. Firstly, all ads in the form of HTML codes have been transformed into regular sentences by the means of extracting HTML codes to inner texts. Then, these inner texts containing the core ads have been converted into the sub ads by traditional methods. After these NLP steps, hybrid clustering algorithms have been used and the same ads expressed with the different sentences could be managed to be detected. For the analysis, 57 positions about Information Technology sectors with 6,897 ad texts have been focused on. As a result, it can be claimed that the clusters obtained contain useful outcomes and the model proposed can be used to discover common and unique ads for each position.

KEYWORDS - Natural Language Processing, Job Ads, Clustering, Machine Learning, Hybrid Algorithms.
A FUZZY LOGIC APPROACH IN THE BANK Q MATIC EVALUATION

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ABSTRACT

Different models are used to evaluate and organize the queuing structure of customers' bank transactions. Banks give a customer number to those who work with them. The average waiting time varies depending on whether or not a customer of the bank and the score of the customer. The parameters used in determining the individual queue group and average waiting time in bank q-matic transactions contain uncertainties. This study proposes a fuzzy logic-based approach in bank q-matic systems. Also, the identification number is a determining factor for the priority of transactions in bank q-matic systems. People who are not customers of the bank have longer waiting times. As a new approach to the working structure of q-matic systems, this study also suggests that people who do not have a customer number to be given a queue number based on their credit score.

KEYWORDS - Q-Matic, Bank Queue Evaluation, Fuzzy Logic, Fuzzy Model
FEATURE EXTRACTION AND RECOGNITION ON TRAFFIC SIGN IMAGES

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ABSTRACT

It is vital that the traffic signs used to ensure the order of the traffic are perceived by the drivers. Traffic signs have international standards that allow the driver to learn about the road and the environment while driving. Traffic sign recognition systems have recently started to be used in vehicles in order to improve traffic safety. Machine learning methods are used in the field of image recognition. Deep learning methods increase the classification success by extracting the hidden and interesting features in the image. Images contain many features and this situation can affect success in classification problems. It can also reveal the need for high-capacity hardware. In order to solve these problems, convolutional neural networks can be used to extract meaningful features from the image. In this study, we created a dataset containing 1500 images of 14 different traffic signs that are frequently used on TURKEY highways. The features of the images in this dataset were extracted using convolutional neural networks from deep learning architectures. The 1000 properties obtained were classified using the Random Forest method from machine learning algorithms. 93.5% success was achieved as a result of this classification process.

KEYWORDS - Feature Extraction, Traffic Sign Images, Deep Learning
The rising number of people working and living in big cities around the world, many of which own a personal car, lead to a well-known social problem, namely, traffic congestions. Congestions occur when a large number of road traffic participants aim to use the very same infrastructure, while the latter has limited capacity. This situation entails a number of negative consequences, such as slow motion, economic losses, environmental pollution, safety problems and road accidents. The implementation of appropriate transport infrastructure management can make traffic more efficient, safer and greener. Traffic management in an urban environment is mainly realized through traffic light management. It is an integral part of the intelligent transport system (ITS), which is essential for facilitating traffic congestion. Poor traffic management and inefficient settings at signalized intersections cause many problems such as excessive delays for vehicles, increased fuel consumption and CO2 emissions generated by transport means. The efficiency of signalized intersections can be significantly improved by optimizing phase duration and synchronizing traffic lights using intelligent traffic management methods. For this reason, the paper demonstrates the use of function fmincon in environment Matlab for improving the level of service (LOS) in intersection by optimizing the phase length and cycle of network of four consecutive traffic lights. The average weighted controlled vehicle delay at the intersection is the indicator for assessing the effectiveness of the objective function. The results of the study show that the calculated values for delays for passing through intersections have decreased.

**KEYWORDS** - Transport Network
VEHICLE DETECTION APPLICATION BASED ON FUZZY LOGIC

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ABSTRACT

Vehicle detection and identification is a very important function in the field of traffic control and management. Generally, a study should be conducted on big data sets and area characteristics to approach this function. The aim is to find the most appropriate model for these data. Also, the model that is prepared for the data aims to recognize the factors inside the display. In other words, it aims to assign the factors the right classes and differentiate them. A classification of the display is made in that way. Especially, Image processing and computer vision applications are used commonly in vehicle automation, security systems, mobile robot applications, surveillance of friendly and enemy forces in military fields, agricultural applications, biomedical and medical fields, geographical information systems, design and manufacturing applications. In this study, a vehicle identification system is identified in which Fuzzy C-Means Algorithm is used for image segmentation and the Support Vector Machine is used for image classification. Principal Component Analysis is also used in the study to reduce qualification. The being up-to-date of these methods which are used is their most important property. The obtained results showed the selected methods are applied successfully and effectively.

KEYWORDS - Clustering, Fuzzy C-Means Algorithm, Image Processing, Support Vector Machine, Vehicle Identification
Customer relationship management - CRM systems aim to increase customer satisfaction and loyalty to the company through actions that can be performed by monitoring and analyzing customer behaviours for companies. In these systems, the data obtained from different sources such as sales process, service, and call center are interpreted by the CRM experts as a whole, and the necessary action is taken for the customer. With the rapid progress in information technologies, the diversity of resources that are used to collect data, the size and dynamism of the data have increased. This situation has made it impossible for experts to wholly interpret big-size data from a wide variety of sources in a short period of time. In the CRM area, there is a need for technologies that automatically integrate the data obtained from several sources and can interpret it semantically. In this study, an ontology-based approach is proposed, which allows automatic semantic interpretations on the data obtained from different sources. Based on the proposed approach, a tool has been developed that can unify data from different CRM systems in a common format and make customer-centric interpretations of this data. The tool continuously monitors the systems it is integrated with, and when it detects the conditions defined by the users on the data, it can automatically perform the actions determined by the users. The tool developed was experienced by integrating a CRM system of a company and the evaluation results obtained in this process were discussed.

**KEYWORDS** - Ontology Engineering, CRM, Model Transformation, Semantic Analysis, Data Integration
AUTOMATIC BRAIN TUMOR SEGMENTATION WITH K MEANS FUZZY C MEANS SELF ORGANIZING MAP AND OTSU METHODS

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ABSTRACT

The human brain is an amazing organ of the human nervous system and controls all functions of our body. Brain tumors emerge from a mass of abnormal cells in the brain, and catching tumors early often allows for more treatment options. For diagnosing brain tumors, it has been benefited mostly from magnetic resonance images. In this study, we have developed the segmentation systems using the methods as K-Means, Fuzzy C-Means, Self-Organizing Map, Otsu and the hybrid method of them, and evaluated the methods according to their success rates of segmentation. The developed systems, which take the brain image of MRI as input, perform skull stripping, preprocessing, and segmentation is performed using the clustering algorithms as K-Means, Fuzzy C-Means, Self-Organizing Map and Otsu Methods. Before preprocessing, the skull region is removed from the images in the MRI brain image data set. In preprocessing, the quality of the brain images is enhanced and the noise of the images is removed by some various filtering and morphological techniques. Finally, with the clustering and thresholding techniques, the tumor area of the brain is detected, and then the systems of the segmentation have been evaluated and compared with each other according to accuracy, true positive rate, and true negative rate.

KEYWORDS - Brain Tumor Segmentation, Medical Imaging, K-Means, Fuzzy C-Means, Self-Organizing Map, Otsu Method.
SMART HOME SYSTEM FOR MAKING EASIER THE LIVING OF THE ELDERLY

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ABSTRACT

In this study, it has been researched how smart home technologies, which enable people to lead a more comfortable and safer life, can provide the life of elderly and needy people, and which smart home scenarios can be used to provide convenience to these people in the Smart Home project developed. With this project, we aim to make the elderly, and someone need for care living in our society live an easier and more comfortable life. Our most important goal is to develop a smart home system that will improve the quality of life of these people. While making this determination, both the demands of elderly and needy people in this direction and the smart home scenarios used in the previously developed smart home systems were based on. We think that this system we developed will be effective in increasing the welfare level of the society. At the same time, many people living far away from their families will be able to be constantly informed of them by using this system. This system can be developed in the future and turned into a state application. Many elderly and bedridden patients can be controlled remotely in any situation and can be interfered to them quickly. In addition, one of the biggest advantages of the project is that it can be controlled remotely through both the mobile application and the website we designed.

A HEURISTIC APPROACH WITH ARTIFICIAL NEURAL NETWORK FOR PARKINSON’S DISEASE

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ABSTRACT

Parkinson’s disease is a common neurological disorder. Its symptoms are more commonly in the form of motor misfunctionings. As the disease progresses, non-motor symptoms are also observed. In previous studies, feature selection methods have been used and shown significant benefits in the diagnosis of the Parkinson’s Disease in patients. Feature selection methods aim to improve the classification performance by eliminating non-valuable or less-valuable features. In this study, we aim to analyze, for diagnosing Parkinson’s disease, the voice recordings of the patients with applying a recent bio-inspired optimization technique namely the Wolf Search (WS) algorithm. WS is a bio-inspired heuristic optimization algorithm which has been inspired by the natural behavior of wolves in daily life. We also use an artificial neural network model with feature selection methods, for the purpose of classification of the Parkinson’s Disease in patients. We investigate the classification performances of the combinations of WS-based feature selection method with well-known feature selection methods namely Information Gain and ReliefF feature selection methods. Experimental results show that ReliefF feature selection method outperform than other feature selection method combinations for the diagnosis of the Parkinson’s Disease in patients, even more, the time needed to classify new patients reduced sharply as the number of features were decreased.

KEYWORDS - Artificial Intelligence, Artificial Neural Network, Cuckoo Search, Machine Learning, Feature Selection, Parkinson
ANALYSIS OF ARTIFICIAL INTELLIGENCE TECHNOLOGIES USED IN THE CORONAVIRUS OUTBREAK PROCESS

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ABSTRACT

In the course of the outbreak of coronavirus (Covid-19), which emerged in Wuhan, China at the end of 2019, and then spread all over the world, the biggest assistants in the fight against this virus were the technologies which used. Today, the areas where artificial intelligence is applied and the developments in the focus of artificial intelligence lead the technology. With Industry 4.0, there is no need for manpower to meet especially unqualified workforce in many business sectors. The idea of doing things by machines has begun to cause serious changes in the world. In order for the work to be done by the machines, importance has been given to the development of the decision making capabilities of the machines. The decision-making ability of the machines is based on previous periods. The lack of necessary computer hardware parts in testing the hypotheses made in the previous periods caused. It has not been applied in the past due to the high time and cost of hypotheses developed. Today, as a result of the rapid growth of technology, hardware elements with high processing capability can now be obtained at affordable prices. As a result of the acceleration of the developed hardware elements, many methods that took a long time in the past have reached the level that everyone can apply. We observe that what needs to be done for digital transformation in our country has been tested in many sectors. The most basic element for digital transformation is artificial intelligence technology. This is an indication that artificial intelligence technologies have started to be used in many areas of our lives. Accordingly, the use of artificial intelligence technologies in different areas, especially in medicine, played an important role in combating the epidemic during the coronavirus (Covid-19) epidemic process. In this study, the concept of artificial intelligence and the usage areas of artificial intelligence techniques are discussed in the literature section. Then, the applications developed using artificial intelligence technologies during the coronavirus (Covid-19) epidemic process were evaluated and the adequacy of the applications developed by analyzing in the method section was discussed.

KEYWORDS - Artificial Intelligence, Coronavirus, Computer Vision, Expert Systems, Robotics
EVALUATE OF THE REPRODUCTIVE EFFICIENCY OF COWS WITH FUZZY LOGIC

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ABSTRACT

Fuzzy Logic (Fuzzy Logic) is a branch of science based on thinking like human beings and solving them with mathematical functions. Fuzzy logic theory is a mathematical theory. Based on fuzzy set theory, it also uses intermediate values. The fuzzy logic that emerged in 1965 is used in many fields. In the production of pacemakers, in the production of artificial organs, in many electronic devices, company efficiency estimation, etc. situations are used. Fuzzy logic, which is frequently used in the solution of problems that occur in uncertain situations such as quality assessment in recent years, is one of the artificial intelligence methods. The fuzzy logic approach gives machines the ability to process people's private data and operate from their experience and foresight. In this study, by using Matlab Fuzzy Toolbox, it was aimed to design a system that gives information about the breeding performances of cows. The expert system was designed based on the optimal values under the ideal conditions specified in the literature. The architecture of the system is designed as three input parameters and one output. The designed system was tested with 100 sample values. Afterwards, expert results were evaluated and system decisions were compared. The success of the decision support system was 94%. As a result, the reproductive efficiency of cows can be determined with this designed system. With this determination, the handling or disposal of cows can be determined.

KEYWORDS - Fuzzy Logic, Expert System, Farm Yield, Reproductive Efficiency, Cow
STACKED HOURGLASS NETWORK WITH ADDITIONAL SKIP CONNECTION FOR HUMAN POSE ESTIMATION

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ABSTRACT

The human posture estimation is a problem of localizing human joints in a single image, and that is still a challenge in the field of computer vision. The hourglass network has been used in many researches to achieve good performance in human pose estimation problems. For human pose estimation problem, not only high-level features but also low-level features are important for understanding the whole human body. However, the vanilla hourglass network has the problem of passing only high-level features to the next stack. Therefore, we propose a network structure that can solve the problems of the vanilla hourglass by using an additional skip connection. The proposed skip connection improves network performance by passing relative low-level features to the next stack. In addition, the skip connection is a simple element-wise Sum operation, so there is no increase in the number of parameters. In this work, we use the well-known human posture estimation data set, MPII, to evaluate the proposed method. We conducted experiments to evaluate the objective performance of the proposed method, and it was confirmed through this evaluation that the proposed method improves the performance of human pose estimation of the vanilla hourglass network.

KEYWORDS - Human Pose Estimation, Hourglass Network, Deep Learning
AN IMPROVED SPLIT ATTENTION ARCHITECTURE BASED ON CIRCLE LOSS FOR PERSON RE IDENTIFICATION

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ABSTRACT

Person re-identification aims to match pedestrian images across multiple surveillance camera views. It is still a challenging task due to the partial occlusion of pedestrian images, variations in the illumination of surveillance cameras, and similar appearances of pedestrians and so on. In order to improve the representation ability of pedestrian features extracted from the convolutional neural networks, in this paper, we proposed an improved split-attention architecture for person re-identification. Specifically, we first divide the feature map into two sub-groups and then split the features in each subgroup into three more fine-grained sub-feature maps. Moreover, in order to minimize the inter-class similarity and maximize the intra-class similarity, we use circle loss and identification loss to optimize our network together. Circle loss makes the similarity scores learn at different paces, which benefits deep feature learning. The circle loss not only makes the model have higher optimization flexibility but also makes the convergence target of the model more definite. Unlike many methods that use complex convolutional neural networks to represent pedestrian feature maps in a layer-wise manner, our proposed method improves the representation ability of pedestrian features at a more fine-grained level. We evaluated the performance of our proposed network on two large-scale person re-identification benchmark datasets Market-1501 and DukeMTMC-reID. Experimental results show that the proposed split-attention network outperforms the state-of-the-art methods on both datasets with only using pedestrian global features.

KEYWORDS - Person Re-Identification, Circle Loss, Deep Learning
DIMENSION AND COLOR CLASSIFICATION OF OLIVE FRUIT WITH IMAGE PROCESSING

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ABSTRACT

The development of image processing technology appears in agriculture as well as in many other fields. According to the data of the Republic of TURKEY Ministry of Agriculture and Forestry, TURKEY's share in world olive planting area is 9.3%. TURKEY's rank was the fifth after then Spain, Tunisia, Italy and Greece. The most important olive oil importer in the world is the United States. In addition, it is known that the producer countries such as Italy and Spain also traded and sold olives. This is an important export revenue for them. Various classifications are carried out for fruits and vegetables. These are processes such as determining the harvest time according to their degree of maturity, deciding the way of collection and performing packaging operations according to their size. This study aims to classify the fruit according to its intended use in order to benefit more from the olive fruit that is important in industrial terms. In this study, olive fruit is classified as big, medium and small according to its dimensions. Also classified as black and green according to their colors. This classification process was made in MATLAB environment and the KNN algorithm was used. With this algorithm, Euclid and Manhattan City Blocks methods were obtained and compared. According to the results of the application, 100% in the color classification and 95.83% in the size classification was obtained.

KEYWORDS - Image Processing, Olive Classification, KNN Classification Algorithm
OBJECT RECOGNITION WITH ZERO SHOT LEARNING

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ABSTRACT

The studies using zero-shot learning rapidly increases. This method is used when there is not enough training data. Latest studies in zero-shot learning, creates a direct link between image space to semantic space. Zero-shot learning aims to recognize objects and classify unseen class examples. It gained popularity in applications where examples for categories are limited. The main issue to consider is transferring information from seen classes to unseen classes via mapping image space to semantic space. Therefore, mapping from image space to semantic space is very important. In order to implement a machine learning algorithm, we need to represent our data with enough features. In zero-shot learning, some of the data are never used in training phase. However, there must be something providing a connection between training and zero-shot classes. We are using two embeddings to achieve that: image embeddings and class embeddings which acts as an auxiliary role. Image embedding represents a feature vector extracted from images using a convolutional network. We are using pre-trained VGG16 network for image feature extraction. In this work, Google’s Word2vec were used for semantic space. Total of 20 classes, 15 for training and 5 for zero-shot classes, were chosen from Visual Gnome dataset. We have achieved 0.71 accuracy for top-5 classes.

KEYWORDS - Zero-Shot, Classification, Object Recognition
FUZZY EXPERT SYSTEM DESIGN FOR EVALUATION OF SOFTWARE QUALITY

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ABSTRACT

Software quality is an essential evaluation for describing the attributes of the application, such as functionality, compatibility, usability, efficiency, and security. Assessment of the software quality is a series of tasks that include evaluations like development process evaluation, design process evaluation, functional evaluation, and user experience evaluations. According to the IEEE standard glossary of software engineering terminology, the quality of the software is defined based on specific requirements and also user requirements. In this study, a fuzzy expert system is designed for evaluation software quality based on ISO 25010 Quality Model. In the evaluation process, the quality model parameters are used as factors for deciding the output of the FES. The ISO 25010 quality model parameters are defined as functional suitability, performance efficiency, compatibility, usability, reliability, security, maintainability, and portability. This FES system helps in deciding whether the software quality is good enough or if the software quality is below the requirements.

KEYWORDS - Fuzzy expert system (FES), Fuzzy Logic, Software Quality Evaluation
PERFORMANCE ANALYSIS IN MULTI KPI OPTIMIZATIONS

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ABSTRACT

Importance of resource planning at airports, ports, logistic centres and similar operation points significantly increasing each day due to competitions, intensities and irregularities in operations. Multi-objective optimization algorithms try to reach the user defined objectives of the related operations as much as possible but the performance of these algorithms starts to differ while the number of defined KPI’s are increasing. In multi-KPI optimization algorithms, there are many issues and parameters to consider which affect the optimizer performances such as; relationship between KPI’s, the number of KPI’s, number of resources, tasks. In addition, due to some specific business rules in the operation, not every resource can be assigned to every task and the optimization algorithm needs to consider these rules when generating allocation plan. Within the scope of this study, an optimization algorithm which is developed by TAV Technologies is used to analyse optimizer performance changes according to the number of defined KPI’s. For the same resource and task group, the optimization algorithm configured with different KPI combinations and run repeatedly. Except for the KPI definitions, all other optimizer inputs were kept constant in all tests and the results were compared with each other. Specific business rules were ignored in this study to analyse test results clearly.

KEYWORDS - Multi Objective, Multi KPI, Optimization, Resource Allocation, Resource Planning
The automated image captioning task is a long-standing and challenging task, which combines various subfields of artificial intelligence such as computer vision, machine learning, and natural language processing. Image captioning plays a critical role in many applications of artificial intelligence including but not limited to improving the accessibility of existing image collections, story illustration, automated video surveillance, and assistive technology for visually impaired people. In this paper, a novel image captioning model based on the encoder-decoder architecture, namely DeepCaptioner, is proposed. Unlike some of the related work, DeepCaptioner was specifically designed to not require templates, structured prediction, or syntactic tree for image captioning. For the encoder of DeepCaptioner, a widely-used convolutional neural network, namely Inception V3, was employed thanks to the transfer learning technique. In order to map each word in the image captions to a fixed-sized vector, a pre-trained model, namely GloVe, was utilized. The decoder of DeepCaptioner is a merged model and utilizes a Long-Term Short Memory as word sequences are needed to be evaluated while generating image captions. The model was trained and evaluated on a gold-standard dataset, namely Flickr8k, and the validation accuracy calculated as high as 0.99837 during the training. The generated captions for the given test images were evaluated using widely-used metrics, namely, BLEU, METEOR, and ROGUE. According to the experimental result, DeepCaptioner generated very promising captions, which were quite close to the captions generated by humans.

**KEYWORDS** - Convolutional Neural Networks, Recurrent Neural Networks, Multi-Layer Neural Network, Image Annotation, Feature Extraction
CONTROL AND MONITOR IOT DEVICES USING EOG AND VOICE COMMANDS

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ABSTRACT

This paper aims to deploy a machine to control and monitor home devices, and to assist people who suffer from spinal cord injuries, that causes them to lose their ability to use their body movements to control devices, and people may use voice commands as well. The prototype used electrooculography (EOG) system for the patients who have a spinal cord injuries to help them control household appliances and using the voice system to control home devices. This prototype use internet of things (IoT) technology through Wi-Fi and Arduino microcontroller to capture eye muscle movement signals, that are taken from patients, or voice signals to compare them with pre-recorded voice commands. Many tests have been made to assure correctness and speed using different environment parameters and conditions. The error rate was 2.5% for EOG and 1% for voice commands in the best cases. The idea could be developed further and use smartphones and mobile data for controlling and monitoring homes remotely. An IoT based system was designed to help people to communicate with the surrounding environment using eyes movement, or by voice to control devices at homes. The surrounding environment effects the error rate, when increasing the light rate, and when the patient is tired, the error rate in EOG increased. and when increase the noise, the error rate in voice command increased. Many changes were made on the EOG system with calibration and increase the number of similar command voices to decrease the error rate and increase accuracy.

KEYWORDS - Internet of Things (IoT) , EOG Control, Arduino, NodeMCU, Smart Home, Voice Control.
GENETIC ALGORITHM BASED STORAGE AND RETRIEVAL SYSTEM OPTIMIZATION CONSIDERING OPERATIONAL CONSTRAINTS IN A MULTIDIMENSIONAL WAREHOUSE

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ABSTRACT

Efficient use of warehouse resources is an important issue that makes them more manageable and useful, also helps product flow faster. In multidimensional warehouses with many constraints such as weight, volume, product compatibility, etc., storage and retrieval processes are complex optimization problems that need to be solved. Considering the number of constraints, the solution to the storage and retrieval problems with traditional algorithms take a long time. Meta-heuristic algorithms are frequently used in the solution of many complex optimization problems as they can provide acceptable solutions in a short time. In this study, the Genetic algorithm which is one of the popular meta-heuristic methods was used to solve this problem, and the A-star algorithm was used to travel the shortest path between the shelves. A three-dimensional warehouse with operational constraints was designed. Storage and retrieval orders containing a different number of pallets were produced randomly to perform warehouse product flow, and some of these orders were assumed as storage requests and the remainder were retrieval requests. Results show that the proposed approach is capable of finding effective solutions for storage and retrieval problems with operational constraints in a short time.

KEYWORDS - Storage and Retrieval System, Operational Constraints, Genetic Algorithm, A-Star Algorithm
BIG MEDIUM AND LITTLE BML SCHEDULING IN FOG ENVIRONMENT

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ABSTRACT

With about to 20 billion network devices (and counting) globally, the quest for an efficient and reliable resource sharing has been on the rise. The technology to handle demand and bring resource closer to clients has found solution in Fog (edge) computing, a cloud computing approach. Since the advancement of these grid computing technologies, there have been myriad of efforts to finding an efficient method in handling the ever-growing demand of resources, such as reducing delay in providing service to Internet of Things (IoT) or clients in need of computing resources. In this context, mobile devices (such as those along the highways) demand high quality streaming via proxies and access points position along the highway and other places from a nearby Fog node, which must be equipped with high-quality streaming capabilities to meet the client demand. Due to the geographical proximity of resources, Fog computing exhibits lower latency compared to cloud computing and inefficient resource allocation in Fog environment can result in higher delays and degraded performance. Efficient resource scheduling in Fog computing is crucial to get true benefits of the cloud like services at the proximity of data generation sources. In this paper, a Big-Medium-Little (BML) scheduling technique is proposed to efficiently allocate Fog and Cloud resources to the incoming IoT jobs, with cooperative and non-cooperative Fog computing environments explored. In addition, a comparative study of existing scheduling techniques in Fog-cloud environment is also presented. The technique is rigorously evaluated, and it shows an improved result in terms of makespan, energy consumption, latency and throughput. This result has been achieved with a proposed algorithm based on an improved max-min and min-min scheduling algorithms in cloud environment which aimed at providing an appropriate scheduling scheme for a set of tasks for the cloud resources. The proposed algorithms aimed at an efficient fog environment, specifically in the following regards: I. Reducing make-span: The make-span determines the maximum time at which all the resources will complete executing a given task, therefore reducing the maximum make-span implies reducing the time a task will wait seeking computing time. II. Higher Utilization rate: Making the system as busy as possible is another important issue, as cost of processing can yield to more profit to the providers. III. Fair Processing Time: The algorithm gives task a fair processing time, i.e. a task is not deprived of processing time and not given too much processing time as well, this can translate into user and providers concession. IV. Cooperation between Cloud to Fog and Fog to Fog environment for computing resources.

KEYWORDS - Cloud Node, Fog Node, Max-Min, Min-Min, Big, Medium, Little, Task, Resource, Cooperative and Non-Cooperative Systems.
VERTEX COVER BASED LINK MONITORING TECHNIQUES FOR WIRELESS SENSOR NETWORKS

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ABSTRACT

Wireless sensor networks (WSNs) are generally composed of numerous battery-powered tiny nodes that can sense from the environment and send this data through wireless communication. WSNs have wide range of application areas such as military surveillance, healthcare, habitat monitoring, miner safety, outer space exploration and volcanic activity detection. Inherent security weaknesses of wireless communication may prone WSNs to various attacks such as eavesdropping, jamming and spoofing. This situation attracts researchers to study countermeasures for detection and prevention of these attacks. Graph theory provides a very useful theoretical basis for solving WSN problems related to communication and security issues. In this manner, sensor network is modeled as graph G(V,E) where V and E represent sensor nodes and communication links, respectively. One of the important graph theoretic structures is vertex cover (VC) in which a set of nodes are selected to cover the edges of the given graph where each edge is incident to at least one node in VC set. Finding VC set having the minimum cardinality for a given graph is an NP-Hard problem in which designing an algorithm that guarantees the optimal solution in polynomial time is not possible. In this paper, we describe VC algorithms aiming link monitoring where nodes in VC are configured as secure points. We investigate variants of VC problems such as weight and capacity constrained versions on different graph types to meet the energy-efficiency and load-balancing requirements of WSNs. Moreover, we present clustering and backbone formation operations as alternative applications of different VC infrastructures.

KEYWORDS - Wireless Sensor Networks, Link Monitoring, Graph Theory, Vertex Cover, NP-Hard Problem.
A COMPREHENSIVE EVOLUTION FOR APPLICABILITY OF MACHINE LEARNING ALGORITHMS ON VARIOUS DOMAINS

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ABSTRACT

Machine learning algorithms are able to learn from data, make decision and improve what they learn by having experience without human intervention. Machine learning techniques are becoming increasingly important nowadays that everything is going to be fully automated. They have been used in various fields such as recommendation engines, self-driving cars, offering personal suggestions from retailers, cyber fraud detection, face recognition, and etc. This study presents some of the most commonly used machine learning techniques from supervised and unsupervised learning classes such as linear regression, logistic regression, neural networks, and self-organizing map. In linear regression technique, it is tackled to fit a linear function to user data in order to model the relationship between variables. It can be a useful technique to make weather estimation, to understand marketing effectiveness and to model consumer behavior. Logistic regression is a statistical model that uses a logistic function and is appropriate when dependent variable is binary. Neural networks mimic the operation of human brain to recognize patterns from the underlying data. They have wide range of application such as cancer diagnosis, e-mail spam filtering, and signal classification. Self-organizing map, a special type of neural networks, is utilized to achieve dimensionality reduction that generally used for seismic analysis, project prioritization, and image processing such as color reduction. Each implementation in this study shows that the success of the results obtained by applying machine learning techniques depends on using the right technique in the appropriate area.

KEYWORDS - Machine Learning, Linear Regression, Logistic Regression, Gradient Distance, Self-Organizing Map, Color Reduction.
HOMEMADE FOOD PREPARATION OPTIMIZATION FOR DOGS

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ABSTRACT

Nowadays, people feeding pet animals in TURKEY is increasing daily. The feeding of dogs, which are members of the houses as valuable assets, is at least as important as family members. Calculation of daily nutrient needs of dogs; race, gender, weight, pregnancy, breastfeeding, working, etc. are very variable and require an intense calculation. Feeding home dogs only with industrially prepared foods can affect the economy of the family and the health of dogs negatively. Specially, it is constantly questioned by the animal owners whether foods and additives that may harm health are used in industrially prepared foods. Desktop, web, and mobile-based software are used in the animal feeding area. Nevertheless, according to the researches, there is no web-based software that is used for dog diet preparation that can be used by dog owners who is able to calculate exactly the daily nutrient needs of dogs and meet these needs with available foods so far. The data used in this study were taken from Selcuk University, Faculty of Veterinary Medicine, Animal Science and Animal Nutrition Department. In this study, a linear programming model is proposed in order to calculate dogs feeds that both are able to meet the nutrient need of dogs and is able to engage cost optimization, user-friendly web-based dog feeding prepare software is performed.

KEYWORDS - Cost Optimization, Dog Feeds, Linear Programming, Optimization
A DEEP LEARNING BASED SYSTEM FOR TRAFFIC ENGINEERING IN SOFTWARE DEFINED NETWORKS

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ABSTRACT

Traffic engineering is essential for network management, particularly in today’s large networks carrying massive amounts of data. The goal of traffic engineering is to increase the efficiency and reliability of the network through intelligent allocation of resources. In this paper, we propose a deep learning based traffic engineering system in software-defined networks (SDN) to improve bandwidth allocation among various applications. The proposed system conducts traffic classification based on deep neural network and 1D – convolution neural network models. It aims to improve the QoS through identifying flows from various applications and distributing traffic to multiple queues with different priorities. Also, it applies traffic shaping to manage network bandwidth and the volume of incoming traffic to avoid congestion. With the purpose of increasing the performance of the network and to avoid traffic congestion, we implement a technique considering the capacity of each egress port to accomplish general load balancing. We have evaluated and compared the performance of deep learning and machine learning models, and tried to solve the data imbalance through implementing the SMOTE technique. The experiments show that the deep models able to identify the traffic flows with high precision compared to machine learning models, and applying traffic shaping increased the performance of the network and the availability of bandwidth.

KEYWORDS - Traffic Engineering, Software Defined Networking, Deep Learning, Artificial Neural Network, QoS
THE SIGNIFICANCE OF ENTERPRISE ARCHITECTURE IN DRIVING DIGITAL TRANSFORMATION ON PUBLIC SECTORS

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ABSTRACT

Industries and organizations have recently engaged in initiatives focusing on the exploration of methods and models for digital transformation. As a result, it somehow remains unclear to many business leaders as to what digital transformation mean. However, based on the mere fact that industries at large are embracing the concept of digital transformation and initiating programs around this concept. It can only mean that there are common benefits envisioned though, the main challenge to be addressed is how best can organizations get over the initial humps from vision to execution. Enterprise Architecture (EA) discipline on the other hand, have been praised for being a good approach on mapping the future state of the enterprise ranging from business processes reorganization to technology alignment. Hence, the focus of this paper is to examine the capability of EA approach in driving the digital transformation, more so in the public sector. This study employed a case study research approach to investigate the significance of EA in driving digital transformation on public sectors. Semi-Structured technique was used as a method for collecting data. The analysis was carried out, using Actor Network theory (ANT). Through the findings that was established using ANT as a framework for driving a digital transformation for public sectors was proposed.

KEYWORDS - Enterprise Architecture, Digital Transformation, Public Sector, Moments of Translation
A HYBRID APPROACH OF HOMOMORPHIC ENCRYPTION AND DIFFERENTIAL PRIVACY FOR PRIVACY PRESERVING CLASSIFICATION

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ABSTRACT

Privacy preserving data mining is a substantial research area and it aims at protecting the privacy of individuals while enabling to perform data mining techniques. In this study, we propose a secure protocol that fulfills the privacy restriction by combining homomorphic encryption with differential privacy and integrate this protocol into Holte’s One Rule which is a simple, but accurate and efficient classification algorithm. The proposed method allows a researcher to get the answers of his/her queries to build One Rule classifier by processing the encrypted training dataset under Paillier cryptosystem and also applies differential privacy to minimize the privacy leakage of individuals as much as possible in this training dataset. Therefore, both of security and privacy of the individuals in the training dataset for classification is provided thanks to our proposed method since neither the parties nor the researcher attain any information about the individuals in the database. Besides One Rule classifier, we apply our proposed privacy preserving model to Naïve Bayes classification algorithm for the performance comparison and show the efficiency of the proposed method through experiments on real data from UCI repository.

KEYWORDS - Differential Privacy, Homomorphic Encryption, Privacy Preserving Classification, One Rule, Paillier Cryptosystem
LUNG DISEASE CLASSIFICATION USING MACHINE LEARNING ALGORITHMS

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ABSTRACT

In this study we compared support vector machines (SVM), k-nearest neighbour (k-NN), and Gaussian Bayes (GB) algorithms in classification of respiratory diseases with text and audio data. An electronic stethoscope and its software are used to record patient information and 17930 lung sounds from 1630 subjects. SVM, k-NN and GB algorithms were run on 6 datasets to classify patients into; (1) sick or healthy with text data, (2) sick or healthy with audio MFCC features, (3) sick or healthy with the text data and audio MFCC features, (4) 12 diseases with text data, (5) for 12 disease with audio MFCC features, (6) for 12 disease with the text data and audio MFCC features. Accuracy results in SVM were %75, %88, %64, %73, %63, %70; for k-NN %95, %92, %92, %67, %64, %66; for GB %98, %91, %97, %58, %48, %58 respectively. In 12 class classification of lung diseases, the most accurate algorithm was SVM with text data. In classifying via audio data, k-NN was the most accurate. Using both audio and text data, SVM was the most accurate. When we classify healthy versus sick via text, audio and combined data, GB was always the most accurate with very high accuracy, closely followed by k-NN. We can infer from here that when we have large number of features but limited amount of samples, SVM and k-NN are best in classifying the dataset in more than two classes. However GB is best when it comes to classifying into two classes.

KEYWORDS - Gaussian Bayes, K-Nearest Neighbour, Lung Diseases, Lung Sounds, Support Vector Machines
SENTIMENT ANALYSIS IN TWITTER VIA NATURAL LANGUAGE PROCESSING AND DEEP LEARNING CLASSIFICATION

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ABSTRACT

Twitter is a popular social network where users can interact with each other using posts called tweets. Tweets are used as a tool to express sentiments about various subjects. Many corporations make sentiment analysis about some specified keywords in twitter social media platform which is valuable source for this purpose. In this study twitter data is utilized for sentiment analysis using natural language processing techniques and deep learning. In the first part of the study, pre-processing of positive and negative labelled dataset is implemented to convert data into a standard digitized vector form. Feature vectors are extracted from the text as the representation of the tweets. In the second part, Support Vector Machines (SVM), Random Forest (RF) and Naïve Bayes (NB) machine learning and Convolutional Neural Networks (CNN), Long-Short Term Memory (LSTM) deep learning algorithms are used to analyse sentiment via the features. It is aimed to increase the accuracy rate by using multiple models instead of single model. The obtained models are trained in different sizes of the data and the most optimum values were used in the analysis. According to the experimental results the sentiments regarding a requested keyword can be analysed with the accuracy of 82.46% via LSTM algorithm.

KEYWORDS - Sentiment analysis, Deep learning, Long Short Term Memory, Support Vector Machines, Natural Language Processing
DECISION SUPPORT SYSTEM FOR ASSESSING THE DEGREE OF WEAR OF EQUIPMENT AND STRUCTURES OF OIL REFINING COMPLEXES

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ABSTRACT

At the present stage of development of oil refining complexes, a decision support system for assessing the condition of equipment and structures is extremely important. This phenomenon is caused by a high degree of depreciation of fixed assets at enterprises, as well as a reduction in operating costs and losses from accidents and production downtime. Losses associated with the operation of the equipment and facilities may be reduced to a minimum by using the maintenance based on the inspection of the wear condition in real time. The current situation in various oil production and processing complexes requires the development and modernization of support systems, which will increase the efficiency of equipment and facilities. Modeling of the decision support system based on the degree of reconstruction of industrial complexes, using methods of mathematical statistics and predicting situations. Based on existing solutions for assessing the degree of depreciation of fixed assets of oil refining complexes, a model is created that allows you to develop a program. The introduction of modern reliability analyses and the creation of an automated system will solve problems with failures and wear, as well as reduce the impact on the safety of operating fixed assets at enterprises.

OBJECT BASED DISTRIBUTED ENVIRONMENT MODELLING AND SIMULATION

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ABSTRACT

In distributed environment, some operations related to objects are performed. For example, objects can be accessed or they can be moved. In our study, events related to objects (object-access, object-move) were created as independent events. In this study, the distributed environment simulation was performed and the effectiveness and success of the path compression algorithm, which we proposed as a result of the experimental study, was demonstrated. The purpose of this study is to show the effectiveness and benefits of the path compression algorithm. Path compression algorithm is an efficient algorithm whose runtime is linear. With the path compression, the long node chain that is formed while data objects are passing between the source node and the destination is broken, so that the objects are retrieved fast and the cost of access is reduced. This result is shown with experimental study by modeling the distributed environment. It is shown comparative the results of the distributed environment simulation according to the various Access/Move (%) rates using binomial distribution. When we use the path compression, the maximum length and mean length of the chain decreases. Thus, with the path compression algorithm, the long node chain created by the objects is broken, the cost of accessing the objects is reduced, and fast access to the objects is ensured. In short, with our study, fast access to data is ensured in a distributed environment.

KEYWORDS - Path Compression, Distributed Environment, Object Access, Object Move
PERFORMANCE MONITORING FOR NETWORK INFRASTRUCTURES

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ABSTRACT

Network infrastructures are systems of structures, which are in constant communication on multiple computers or similar systems, enabling them to be connected to each other for various reasons such as ease of central administration and support. Today, it is possible to see network infrastructures in use in many contexts, ranging from municipal services to our home applications. It is an important problem to plan and manage network structures correctly. It is also important to ensure continuity, efficiency and user satisfaction of the infrastructure by accurately measuring the factors affecting the performance of a service offered on the infrastructure. Mathematical methods are used to assess network infrastructures and evaluate their efficiency. The important issue is to determine the key performance indicators for the critical points of the network infrastructures, and to monitor these indicators, whose measurement frequency is determined according to their respective criticality, and to provide timely intervention by creating warnings when critical thresholds are exceeded. Network monitoring tools can be used to monitor the key performance indicators. The efficiency and continuity of the network infrastructures monitored through these software will make a significant contribution to the desired level of service with an experienced team and the right investment.

Within the scope of this study, key performance indicators have been created for network infrastructures, measurement methods for important indicators have been explained and examples of software that can monitor indicators and network infrastructures have been presented. In the study, sample indicator screens showing real data taken from real monitoring software that monitor real big network systems are provided. An infrastructure that can be followed and monitored by measurements regarding the training level of the technical team or the number of support provided annually per device will be easier to achieve the targeted accessibility and efficiency. Therefore, infrastructures and systems that provide important services and do not tolerate long downtimes, identification of appropriate indicators under the headings such as error management, configuration management, performance management, security management, change management, and monitoring these indicators with appropriate test methods through monitoring software will contribute significantly to user satisfaction and the sustainability of such systems.

KEYWORDS - Network Infrastructures, Network Performance Measurement, Network Monitoring Tools, Key Performance Indicators, Network Continuity, Network Efficiency
DEEP LEARNING BASED MAMMOGRAM CLASSIFICATION FOR BREAST CANCER

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ABSTRACT

Deep Learning (DL) is a rising field of researches in last decade by exposing a hybrid analysis procedure including advanced level image processing and many efficient supervised classifiers. Robustness of the DL algorithms to the big data enhances the analysis capabilities of machine learning models by feature learning on heterogeneous image database. In this paper, a Convolutional Neural Network (CNN) architecture was proposed on a simplified feature learning and fine-tuned classifier model to separate cancer-normal cases on mammograms. Breast Cancer is a prevalent and mortal disease appeared resultant mutating of normal tissue into tumour pathology. Mammograms are the common and effective tools for the diagnosis of breast cancer. DL-based computer-assisted systems have capability of detailed analysis for even small pathology that may lead the curing progress for a complete assessment. The proposed DL-based model aimed at assessing the applicability of various feature learning models and enhancing the learning capacity of the DL models for an operative breast cancer diagnosis using CNN. The mammograms were fed into the DL to evaluate the classification performances in accordance with various CNN architectures. The proposed Deep model achieved high classification performance rates of 92.84%, 95.30%, and 96.72% for accuracy, sensitivity, specificity, and precision, respectively.

KEYWORDS - Deep Learning, Convolutional Neural Networks, Breast Cancer, Mammogram, DDSM, Transfer Learning
PERFORMANCE EVALUATION OF CAPSULE NETWORKS FOR CLASSIFICATION OF PLANT LEAF DISEASES

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ABSTRACT

Deep Learning (DL) is a high capable machine learning algorithm which composed the advanced image processing as feature learning and supervised learning with detailed models with many hidden layers and neurons. DL demonstrated its efficiency and robustness in many big data problems, computer vision, and more. Whereas it has an increasing popularity day by day, it has still some deficiencies to construe the relationship between learned feature maps and spatial information. Capsule network (CapsNET) is proposed to overcome the shortcoming by excluding the pooling layer from the architecture and transferring spatial information between layers by capsule. In this paper, a CapsNET architecture was proposed to evaluate the performance of the model on classification of plant leaf diseases using simple reduced capsules on leaf images. Plant leaf diseases are common and prevalent diseases that disrupt harvesting and yielding for agriculture, and mortal disease appeared resultant mutating of normal tissue into tumour pathology. CapsNET has capability of detailed analysis for even small stains that may lead seed dressing time and duration. The proposed CapsNET model aimed at assessing the applicability of various feature learning models and enhancing the learning capacity of the DL models for bell pepper plants. The healthy and diseased leaf images were fed into the CapsNET. The proposed CapsNET model reached high classification performance rates of 95.76%, 96.37%, and 97.49% for accuracy, sensitivity, and specificity, respectively.

KEYWORDS - Deep Learning, Capsule Network, CapsNET, Bell Pepper, Plant Leaf Diseases, Plantvillage
THE EFFECT OF THE GRAPHENE OXIDE NANOSTRUCTURED FILM ON THE DEVICE PERFORMANCE OF THE N INP METAL SEMICONDUCTOR MS CONTACTS

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ABSTRACT

InP is a III-V compound semiconductor which has increasing interest as a substrate in electronic technology especially in optoelectronics such as solar cells, photodetectors, and laser diodes. InP also has attracted attention for use in high-speed electronic devices because of its direct band gap and high electron mobility. However, an important disadvantage for InP is its low Schottky barrier height. Due to the Fermi level pinning effect, it is quite difficult to produce especially n-type InP Schottky diodes with a barrier height greater than 0.5 eV [1]. The presence of an interlayer between the metal and the semiconductor is often preferred for improving the electrical properties of the diodes. Herein, graphene oxide was used as an interlayer of the n-InP MS device to improve its electrical and electronic properties. In addition, graphene oxide is an attractive material with its adjustable band gap responsible for unique optical and electronic properties so, recently many researchers have concentrated their work on it [3]. The graphene oxide (GO) was synthesized by the modified Hummers method literature [2] and coated on n-type InP substrate by spray pyrolysis method and then, metal contacts were created to fabricate the diode. The morphological properties of the GO film were analyzed by XRD and SEM. Optical band gap of the film was calculated with using absorption measurements. The electronic parameters such as, ideality factor, barrier height were calculated as a function of the sample temperature and attributed to the presence of the lateral inhomogeneities of the barrier height.

KEYWORDS - Graphene Oxide, N-Inp, Metal-Semiconductor Contact, I-V Characteristics
MACHINE LEARNING VS ARTIFICIAL NEURAL NETWORK A COMPARATIVE STUDY TO INVESTIGATE THE DIFFERENCE

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ABSTRACT

The difference between machine learning and artificial neural network is a very thin slippery ground. It could be told that they were different interpretation of each other at the beginning but today they are separating from each other very fast. Although, they are both subfield of artificial intelligence, their applications and usage areas are different from each other. On the other hand, artificial neural network has many different types and methods while machine learning approaches has limited. However, this does not mean artificial neural networks are better than machine learning algorithms. They both have their different specialty to work on different cases. This study will focus on the key difference between machine learning and artificial neural networks. Their definition and working environments will be discussed by emphasizing their differences. Furthermore, a comparative study which is identification of appliances by using their powerline parameters, will be demonstrated to investigate the difference. Power parameters such as voltage, current, active power, reactive power and phase difference will be used for identification of appliance. This method can be used within low-cost embedded system for smart homes and smart grids.

KEYWORDS - Machine Learning, Pattern Recognition, Artificial Neural Network, Powerline Parameter, Appliance Identification, Smart Home
WEARABLE TEXTILE SLOT ANTENNA FOR C BAND WIRELESS APPLICATIONS

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ABSTRACT

With the increasing developments in technology and antenna systems, miniaturized and practical wearable antenna structures are in high demand. In this study, a wearable textile slot antenna is proposed to be used for C-band wireless applications. Jean fabric ($\varepsilon_r=1.78$), with a thickness of 0.6 mm, is preferred as the substrate material in the design process of the antenna. Microstrip to substrate integrated waveguide (SIW) transition is implemented, as a circular and rectangular slot is etched on the top of the antenna to realize the radiation from the SIW cavity. Furthermore, to have a more realistic result, the simulations of the reported antenna are performed by including a three-layered human model (skin, fat, muscle) and an SMA connector. The impedance bandwidth ($S_{11}\leq -10$ dB) of the antenna is 440 MHz (from 6.435 to 6.875 GHz) and has a resonance at 6.65 GHz. Moreover, the size of the fabric substrate is 50×25 mm² and the dimension of the antenna element is 14×25 mm². The simulated gain, efficiency, radiation pattern, current distribution and specific absorption rate (SAR) analysis of the proposed antenna are also made and successful results are obtained. Thanks to all these aforementioned features, the antenna is convenient to be used for C-band applications.

KEYWORDS - C-Band Applications, Jean Textile, Substrate Integrated Waveguide (SIW), Wearable Antenna
SMART METERING FIELD IMPLEMENTATION WITH POWER LINE COMMUNICATION IN LOW VOLTAGE DISTRIBUTION GRIDS


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ABSTRACT

Smart Grids enable power generation, transmission, distribution, utilities and customers to transfer, monitor, predict, control and manage energy usage effectively. In order to provide them, Smart Grids need to be fully realized by integrating communication network technologies infrastructures. Today, Smart Grids have some main systems. These are Advanced Meter Reading (AMR), transmission, distribution control and monitoring with Supervisory Control and Data Acquisition (SCADA), distributed renewable electricity generation, energy storage, electric vehicle and smart city-smart home implementations. AMR is the most prominent smart grid component between all smart grid main systems. Because it provides to follow all consumers remotely and momentarily using their smart meters. AMR system is based on smart meter, gateway, meter data management software and wired or wireless communication method between field and software. Nowadays, Power Line Communication (PLC) is the most popular wired communication method for remote meter reading because of try to use existing electric distribution grid infrastructure. On the other hand GPRS/EDGE/3G is one of the widespread wireless communication method for remote meter reading implementations but its costly and external dependence has started the search for new communication methods instead. In this paper, practically twelve electric meters are tried to read remotely with PLC in Yeşilirmak Electric Distribution Company field until the distribution transformer. These remote meter reading results that captured with PLC will evaluate in AMR software. Then an AMR system model is put forward thanks to this field implementation. Beside this a hybrid communication method has been suggested for smart metering. PLC key parameters will find out. In addition, data concentrator, meter and gateway that has PLC features equipment field configurations will research.

KEYWORDS - PLC, AMR, Smart Metering, Smart Grid
THE COMPARISON OF MICROSTRIP ANTENNA STRUCTURES DESIGNED FOR DETECTION OF CARDIOVASCULAR OBSTRUCTION ACCORDING TO RADIATION BAND NUMBERS

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ABSTRACT

In the study, there are evaluations for early detection of diseases that develop due to cardiovascular obstruction, which is suffered by many people in the world, with microstrip antenna structures. There are 5 different antennas. 3 of these antennas have 4 operating frequencies. The others have 5 different operating frequencies. Microstrip antenna structures are explored in many biomedical fields for their design convenience. The simulations of the antennas were made in Ansys HFSS by modeling the cardiovascular obstruction structure. Antennas with a different number of operating band were evaluated based on the presence and absence of obstruction in the heart vein by obtaining the electric field data. When the data are examined, the highest difference between the electric field values is the microstrip antenna structure with 27 mV / m and 4 operating frequency regions. The differences among others are 1.38, 3.85, 23.5 and 24.76 mV / m. The highest difference between these values, 24.76 mV / m, was obtained from the antenna structure belonging to 4 operating frequency bands. Compared to the percentage, the highest ratio in electric field values is 41.23% with 27 mV / m difference according to the conditions of obstruction and absence. When the values are examined, it is concluded that the antennas with 4 operating frequency regions are more successful among the antennas with 4 and 5 operating frequency regions in microstrip antenna structures for early detection of cardiovascular obstruction.

KEYWORDS - Biomedical Microstrip Antennas, Electric Field, Multiple Band, Cardiovascular Obstruction, Hfss
DESIGN AND IMPLEMENTATION VIRTUAL REALITY MODEL OF OPTIMAL TRAJECTORY FOR REAL HUMAN MANIPULATOR BASED ON INTELLIGENT SYSTEM

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ABSTRACT

The utilization of Virtual Reality (VR) for clinical or clinical related field's instruction can improve the customary learning techniques by the expansion of practical representation as well as control of body structures. This paper presents design and implement human manipulator model in VR environment with genuine planer movement dependent on explanatory arrangement of converse kinematics issue (IKP) and forward kinematics to get optimal trajectory for any complex job within envelope of human movement concertinas. The planer and space movements actualized by picks the arbitrary end-effector inside the envelope of human manipulator viable the genuine obliges for developments. The fathoming of IKP used to compute the edges of a human manipulator joints as three (shoulder, elbow and wrist) to show up this end-effector by utilizing the systematic arrangement. The estimations of joints edge are utilizing with the forward kinematics model with genuine compels of human arm movement to arrive at the end-effector to target point. The solution applies by intelligent system especially by using Locally Recurrent Neural Networks (LRNNs), the training of the LRNN achieved by Levenberg-Marquardt back propagation (LMBP). The VR human manipulator model develops by utilizing the skeleton structure and muscles conditions for movement to execute the genuine planer and space developments. This procedure is accomplished by association the Virtual Reality Modeling Language (VRML) with Matlab/Simulink Ver.2019b. Fulfilled outcomes are acquired, that clarifies the capacity of the model to actualize the genuine planer human arm movement by this strategy of reproduction with high exactness.

KEYWORDS - Human Manipulator Planer Motion, Inverse Kinematics Solution, Locally Recurrent Neural Networks, Virtual Reality
THE EVALUATION AND COMPARISON OF ELECTROMAGNETIC DATA FOR DETECTION OF CARDIOVASCULAR OBSTRUCTION OF TWO DUAL BAND ANTENNA IN X BAND

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ABSTRACT

Most of the death rates in the world are from the circulatory system. Cardiovascular obstruction is also one of these reasons. Especially as a result of blockage of the coronary arteries feeding the heart, sudden heart attack risk may develop. Microstrip antenna structures that are frequently used in the biomedical field are tested in order to detect the occlusion of these vessels in the early period. The substrate material of the antennas is FR-4. Two antennas operate on the X band. The first antenna has operating frequency of 10 and 12 GHz. The second antenna has operating frequency of 7.11 and 11 GHz. Narrowband antennas are preferred because exposure is low in biomedical applications. Antennas have been tested by modeling the heart region. Simulations were performed with and without cardiovascular obstruction in Ansys-HFSS. The electromagnetic field data obtained from the antennas were compared according to the occlusion status. In this case, the maximum electric field difference increases 5.4% for the first antenna and 8.4% for the second antenna. The changes in the electric field data are important for both antennas. In the study, the electric field values obtained according to different theta and phi angles were compared. It was observed that the differences in the percentage changes of the first antenna were higher.

KEYWORDS - Microstrip Patch Antenna, Heart Diseases, Electromagnetic Field, Hfss
CLASSIFICATION OF EMG SIGNALS USING CONVOLUTION NEURAL NETWORK

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ABSTRACT

In this study, it is aimed to increase the classification success of the daily used hand movements using the Convolutional neural networks (CNN), which is one of the machine learning methods. The advantage of the deep learning methods like CNN is that the relationships in big data are learned by the network. Firstly, the received EMG signals for forearms are windowed to increase the number of data and focus on the contraction points. Then, to compare the success rate, raw signals, Fourier transform of the signal, the root means square, and the Empirical mode decomposition (EMD) is applied to the signal and intrinsic mode functions are obtained. The modes may provide insight into various signals contained within the data. These signals are given to four different CNN. Afterward, to find the most efficient parameters, the results were obtained by dividing data set into three as 70% training set, 15% validation set, and 15% test set. In order to test the performance of the system, 5 cross-validations were applied. The best results are obtained from the CNN, which receive the EMD applied signal as input. The result obtained with the cross-validation is 95.90% and the result obtained with the other separation method is 93.70%. When the results were examined, it was seen that CNN is a promising classifier even the raw signal is applied to the classifier. Also, it has been observed that EMD method creates better classification accuracy.

KEYWORDS - Electromyography, Machine Learning, Convolutional Neural Network, Cross Validation, Fourier Transform, Root Mean Square, Empirical Mode Decomposition.
A COMPARATIVE STUDY ON CUTOFF FREQUENCY SELECTION IN FREQUENCY DOMAIN DENOISING FOR DIFFERENT NOISE LEVELS

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ABSTRACT

Noise reduction is very important step for image processing. One method to reduce the noise in the image is to transform the given noisy image to another domain, and then to apply a denoising procedure. The frequency domain filtering transforms the noisy image into frequency domain. The filter function in the frequency domain filtering is the most important step to reduce the noise in the image. Butterworth lowpass filter is widely used in frequency domain for filter function. The choosing the appropriate cutoff frequency effects the success of this filter. In this paper, we have filtered the noisy images using Butterworth lowpass filter with the different cutoff frequencies. Noisy images have been obtained by adding two types of noise, salt&pepper and Gaussian, with the different noise levels 0.1, 0.3, 0.5, 0.7 and 0.9 to the two noise-free images. Thus, twenty noisy images are filtered with the Butterworth lowpass filter. The cutoff frequency has been set to a hundred different values between 0.01 and 1 by increasing the value by 0.01. Thus, 100 filtered images have been obtained from each noisy image. The filtered images have been assessed with two quality metrics according to the denoising and edge preserving. Thus, effect of the cutoff frequency selection on denoising and edge preserving have been analyzed for Butterworth lowpass filter.

KEYWORDS - Butterworth Lowpass Filter, Cutoff Frequency, Frequency Domain, Image Denoising, Edge Preserving
STUDY AND DESIGN OF POWER SUPPLY BASED ON PELTIER TO CHARGE THE EV AUXILIARY BATTERY

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ABSTRACT

Providing enough energy for the work of rechargeable electric devices to have relatively long periods of runtime is one of the biggest problems facing these devices. To solve this issue, a lot of methods such as energy saving systems and fast charging devices have been used. In this article, we studied the use of a peltier chip in EV (electric vehicle) for power generating, and its effectiveness in generating energy. This article is one of the first articles to discuss the effectiveness of using the peltier chip for power generation in electric cars, where the elements of the car that heat during operation like transistors in inverter, converter and BMS (battery management system) will be used to generate energy. In order to charge the electric car battery, a number of peltiers will be connected in series, then a convertor, will converts the generated voltage into a sufficient voltage to charge the battery. According to the study, when using a series of 40 pieces, we can obtain 140 Watt. It was found that using 40 Peltier pieces can produce about 140W. This represents approximately 30% of the Tesla 3’s secondary battery capacity, which is 480 Watts. When using radiator water to cool the transistors, the TC will be about 300, then each peltier will generate approximately 4.5 watts. the amount of energy generated will be: 180 watt. This represents approximately 39% of the Tesla 3’s secondary battery capacity, which is 480 Watt.

KEYWORDS - EV, Auxiliary Battery, Peltier, Thermoelectric, Charge Unit.
USING ARTIFICIAL NEURAL NETWORK APPROACH FOR VALUATION OF THE WIND SPEED

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ABSTRACT

Estimation of the wind speed makes a very important contribution to the seamless integration of wind power plants into the grid. In this way, the maximum amount of electricity can be generated by estimating the amount of energy that can be generated from wind energy. The measurements of the wind speed in the region, where the plant is plant to be established, made before the installation of the wind power plants (WPP), takes between 6 and 18 months. In this study, it was investigated what could be done to make a foresight and estimation about the wind speed in the future for the selected region. In order to accurately determine the wind speed, it was tried to be estimated by using artificial neural networks (ANN) included in the MATLAB package program. In this study, an annual data of the previous years (365 days) of the region to be examined was provided and used to train the ANN of the planned study. In practice, the parameters of temperature, humidity and pressure, which are among the factors affecting wind speed, were taken into consideration. An R value of 91.20% in the training phase, 93.04% in the validation phase and 92.76% in the test phase was obtained. High accuracy values were obtained in predicting wind speed at all stages, and it was shown in this study that ANN can reliably predict wind speed for a desired day without memorization.

KEYWORDS - Wind Speed, Renewable sources, Prediction, Artificial Neural Network, ANN
THE VARIABLE INDUCTANCE ESTIMATION WITH ARTIFICIAL INTELLIGENCE ON INDUCTION HEATING SYSTEMS

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ABSTRACT

Heating, melting and hardening applications of a material with the induction method are frequently used today. Due to the use of this method, the risk of explosion, flammable, non-flammable, and suitable projects for automation, the use of induction technology has been increasing recently. In this study, heating of a part of a medium carbon steel up to 1200 degrees by the induction method is discussed. In this method, serial resonance topology is used as power electronic circuit and constant voltage circuit is preferred as the type. The heated material has two important parameters such as electrical resistance and magnetic permeability. These values are considered constant in many applications and are designed according to these values. However, when this material placed inside the induction coil starts to be heated, it is observed that these values change according to the temperature. Accordingly, the total inductance of the system is very variable according to the temperature of the material. By sending a signal to the switching elements at the resonance frequency in the series resonance circuit, both the system is efficient and the losses of the switching elements are minimized. Switches are enabled to open and close at zero current. In addition, in this study, an attempt was made to estimate the natural resonance frequency of the system using artificial neural networks. With the air gap of the designed induction coil fixed, data is trained in artificial neural networks according to a predetermined dataset according to a material, and the inductance and electrical resistance values at a certain frequency are estimated. It is observed that the result obtained is very close to real values.

KEYWORDS - Induction System, Heating, Artificial Intelligence, Inductance Estimation
INVESTIGATION OF CAPACITIVE EFFECT ON XLPE TYPE MEDIUM VOLTAGE CABLES

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ABSTRACT

Electrical energy is the most widely used form of energy due to its technical superiority in the areas of obtaining, carrying, distributing, and using, although its a very costly energy source. Therefore, it should be produced with minimum cost and losses, and maximum savings. To meet the increasing energy demand due to rapid population growth and technological advances, besides increasing production, it should be used with the highest efficiency in the existing energy produced. Therefore, this valuable energy source is conveyed in a lossless manner from its production to its end-user. In the transmission and distribution of the electrical energy generated, its current and voltage must be delivered to the final receiver in the form of a full sine curve, which is one of the main factors that indicate the quality of electrical energy. - In this study, the capacitive (reactive) effect of XLPE type power cables used in medium voltage distribution systems has been investigated. XLPE type cables used in electrical transmission and distribution systems cause a reactive effect because the structure of these cables is similar to capacitors that consist of an insulating material placed between two conductive plates. If this reactive effect is not eliminated, it considerably causes increment on losses and costs, and decrement on the capacity. The most useful way to eliminate this negative effect is to utilize the compensation technique. For this reason, the structure of shunt reactors, which is one of the methods developed depending on technological improvements, was examined. Moreover, compensation applications used in medium voltage distribution and low voltage systems were investigated. The medium voltage distribution network, which was approximately 5500 m long, was analyzed with the measurements. The simulation was performed by modeling XLPE cable by using data from the distribution network and the PSCAD / EMTDC program. The results of the simulation and the distribution network were compared to verify the validity of the analysis.

KEYWORDS - XLPE Cables, Capacitive Effect, Medium Voltage Distribution Network
THERMAL TREATMENT OF SOL GEL PREPARED SILICON DIOXIDE THIN FILMS FOR SOLAR CELLS

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ABSTRACT

The reflection of the light coming on the surface of the solar cells is an important factor affecting the conversion efficiency. Therefore, anti-reflection coatings (ARC) are very important for higher efficiencies of crystal silicon solar cells. By applying one or more layers of ARC to photovoltaic cells or other optoelectronic devices, the reflection of incoming light can be reduced and the performance of the device can be improved. Energy costs can be reduced by reducing costs in the production methods including the solution based techniques. Reflection properties of sol-gel based prepared Silicon Dioxide (SiO₂) thin films was studied in this work. Solutions were deposited by spin coating method. Antireflection coating effect of SiO₂ thin films on crystalline silicon substrates were analyzed after optimizing the solution, deposition and thermal treatment processes. Characterizations were carried out including XRD analysis, Scanning electron microscopy measurements and spectrophotometer reflectance measurements. Annealing conditions of 950 °C for 7 min in air was determined to be the optimum to deposit sol based SiO₂ thin films for solar cell applications. With the coating of SiO₂ thin film on the c-Si surface, the average reflectance (350 – 1100 nm) value decreased from approximately 36% to around 19% where the minimum was below <10%.

KEYWORDS - SiO₂, Anti-Reflection Coating, Thin Film
EXPERIMENTAL SETUP TO EAVESDROP ON A VISIBLE LIGHT COMMUNICATION SYSTEM

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ABSTRACT

The author utilizes from side-channel attack in order to extract the data transmitted by visible light waves inside a room enclosed by solid walls. Visible light communication (VLC) uses the idea that standard LEDs use a constant amount of current which is perceived by human eye as visible light and used for illumination. On the other hand, the data are transmitted by subtle and rapid changes in the intensity of the LEDs. Consequently, there are two levels of intensity whose subtle difference is not distinct to human eye and these two levels determine the binary data, i.e. the higher level of intensity is defined as 1 and the lower level of intensity is defined as 0. Since the intensity of an LED is determined by the current flowing through it, the theory asserts that these LEDs in a VLC circuit will draw different amounts of current while transmitting binary data. Side-channel attacks exploit data based on information gained from physical implementation. As the name implies, the attack occurs by exploiting an extra source of information such as timing information, power consumption, electromagnetic leaks or sound. It is not a direct attack via a brute force on the theoretical weaknesses in the algorithms, but rather is a sideway approach to a fully-functioning system. Instantaneous power consumptions of the electrical components in the VLC system are exploited for this purpose. The author not only designed and implemented a bidirectional basic VLC system, she also implemented a current sensor on the power line from the power supply to the transmitter unit. These current sensor measurements enabled the author to deduce that power consumption analysis are indeed effective in jeopardizing the security of VLC systems.

KEYWORDS - Visible Light Communication, Side-Channel Attack
COMPARISON OF LTE AND MILLIMETER WAVE TECHNOLOGIES FOR 5G V2I COMMUNICATIONS

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ABSTRACT

5G vehicle-to-everything (V2X) aims to provide the Connected and Autonomous Vehicles (CAVs) services by enabling the data exchange between vehicles, infrastructure, and pedestrians, using different wireless technologies. To this end, it is estimated that CAVs will generate large amount of data (such as lidar, camera data etc.). CAVs communications are inherently susceptible to cyber-security threats. Thus, it requires very high throughput and reliable wireless connections to securely off-load their data to cloud or fog services in order to minimise the time required to identify potential threats and hence reduce the cyber-security incidents. Millimeter wave (mmWave) communication has a potential to deliver higher throughput data with the use of large available bandwidth. However, these frequencies suffer from high propagation losses and also fast changing nature of vehicular channels imposes further challenges for implementing mmWave communications. In this paper, the performance of the mmWave and Long Term Evolution (LTE) communications are studied for a Vehicle-to-Infrastructure (V2I) deployment scenario in which CAVs off-load their sensor data. For this purpose, an end-to-end system level simulator combined with a realistic channel simulator is used to evaluate the results. The results show that with the proper configuration, mmWave can provide a viable solution to enable both high-capacity and reliable V2I communications for CAVs.

KEYWORDS - 5G, Connected and Autonomous Vehicles (CAVs), LTE, Millimeter Wave (mmWave), Vehicular Networks, Cyber-Security
SET POINT ADAPTATION FOR CONTROLLING DELTA PRESSURE OF CIRCULATION PUMP SYSTEMS

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ABSTRACT

Pumping systems are among the most widely used engineering systems all around the world. As a result of the dramatic rise in energy consumptions, the processes have to be more efficient. Generally, the pumps used in circulation systems are operated at constant delta pressure. According to the system demand, this method may not be efficient enough in certain occasions. The purpose of this research is to develop a new control method which adapts the set point according to system flow demand without using any flow sensor. The necessary mathematical equations and theories are researched. According to these backgrounds two possible control methods were proposed. One of them derived by using only frequency of the motor. For the other one, Actual power values must be taken into account and the characteristic graphs of the pumps must be defined to the system. Both methods are tested on a mock up and the results are analyzed and compared. Due to the lack of flowmeter, a low tolerance flow estimator is designed for field tests. The method is improved according to obtained data and the system is implemented on a real field application. Results reveal the improvement in energy efficiency by the suggested set point adaptation method.

KEYWORDS - Set Point Adaptation, Variable Delta Pressure, Circulation Pump, Delta Pressure Control, Adaptive Pressure Control
DETERMINATION OF CONDUCTED EMI IN SiC BASED DUAL ACTIVE BRIDGE CONVERTER

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ABSTRACT

Power converters are required to work faster and with higher power density with the developing technology. Therefore, the converter is expected to work in more than one direction. Usage of Dual Active Bridge DC-DC Converter is an example. To increase the power density of the converters, it is necessary to increase the switching frequency. In conventional Si MOSFET based converters, power losses are very high and cause high electromagnetic interferences at high frequencies. These disadvantages lead developers to the use of wide-band gap semiconductor based converters such as SiC. However, SiC MOSFETs will also emit electromagnetic interference (EMI) above a certain frequency. In this study, the EMI, emitted at certain frequencies by the Dual Active Bridge (DAB) DC-DC Converter, is simulated by the LTspice. It was observed that the Si-based inverter parts of the DAB converter generate 10 V EMI on the linear base, 140 dBµV EMI on the logarithmic base, at 20 kHz. The SiC-based converter does not emit any noise at the same frequency. When the frequency was increased to 250 kHz, it was determined that the SiC based converter emitted 2.3 V noise on the linear base and 123 dBµV noise on the logarithmic base.

KEYWORDS - WBG SiC MOSFET, Dual Active Bridge DC-DC Converter, Electromagnetic Compatibility, EMI, LTspice
VEHICLE TO VEHICLE COMMUNICATION CHANNEL MEASUREMENTS ON A VERTICAL CURVE ROAD

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ABSTRACT

Vehicle to Vehicle communication channel measurements carried out in different environments such as urban, suburban, rural, highway, tunnel, overpass etc. The roads in these environments have generally a flat ground. However, there are roads with horizontal or vertical curves which are not investigated in the literature. In this study, we performed a few vehicle to vehicle measurements on a vertical-curve road in a rural environment to show how received signal strength changes with the distance between the transmitter and the receiver. According to measurement results, path loss exponent parameter of log-distance path loss model are calculated by using least-square method. Experimental measurements of V2V communication channel are crucial to understand the effect of various environment. Although there are a lots of studies carried out in urban, suburban, rural, highway, etc., the vertical curves roads have not been investigated. In this study, experimental measurements are performed on a vertical curve road in rural environment. The reference distance is chosen according to approach mentioned in section \ref{sec2} and the path loss exponent in log-distance path loss model is calculated. The measurement data and customized log-distance path loss models are given both in formulas and figures. The all extracted parameters from the measurement data according to log-distance path loss model are given in Table \ref{tab2}. The authors observed that the vertical curve road in this study sharply attenuates received signal power in the order of 30 dB in 50 m distance. It can be also said that the attenuation rate is proportional to the amount of the piece of land which signal passed through. It is suggested that the vertical curve roads should be considered for V2V communication channel modeling and included in wireless communication simulators.

KEYWORDS - Vehicle To Vehicle Communication, Experimental Measurement, Channel Model, Path Loss Exponent, Vertical Curve Road
CURVE FITTING METHODS FOR DETERMINATION OF INERTIAL MEASUREMENT UNITS STOCHASTIC ERROR PARAMETERS

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ABSTRACT

Inertial measurement unit, which is constructed from inertial sensors, is essential components for inertial avigation systems. The measurements from inertial sensors are used as input for navigation calculations by using navigation equations and advanced estimation algorithms. Nevertheless stochastic errors on inertial sensors are one of the major parameters for estimation performance. Numerical integration equations are used for inertial navigation. Stochastic inertial sensor errors accumulate in process of time and affect estimation results. Information of stochastic sensor errors determines quality of navigation system. This means inertial sensor errors are the performance parameters of navigation systems. Thus determination of error parameters becomes necessity for navigation system design. Allan variance method is used widely for determination of stochastic error. Since this method has good performance to reveal error parameters. Local line fitting method is used to utilize on Allan variance to determine error parameter, but usage of this method takes long time. Because magnitudes of local lines need to be change until local lines fit to Allan variance aim regions. In this paper Allan variance method is used with curve fitting methods. Using differential functions, aim region points are found from fitted curves. Then the stochastic errors of inertial sensors are defined from aim region points which indicate error parameter values.

KEYWORDS - Inertial Measurement Unit, Inertial Sensors, Accelerometer, Gyroscope, Allan Variance, Stochastic Errors, Curve Fitting, Least Squares Method
ADAPTIVE CRUISE CONTROL FOR AN ELECTRIC VEHICLE EVALUATION OF PERFORMANCE AND CONSUMPTION USING DIFFERENT CONTROLLERS

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ABSTRACT

Research on electric vehicles became a very hot topic in the last few years because they have advantageous in terms of efficiency, carbon emission and performance compared to combustion engines. However, high battery cost, long charging time and limited traveling range of electric vehicles are the challenges that researchers are still currently working on. Innovative battery and its management systems have been developed to increase travelling range of electric vehicles. Furthermore, lowering the battery power consumption of the comfort and safety systems in the vehicle is another research topic to increase battery range. Adaptive Cruise Control (ACC), which is one of the comfort and safety systems, has also been used to increase the travelling range of electric vehicles. In this study, we design ACC with three well-known Proportional-Integral-Derivative (PID), Fuzzy and Model Predictive Controller (MPC) controllers, and evaluate their acceleration/deceleration performance, and power consumption effect. Initially, the dynamic model of an electric vehicle, which includes electric vehicle longitude dynamic, and battery consumption equations, were developed. Later, ACC mathematical equations with Proportional-Integral-Derivative (PID), Fuzzy and Model Predictive Controller (MPC) were derived, and integrated inside the dynamic model of the electrical vehicle. Simulation were performed to evaluate the performance and power consumption when these three controllers and their different configurations were used on ACC of the electrical vehicle.

KEYWORDS - Adaptive Cruise Control, Power Consumption, Energy Efficiency, Proportional-Integral-Derivative (PID), Fuzzy, Model Predictive Controller (MPC)
FOLLICLE DETECTION IN POLYCYSTIC OVARY SYNDROME WITH IMAGE PROCESSING METHODS

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ABSTRACT

Polycystic ovary syndrome is a hormonal disorder seen in many women. It is the case of many small and benign cysts coming together in the ovaries. These cysts which are called follicles in the ovaries create a special pattern on the ultrasound imaging. In ovarian diseases, the number, structure, and the size of these follicles provide important information for diagnosis. In this study, two different methods of follicle detection are tested for Polycystic ovary syndrome. The first method consists of noise filtering, contrast increment, binarization, and morphological processes. For this method, Median Filter, Average Filter, Gaussian filter, and Wiener filter are used to noise reduction, and then histogram equalization and adaptive thresholding are tested. In the second method, Gaussian filter and Wavelet Transform are used to noise reduction. For the second method, k-means clustering and morphological operations are applied to the image to detect the follicles. Then segmentation is done in both methods. In the segmentation phase, follicle detection is done with the Canny edge detection algorithm. False Acceptance Rate (FAR) and False Rejection Rate (FRR) are used to evaluate the accuracy of the two methods. As a result, in this study, Wiener Filter and Gaussian filter provide the best follicle number results.

KEYWORDS - Follicle Detection, Polycystic Ovary Syndrome, Ultrasonography Images, Image Processing
EXPERIMENTAL MEASUREMENTS ON THE EFFECT OF VEHICLE MOVEMENT DIRECTION ON RECEIVED SIGNAL POWER IN V2V COMMUNICATION

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ABSTRACT

Vehicle-to-Vehicle (V2V) communication has been a popular topic in recent years. V2V communication channel measurements have been carried in different environments and scenarios. These measurements generally consider various differences such as measurement environment, operating frequency, vehicle density, high and low speed measurements, etc. However, vehicle movement direction is generally neglected while the measurement data are analyzed. In this study, V2V channel measurements were carried out with commercially-available Dedicated Short Range Communication (DSRC) On-Board Units (OBU) in open roads similar to a highway but with less traffic. The measurement data are divided into two groups: the vehicles approaching each other and moving away from each other. By comparing the received signal power values of these two groups, the effect of vehicle movement direction on the received signal power is presented. The results show that the received signal power is changing even in the same road depending on vehicle movement direction. However, it is not clear which movement direction causes more path loss according to our findings. The authors suggest that vehicle movement direction should be taken into account in analyzing, modeling, and simulations of V2V communication channel.

KEYWORDS - V2V, Vehicle to Vehicle Communication, Experimental Measurement, Channel Model, Vehicle Movement Direction
A LOW COST HYBRID SYSTEM OF A ZERO CROSSING SWITCH AND LEAKAGE CURRENT RELAY

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ABSTRACT

Classical relay switches, which operate on the principle of the magnetic field, have some problems such as energizing the relay, the time elapsed for pulling the contact, melting, and sticking of the contact due to overheating in high-power applications, causing fire, and energy saving. In leakage current relay, which is used as lifesavers in electric shocks and for reducing fire hazard, the time elapsed for energizing the relay, pushing the contact, and de-energizing the system must be in microseconds for saving human life. In the literature, zero-crossing electronic switch has been used in low-power circuits, and electronic switch and leakage current relay are separate. In this study, a zero-crossing electronic switch and a leakage current relay were developed in a low-cost hybrid way for use in high-current circuits. The aim of this study is to prevent the dangers that may occur during the energization of high voltage systems with the designed system and to combine the two systems used separately in the market and to make them cheaper. It was compared with the conventional relay electronic switch and leakage current relay, and zero-crossing detector suggested in the literature, and their performances were examined. According to the data obtained as a result of the study, it has been determined that the proposed system operates faster than the systems used in the market and that it is more affordable in terms of price.

KEYWORDS - Electronic Switching Systems, Leakage Current, Circuit Breakers, Hybrid Power Systems, Optoelectronics System
ANALYSIS OF FALSE DATA INJECTION ATTACK ON POWER SYSTEM STATE ESTIMATION

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ABSTRACT

Electricity networks, one of the critical infrastructure systems, have become open against malicious attackers with the development of communication technologies. Therefore, power systems are among the issues to be examined in terms of cyber security. The system operator monitors the measurements in the system and is responsible for its security. For this reason, monitoring power measurements in power systems is important for the safety of the power system state estimator. State estimation is used to obtain unknown state variables from known measurement values. Weighted least-square (WLS) criterion is commonly used for state estimation in power systems. There may be errors due to the nature of sensors and communication problems in a transmission system. A state estimator can fill out inaccurate measurements due to sensor and communication errors by correcting small errors in the measurements. However, besides sensor and communication errors, when an attacker changes the measurements appropriately, it can bypass detection algorithms and cause errors in power system state variables. In this study, False Data Injection (FDI) attack is mathematically modeled. Simulation of FDI attack was made in Matlab environment by using IEEE 9 bus electrical network as test system. As a result of the study, the targeted state variable was disrupted by mathematically obtained attack vector.

KEYWORDS - Cyber Security, False Data Injection (FDI) Attack, State Estimation, Power Systems, Weighted Least Square (WLS)
A SMARTPHONE CONTROLLED FERTILIZING AND PLANT WATERING GARDUINO

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ABSTRACT

Our life is enduring from the nutrients taken by the plants. For many living organisms, plants create the habitat, nurture food and shelter. They help by cleaning the air and diminishes toxins. They accommodate numerous products for the welfare of human beings. However, plants are getting perished due to the deficient amount of water. So, they must require water for their survival, but all of them don't need the same amount of water. Too much or too little water both can be harmful to the plants. In the same way, fertilizing the plants are also important as most of the soils are infertile these days. The objective of this paper is to develop a robot that can tell us how much water a plant requires and water it accordingly as well as fertilize it. This robot is being controlled by a Bluetooth module, and it carries a water and fertilizer tank, a soil sensor, and a digital display. Initially, the soil is fertilized, then the soil sensor is implanted into the soil, and the moisture percentage is displayed in the digital display, accordingly, the plants are watered until the moisture content reaches 100%. This system helps in watering and fertilizing the plants properly so that the plants can thrive.

KEYWORDS - Arduino UNO, Soil Sensor, Bluetooth Module, DC Motor Pump (12V), Relay Module.
DESIGN OF A 10 KW 100 KV HIGH VOLTAGE DC POWER SUPPLY

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ABSTRACT

Thanks to the rapid advancement of power electronic components, High voltage dc (HVDC) power supplies are now being used in many different sectors including medical industries, military radar technology, telecommunications, and aerospace. However, the design of a high voltage dc supply presents many challenges. Especially, selection of proper topology, control scheme, and appropriate voltage boosting techniques are of great importance. In this study, a 10 kW, 100 kV dc power supply is designed using two approaches. A phase-shifted full bridge inverter is used for producing high frequency ac voltage. Then, two different voltage boosting approaches are tried to produce the full output voltage. The first approach uses the input parallel output series (IPOS) modular strategy and the second approach uses the Cockcroft-Walton (CW) voltage multiplier strategy. This paper provides the design of these two converters and evaluates their performance. The PLECS simulation software is used to validate the design and to compare the overall performance of the converters. We also compare the efficiency based on the analytical calculation of power losses in each converter. Consequently, the results prove the successful operation of both approaches; however, in terms of dynamic response and voltage ripple IPOS modular approach provides superior performance, while the power losses in CWVM strategy are less compared to IPOS strategy.

KEYWORDS - High Voltage DC Power Supply, IPOS DC Converter, Cockcroft-Walton Voltage Multiplier, Phase Shift Pulse Width Modulation
PNEUMONIA DETECTION AND CLASSIFICATION USING DEEP LEARNING ON CHEST X-RAY IMAGES

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ABSTRACT

Pneumonia is a bacterial infection caused people of all ages with mild to severe inflammation of the lung tissue. The best known and most common clinical method for the diagnosis of pneumonia are chest X-ray images. But the diagnosis of pneumonia from chest x-ray images is a difficult task, even for specialist radiologists. In developing countries, this lung disease becomes one of the deadliest among children under the age of 5 and causing 15% of deaths recorded annually. Therefore, in this study, firstly the presence of the disease was tried to be determined using Chest-Xray dataset. In addition, using the bacterial and viral pneumonia classes which are two different types of pneumonia, multiclass classification which consists of viral, bacterial pneumonia and healthy has been done. Since the used dataset does not have a balanced distribution among all classes, SMOTE method has been used to deal with imbalanced dataset. For each classification problem, two different deep learning methods which are CNN and ensemble learning has been used and %95 average accuracy has been obtained for each model, for binary classification and 78% and 75% average accuracy has been obtained for each model respectively for multi class classification problem.

KEYWORDS - Pneumonia, Viral Pneumonia, Bacterial Pneumonia, Deep Learning, CNN, Ensemble Learning, SMOTE Method.
EFFECT OF OBJECTIVE FUNCTION IN PID CONTROLLER DESIGN FOR AN AVR SYSTEM

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ABSTRACT

The regulation capability of an automatic voltage regulator (AVR) system still needs to be improved to keep the output voltage of the generator within the AVR system at the desired level. Researchers have been studying on to develop new control structures or to design controllers to improve the performance of the AVR system. Design of PID controller, which is commonly preferred controller due to its simple structure and robustness against to system parameter changes, has an important place among these studies. Especially with the development of metaheuristic algorithms, there are more successful PID controller designs by using these algorithms than traditional design methods. Undoubtedly, the objective function selected also has a significant effect on this success. Therefore, effect of objective function in PID controller design process for an AVR system is examined in this study. Two different PID controllers are designed using two different metaheuristic algorithms, namely, crow search algorithm (CSA) and ant colony optimization (ACO) algorithm. The parameters of the PID controllers are optimally tuned by using five different objective function in the both algorithms. These objective functions are: Integral of absolute error (IAE), integral of squared error (ISE), integral of time-weighted absolute error (ITAE), integral of time-weighted squared error (ITSE), and a commonly used user-defined objective function. The performance of the designed PID controllers are compared in terms of transient response characteristics and performance metrics. In addition, in order to evaluate the stability of the AVR system with designed controllers, bode analysis, pole-zero map analysis and robustness analysis, in which the effects of the AVR system parameters on the system can be observed, have been performed.

KEYWORDS - Automatic Voltage Regulator (AVR) system, Ant Colony Optimization, Crow Search Algorithm, PID Controller
USE OF SUPERCAPACITOR IN SMART METERING GATEWAY

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ABSTRACT

Advanced Metering Infrastructure (AMI) consists smart meter, gateway, meter data management software. Smart meter and gateway work together to measure energy on the field. Then, gateway send the measured smart meter data that can be periodic or instant meter reading results, power factor, voltage-current-power information, energy is available or not information to the meter data management software with a communication method from the field. If there is an integration between AMI and other distribution network systems like Outage Management System (OMS), Customer Relations Management (CRM), AMI provides measured data to these systems. Supercapacitor is a new type small energy storage device and it can easily use power system to provide the energy certain time in case of power failure. The gateway that is part of AMI connects the distribution grid physically on the field and provides own energy so when the power failure occurs in distribution grid at same time gateway energy will be cut. This means last measured data and last field situation can’t be send to the AMI software so all system integration and remote meter operation will halt. This paper handles supercapacitor usage as a part of AMI system gateway on the field to provide last measured data to the AMI software. Supercapacitor benefits are shown using AMI system with real time measured data in distribution grid. Supercapacitor model will explain considering gateway design. Gateway with supercapacitor and gateway without supercapacitor situations will compare in terms of AMI and other system integrations.

KEYWORDS - Supercapacitor, Ami, Smart Metering
SENSORLESS BRUSHLESS DC MOTOR CONTROL USING TYPE 2 FUZZY LOGIC

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ABSTRACT

BLDC motors have many advantages such as a better speed versus torque characteristics, high dynamic response, high efficiency and reliability, low cost drives, long operating life (no brush erosion), noiseless operation, higher speed ranges, and reduction of electromagnetic interference. For this reason, it is used in many different fields today. A BLDC motor requires an inverter and a sensor to achieve commutation process. However, the hall sensor presents quite a few disadvantages from the standpoint of drive’s cost, machine size, temperature sensitivity requiring special arrangements and noise protection. As a result, with the increasing power of embedded computing in recent years sensorless control techniques have been developed and widely used. Additionally, conventional controllers do not give the desired results as these motors are non-linear in nature. Many techniques for BLDC motor speed control have been developed such as PI, Fuzzy logic controller, adaptive neuro fuzzy inference system. But the responses obtained were oscillatory and when a load was applied to these systems, the system's responses were much lower than the reference value. To remove oscillations and achieve a better performance, some new techniques were required. Due to their ability to handle uncertainty with robust and adaptive structure against complex systems, type-2 fuzzy logic systems, which is one of the artificial intelligence techniques started to use in recently years. In this study, the brushless motor was used as without sensor with back emf technique and zero crossing detection. Interval type-2 fuzzy logic controller was used to better resolve the uncertainties in the system. Simulation performed in Matlab – Simulink and PI, type-1, interval type-2 fuzzy logic controller results were compared and as a result, it was observed that interval type-2 fuzzy logic controller gave the most suitable system response to reference value.

KEYWORDS - Type-2 Fuzzy Logic, BLDC Motor, Sensorless Control, Type-1 Fuzzy Logic, PI Controller
MOTOR IMAGERY BCI WITH FREQUENCY AND TIME
FREQUENCY FEATURES BY REDUCING THE DIMENSION OF
THE FEATURE SPACE USING AUTOENCODERS

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ABSTRACT

Brain-Computer Interfaces (BCIs) enable the users to directly communicate with machines based on various desired purposes through brain signals without moving any body parts. Thus, they nowadays have become very useful for prosthesis, electrical wheelchairs and virtual keyboards as well as other studies like survey applications and emotion classifications. In this study, EEG signal processing was performed on the BCI Competition IIIa dataset, which contains motor imagery (MI) signals with four classes, obtained in the BCI laboratory of Graz University of Technology, Austria. Features of the non-stationary EEG signals belonging to three subjects were extracted using Welch Method, Wavelet Decomposition (WD), Empirical Mode Decomposition (EMD) and Hilbert-Huang Transform (HHT). From extracted 900 features, feature space dimension reduction was realized using Autoencoder, which is an unsupervised learning algorithm. The accuracy obtained after classification with Artificial Neural Network (ANN) is 78.2% which is generally a good result because of the non-stationary nature of EEG signals

KEYWORDS - Autoencoder, BCI, BCI Competition, EEG, EMD, Hilbert-Huang, Wavelet
HEXAGONAL RING MICROSTRIP PATCH ANTENNAS FOR PCS AND S-BAND RADAR APPLICATIONS

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ABSTRACT

In this study, two hexagonal ring microstrip patch antennas for Personal Communication Service (PCS/1850-1990 MHz) and S-band (2000-4000 MHz) radar applications are proposed and simulation results for the antenna performance parameters are presented. The antennas consist of a hexagonal ring patch, a ground plane and a dielectric substrate in between. Edge length of each square antenna is 25 mm. Substrate height is 4.3 mm. Relative permittivity and loss tangent of the substrate material are 15.5 and 0.0001, respectively. Distance from center of the antennas to inner and outer hexagon corners are 4 mm and 10.19 mm, respectively. The antennas are fed by a 50-ohm coaxial probe. Depending on the feed location, resonant frequency and therefore the application choice is achieved. Center of the antennas is denoted as (0, 0) mm. For the feed location of (-1.50, -4.19) mm, the antenna for PCS application resonates between 1830-2035 MHz with a -10 dB impedance bandwidth of 205 MHz. Voltage Standing Wave Ratio (VSWR) value at 1900 MHz is 1.1097. Unidirectional radiation patterns are obtained for both $\Theta=0^\circ$ and $\Theta=90^\circ$ planes. Maximum radiations occur at boresight with radiation levels of 12.09 dB and 12.10 dB for $\Theta=0^\circ$ and $\Theta=90^\circ$ planes, respectively. Maximum gain is 3.26 dBi for $\Theta=0^\circ$ plane and 3.09 dBi for $\Theta=90^\circ$ plane. For the feed location of (-7.36, 0.95) mm, the antenna for S-band application resonates between 3280-4015 MHz covering S-band with a -10 dB impedance bandwidth of 735 MHz. The frequency range and bandwidth are suitable for the radar application. VSWR value at the resonant frequency of 3650 MHz is 1.0164. Again, unidirectional radiation patterns are obtained for both $\Theta=0^\circ$ and $\Theta=90^\circ$ planes. Maximum radiations occur at boresight with radiation levels of 5.82 dB and 5.75 dB for $\Theta=0^\circ$ and $\Theta=90^\circ$ planes, respectively. Maximum gain is 4.14 dBi for $\Theta=0^\circ$ plane and 4.03 dBi for $\Theta=90^\circ$ plane.

KEYWORDS - Hexagonal Ring, Microstrip Patch Antenna, Personal Communication Service, S-Band Radar, Antenna Parameters
AN INSIGHT INTO DEEP NEURAL NETWORKS BASED ON IMAGE CLASSIFICATION PROBLEM

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ABSTRACT

Artificial neural networks have shaped technology trends for more than half century starting from the discovery of the perceptron, the first artificial neural network. In today’s modern world, they have broad applications ranging from autonomous systems, aerospace, and medicine to data analytics, language processing and computer vision tasks. In the last few decades, a phenomenon called deep learning have gathered impact on such areas. Especially, convolutional neural networks mimicking our visual cortex system in the brain have become very attractive for image classification and recognition tasks employed in many machine learning and computer vision systems. In this paper, we review the current architecture of the neural networks and give an insight into deep neural networks based on classical image classification problem. We employ the MNIST database of handwritten digit images for the recognition task. The operations inside a convolutional neural network such as convolving (masking), rectifier linear unit (ReLU), and pooling are described in detail.

KEYWORDS - Convolutional Neural Network, Deep Neural Networks, Deep Learning, Image Recognition, Machine Learning
PARTICLE SWARM OPTIMIZATION METHOD FOR FINDING OPTIMUM SPEED POINTS IN TRAMS

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ABSTRACT

All the studies in urban railways gained importance with the requirement of developing in this area. However, not only technological development but also energy-saving conditions have great importance. One of these efficiency conditions is to know the optimum operating conditions. There are two electronic drive warning systems. design phase, simulation is a great help. It is known that both electronic driver warning systems are successful to determine the optimum driving solution correctly. These are the Driver Advisory System (DAS) and Automatic Train Operation (ATO); It should be noted that it is a success because their algorithms are planned correctly. Algorithms are often determined on convergence and computation times, but it is recommended that many algorithms are used when solving a problem and the best solution is compared by comparing these methods since it provides convergence over optimum rather than only possible solutions. To enrich these algorithms with meta-heuristic methods provides that it can be adapted to the changing operating conditions. Thus, flexible management can be achieved. Using the Particle Swarm meta-heuristic method, optimum driving speed and acceleration, cruising, coasting, and full braking times were calculated under different operating conditions. Thus, attention was drawn to efficiency in this area.

KEYWORDS - Energy Efficiency, Railway, Particle Swarm, Optimization, Drive Warning Systems
LEAKAGE DETECTION IN UNDERWATER OIL AND NATURAL GAS PIPELINES USING CONVOLUTIONAL NEURAL NETWORKS

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ABSTRACT

Underwater oil and natural gas pipelines are an underwater transport infrastructure known to be reliable, fast and efficient, preferred for the transmission of energy to far distances. The rapid and continuous increase in demand for energy due to population growth, industrial developments and global growth requires economic and environmental solutions for the safe transmission and control of energy sources such as oil and natural gas. These lines are damaged due to their work in corrosive ambient conditions, natural elements such as sudden change of air and water temperatures, tectonic activities and external elements such as blows caused by fishing equipment and military exercises. Therefore, it is necessary to determine the damages without requiring more hardware, saving time and cost. In this study, images of underwater oil and natural gas pipelines are enhanced. They are detected using convolutional neural networks and the artificial neural network performance is analyzed. A reliable, fast, efficient, controlled and sustainable model is established to prevent potential damage to underwater pipelines from becoming an environmental threat to water and air pollution and living creatures in the underwater ecosystem with this study.

KEYWORDS - Unmanned Underwater Vehicle, Underwater Object Detection, Underwater Oil and Natural Gas Pipelines, Underwater Pipelines Detection, Leakage, Convolutional Neural Networks
STATE AND PARAMETER ESTIMATION OF A NONLINEAR SERVO SYSTEM HANDLING NOISES AND VARYING PAYLOADS

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ABSTRACT

In the real-time applications, payload estimators are used to estimate the constant or varying payload using the accurate position and velocity information of the system. In this paper, first recently proposed sliding-mode observers (SMOs) are designed and compared for velocity estimation of a nonlinear servo system. Second, a parameter estimation based on sliding-mode super-twisting approach is designed to estimate unknown and varying parameter for a class of nonlinear systems. The convergence property of observers are considered using Lyapunov stability method. In the applications, the constant and varying payloads of the servo system have been estimated using the designed method and compared with Extended-Kalman Filter (EKF). In the final section, artificial noises with different SNR are applied to the measurement signal. When the less amplitude of noise signal were applied, second order SMO estimated the states and the payload better than EKF. However, EKF provides much better estimation results than second order SMO for large amplitude of noise signals. For the sake of generalization, second order SMO is a fast and robust observer for small noise cases. In addition, the filtering property of EKF has still importance for large noise cases.

KEYWORDS - Sliding Mode Control, Extended-Kalman Filter, Noise, State And Parameter Estimation, Varying Payload, TURKEY
In this paper, a modified (proportional-integral) PI control is suggested to improve current tracking performance of three-phase grid-tied inverters (GTI). Presence of the L filter between inverter and grid, makes complex to design a controller with proper parameters, due to characteristics of the filter. Classical PI control depends on an accurate dynamical model, thus its performance is deteriorated by parametric uncertainties, unmodelled dynamics and external disturbances, when operating conditions affect the filter parameters. To solve this problem, uncertainty and disturbance estimator based PI current control approach is proposed for grid-tied inverters, which provides robustness against to parametric perturbations. An UDE based observer that has been adopted into the PI current loop is used to eliminate lumped disturbances and the steady-state tracking error of current states, which can enhance the robustness of the control performance. Then, parameter design method, stability and robustness analysis are explored and presented. Performance comparison among the classical PI and proposed control scheme. Efficacy and performance of the proposed approach are carried out by simulations and experiments. Experimental results show that effectiveness of the suggested control method against parametric uncertainties and disturbances are successfully validated. Besides, the precise current tracking performance with zero steady state error has been reached.

**KEYWORDS** - Uncertainty and Disturbance Estimator (UDE), Grid-Tied Inverter (GTI)
METHOD OF TYPES BASED ROBUST BAYESIAN BINARY HYPOTHESIS TESTING

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ABSTRACT

There are several engineering application where the classical hypothesis testing framework can not be applied directly, because the probability distributions that are associated with different hypothesis are not known exactly. Some examples are classification that is based on training data, signal detection under statistical model uncertainty. For these applications, robust methods that are capable of providing acceptable performances are needed. Let \( x_n = [x_1, x_2, ..., x_n] \) be a random vector with discrete elements \( x_i \in X, i=1,2,...,n \), where \( X \) denotes the discrete alphabet whose size is \( |X| \). Consider binary hypothesis testing problem where under hypothesis \( j, j \in \{1,2\} \), the elements of \( x_n \) are generated independently from distribution \( Q_j \). We investigate the case where \( Q_j \) are not known, but one has access to another pair of distributions, \( P_1 \) and \( P_2 \), together with the knowledge that \( ||P_j - Q_j||_1 < \varepsilon_j \). We propose a robust test and obtain an upper bound on its error exponent independently of \( Q_j \). The proposed method offers adjustability between robustness and performance, and as \( \varepsilon_j \to 0 \) its performance matches the ideal case. For \( \varepsilon_j > 0 \) the derived upper bound provides sufficient conditions on \( Q_j, \varepsilon_j \) and \( |X| \) to obtain non-vanishing error exponents.

KEYWORDS - Bayesian Hypothesis Testing, Robust Hypothesis Testing, Chernoff Distance, Method of Types, Minimax Hypothesis Testing
FRACTURE ENERGY COMPARISON OF ALUMINUM AND BORON COMPOSITES FOR FUEL CELL END PLATES

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ABSTRACT

Fuel cells have become an attractive choice because they do not cause environmental and noise pollution. Additionally, they do not contain any moving parts and have higher efficiency than fossil fuels. Therefore, improving fuel cells will contribute to clean energy. For this reason, the material selection for different components of fuel cells is important. The materials used in fuel cells are determined as metal, non-metal, or composite depending on where they are used. Strain energy release rate is important in determining whether the materials are safe under different loads. Fracture energy is an significant case to decide safe conditions of material. When different load or loads are applicated to specimen, it is significant to determine what kind of brekage may ocur. There are three fracture toughness modes which are Mode I (opening), Mode II (sliding shear) and Mode III (tearing). The use of different test cases can lead to diffucult test conditions and results. To carry out mixed mode conditions to test material, Arcan Specimen is efficient due to facility observation of different mixed modes. In this study, aluminum and two different boron composites were investigated as material of the end plate that holds the fuel cells together. Also, strain energy release rates were found numerically and the results were compared.

KEYWORDS - Fuel Cell, End Plate, Strain Energy Release Rate, Composite Material
CALCULATE THE DRAG COEFFICIENT OF BULLET WITH OPENFOAM

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ABSTRACT

The drag coefficient is a physical quantity that we do not notice in our daily lives, but often affects the air friction that we encounter most of the time. As an example, we want the planes to get more distance with less fuel. One of the factors enabling this is to minimize the drag coefficient. The first factor that reduces the drag coefficient to the minimum was seen as the changes made in the figure. For this reason, the planes are in the form of water drops. The smallest drag coefficient was found close to this shape. This quantity also plays an important role in the defense industry, especially in ammunition. The range plays a major role in missile, rocket and cannon ammunition. If it is desired to ignore the shape and increase the range, the increase in fuel in ammunition such as missiles and rockets will be increased in gun ammunition. However, increasing the fuel of the rockets will cause an increase in the weight, as the combustion of the fuel will turn into heat and will cause the growth of the cooling systems, and the weight will increase again and cause inefficiency. In gun ammunition, the increase of gunpowder will increase the energy and this will cause the barrel to break down in the first ignition. For such reasons, ammunition design plays an important role. Measuring the drag coefficient in ammunition is a costly and time-consuming process, especially since the designs of prototype ammunition are repeated. For this reason, designers turned to computer simulation programs. In this study, OpenFOAM, a free alternative to the Ansys, which is frequently used in the industry, was studied and the results were compared.

KEYWORDS - OpenFOAM, Velocity, Bullet, Drag Coefficient, Navier Stokes
IMAGING OF VELOCITY PRESSURE AND TEMPERATURES AROUND A BULLET WHICH HAS A CERTAIN SPEED WITH OPENFOAM

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ABSTRACT

Defense industry has entered into a breakthrough and domestic production quantities are wanted to be increased. To accomplish this, the designs will also give great advantage to being original. The simplest bullets are of various sizes, ranging from size to small, and have specific standards and are developed according to these standards. The smallest projectiles have only undergone shape changes, not showing much improvement, although the technology has improved. The biggest reason for the change in shape is that the deflection rate at a certain distance is the lowest and the intensity of hitting a certain area is high in the series of shots. To reach this conclusion, examining the changes in velocity, pressure and temperature as the projectile travels through the air will tell designers whether the shape is efficient or not. This is normally provided with special systems. However, with the advancement of computer technology and the analysis of finite element programs by computer programs, these images are realized very easily and provide designers with the necessary data for bullet shape. In this thesis, OpenFOAM, an open source computational finite element solver, was used to analyze the G7-designed projectile at a certain speed and display velocity, temperature and pressure fields.

KEYWORDS - OpenFOAM, Velocity, Pressure, Temperatures, Bullet
PROPOSED DIRECTIONS FOR ORGANIZING THE FUNCTIONING OF THE SHIP CREW RESCUE SYSTEM

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ABSTRACT

Sea transport is the most efficient mode of transport in the world. The main direction of ensuring water safety is to equip ships with fail-safe and effective rescue means for collective use (SSKP). Now the standard rescue operation when using the SSCP is a series-parallel action of the ship’s crew, in which the ship will sink on an even keel, or with a slight roll to one of the sides. However, such cases are extremely rare. Basically, the situation develops instantly and there is nothing about the implementation of the so-called "Standard rescue operation" speech cannot go. The number of such incidents is already numerous and it is imperative to change the approach to ensuring the safety of human life at sea. Now there are two directions for ensuring the safety of human life at sea. The first is the development and implementation of artificial intelligence systems for SSCP. That is, SSKP independently, without human intervention, responds to an emergency, in which there is a large share of the probability of the death of the vessel and crew. Secondly - this is when there is no need to save someone. In this case, we are talking about crewless vessels. Specialized marine diesel engines are used as domestic engines for lifeboats: 4CHSP9.5 / 11 - Caspian 30M and 4CHSP9.5 / 11 - Caspian 40. Both engines are equipped with a dual start-up system - manual and electric starter, have a reverse gear transmission, a single-circuit flow-through cooling system with outboard water, are equipped with decompression devices and standard mounted units provided for by SOLAS and KSS requirements. Currently, scientific foundations and technical solutions are being developed to ensure reliable start-up of vortex-chamber diesel engines by exposing the fuel to physical fields without the use of glow plugs.

MAGNETITE Fe3O4 OXIDATION OF 1.2367 HOT WORK TOOL STEEL AND INVESTIGATION OF WEAR PROPERTIES

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ABSTRACT

In the metal forming industry, dies can be subjected to complex and surface-related mechanical, thermal, or tribological effects. Wear is one of the important factors that limit the life of hot forging tools. The aim of this study is to evaluate the effects of the oxidation process on nitrocarburized 1.2367 hot work steel. Nitrocarburizing was applied to 1.2367 tool steel samples after quenching and tempering. After this surface hardening procedure, Fe3O4 is formed by the oxidation process. In this work, it was examined how to wear performance changed if the thin oxidation layer was continuous and discontinuous and also some of the samples were not subjected to both oxidation and nitrocarburizing. Therefore, the wear behavior of the surface hardened and oxidized samples were compared to only heat treated hot work steel. Wear tests were performed using a ball-on-disc type tribometer and counterpart material was Al2O3. As a result, it was found that wear rate clearly decreased with the formation of a shallow and continuous Fe3O4 layer on the surface. Moreover, discontinuously presence of Fe3O4 on the surface resulted in a lower wear performance than only heat-treated samples. The friction characteristics were examined for all conditions. While the oxide layer could improve the wear resistance, it was reported that the oxide layer could be easily removed from the surface during friction if this layer was not formed homogeneously on the surface; so the wear resistance worsened compared with non-oxidized samples.

KEYWORDS - Wear, Hot work tool steel, Oxidation, Nitrocarburization, Surface Hardening
HEALTH DIAGNOSTIC MODELING OF ENGINE USING MULTI-LAYER PERCEPTRON

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ABSTRACT

The development of aviation technology has a pivotal role in both the strength of the national power and the economy that provide people's livelihoods with. It is also an important indicator for the country's industrial technology. This paper focuses on the prevention of engine failure, which is a key issue in the engine-related research. In 2018, Chen et al. proposed a nonlinear regression model to predict the parameters of turbine engines, the temperature of the low pressure compressor section, and the temperature of the high pressure compressor section. However, it is difficult to determine the coefficients and the order of polynomial, decreasing the accuracy of prediction. In 2019, we used multi-layer perceptron to predict thrust of TFE731 engine, in which the prediction accuracy is higher than that of the related methods. However, the structure of multi-layer perceptron is also determined difficultly. Consequently, in this paper, we expanded the multi-layer perceptron to determine an appropriate perceptron structure and predict another parameter of engine, i.e., low pressure turbine outlet temperature. The experimental results showed that the root mean squared error and the absolute value of the maximum error were smaller than they were in the correlation method, which shows the effectiveness of the proposed method.

KEYWORDS - TFE731 Engine, Multi-Layer Perceptron, Health Diagnostic Modelling, Thrust, Low Pressure Compressor Section
DIGITAL PROJECT MANAGEMENT APPLICATIONS IN THE AUTOMOTIVE INDUSTRY

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ABSTRACT

Digitalization is an inevitable necessity for all companies in order to keep up with the modern era and to be take one-step much more ahead of competing companies. As the number and qualifications of the projects owned by the companies increased, project monitoring and controllability becomes more and more difficult. At this point, traditional project management applications may be insufficient. Digitalization in project management provides a big convenience to project managers about project tracking and management. In addition to this, more than one person can work in the project according to the quality of the project and thanks to the digital project and management strategy, team members can easily access the information they need at any time. As a result of this facilities, the project traceability quality would be increase. In this study, the application of digital project management strategy in automotive sector and some auxiliary computer software used for digital project management are mentioned. At the same time, the process from the emergence of the project idea in an automotive company to the completion of the project and the materials and methods used in this process will be discussed. In addition, some of the weaknesses and positive aspects of these software have been mentioned.

KEYWORDS - Digital Project Management, Project Management, Digitalization
A NUMERICAL MODEL FOR BETTER COMPUTER THERMAL MANAGEMENT

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ABSTRACT

In this numerical work, thermal management in a computer tower case is studied using the commercial software Ansys Fluent©. Study shows that, for a given case layout and air inlet and outlet, the flow path is more important than the cooling air flow rate to obtain the necessary cooling to keep the components at their safe operating temperatures. Overheating in these components, especially the processors, not only adversely affects the overall computational performance but may result in component failure in the long run. With the ever increasing computational capabilities of these processors over the past 50 years, the heat generated per unit volume has almost reached its physical limits as far as the convective air cooling is concerned. Therefore, CFD simulations as outlined in this study may need to be performed before the actual product is manufactured and marketed. This way, it would be possible to predict whether forced convection using external fan/fans only would suffice for the necessary heat extraction or to determine using more sophisticated cooling techniques such as finned heat sinks to be attached to the processors with very high power consumption, or dedicated internal fans directly providing air onto these processors where high heat transfer coefficients can be obtained.

KEYWORDS - Heat Transfer, Forced Convection, Enclosure, CFD, Thermal Management
DESIGN OF A CABLE DRIVE SYSTEM WITH CURVED GUIDE RAIL MECHANISM

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ABSTRACT

Today, due to the global competitive environment and constant change in market demands, automation systems are used in production and the basic principles of Industry 4.0 are adopted. Operational efficiency, speed, flexibility, and applicability are aimed at production with Industry 4.0. Smart factories are one of the key components of Industry 4.0. Robotic systems are used in smart factories where different system units are in constant communication with each other and production is provided in real-time with automation. The capacities, operating principles, and functions of the robots vary according to the sector and the purpose of use. In addition to the degree of freedom provided by the limbs of the robot arm used, the robot arm can be moved over a larger area by the movement of the platform on which the robot arm is fixed. For this reason, linear and nonlinear rail systems are widely used in robotic systems. The purpose of this study is to design a more efficient alternative driving system with an innovative approach in line with the basic principles of Industry 4.0. Within the scope of the study, an original curved rail mechanism was designed for an industrial robot arm. The motion of the mechanism is provided by cable driving. The mechanism is driven by only one actuator. All design operations were carried out using the SolidWorks package program. As a result, an alternative new drive system design is realized. In addition, a new method is presented to the feature of driving back in driving systems with the original curved rail mechanism designed.

KEYWORDS - Industry 4.0, Cable Drive, Curved Guide Rail
THEORETICAL ESTIMATION OF CRACK INITIATION ANGLE IN PMMA

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ABSTRACT

In computational fracture mechanics and its applications, prediction of crack initiation angle is a key parameter which affects the shapes of the incrementally growing crack profiles and resulting fatigue crack growth lives. Fracture and fatigue crack growth studies for many practical engineering problems have mostly concentrated on structures containing cracks exposed to pure mode-I loads which is known as opening mode acting perpendicular to the crack plane. In pure mode-I loading conditions, the crack propagates straight along its initial plane. However, in practice, many structures containing cracks are exposed to biaxial loads, i.e., directions of the loads are not perpendicular to the crack plane. In two-dimensional fracture problems, cracks can propagate two-dimensionally deflecting from its plane. Thus, determining the crack deflection angle as well as the crack initiation under the critical load corresponding to the lowest fracture resistance of an engineering structure containing cracks is the main subject of two-dimensional fracture problems. In this study, the fracture behavior of PMMA in terms of prediction of crack initiation angle was investigated. Theoretical estimations were performed for two different applications and obtained results were compared with the experimental data from literature, conducted by angled cracked plates and by short beam bend specimen containing inclined edge crack. Very good agreements were obtained between the theoretical and experimental results.

KEYWORDS - Fracture, Crack Initiation Angle, PMMA.
DATA DRIVEN APPROACH FOR ESTIMATION OF MARINE VESSEL’S FUEL OIL CONSUMPTION

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ABSTRACT

The huge capacity of cargo transportation is carried out by the maritime, and a remarkable percentage of the worldwide emissions are released into the atmosphere by marine vessels. Therefore, some regulations are implemented by the International Maritime Organization to reduce emissions from the ships and to realize energy-efficient management. In line with these sanctions, studies conducted by maritime companies and researchers in the areas specified recently have become widespread. Ship energy performance estimation studies performed with data-driven machine learning techniques are evaluated within this scope. Fuel consumption is one of the most effective performance indicators on ships and also constitutes a large part of the operating cost. By monitoring the fuel consumption of the marine vessel, foresight could be gained about many parts of the ship, thus that efficiency management could be achieved by successfully estimating fuel consumption. In this study, artificial neural networks that have high predictive success in non-linear systems are established in accordance with the noon reports obtained from a bulk carrier ship. Variables affecting fuel consumption on the data set are determined to constitute the artificial neural network structure and used for prediction. As a result of the estimation process, the fuel consumption of the marine vessel is carried out effectively based on historical data.

KEYWORDS - Artificial Neural Network, Energy Efficiency, Marine Vessel, Fuel Consumption
H CONTROL TO ATTENUATE BOEING 747 100 LATERAL DISTURBANCES

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ABSTRACT

The lateral-directional flight of Boeing® 747-100 is simulated at (Mach, altitude) conditions of (0.2, sea-level), (0.5, 6096m); and (0.9, 12192m). The lateral-directional states coupling with aileron and rudder have been controlled using the H∞ stability augmentation design (H∞SAD). The H∞SAD augments a degree of freedom in guaranteeing quadratic performance under moderate sideslip and bankroll disturbances. Stable complex eigenvalues and steady-state convergences are achieved within a few seconds with acceptable flying qualities for coupling aileron and rudder of 1° step references. The controller has been also revised to cope with flight constraints, demonstrating the need of autopilot to track reference manoeuvres clear of those lateral perturbations. The side velocity and bank angle responses agreeably converge at the three cases studied here. Acceptable flying quality is verified for Dutch roll modes whereas insignificant discrepancies are found for roll and spiral modes as the flight condition getting closer to 0.2-Mach and sea-level.

KEYWORDS - Boeing® 747-100 Lateral-Directional Stability, Coupling States With Aileron And Rudder, H∞ Stability Augmentation Control Design, Mach-Altitude Conditions, Flying Quality, Lateral Modes
H ARTIFICIAL BEE COLONY FOR 6DOF BOEING747 100
CONTROL

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ABSTRACT

In this paper, the six degrees of freedom (6DOF) of Boeing® 747-100 (B747-100) flight has been simulated at Mach = 0.5 and altitude = 6096m using a quasilinear decomposition model of longitudinal and lateral motions. The longitudinal states coupling with elevator and throttle and the coupling of the lateral state with aileron and rudder have been controlled using the $H_\infty$ stability augmentation design ($H_\infty$SAD) based on the artificial bee colony algorithm (ABC). The ABC optimizes the $H_\infty$ weighting matrices instead of traditional techniques which suffers in case of large scale models. The ABC has comfortably delivered the full state feedback gain and controlled state matrices for a quadratic performance on order of nine. A reasonable realisation of 6DOF B747-100 flight is achieved in terms of converged simulations of a few seconds, negligible overshoots and steady-state errors. The eigenvalue spectrum indicates several dynamically stable flight modes fulfilling the most flying quality properties being inspected.

KEYWORDS - Boeing® 747-100 Lateral-Directional Stability, Artificial Bee Colony
SOLAR POWER PLANT SITE SELECTION USING MULTI-CRITERIA DECISION MAKING METHOD A CASE STUDY IN FIVE CITIES IN TURKEY

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ABSTRACT

Solar energy is considered one of the best and most promising renewable energy toward a sustainable and free carbon energy future. In a solar power plant, different factors can affect the system performance. One of the main issues related to solar plants is choosing the right location to install the facility. The study aims to evaluate and select the best location for a solar power plant in TURKEY using Multi-Criteria Decision-Making (MCDM) method. Five different cities Antalya, Mersin, Nigde, Isparta, and Konya are considered in the analysis. Different factors might affect the performance of the solar power plant, in this study the selected factors are the amount of solar radiation and sunshine received, temperature, land cost, population, precipitation, earthquake risk, snow duration, and closeness to main roads and city center. MCDM is a significant tool that helps decision-makers in the field of energy planning since it considers all objectives and criteria at the same time. Two well-known MCDM methods (Analytic Hierarchy Process (AHP) and Analytical Network Process (ANP)) are used to determine the best alternative according to the criteria. The results of the study demonstrate that Mersin is the best alternative followed by Antalya and the other alternatives might change according to each method, while Nigde scored the lowest score to be considered the least preferred alternative.

KEYWORDS - Multi-Criteria Decision-Making, Renewable Energy, Solar power plant, AHP, ANP
SYNERGIES DURING CO2 GASIFICATION OF CHARS OBTAINED FROM FAST PYROLYSIS IN A DROP TUBE FURNACE

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ABSTRACT

This work investigated the gasification of chars obtained from the pyrolysis of solid fuels at high temperatures and heating rates in an electrically heated drop tube furnace. The fuels studied were olive residues and Soma lignite, both dried, ground, and sieved to a size cut of 106-125 µm. The sieved fuels were initially pyrolyzed in a drop tube furnace and the char particles were collected using a 3-stage stack impactor. During pyrolysis in the drop tube furnace, its temperature was set to 1000 ºC and the particles heating rate were estimated to be 104 ºC s⁻¹. The chars obtained from the drop tube furnace were then analyzed for their chemical composition; morphology, using scanning electron microscopy and BET surface area analysis; inorganic content, using X-Ray spectroscopy; and particle size distribution, using a laser diffraction technique. The chars showed similar particle size but quite different morphologies. Olive residue chars displayed significant melting, whereas Soma lignite chars kept their initial shape. Following fast pyrolysis, the olive residue chars showed a decrease in surface area from 7.9 to 2.9 m² g⁻¹, and the surface area of the Soma lignite chars increased from 10 to 31 m² g⁻¹. The characterized chars were subsequently gasified in a thermogravimetric analyser in dynamic runs (25-1000 ºC at 10 ºC min⁻¹), with the atmosphere composition set to 100 vol.% CO2. The dynamic gasification runs enabled to obtain conversion vs temperature and reactivity vs temperature data.

KEYWORDS - Fast Pyrolysis, CO2 Gasification, Olive Residue, Soma Lignite, Drop Tube Furnace, Char
PASSIVE AND ACTIVE CONTROL OF ACOUSTIC RESONANCE IN CAVITY FLOWS USING FFOWCS WILLIAMS HAWKINGS EQUATIONS

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ABSTRACT

Abstract- In the aerospace industry, interior storage carriages, that carry items such as weapons and bombs form cavities. Turbulence-cavity interaction causes significant vibration, sound pressure levels, resonance, and structural problems. Therefore, control methods are can be useful to reduce drag, minimize pressure fluctuations, and SPL levels. This work studies the passive flow control methods to reduce the noise induced by the flow over the cavity. For this purpose, cavity leading, and trailing edge wall modifications were made such as inclination, placing a block upstream of the cavity, etc. The broadband nature of the noise sources is captured generally with DNS or LES approach. Large Eddy Simulations (LES) is used to compute the flow field to reduce computational cost. ANSYS Fluent software is utilized to solve compressible, two-dimensional, transient subsonic cavity flow. For the determination of sound pressure levels, Ffowcs-Williams–Hawkings (FW-H) integral method is used. In this study, effects of ramped cavity, curvature cavity, and air blowing on sound generated aerodynamically is investigated and compared with each other. According to the results, it is discovered that creating curvature in trailing edge wall among all tested methods is the efficient method with decreasing the SPL level 20.3%. The periodic pressure fluctuation is eliminated and amplitude is lowered efficient with trailing edge curvature modification. Introducing a jet blowing is the second most effective method that reduces SPL levels up to 70.4 dB that means 10.2 % reduction. In this study, mass flow rate of the blowing is not investigated. As a further study, the effect of the blowing velocity should be investigated as at the optimized mass flow rate value, efficiency of the jet blowing method can be increased. If the results obtained are summarized briefly, with this study it is seen that the tried passive and active control methods are able to reduce the pressure fluctuations so the SPL levels; however the optimization of the active and passive techniques parameters (angle, location, height, velocity…) should be performed to maximize the efficiency.

KEYWORDS - Passive Control, Compressible Flow, Ffowcs-Williams–Hawkings Equations, CFD, Aeroacoustics
THE ESTIMATION OF SIZE DISTRIBUTION OF ROCK FRAGMENTATION BASED ON FRACTAL THEORY FOR MINING AND TUNNELING APPLICATIONS

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ABSTRACT

Rock failure wildly exists in geotechnical engineering, particularly in tunneling and underground mining. Accurate estimation of fragment size distribution can not only ensure the safety and efficient of engineering project but is also helpful to save transportation costs and avoid investment caused by secondary fragmentation. Based on the self-similarity of rock fragmentation, this research proposed a method which could be used to estimate the size distribution of rock fragment. In this paper, the combined use of fractal theory, elasto-plastic theory and energy conservation theory was adopted. By considering damage, energy and size distribution, the fractal damage constitutive model was proposed. In this model, fragment size, damage state and fractal dimension are three main influencing factors. To verify this model, the red sandstone was selected as case study. By fitting the stress-strain curves and quantity-frequency curves, the brittle index and fractal dimension was calculated. Through utilizing the method proposed in this research, the damage status and fragment size of jointed rock mass and collapsed roof in goaf can be estimated. Eventually, implementation of estimator model would support the attempts towards autonomous operations and vision-based monitoring approaches.

KEYWORDS - Fractal Theory, Damage Constitutive Model, Size Distribution, Rock Fragmentation.
ENERGY AND COMFORT IN A NEW HVAC SYSTEM BASED IN CONFLUENT JETS APPLIED IN AN OFFICE IN A VIRTUAL CHAMBER

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ABSTRACT

In this study the energy and comfort in a new HVAC (Heating, Ventilating and Air Conditioning) system based in confluents jets system applied in an office in a virtual chamber is made. The electrical and mechanical energy, used in the confluents jets system, in order to guarantee acceptable thermal comfort to the occupants, is evaluated. The confluents jets system, that considers four vertical ducts placed in the wall corners, is installed in a space, inside a virtual chamber, equipped with two tables. Around each table are seated eight virtual manikins. The thermal comfort, the indoor air quality, the Draught Risk, the effectiveness for heat removal, the effectiveness for contaminant removal and the Air Distribution Index, ADI, are also evaluated. This numerical study considers an integral numerical model, which simulates the Building Thermal Response, and a coupling of a differential numerical model, that simulates the Computational Fluid Dynamics, CFD, and an integral numerical model, that simulates the Human Thermal Response. The ADI is calculated in accordance with the thermal comfort level, the indoor air quality level and the effectiveness values. The integral Human Thermal Response model evaluates the tissue, blood and clothing temperatures distribution. The differential CFD model calculates the air velocity, air temperature, turbulence intensity and carbon dioxide concentration. Finally, the integral Building Thermal Response model evaluates the opaque, transparent and indoor surfaces temperatures. The evolution of indoor environmental conditions, obtained results for the thermal comfort, indoor air quality, Draught Risk levels are acceptable, and the ADI increases when the airflow, and energy consumption, increase.

KEYWORDS - Human Thermal Response, Computational Fluids Dynamics, Thermal Comfort, Indoor Air Quality, Energy Consumption
NUMERICAL DEVELOPMENT OF A DSF USED IN MULTIPLE ENERGY PRODUCTION

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ABSTRACT

This paper presents a numerical study of the development of a DSF (Double Skin Façade) used in multiple energy production, namely, the thermal and electrical energy production. The study considers a virtual chamber, equal to an existing experimental chamber, equipped with one DSF, turned to the south direction. The DSF is connected, using a duct system, to a HVAC (Heating, Ventilating and Air Conditioning) system installed inside the virtual chamber. The thermal energy, produced in the DSF is used to promote internal air comfort and thermal comfort that the occupants are subjected. The DSF is built with two transparent surfaces, which form an internal canal used to transport the warm air. The DSF is also equipped with a lateral wall, the base and the top. The DSF is equipped with twenty-four lamellas equipped with photovoltaic cells, used in the electrical energy production used inside the virtual chamber. The numerical study used a software that simulates the virtual chamber equipped with a DSF. The software, that simulates the building thermal response and the DSF performance, use energy and mass balance integral equation for the opaque surfaces, transparent surfaces and interior air. The software, that simulates buildings with complexes topologies, also considers the solar radiation simulator, the photovoltaic evaluator, the radiative and convective coefficients evaluation and the glass radiative proprieties. In accordance with the obtained results, the energy produced in the DSF, using solar radiation, in winter conditions, guarantee acceptable thermal comfort conditions in the final of the morning and in the beginning of the afternoon.

KEYWORDS - Energy Production, Numerical Model, Double Skin Façade, Energy and Mass Integral Equations
A MULTIVARIATE NONLINEAR REGRESSION MODEL FOR THE RESISTANCE POWER OF A LIGHT RAIL VEHICLE

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ABSTRACT

In TURKEY, 20% of energy use caused by transportation. Light rail transportation has developing nowadays. However, it is very important to issue having information about the energy consumption of the light rail vehicle according to different both vehicle and railway situations. It is necessary to predict the power losses that will occur under different driving conditions sensitively to ensure energy efficiency in light rail systems. The most important of these power losses is the resistance loss caused by contact with the route. Resistance loss is dependent on multiple environmental conditions. The most important of these conditions can be listed as the weight of the light rail vehicle, the instantaneous speed of the vehicle, the curve of the route, the ramp slope of the route, and the friction force arising from these conditions. Resistance loss is proportional and linearly dependent on some of these variables while others show reverse or nonlinear dependence. Due to these different types of dependencies, it is seen that a single multivariate nonlinear model is needed to explain the loss of resistance in all different conditions. In this study, a new and accurate model for resistance losses has been developed by fitting numerical values obtained from different scenarios to the multivariate nonlinear regression model.

KEYWORDS - Railway, Nonlinear Regression, Optimization, Energy Efficiency
STATIC ANALYSIS OF MICRO TUBES USING A HIGHER ORDER SHEAR DEFORMATION THEORY

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ABSTRACT

A modified couple stress based model to study statics of micro-tubes using a refined beam theory is presented. In the studies available in technical literature, generally Euler-Bernoulli and Timoshenko beam models are used to express the displacement field. Euler-Bernoulli model neglects transverse shear stress, and Timoshenko beam theory assumes a constant shear stress distribution through the thickness of the tube, which are both strictly simplifying assumptions. Therefore, there is a need for a refined model to satisfy stress-free conditions in the inner and outer surfaces of tubes. By utilizing a higher order tube model, transverse shear deformation is evaluated properly which results in accurate prediction of mechanical responses. Experimental studies show that as the size of the element gets smaller, the conventional elasticity theories cannot predict mechanical responses properly. Modified couple stress theory is one of the nonclassical higher order theories which, by employing a length scale parameter, is capable of taking the scale effects into account. In the current study, the equations governing statics of micro-tube are derived by employing Hamilton’s variational principle and are numerically solved by means of differential quadrature technique. The analyses reveal that the effects of size, captured by length scale parameter, and shear stress distribution, characterized by different beam models, are significant, and hence, must be considered for accurate analysis of small-scale tubes.

KEYWORDS - Small-Scale Tubes, Modified Couple Stress Theory, Higher Order Shear Deformation Theory, Length Scale Parameter, Static Analysis
INVESTIGATION OF LAMINATION THICKNESS OF SEAT UPHOLSTERY EFFECT ON SEAT HEATER PERFORMANCE

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ABSTRACT

One of the main components that contact the customer in cars is the seat. The seats have many features that will meet the demands of the customers in terms of functionality and aesthetics. Among these features, one of the important components that increase customer perception is the heater pads in the seat. These pads are located between the seat upholstery and the seat cushion foam. The seat upholstery providing aesthetic perception has a direct effect on the heater function and the composite structure consisting of fabric laminated foam lining. In this study, the effect of the foam laminated under the fabric on the heating pad was investigated objectively and subjectively. While the fabric type is kept constant, two different thicknesses of foam are laminated under the fabric separately. Firstly, an objective evaluation was made on the seats prepared by adding heater pad functions under these two upholstery, and how long it took to reach the target temperature was observed. In addition to the graphics produced as a result of objective evaluations, subjective evaluations were made with the relevant experts in the vehicle. The graphic results of the laminated foam thickness effect on the heating pad were compared with the effects / comments evaluated by experts.

KEYWORDS - Seat Upholstery, Lamination Process, Seat Functions, Heater Pad, Customer Perception
MECHANICAL AND MICROSTRUCTURAL PROPERTIES OF COLD METAL TRANSFER CMT WELDED 6082 T6 ALUMINUM ALLOYS

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ABSTRACT

Aluminum alloys have recently increased their usage in different fields, especially for automotive manufacturing, due to their unique properties, including corrosion resistance, low density with high strength and good formability. However, some features of aluminum cause different problems when joining with arc welding methods. Cold metal transfer (CMT) arc welding method stands out as a new joining technology in the welding of aluminum alloys, where the insufficient aspects of traditional gas welding methods are developed. CMT technique is a possible innovative welding process for similar and dissimilar aluminum parts and it offers high quality, energy efficiency joints. In this study, the effects of heat input on the mechanical and macrostructural properties of the CMT welded 6082-T6 series extruded aluminum alloys were investigated. In order to evaluate mechanical properties, the tensile shear tests were conducted. In addition, macro-structural examination and microhardness measurements were used to analyze the weld microstructure. There is a relationship between welding process parameters and mechanical properties and weld bead geometry. Experimental results indicated that the welding speed affects the tensile strength and fatigue life of the welded parts. It was observed that the tensile shear load increased with an increase in the heat input level. As well as maximum tensile shear load achieved with maximum heat input level with wavy torch movement.

KEYWORDS - Aluminum, CMT Welding, Microstructure, Mechanical Properties
BATTERY ELECTRIC VEHICLES EFFECT ON GREENHOUSE GASES EMISSION IN EUROPE

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ABSTRACT

The fuels used in an internal combustion engine (ICE) has a harmful effect on the environment and the depletion of their resources have increased the necessity for alternative drive systems. In parallel to depletion of the natural resources, the Green House Gas (GHG) emissions have been incrementally accumulated in the atmosphere. In this context, electric vehicles are the most important alternative to be used soon. Although they emit fewer emission gases to the environment, the emissions generated during the electric energy generation in the plant used to drive these vehicles are generally not considered. In this article, GHG emissions in Europe were investigated in terms of electricity production and fuel consumption of vehicles and comparatively for three main situations. The GHG emissions emitted during the production of the vehicles were excluded from the scope. First, the current situation is exposed, then the scenario that all passenger cars and commercial vehicles used in Europe being electrified by preserving the current electricity production conditions and, finally the realization of this transformation with completely renewable energy is examined. All these studies are compared with each other and the results are discussed in terms of the vehicle industry, environment, and energy production methods.

KEYWORDS - GHG, Emission, Electric, Automotive, Well-to-Wheel, Renewable
SHIP ELECTRICAL POWER ESTIMATION WITH MACHINE LEARNING

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ABSTRACT

Ship energy performance prediction studies are becoming widespread with data-driven machine learning techniques since the emission rates from the maritime industry are considerable and the policies regarding the execution of energy-efficient management in the maritime field are increasing. In the maritime sector, it is important to calculate the ship's energy efficiency and carry out increasing methods to meet the sanctions imposed by the International Maritime Organization. One of these methods is to estimate the performance indicators with high accuracy under various variables. There are many studies in the literature on fuel consumption and emission estimation. Besides these variables, knowing the electrical power obtained from the shaft generator connected to the main engine on the ship is important for calculating the energy efficiency. In this study, the electrical power obtained from the shaft generator is estimated by using Lasso, and Multiple-Linear Regression methods for a commercial vessel using a six-month noon report data. The case study shows that the electrical power obtained from the main engine, which is important for efficiency in a commercial ship, could be found by machine learning methods. At the end of the study, the Lasso Regression method is found to be more successful than the Multiple Linear Regression method in estimating the vessel electrical shaft power.

KEYWORDS - Machine Learning, Ship Energy Efficiency, Marine Vessel, Ship Electrical Power
ABSTRACT

Poly(aniline) (PANI) is a promising material for membrane applications due to its simple synthesis, good environmental stability, high conductivity, outstanding chemical properties. Despite the mentioned characteristics, the PANI membranes rejection performances are in the UF-range and they had low stability. Crosslinking is an effective way to increase rejection performances. Among the crosslinking methods, the thermal crosslinking is the simplest and cheapest technique, as there is no need for chemicals like solvents and crosslinkers etc. For the preparation of crosslinked membranes, dynamic scanning calorimetry (DSC) analysis performed on PANI membranes for the determination optimum temperature for the process. With the investigation of the transitions on the DSC thermograms, the appropriate temperature for the crosslinking determined as 160 °C. For the characterization of the membranes FTIR, SEM, AFM, contact angle (CA), solvent stability studies performed, mean pore radiuses calculated and rejection performances investigated. FTIR spectra comparison of pristine and the crosslinked PANI membranes supported the occurred crosslinking, shifts to the lower wavenumbers on the asymmetric C6 ring stretchings and C–N stretch band at 1498 and 1298 cm−1, respectively. Also the decrease in the intensity of the secondary amine band at 1298 cm−1 thought to be an evidence for crosslinking. SEM images gave information about surface and cross-section structure, AFM image showed the rough surface of the crosslinked membrane. The pore radiuses decreased from 57.4 nm to 2.47 nm, and also %99.6 and over rejection were obtained for the different MW PEGs (which were standard technique for rejection performance determination) these confirmed the crosslinked membrane is the nanofiltration membrane. Also the stability tests confirmed the perfect solvent stability of the membranes. Overall results showed that the crosslinking process was extremely effective in obtaining membranes with excellent rejection performance and high stability.

KEYWORDS - Polymeric Membrane, Nanofiltration, Crosslinking, Rejection Performance
OPTICAL PROPERTIES OF SEASHELL INCORPORATED CERAMIC GLAZES APPLIED ON THE SURFACE OF DIFFERENT FIRED CLAY BODIES

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ABSTRACT

The optical properties of seashell added matte and white ceramic glazes applied on four different fired clay bodies were investigated. Firstly, the seashells obtained from Black Sea beaches of Samsun, TURKEY were purified at 700°C for 1 h to remove organics in composition. As-received and purified seashells were incorporated into two different ceramic glaze compositions up to 30 wt.%. Secondly, four different types of clay bodies (red clay, chamotte, white, and porcelain) were heat-treated at 800°C for 7 h. Finally, the fired clay bodies were coated with prepared glaze compositions by dipping technique and then, sintered at 1100°C for 8 h. The qualitative phase analysis of non-glazed bodies was carried out using X-ray diffractometer. The optical properties of the glazed bodies were determined using a chromometer (CM-2300d, Konica Minolta). Calcite phase in seashells decomposed to aragonite and CaO phases during purification. Higher transparency was obtained in matte glaze with the addition of seashells by 10 and 20 wt.% because of the lowered viscosity by aragonite phase. The increment of seashell content to 30 wt.% caused a non-homogenous matte appearance due to the increased crystallinity. The presence of CaO phase enhanced gloss (60°) values of white ceramic glazes. The obtained results exhibited that transparent glazes can be produced by addition of purified seashells in 20 wt.% and white ceramic glazes can be prepared by addition of as-received seashells in 15 wt.% in eco-friendly and cost-effective way.

KEYWORDS - Ceramic Glazes, Seashells, Clay Products, Optical Properties, Microstructure
ROLE OF PRESSURE ON DENSITY AND STRUCTURE OF MGB2 BULK SUPERCONDUCTOR PREPARED WITH COLD ISOSTATIC PRESS

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ABSTRACT

MgB₂ bulk superconductors are of technological importance for applications such as magnetic shielding, magnetic levitation and fault current limiters etc. Therefore, high density superconducting material production is important for this type of applications. In the present work, a series of MgB₂ bulk superconducting samples were pressed at different pressures (0, 50, 100, 150, 200 and 250 MPa) and fabricated by conventional in-situ solid state reaction. Magnesium and amorphous boron powders were used as starting powders. In order to obtain a homogeneous mixture, the starting powders were first mixed and ground in a ball mill by using a tungsten carbide jar and ball. After this process, the powders were pressed by using an 11 mm diameter die. The pellets obtained were pressed under different pressures by cold isostatic press (CIP). Finally, all samples were heat treated at 850 °C for 1 hour under Ar atmosphere. Among these processes, the effect of pressure on the density of superconducting sample was systematically investigated by calculating the theoretical density of the samples. As a result of these calculations, it was observed that the density increased with increasing pressure. Phase formations of all the samples were examined by X-ray powder diffractometer. When the X-ray pattern of the materials was analyzed, it was seen that the main phase of the materials was MgB₂ and there was also a small amount of MgO. The lattice parameters of the samples were determined by using X-ray pattern and (hkl) indices.

KEYWORDS - MgB₂, CIP, Densification
INVESTIGATION OF THE EFFECT OF OLIVE CORE GRANULATED ON GLASS FIBER REINFORCED HYBRID COMPOSITE PADS AS FRICTION MODIFIER

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ABSTRACT

Asbestos used in the production of brake lining negatively affects human health, the researchers searched for new materials alternative to asbestos. Especially nowadays, studies made with organic materials for brake lining have increased. In order to examine the usability of organic materials as brake lining materials; Studies have been carried out using materials such as mussel shell powder, the juniperus drupacea cone powder, winkle powder and crab powder. In this study, olive seed powder(OSP), which is an organic material, was used instead of asbestos in brake lining. The effects of olive seed powder on the wear properties of the lining were investigated. To examine the wear properties; Olive seed powders are composed of 3 different compositions as filling material in the ratio of 0%, 5% and 10% by weight. To examine the lubricant properties; Instead of coke at 0% and 5% rates, 2 different compositions were created as solid lubricants. Glass fiber was used as a reinforcing material, barite as a filling material, phenolic resin as a binder, olive seed powder as a friction regulator, and coke as a solid lubricant. For the samples; pressing time is taken as 15 min, mixing time as 15 min, pressing pressure is 100 MPa and pressing temperature is 160 °C. In order to obtain a smooth surface in the produced test samples, first sanding and then ultrasonic cleaning was done. Density, hardness, wear rate friction coefficient results of these produced samples were examined. Test results of samples and commercial lining samples were compared with each other. At the end of the study, it was observed that the hardness and density values decreased as the OSP rate increased in the produced samples. The wear rate, the coefficient of friction decreased as the ratio of the OSP increased under constant speed, distance and pressure.

KEYWORDS - Brake Lining, Friction, Organic, Olive Seed Powder, Solid Lubricants, Wear
ABSTRACT

Transparent displays have attracted significant interest as new generation display technology in diverse fields, such as glasses, automotive industries, or military technology applications. These applications need simultaneous projection or display of data and visibility of the surroundings through the device to reach transparent OLED, the color of the emission layer materials, and the opaqueness of the metal thin film cathodes are the important aspects that have to be addressed. In the last few years, Transparent Organic Light Emitting Diode (TOLED) display got a very big attention in terms of developing and improving its transparency to be able to make the background visible to the user as much as possible. In this paper, a review of some studies in literature about Transparent Organic Light Emitting Diode (TOLED) has been made. Some information about prototype applications and technology has been given. There are some factors which are affecting the transparent OLED display in a negative way by making the vision not clear through a TOLED such as; haze, distance between TOLED display and the object behind it, illumination, transparency and contrast. There are also some studies about using TOLED displays in vehicles. It recommended that the transparency should be ideal and clear as well for the driver.

KEYWORDS - TOLED, Contrast, Transparency, Illuminance, Haze, Vehicle
EFFECT OF HF ACID ON THE FORMATION OF NEW 2D Ti3C2 MXENE FROM Ti3SiC2

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ABSTRACT

With the developing technology, our need for renewable energy also increases. Limited energy sources brought along our need for alternative energy sources. When layer A in MAX phases is scraped to highlight the similarity to graphene called MXene a new 2D material type is created. Studies on 2D materials are carried out by researchers in many areas from energy to health. Converted to rechargeable materials to meet energy needs MXene has become a new energy storage material with its layered structure. With the etching of Ti3SiC2 powder in MAX phase with Hydrofluoric Acid (HF), it becomes an accordion-like two-dimensional Ti3C2 MXene structure. Hydrofluoric Acid etching is the most used method in converting MAX phase to MXene structure. Like conductivity properties of 2D materials determining and changing many features surface terminations such as -O, -OH, -F group on MXene were effective. The MXene structure is an extraordinary combination of electrical and mechanical properties that combine the properties of metals and ceramics. In this article, the effect of etching time with hydrofluoric acid is investigated. MXene phase Ti3C2Tx powder subjected to hydrofluoric acid (HF) at room temperature for 2, 8, 16, 32, and 48 hours, X-ray diffraction (XRD) was analyzed by scanning electron microscopy (SEM & FESEM) and Raman Spectroscopy.

KEYWORDS - MAX phase, MXene, Ti3SiC2, Hydrofluoric Acid, 2D Material
THE EFFECT OF MICROWAVE IRRADIATION ON THE MECHANICAL PROPERTIES OF KIMBERLITE AND LIMESTONE

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ABSTRACT

In underground excavation, rock fragmentation can be achieved by blasting with explosive materials or using continuous excavation machinery. The significant challenges with the explosives include noise, vibration, pollution, and potential issues such as damage to nearby structures. A less disruptive method for breaking rocks is using machines such as tunnel boring machine and road header those have the capability of continuous operation and are suitable for autonomous mining. In hard rock applications, the excavation machinery is associated with high equipment wear rates, low penetration rates and consequently high operating costs. This paper investigates the work being undertaken at McGill University on the effect of microwave (MW) irradiation on hard rocks to facilitate continuous mining and improve the production rate while reducing costs. Tuffistic Kimberlite (TK) and limestone rocks were studied in this research. Physical properties of untreated samples were measured, and the rock samples were treated for various exposure times in a multi-mode MW unit at power levels ranging from 2 to 10 kW. The results indicate that MW irradiation reduced the strength of TK and limestone rocks. It was concluded that Brazilian Tensile Strength (BTS) and Uniaxial Compressive Strength (UCS) of samples decayed proportionally with exposure time and power level.

KEYWORDS - Kimberlite, Microwave Irradiation, Fragmentation, Mechanical Strength, Rock Excavation
ELECTROCHEMICAL ACTIVATION OF MOO2 THIN FILM CATALYST FOR HYDROGEN EVOLUTION REACTION

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ABSTRACT

The heavy use of fossil fuels causes serious environmental problems. Hydrogen is considered as a clean alternative that can be produced via water splitting reaction exploiting renewable energy sources. Water splitting is a two-step reaction which comprises of hydrogen evolution reaction (HER) on cathode and oxygen evolution reaction (OER) on anode. Catalysts are used to minimize the potential to derive the water splitting reaction. Pt is the most active catalyst for HER, however, the large-scale use of Pt is limited by its low abundance and high cost. Recently, Mo based catalysts have emerged as promising catalysts for HER. Among those, MoO2 is an encouraging candidate owing to its metallic conductivity. Here, an electrochemical activation method is applied to dramatically improve the HER performance of the MoO2 catalyst. After the electrochemical activation, the overpotential to achieve the benchmark current density of 10 mA/cm² reduced from 608 to 238 mV. The physical and chemical analysis of the MoO2 film conducted before and after the activation process showed that the observed improvement is possibly due to that Ag atoms dissolving off the reference electrode deposit on the MoO2 film.

KEYWORDS - Moo2, Hydrogen Evolution Reaction, Catalyst, Activation
INVESTIGATION OF THE LOADING RATE OF GRAPHENE OXIDE ON THE PROPERTIES OF COMPATIBILIZED GRAPHENE OXIDE POLY ETHYLENE TEREPTHALATE POLY BUTYLENE TEREPTHALATE COMPOSITES

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ABSTRACT

Poly (butylene terephthalate) (PBT) and Poly (ethylene terephthalate) (PET) which is used in different application areas are important commercial polyesters. PET has excellent chemical resistance, very good mechanical and electronic properties. PBT is another engineering polyesters and it prefers due to the high crystallization rate and good processability properties. The blending of PET and PBT have studied many times in order to eliminate the two polymers and to obtain a blend of new properties. Also, improved properties for the blend have been obtained compared to pure polymers [1]. Graphene has excellent electronic, thermal and mechanical properties, large surface area and high aspect ratio [2, 3]. Therefore, when used as a graphene additive in a polymer matrix, it can be thought that it can effectively improve the electrical and mechanical performance of the composite. [3,4]. Good interfacial interaction of graphene in the matrix provides an improvement in composite properties. Using compatibilizer to increase interface interaction is both an economical method and safe. Compatibilizers should have functional groups that can bond with polymer and reinforcement [5, 6]. In this study, Joncryl was used as a compatibilizer. First, 1%, 3% and 5% graphene oxide (GO) were added to the 70PET / 30PBT blend without using a compatibilizer. Then, 1%, 3% and 5% GO and Joncryl were added to the 70PET / 30PBT blend. The nanocomposites were prepared with the twin-screw mini extruder and the injection molding. Characterization of samples was carried out using tensile testing, dynamic mechanical analysis, differential scanning calorimeter, Fourier transform infrared spectroscopy, dynamic mechanical analysis, thermogravimetric analysis. According to the tensile test results, it was observed that the breaking elongation values decreased with the increasing GO loading rate and the highest elongation at break value observed for the Joncryl including PET/PBT/GO composites.

KEYWORDS - Poly (Ethylene Terephthalate), Poly (Butylene Terephthalate), Graphene Oxide, Compatibilization, Characterization.
INVESTIGATION OF THE EFFECTS OF METAL NANOPARTICULLES ON THE PROPERTIES OF COMPATIBILIZED PE TPS FILMS

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ABSTRACT

Polyethylene (PE) is one of the most used polyolefins in the world due to its attractive properties such as mechanical strengths. Also, PE has a lot of applications for different products in packaging production [1-2]. Blending of synthetic and natural polymers is a way of obtaining advanced materials with acceptable physicochemical and mechanical properties. Besides, obtained materials in this way can deteriorate in a shorter time in nature. For this reason, this method can be seen as an important alternative for reducing environmental pollution caused by plastic wastes [3,4]. PE/Thermoplastic starch (TPS) blends draw attention especially, for biodegradable food packaging applications. In this study, the PE/TPS blends were compatibilized with the use of a compatibilizer and food packaging was produced by adding different metal and metal oxide nanoparticles. Nanoparticles were used to provide mechanical strength and antimicrobial properties to the films. TPS was added to the low-density polyethylene (LDPE) at two different loading levels as 30 wt. % and 40 wt.%. Then, PE/TPS films were used as control samples. Polyethylene-grafted maleic anhydride (PE-g-MAH) was used as the compatibilizer in the films. Three different nanoparticles were added to the compatibilized PE/TPS blends at a loading level of 1wt.%. Ag, ZnO and CuO were used as nanoparticles. The Films were prepared by the twin-screw extruder and hot press. Fourier Transform Infrared Spectrometry (FTIR) analyses were performed to see the effect of the compatibilizer on the PE/TPS blends. The chemical interaction has been demonstrated after the addition of the PE-g-MAH to the PE/TPS blends by FTIR. The tensile test was performed to determine the effect of adding compatibilizer and metal nanoparticles to the PE films. Biodegradability tests were carried out by embedding of the films in the compost. It was observed that decreasing the weight of the films and deteriorated the surface structure. The authors thank Scientific Research Projects Unit of Kocaeli University (KOUBAP) for financial support under Project number FLY-2020-2186.

KEYWORDS - Polyethylene, Nanoparticle, Thermoplastic Starch, Polyethylene
NEW GENERATION GROUNDBREAKING TECHNOLOGY
ORGANIC SUPERCONDUCTORS

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ABSTRACT

As technology develops it becomes the main objective for science to find locomotive, competitive and environment-friendly methods. Superconductors are one of such technologies. These materials have many unusual electromagnetic properties, magnetic field vs. temperature relations. The critical temperature of these materials has become the main obstacle that should be exceeded. As researchers are doing their best to find a suitable material to reach critical temperatures at room-temperatures they have noticed that Organic Chemistry will help them to find room temperature critical temperature material thanks to the flexible and customizable system of Organic Chemistry. The attitude to find a proper material spins off as environment-friendly materials. As technology develops many technological products are produced. It is rather possible to see a disastrous day that nature will be polluted irreversibly and the life of each creature will be in danger. At this point, organic materials come to help nature to recycle. Environment-friendly structure of organic materials will hand-shake with nature and join them smoothly. Organic superconductors will care about nature while superconductors are seen in applications of medical instrumentation, transportation, energy storage, power generation systems. In this study, information about the history, development, and types of superconductors is given. Besides, organic materials with high technological importance and potential superconductivity are discussed.

KEYWORDS – Superconductor, Organic Superconductor, Organic Material, Electromagnetism, Magnetism
EVALUATION OF MECHANICAL PERFORMANCE OF DIFFERENT ADHESIVES IN CARBON FIBER BONDING BEFORE AND AFTER AGEING TESTS

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ABSTRACT

Air pollution is increasing day by day because of 800 million vehicles and industry development. In order to decrease CO2 emission caused by vehicles, two scenarios are worked. First is electrical/hybrid vehicle production and usage and the other scenario is using lightweight composite materials. New generation electrical vehicles are developed by Automotive makers, but battery discarding might be a problem in near future. As lightweight materials, natural and synthetic fibers can be used to produce fiber reinforced plastics. Glass and carbon fiber have higher mechanical performance compared to natural fibers and carbon fiber reinforced materials are lighter than glass fiber if high modulus, tensile strength and high energy absorption are needed. In a vehicle parts are needed to join to other parts or their inner skeletons. There are different methods to bind. For riveting and screwing, a hole should be made that are damaging the material. Welding can be used for the same type materials and by high heating, chemical property of materials is changing. Adhesive bonding is a versatile method and it provides joining different types of materials, (glass-metal; glass-plastic; metal-plastic etc.). In addition, adhesive joining method allow thinner material usage. They cover all the adherent surfaces that supports to sustain large impact loads, transmitting the load to the structure without damaging the joint, to improve the corrosion resistance and to damp vibrations. In this regard, the aim of this study was investigation of mechanical performance of adhesive bonded carbon fiber materials before and after ageing. Two different adhesives that can be applied on assemble part, were tested; 2 component polyurethane (2C-PU) and polymethylmethacrylate. and epoxy adhesive that can be applied on body side was tested. Lap shear strengths of adhesive bonded carbon fiber materials were measured at room temperature after curing, after 500h damp heat (40 °C saturated humid air) ageing and 500h 90°C heat ageing. Moreover, tensile strengths of carbon fibers were investigated at room temperature by pulling different speeds.

KEYWORDS - Carbon Fiber, Adhesive, Methylmethacrylate, 2C-PU, Ageing
ELIMINATION OF PAINTING PROCESS WITH MOULD IN COLOUR PLASTIC INJECTION PROCESS APPLICATIONS

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ABSTRACT
MIC (Mould in Colour) Technologies on thermoplastic materials are accelerated innovation activity in paint elimination systems. Enhanced material formulations and improved plastic injection process get ready on shiny exterior/interior trim applications in automotive industry. Targeted part is front bumper on the commercial vehicles. All process parameter optimization, tool preparation and material tests are performed to reach desirable surface structure. In injection process parameter optimization, DOE (Design of Experiment) methodology is used.

KEYWORDS - MIC (Mould in Colour) Technologies, Paint Elimination, Process parameter DOE approach, Plastic injection Parameters Gloss & Colour effect, exterior trim applications, MIC white
A REVIEW OF EXPLOSIVE FREE ROCK BREAKAGE EFRB TECHNOLOGIES IN MINING INDUSTRY

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ABSTRACT

There are strategic drivers within the mining industry which are making explosive-free rock breakage approaches an option that is being reconsidered for the excavation of rock masses. A comprehensive review of the performance and related aspects of explosive-free rock breaking (EFRB) technologies is necessary to assess and demonstrate their applicability in the mining industry, particularly in continuous operations and autonomous mining. Additionally, it would facilitate a clear path of research and development. A comprehensive review of rock breakage technologies and expert projects would also provide sufficient understanding from available information and expert opinions of the advantages, limitations, and broad performance specifications of existing and promising EFRB methods for open pit and underground mining applications. The main EFRB technologies include mechanical cutting, microwave, laser, fluid, thermal and electrical applications. Finally, the application of microwave irradiation of rocks has been conducted successfully in the laboratory as a high potential concept. The approach can be expanded to full-scale field implementation as a pre-conditioning tool to facilitate the mechanical breakdown of rock in a continuous fashion as well as possible destressing of rock under high stress. A reduction in mechanical strength of rocks as a result of microwave irradiation could improve the performance of rock excavation equipment such as a tunnel boring machine. This will be increasing the rate of penetration and reducing operation time.

KEYWORDS - Mining, Rock Breakage, Fragmentation, Explosive-Free, Excavation
THE EFFECTS OF ZIRCONIUM ADDITION TO ALUMINUM SILICON IRON ALLOYS ON THE RECRYSTALLIZATION MECHANISM

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ABSTRACT

Mechanical properties of aluminum products are strongly affected by alloying operation and alloy design. In this study, the effect of zirconium addition on recrystallization behavior, final mechanical properties and microstructure was investigated. For this purpose, samples containing 0.2 w % Zr were compared with standard Zr free samples. After twin roll casting operation, homogeneous heat treatment was performed for both samples and were cold rolled up to 0.2 mm thickness. After this cold rolling operation, various final heat treatmet process was performed for samples (Zr containing and Zr free samples) to detect the effect of Zr addition on mechanical properties. The processing temperatures were changed for the final annealing, but the heat treatment time was kept constant. For both samples, final annealing was applied at 250 0C 280 0C 310 0C and 340 0C for 4 hours, respectively. Mechanical tests and microstructure analyzes were carried out from the obtained samples. Results reveal that, Zr free samples exhibits lower recrystallization temperature as compared to Zr containing samples for same process and parameters. In addition, mechanical test results and microstructure analysis show that, Zr containing samples can retain their strength (Yield and tensile strength) at relatively higher temperatures compared to zirconium-free samples.

KEYWORDS - Aluminum Alloying, Zirconium, Recrystallization, Microstructural Evolution
A COMPARISON OF SEARCHING ALGORITHMS ON LOWEST ENERGY STRUCTURE FOR ATOM CLUSTERS MOLECULAR DYNAMICS MONTE CARLO AND GENETIC ALGORITHM

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ABSTRACT

The research on atom clusters is significant for technological development in many scientific areas from chemical engineering to material science. The improvements in the computational methods bring new insight into research. For instance, the searching algorithms help to find the lowest energy structures of the atom clusters. It is possible to find the most probable structure of the atom groups on nature before synthesizing them and to determine their structural, energetic, spectral, and all other properties using computational methods. Due to the increase in the importance of computational methods, we must know the advantages and disadvantages of different methods to pick the right method to use on the desired research. In this study, the three major algorithms- Molecular Dynamics, Monte Carlo, and Genetic Algorithm- are investigated to use on the structure searching of silver atom clusters. The lowest energy silver cluster structures in the size range of 2-56 atoms were found by using the three different methods. The lowest energy values for each of them were compared and the structures were checked visually. The homemade codes written in Fortran were used for calculations. The searching algorithms were used for sampling of different coordination of the atoms. The structure temperature was increased to just below the evaporation point to help the atoms change coordinations easily on Molecular Dynamics simulation. Hamming’s predictor-corrector Algorithm was used with 1x10-15 time steps for Molecular Dynamics simulations. Minimum and maximum distances were defined for Monte Carlo and Genetic Algorithm against the simulation errors. The elitism method was applied to transfer the lowest energy structure to the next generation. Embedded Atom Method (EAM) was used for modeling the interactions between the atoms. Limited-memory BFGS (L-BFGS) method was used for the optimization of the sampled coordinates. All of the calculations were done on the Linux Operating System. The lowest energy values and structures were compared between the three methods. For the smaller sizes of up to 38 atoms, the energy results and structures were the same for the three methods. However, for the sizes bigger than 38 atoms, the energy values of the Genetic Algorithm did not have the same trend. For example, the 41-43, 45, 48-50, 52, 55-56 cluster sizes had higher values. The maximum energy difference is seen around 0.6eV on the size of 55 atoms. Based on these results, we can conclude that these three methods are useful in searching the lowest energy structures on atom clusters. However, the potential energy surface has more minimums on bigger cluster size and the Genetic Algorithm is not as successful as Molecular Dynamics and Monte Carlo for sampling for all of the minimums.

KEYWORDS - Atom Clusters, Searching Algorithms, Lowest Energy Structures, Molecular Dynamics, Monte Carlo, Genetic Algorithm
PRACTICAL DATA SCIENCE: EXAMINING THE CORRELATIONS BETWEEN STRUCTURAL AND ELECTRONIC PROPERTIES OF DIFFERENT PHASES OF TiO2 NANOPARTICLES

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ABSTRACT

In this work, we analyse the correlations between structural and electronic properties of anatase, brookite and rutile phases TiO2 nanoparticles (NPs) using data science techniques. For this purpose, we use the geometries of three phases TiO2 NPs under heat treatment obtained from molecular dynamics (MD) simulations in the frame of DFTB+ code. We investigate the relationships among electronic properties of TiO2 and order parameter \( R \) or segregation phenomena & nearest number contacts \( n \). In this architecture, the correlations among HOMO, LUMO, Energy gap \( E_g \), Fermi energy \( E_f \), \( R \) and \( n \) have been analyzed. Our results show that there is a moderate negative correlation between \( R_o \) and \( E_g \) in the brookite and rutile phases, but a strong linear correlation between these two variables in the anatase phase. Additionally, in the brookite phase, the positive linear correlation between \( R_{Ti} \) and \( E_g \) is noteworthy. Moderate linear correlation was observed in the anatase phase and positive in the rutile phase. The positive linear dependence of \( n_{O\rightarrow O} \) and \( E_g \) in brookite phase is remarkable. No strong correlation was observed in any phase between \( n_{Ti\rightarrow Ti} \) and \( E_g \). In the brookite phase, \( n_{O\rightarrow Ti} \) has an almost perfect negative correlation with \( E_g \).

KEYWORDS - Data Science, Statistical Learning, Materials Science, Nanoparticles, Data Analyses
A DFT STUDY OF SUPERCONDUCTING CASN3 COMPOUND AS A RENEWABLE ENERGY MATERIAL FOR THERMOELECTRIC CONVERSION FROM HEAT TO ELECTRICITY BY WIEN2K

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ABSTRACT

The cubic CaSn3(Calcium-Tin) the compound which crystallizes the AuCu3-type simple cubic structure exhibits interesting properties such as topological semimetal, superconductivity, heavy fermion character, and bimetallic character. The material also has many important applications in industry and technology. For instance, it is used as a catalyst, fuel additive that provides safe storing and transporting of ignitable materials, optoelectronic material to make display devices, and adsorbent. Topological semimetals could be used as an energy converter or thermoelectric converter due to their topological electronic band structure and intrinsically low thermal conductivity [1, 2]. The Wien2k program with the LAPW method, which performs the electronic structure calculations for crystals most accurately, was applied and the BoltzTraP software, which calculates Boltzmann transport coefficients, was used to test the suitability of our material for use in renewable thermoelectric technology [3,4]. In total energy calculations, the theoretical lattice constant, which is 4.761 Å, of the material was taken from the previous experimental results [5,6]. Electrical conductivity and electronic thermal conductivity increase with increasing temperature over the entire temperature range, but the Seebeck coefficient increases between 200-260K, decreases between 260-350K, and increases again at 360K and keeps rising up to 500K. Temperature-dependent transport coefficients were evaluated between the 200-500K in terms of renewable thermoelectric energymaterials.

KEYWORDS - Calcium-Tin, Density Functional Theory, Superconductivity, Thermoelectric, Wien2k
STRUCTURAL COMPARISON OF CATIONIC AND NON IONIC SURFACANT TEMPLATED MAGNETIC MESOPOROUS SILICA NANOCOMPOSITES

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ABSTRACT

The combination of the properties of magnetic nanoparticles (MNPs) and mesoporous silicas within a single material is particularly attractive because of the availability to combine the functional groups with the advantages of magnetism and robust inorganic substrate. The type and nature of substrate also display significant influence on catalytic and adsorption behaviours. Basically, MCM-41 type materials are synthesized in alkaline condition, where the cationic surfactant combines with the silicates species using strong electrostatic interaction. In contrast, the SBA-15 is prepared in acidic medium, and the interactions between non-ionic triblock copolymer surfactants are the weak hydrogen bonds. In this study, superparamagnetic Fe3O4 nanoparticles were synthesized as MNPs. The outer shell was prepared by suspending MNPs in basic medium for MCM-41, in acidic medium for SBA-15 with an addition of silica source (Tetraethyl orthosilicate) and the surfactant as structure directing agent (Cetyltrimethyl ammoniumbromide for MCM-41, Pluronic 123 for SBA-15) to get Fe3O4@MCM-41 and Fe3O4@SBA-15 nanocomposites, respectively. According to the characterization results, the wall structure in the atomic level of both Fe3O4@SBA-15 and Fe3O4@MCM-41 is an amorphous phase, thus, it can be supposed that both Fe3O4@SBA-15 and Fe3O4@MCM-41 have the same surface property. Besides, Fe3O4@MCM-41 has smaller pore diameter and relatively low surface area compared to Fe3O4@SBA-15 possessing larger pore size and exhibiting considerable high surface area due to the presence of microporous interconnections.

KEYWORDS - SBA-15, MCM-41, Magnetic Nanocomposite, Mesoporous Silica, Fe3O4
ELECTROCATALYTIC HYDROGEN PRODUCTION ON MODIFIED CARBON FELT ELECTRODE

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ABSTRACT

Hydrogen is the cleanest renewable resource and the alternative fuel to the fossil energy sources for the future energy demand. Sustainable hydrogen generation is the major request to realize the future hydrogen economy. Among the hydrogen production methods, the electrocatalytic hydrogen production is the most promising method and it has been the subject of extensive study in recent years. In this study, it is aimed to develop a new electrocatalyst for electrochemically hydrogen production from the water electrolysis with high catalytic activity to increase the rate of hydrogen gas formation reaction by reducing the overvoltage in the electrolysis system. As the electrode material, carbon felt (CF) was coated with reduced graphene oxide (rGO) and Au nanoparticles (AuNPs). The structure of the composite surfaces were determined by scanning electron microscopy (SEM) and the chemical composition of the surfaces analyzed by energy dispersed X-ray spectroscopy (EDX). The hydrogen evolution reaction (HER) performance of the rGO/AuNPs film coated on the carbon felt was investigated by the electrochemical methods such as cyclic voltammetry (CV), Tafel polarization curves and electrochemical impedance spectroscopy (EIS). As prepared composite is exhibited a high catalytic activity with a low Tafel slope and high stability during the chronoamperometric and voltammetric studies.

KEYWORDS - Hydrogen Energy, Carbon Felt, Reduced Graphene Oxide, Au Nanoparticles
NONLINEAR RHEOLOGICAL BEHAVIOR OF AQUEOUS FINE SCALE CLAY SUSPENSIONS

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ABSTRACT

Clays with fine-scale particle sizes are frequently used in medicine, pharmacy, cosmetics, catalysis, food packaging, textile and oil industry, environmental protection and remediation. Moreover, due to cost reduction and product quality improvement, many application areas of fine-scale clays have been recently discovered. Different rheological methods, setups and protocols have been introduced in the literature to analyze the behavior of these aqueous suspensions. In the present study, Large Amplitude Oscillatory Shear (LAOS) is for the first time considered to monitor rheological behavior of different aqueous fine-scale clay suspensions at 25°C. A types of sepiolite clay taken from Eskisehir in TURKEY, and a commercial bentonite clay (Wyoming bentonite) as the API reference clay were considered to prepare fresh water-clay suspension. The pieces of sepiolite clays were reduced to a smaller size using large crushers. Subjecting to high-speed dynamic air classifier after rotary grinding and vibratory disc mill, the clay powers with fine-scale particle sizes (< 10 µm) were obtained. The viscoelastic nonlinearities of these fluid systems were studied as a function of strain and strain rate with the aid of Lissajous-Bowditch curves and nonlinear quantitative parameters. Discovery Hybrid Rheometer (DHR-II) was used to apply the oscillation sweep tests for nonlinear oscillation measurements. In addition, impact of the frequency on evolution of LAOS properties were investigated by construction of Pipkin diagram at four different frequencies (0.25, 0.5, 0.75, 1 Hz). This comparative study revealed that stress decomposition approach (elastic and viscous nonlinearity) provided a powerful tool to comprehensively characterize the nonlinear viscoelastic properties of aqueous fine-scale clay suspensions under large-amplitude oscillatory shear. Acknowledgement: Sincerely thanks Scientific and Technological Research Council of TURKEY (TÜBİTAK-217M723)

KEYWORDS - Amplitude Oscillatory Shear (LAOS), Aqueous-Clay Suspension, Sepiolite, Nonlinear Rheology, Fine-Scale Particle, Bentonite, Viscoelasticity
AN ACTIVE PASSIVE GRIPPER DESIGN AND MODELLING FOR OBJECT DETECTION

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ABSTRACT

Abstract—In this study, a gripper design with active/passive that can detect objects without visual data is presented. Geometric shapes of the objects are perceived only by touching. For this purpose, passive elements such as spring and encoders are used instead of force or torque (f/t) sensor or tactile sensor. Moreover, the gripper mechanism is designed so that the objects can be sensed whether gripper fingers are actuated or not. In the design process, tendon driven mechanisms are preferred for the convenience instead of direct drive mechanisms. Rotational spring and micro DC motors with gear box are used for the tendon-driven mechanism. Only encoders are used to detect object interaction in the gripper. In addition, geometric parameters of the mechanism were optimized using Finite Element Method (FEM) to make the touch motion easier even on flat surfaces. A simplified contact model and a dynamic model of the gripper were developed in Matlab Simulink environment by assuming that contacted objects are rigid. As a result of the simulation, the geometric shapes of the contacted objects were obtained by utilizing joint angles by employing the kinematic model of the gripper. Simulation results for detecting an object in both active and passive modes.

KEYWORDS - Gripper Design, Gripper Contact Model, Gripper Dynamic And Kinematic Model, Object Detection
AN ANFIS BASED INVERSE MODELLING FOR PNEUMATIC ARTIFICIAL MUSCLES

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ABSTRACT

Pneumatic Artificial Muscles (PAM) are soft actuators with advantages of high force to weight ratio, flexible structure and low cost. On the other hand, their inherent nonlinear characteristics yield difficulties in modelling and control actions, which is an important factor restricting use of PAM. In literature, there are various modelling approaches such as virtual work, empirical and phenomenological models. However, they appear as either much complicated or are approximate ones as a variable stiffness spring for model with nonlinear input-output relationship. In this work, the behaviour of PAM is interpreted as an integrated response to pressure input that results in a simultaneous force and muscle length change. The integrated response behaviour of PAM is not combined effectively in terms of simultaneous resultant force and muscle contraction in many existing models. In order to implement that response, standard identification methods, for instance NNARX, are not suitable for modelling this behaviour. Moreover, an inverse modelling with grey box approach is proposed in order to utilize the model in control applications. Since Neuro-Fuzzy inference systems are universal approximators, the modelling is implemented by an ANFIS structure using the experimental data collected from PAM test bed. According to implementation results, the ANFIS based inverse model has yielded satisfactory performance deducing that it could be a simple and effective solution for PAM modelling and control issue.

KEYWORDS - Soft Actuators, Pneumatic Artificial Muscles, Inverse Modelling, Neuro-Fuzzy Modelling, ANFIS
MODELING AND SYSTEM IDENTIFICATION OF SOLENOID ACTUATORS A SURVEY

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ABSTRACT

Solenoid actuators are well-known electromagnetic devices which convert the magnetic energy into mechanical energy. In recent years, they have been widely used in many industrial applications such as automatic systems, hydraulic systems, electromechanical systems and etc. They are mostly used as an excitation and control elements to perform fast switching actions in hydraulic systems. There are some important challenges in solenoid actuators including accurate operation requirement and the need for robust control action. For overcoming these challenges, an improvement in the dynamic characteristic of these actuators is inevitable. Moreover, an accurate mathematical model and dynamic response analysis of the solenoid actuators have a great importance in design and fault detection. In order to meet these requirements, it is necessary to have an accurate model of the solenoid actuators. Several works have been reported in the research area of the modeling of these devices with the aim of better understanding their dynamic model and improving their performance. Some of these research papers are investigating the dynamic response of the solenoid actuators both theoretically and experimentally. Some other works use several numerical methods to analyse mathematical and physical models of the solenoid actuators. This paper will present a detailed overview of recent developments in the system identification approaches including both mathematical modeling and parameter estimation methods of the solenoid actuators. The main contribution of this research will be investigation of the modeling approaches which will be used for further improvement in the performance of the existing solenoid actuators or designing new actuators.

KEYWORDS - Solenoid Actuators, Dynamic Response, System Identification, Parameter Estimation, Modeling
DEVELOPMENT OF AN INDUSTRIAL ROBOTIC ARM EDUCATION KIT BASED ON OBJECT RECOGNITION AND ROBOT KINEMATICS FOR ENGINEERS

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ABSTRACT

Robotic vision makes systems in the industry more advantageous in terms of practicality and flexibility. For this reason, it is essential to provide the necessary training for the standard use of vision based robotic systems on production lines. In this article, it is aimed to design a low cost computer vision based industrial robotic arm education kit with eye-to-hand configuration. This kit is based on classifying and stacking products in random locations in a short time, making them ready for industrial operations or logistics. In the development phase of the system, firstly, motion simulation of the robotic arm was performed, experimental setup was established and the performance of the system was tested by experimental studies. This system, which operates with a great success rate, has been made available for use within the scope of education. Regarding the use of the system for educational purposes, this kit supports theoretical lessons by reviewing object recognition (vision systems), forward - inverse kinematics and trajectory planning (robot kinematics) and running the system several times. Thus, engineering students are expected to approach the industry more consciously and to develop the industry. It can also be used for training of relevant engineers in the institution where vision based robotic systems are available.

KEYWORDS - Education Kit, Stereo Vision, Robotic Arm, Object Recognition and Classification, Pick-And-Place Task
IMPROVED GLOBAL LOCALIZATION AND RESAMPLING TECHNIQUES FOR MONTE CARLO LOCALIZATION ALGORITHM

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ABSTRACT

Global indoor localization algorithms enable the robot to estimate its pose in pre-mapped environments using sensor measurements when its initial pose is unknown. The conventional Adaptive Monte Carlo Localization (AMCL) is a highly efficient localization algorithm that can successfully cope with global uncertainty. Since the global localization problem is paramount in mobile robots, we propose a novel approach that can significantly reduce the amount of time it takes for the algorithm to converge to true pose. Given the map and initial scan data, the proposed algorithm detects regions with high likelihood based on the observation model. As a result, the suggested sample distribution will expedite the process of localization. In this study, we also present an effective resampling strategy to deal with the kidnapped robot problem that enables the robot to recover quickly when the sample weights drop-down due to unmapped dynamic obstacles within the sensor’s field of view. The proposed approach distributes the random samples within a circular region centred around the robot’s pose by taking into account the prior knowledge about the most recent successful pose estimation. Since the samples are distributed over the region with high probabilities, it will take less time for the samples to converge to the true pose. The results demonstrate the localization efficacy of the proposed scheme even with small sample sets. Consequently, the proposed scheme significantly increases the real-time performance of the algorithm in terms of decreasing the computational cost.

KEYWORDS - AMCL, Global Localization, Likelihood, Probability, Resampling, Sample Distribution
DESIGN AND DEVELOPMENT OF A THRUST SYSTEM FOR UNMANNED UNDERWATER VEHICLES

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ABSTRACT

Underwater researches has been carried out for various purposes such as the protection and investigation of natural and environmental resources, various construction activities, finding and extracting fossil fuel resources, academic and industrial researches. Especially in the last two decades, unmanned underwater vehicles are effectively used in almost all of these researches. One of the most essential parts of those vehicles is their thrust system which gives them the ability to move underwater. In this study, the design and development of a thruster system for unmanned underwater vehicles are given. The designed thruster system consists of four main parts: an electric motor, a driver circuit, a magnetic coupling transmission element, and a propeller. The electrical and/or mechanical designs of these parts are performed depending on the predetermined design criteria. A brushless type DC motor is chosen as an electric motor, and the required torque and rpm values are determined analytically. Depending on the chosen electric motor, a suitable driver circuit is determined. Then the propeller, the magnetic coupling element, and the motor housing are designed by using the SolidWorks software package. Pressure and fluid dynamics analyses of the housing and propeller are performed by using the Ansys software package. The housing and the propeller are produced by 3D printer and CNC machines. After the system integration, functional tests are performed successfully. The test results show that the developed thruster system satisfies the desired performance criteria.

KEYWORDS - Unmanned Underwater Vehicle, Thruster, Magnetic Coupling, Transmission, Propeller
DESIGN AND DEVELOPMENT OF A TEST SETUP FOR A REACTION WHEEL SYSTEM OF NANO SATELLITES

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ABSTRACT

Nano satellites have gained an important place in space applications thanks to developing technology. For a successful operation, attitude determination and control systems in satellites are vital. A reaction wheel system is the widely used drive system for nano satellites. An electric motor driven reaction wheel is a system that operates utilizing from conservation of momentum and law of action and reaction. In this study, the design and development of a test setup for reaction wheel systems of nano satellites are given. By using this test setup, different configurations of reaction wheels can be tested, performances of different control methods can be evaluated, and the energy efficiency of the whole system can be determined. Additionally, measured test data such as orientation angles and system current, voltage, and power can be recorded and monitored via the developed user interface. The test setup consists of a platform, reaction wheels, and a control unit. The mechanical design of the test setup which allows changing reaction wheel configurations is developed in Solidworks software. Modeling and control studies are performed in Matlab Simulink environment for brushless dc motor driven reaction wheels. The electronic control unit is designed, and Raspberry Pi is used as a controller. The test platform is produced by using 3d printer and then, subcomponents (electrical control equipment) are assembled into the platform. The functionality and performance tests of the system are performed successfully. The PD control performance results for attitude control of the satellite with the specific reaction wheel configuration are given. These results match the simulation results and validate the system design.

KEYWORDS - Reaction Wheel, Satellite, Attitude Control, Orientation, PD Controller
A ROBUST BUT EASILY IMPLEMENTABLE REMOTE CONTROL FOR QUADROTBORS EXPERIMENTAL ACROBATIC FLIGHT TESTS

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ABSTRACT

Experimental flight tests are reported about quadrotors UAVs via a recent model-free control (MFC) strategy, which is easily implementable. We show that it is possible to achieve acrobatic control of the UAV, which is beyond the previous standard. The same remote controller is tested on two physical vehicles without any re-tuning. It produces in both cases low tracking error. We show that MFC is robust even when the quadrotor is highly damaged. Even as the dynamics of the vehicle changed—either from having damage inflicted upon it or from changing the vehicle altogether—the proposed technique performed well. The little computational power required to implement this algorithm means that it could be utilized on micro and macro aerial vehicles alike. In order to compare the robustness of MFC to PID, a PID controller was properly tuned and deployed on the large Tarot quadrotor. After a successful flight, the controller was transferred to the DJI F450 and flown without re-tuning. Our results show that MFC is much more robust across vehicles with varying dynamics. The ease of tuning associated with MFC as compared to PID as well as their respective performance indicate that MFC is a better multi-variable control scheme. This is particularly apparent under PID control when performing robust maneuvers on the roll axis, which seems to degrade the performance of the pitch and yaw controllers. A video footage can be found at: https://youtu.be/wtSLalA4szc.

KEYWORDS - Model-Free Control, Output Feedback, Aerospace, Unmanned Aerial Vehicles
DEVELOPMENT OF AN ENERGY CONSUMPTION MINIMIZATION STRATEGY FOR SERIES HYBRID VEHICLE

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ABSTRACT

Road transportation has become a more and more influential actor with increasing demands and a growing economy of developing countries. It is estimated that there are already 1 billion cars in the market and this number will reach 2.5 billion in 2050. Fuel consumption and emissions have also increased by 78% since 1970. It is clear that this situation will bring along some negative effects such as fuel consumption, emission, noise pollution and increase in fuel prices, if existing conventional vehicles are continued to be produced. Research studies have clearly demonstrated that Electric Vehicles (EV) are an ideal solution for resolving the energy crisis and reducing greenhouse gas effects that cause global warming. The lack of maturity in the battery technology and the scarcity of charging stations make the hybrid vehicle technology an important competitor against the fully electric technology. Hybrid vehicles are expected to dominate the market in 10-15 years due to the inadequacy of existing battery technology. The hybrid vehicle technology enables reducing fuel consumption through efficient usage of the ICE on the one hand and keeping the battery state of charge (SOC) in a desired level where charging/discharging is efficient on the other. This is an optimization problem. Many control methods have been suggested for this purpose in the literature. In this study, an energy management algorithm that will solve the problem of range of Series Hybrid Electrical Vehicle (SHEV) and increase vehicle efficiency is developed. It is aimed to save fuel with the energy management strategy developed. Therefore, Equivalent Consumption Minimization Strategy (ECMS) has been considered. This technique utilizes a penalty function of electrical and fuel energies. Its performance is usually improved by adaptively tuning an equivalence ratio between the two forms of energy. This ratio can be tuned according to driving conditions and vehicle specifications. The proposed ECMS controller was applied to a semi-commercial vehicle. The SHEV has been selected as a forward-facing vehicle model. The components have been modeled as quasi-static based on lookup tables. Also, ECMS optimization has been performed offline. In this method, the calculations have been made offline. In the ECMS strategy, using the instant optimization method, the total power requested from the Internal Combustion Engine (ICE) and the battery are provided by the hybrid power system, while determining how much the total power should be shared between the two energy sources in order to obtain the minimum fuel consumption. In other words, the electrical energy is converted to the equivalent fuel consumption. The total consumption is calculated and the energy sharing that ensures the optimization of the hybrid vehicle is determined in each iteration. Depending on whether the SHEV is Tare Mass (TM) or Gross Vehicle Mass (GVM), range results were obtained from four driving cycles. For comparison, the simulation was repeated under the same conditions for the classical thermostat controller. In NREL driving cycle, which is frequently used by semi-commercial vehicles, 125 km and 190 km (for TM and GVM) range results were obtained. The ECMS algorithm has achieved success in range and emissions. Simulation results show that ECMS method is effective in saving the fuel. According to the simulation results, the ECMS algorithm bettered the range 13% compared to the thermostat controller. It also achieved a certain success in the gas emissions.

KEYWORDS - Electric vehicles, hybrid electric vehicles, model based hybrid electric vehicle, energy management algorithm, ECMS, Series Hybrid Electrical Vehicle, Equivalent Consumption Minimization Strategy, Optimal Control
ACTIVE METHODOLOGIES IN THE TEACHING OF MECHATRONICS THE CASE OF PROJECT BASED LEARNING

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ABSTRACT

Active methodologies are useful and necessary to improve learning in engineering, as they promote teamwork, research and problem solving in students. This article presents two experiences on project-based learning (PBL) applied in the Mechatronics career. In the first project, a simulator and a prototype of a Cartesian robot controlled by Ipad is generated, carried out by students from La Salle Northwest University, and in the second case, the development of a Cartesian robot that prints electronic cards is shown, which was developed by students of the Technological University of the South of Sonora. The PBL allowed teachers to systematically manage class projects. The application of the PBL motivated students to work in teams, to improve learning and to develop their social skills. The importance of transmitting knowledge to the student is necessary for their academic and professional training. Using tools that are actually used in industrial practice within their processes. Improving the results of students in their subjects and in academic or professional stays. Currently, this acquired knowledge has also been important in academic exchanges because the same way of working is being implemented worldwide.

KEYWORDS - Active Methodologies, Project-Based Learning, Mechatronics
A MODEL BASED SYSTEM ENGINEERING APPROACH TO SEMI ACTIVE SUSPENSION CONTROL

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ABSTRACT

In this study, semi-active suspension system performance is investigated depending on the vehicle requirements, the common standards and the bounded parametric uncertainty of the vehicle model. In order to evaluate the system performance with the several metrics, a model-based system engineering approach is proposed. The control design for semi-active suspension is compelling because of trade-off between ride comfort and road holding/road friendliness characteristics. Since it is well-known tunable control structure, linear Skyhook controller is selected for semi-active suspension system. Then, three linear Skyhook controllers are designed with distinct design parameters and they are compared to passive suspensions with different tunings. Conventional two degrees-of-freedom quarter vehicle model is used throughout the simulation studies. Afterwards, cost functions are constructed based on steady-state and transient dynamics of semi-active suspension system. In this paper, it is shown that tuning of linear Skyhook parameter depending on model-based system engineering approach provides a compromise among the different requirements and the standards for semi-active suspension systems.

KEYWORDS - Model-Based System Engineering, Semi-Active Suspension, Suspension Control, Objective Performance Metrics
DESIGN AND DEVELOPMENT OF A MOBILE ROBOT FOR SEARCH AND RESCUE OPERATIONS IN DEBRIS

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ABSTRACT

After an earthquake, critical tasks during the search and rescue operations are to quickly detect the locations of victims and recover them. Additionally, effective communication between responders in the field and the emergency management center is also important to provide successful operations. All these tasks are mostly performed by humans and trained dogs in dangerous and risky situations. In this study, the design and development of a mobile search and rescue robot are presented. The design criteria are determined based on operational requirements and stakeholder expectations. Considering the specified design criteria, the mechanical and electrical designs of the mobile robot are performed and corresponding control, communication, and user interface software are developed. Designed parts of the robot are manufactured and the system integration is done. Then robot functionality tests are performed in a test environment. The test results show that the performance of the developed search and rescue robot meets the desired performance criteria. The mobile robot has a four-wheel drive system. The camera is integrated in the system for navigation purpose and also to facilitate human detection in debris. Additionally, it is equipped with temperature and gas sensors to measure temperature and detect gas leaks in the disaster area. The designed robot is remotely operated and able to move in the narrow gaps. All sensor data and video stream can be monitored via the user interface. Furthermore, the robot provides voice communication between search and rescue operator and victims. The developed search and rescue robot has great potential to provide an efficient way to reduce losses of lives by decreasing operation time and for getting accurate information about the situation of the disaster area.

KEYWORDS - Disaster Robot, Mobile Robot, Search and Rescue, Interface, Earthquake Robot
BEHAVIORAL BIOMETRIC BASED PERSON IDENTIFICATION METHOD WITH EMG SIGNALS

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ABSTRACT

This study is about to identification of a personalized bioelectric code, in other words, a personal ID code, by utilizing behavioral biometric data of EMG (Electromyography) signals as an application method of the field of biometric-based person recognition systems. Nerve and muscle cells in the human body are cells that can be stimulated. Electrochemical situations occurring in nerve and muscle cells produce bioelectrical potentials. Bio-electrical signals resulting from muscle contraction are called EMG (Electromyography) signals. EMG signals are analog signals. EMG signal is neither periodic nor deterministic. EMG signals are not repeated at specified time intervals and a single mathematical expression cannot represent EMG signals obtained during a recording period. EMG signals are not fixed signals. Therefore, it is not possible to artificially generate and copy the specific frequency behavior of the motor units and the resulting EMG signals. The EMG signal is directly related to the physiology of each individual and it is individual. It has behavioral biometric data. EMG signals depend on factors such as; – Muscle shape and size of the person, muscle fiber pattern (knitting), muscle strength-producing capacity, muscle heat distribution, – Neural activity, motor unit discharge type, – Age, sex, muscle development, bone density, skin fat layer, and conductivity, – gesture style. – The characteristics of the EMG signals are different from each other even if the appearance of the movement gestures of the two people looks the same. In other words, it has a behavioral biometric feature. EMG signals are behavioral biometric data by taking advantage of the ability to distinguish person and person’s hand movements with personalized bioelectric code that is to identify the personal ID (password) code. Bioelectrical signals transmitted from the brain to the lower arm muscle groups in order to provide hand movements (hand closing, hand opening, wrist inward, up and down movements, thumb-point finger contact, thumb-middle finger contact, thumb-ring finger contact, thumb-little finger contact, object pointing gesture, etc.) are recorded with EMG sensors during movement and then signal processing, feature extraction, and classification process was used and a personalized personal behavioral ID (code) is defined.

KEYWORDS - Personal Behavioral ID, EMG Signals, Biometrics
THE IMPORTANCE OF MANUFACTURING DRAWINGS IN THE DESIGN PROCESS A DIDACTIC CONTRIBUTION TO ENGINEERING EDUCATION

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ABSTRACT

During the direct design or reverse engineering process of products and machinery, various geometric and manufacturing information is generated according to the phases or stages of development applied during a project in various subjects. Much of this information is not used or lost and students face various problems when generating manufacturing drawings. This article discusses the importance of manufacturing drawings during the direct design process and its implications for engineering education. To generate the design information, the concept of manufacturing primitive and a classification of the manufacturing drawings that follow the stages of direct design are applied. It is using a case study to show the process of generating and documenting the information. The importance of transmitting knowledge to the student is necessary for their academic and professional training. Using tools that are actually used in industrial practice within their processes. Improving the results of students in their subjects and in academic or professional stays. Currently, this acquired knowledge has also been important in academic exchanges because the same way of working is being implemented worldwide.

KEYWORDS - engineering education, manufacturing drawings, manufacturing
FAULT DETECTION OF BEARINGS WITH TIME SERIES ANALYSIS A PILOT STUDY

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ABSTRACT

Electric motors failure is an important issue in industry. This situation may cause interruptions in manufacturing but it may also affect the operator safety. Traditional linear methods may not effectively detect failures. In order to overcome this problem, monitoring and diagnosis methods are tried to be developed. This study presents a time series analysis for healthy and faulty bearing and aims to contribute systematic comparison among different methods from frequency, nonlinear and statistical domains for characterizing working status of ball bearings. The results obtained from healthy and faulty bearing signals were found as distinctive from each other and it is suggested that these methodologies can be used for fault detection. Alternatively, the same analysis might be applied on ball race and outer race. On the other hand, it might be applied on different manufacturing, electro-mechanical and robotic systems and all other industrial applications that electric motors are used. Automatic diagnostic tools for differentiating the healthy and faulty bearing states can be improved with identifying changes, and by using presented way bearing signals are measured. This data is aimed to be used for predictive maintenance and fault detection. Intelligent systems for fault detection can be designed by utilizing this data documented for maintenance, test conditions and fault status.

KEYWORDS - Fault Detection, Predictive Maintenance, Bearings, Time Series Analysis
AN ADVANCED MECHANICAL DESIGN FOR TRANSFORMABLE WHEEL LEGGED HYBRID MOBILE ROBOT

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ABSTRACT

The use of mobile ground robots (MLRs) in the military industry in recent years is rapidly important in applications such as exploration, observation, target detection, destruction, search and rescue. Different mechanical designs for mobile land robots are developed in variable and challenging conditions with high maneuverability. In this study, a four-wheel mobile land robot with a transformable wheel structure was designed and manufactured, which can be used for flat and raw terrain. By using 3D printing technology and using Polylactic Acid (PLA) material, mechanism components were produced and a prototype was manufactured. In this way costs, manufacturing times, and the total mass of the mechanism have been decreased. The purposed robot combines a wheel robot’s stability and maneuverability with the obstacle climbing capacity of the legged robot, using a transformable mechanism with the wheel legs. Those two modes can be easily changed with a transformation structure based on a four-bar mechanism. Each four-wheeled robot wheel has six parts, and it opens up in rough terrain as a star, allowing the robot to overcome obstacles with ease. Six parts are locked on flat ground, in wheel mode, and take the form of a wheel, enabling the vehicle to move quickly and with high maneuverability.

KEYWORDS - Hybrid Robot, Transformable, Wheel-Legged Robot
DESIGN AND DEVELOPMENT OF A MOBILE CONTROLLED AGRICULTURE ROBOT FOR ROW TYPE SEED SOWING APPLICATIONS

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ABSTRACT

In agriculture, seed sowing applications take a fundamental role. Various seed sowing types are used by farmers. The most prevalent types are row and broadcast seeding. Compared with the broadcasting type, the sowing in a row is more complicated and requires higher manpower. Therefore, farmers use expensive, inefficient, and non-eco-friendly machines for the sowing in a row. In this study, the design and development of a mobile controlled agricultural robot which has row type seeding feature is presented. The robot consists of four subsystems; a four-wheel mobile platform, a digger mechanism, a seed sowing mechanism, and an irrigation mechanism. The electrical and mechanical designs of the robot are performed depending on the specified design criteria. System control software and user interface are developed considering stakeholder expectations. Designed subsystems are manufactured and integrated. Furthermore, robot functionality tests are performed and the desired performance of the agriculture robot is validated by the test results. The robot is remotely operated by an android application on a mobile phone. Additionally, all operation data can be monitored via this mobile application. After the determination of a sowing area with proper sowing distance on the user interface, the robot starts sowing operation automatically. Firstly, the soil is dug. Then seeds are dropped into the dug area and a small amount of water is given by a nozzle. Finally, the dug area is closed with soil by the broom part of the robot. Thus, the single period of the seed sowing process is concluded. The robot location is always checked by a control algorithm to avoid possible path deviations. The developed agriculture robot has potential to provide an efficient and inexpensive way for future seed sowing applications.

KEYWORDS - Digger Part, Remotly Operated, Mobile App, Agricultural Robot, Row Type Seed Sowing
INVESTIGATION OF LOW VELOCITY IMPACT BEHAVIOR OF NANO SILICA AND BASALT FIBER REINFORCED NANO COMPOSITES BY IMAGE PROCESSING METHOD

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ABSTRACT

In this study, SiO2+Basalt/Epoxy nano composite plates with 4% SiO2 nanoparticle filled and Basalt/Epoxy composite plates without nanoparticle filled were produced. 6-layer SiO2+basalt/Epoxy composites produced and non-nanoparticle filled Basalt/Epoxy composites were used for low velocity impact experiments at 10j and 20j and microscope pictures were taken. and image processing method was applied on Microscope pictures. As a result of the comparisons made after the image processing method, it was observed that the damage was increased in all composites since the low velocity impact energy increased from 10j to 20j. It was determined that the highest increase in damage was in basalt / epoxy composite plates without nanoparticle filled, and the least increase was in SiO2+basalt/ Epoxy composite plates. It has been concluded that SiO2 nanoparticles increase and provide fiber/matrix interface strength, improve the mechanical properties of basalt / epoxy composites by cracking tip blinding, crack deviation and branching, delaying and slowing crack formation, local plastic deformations and increased interfacial area. It was seen in the field analysis after the image processing method that SiO2 nanoparticles had a great effect on increasing the strength of basalt fiber reinforced composites. Thanks to the image processing method, the microscope pictures were examined in more detail and broader comments were made on the damages.

KEYWORDS - Composites, Nanoparticles, SiO2, Image Processing, Basalt Fibers
DEVELOPMENT OF MACHINE FASTENERS CLASSIFIED SYSTEM

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ABSTRACT

Machine fasteners (bolts, nuts, washers, etc.) are an integral part of the production, maintenance, repair, and assembly processes. Machine fasteners that have been previously used but are scatheless can be reused in new processes. For this reason, used machine fasteners that are generally mixed in an area are subjected to a sorting process, and those that cannot be used are scrapped. In this process, the fasteners are sorted with respect to their types, sizes, and metrics. Similarly, the new fasteners can be mixed in the area where they are kept for use, and sorting may be required. This sorting process is usually done with manpower and this leads to errors and loss of labor which diminish the productivity. In this study, the development of an automation system that classifies mixed machine fasteners as type, size, and metric using the image processing method is presented. The system consists of four main units: a vibrating feeder, a conveyor belt, an image processing unit, and a packaging mechanism. The fasteners are put in the vibration feeder in order to be sent to the conveyor. The elements lined up are transferred with the conveyor to the image processing unit and are classified as type, size, and metric in this unit. Classified elements are placed in the relevant boxes in the packaging mechanism. During these processes, all system data are recorded and transferred to the computer environment, and the user can access these data thanks to the developed user interface. Firstly, the electrical and mechanical designs of the system are done depending on the specified design criteria. Then, graphical user interface, control, and image processing algorithms are developed. After the production of mechanical parts, the integration of the system is completed and functional tests are carried out successfully. Test results show that the success rate of the developed image processing algorithm is over 90%.

KEYWORDS - Machine Fastener, Internet of Things (IoT), Image Processing, Sorting, Vibration Feeder
DESIGN AND PROTOTYPE OF THE TRANSFORMABLE UNMANNED GROUND VEHICLE

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ABSTRACT

Nowadays, the use of unmanned ground vehicles (UGV) is increasing rapidly in various applications such as terrestrial and planetary exploration, forestry, agriculture, mining industries and military. The unmanned ground vehicle must pass through rough terrains, climb obstacles and slopes. In order for accurate measuring devices to carry accurate measurements, they must be in good contact and fully balanced. It should also be resistant to tipping. Despite the curvature of the ground, the unmanned ground vehicle we recommend against this problem always maintains its stability. Our vehicle is four-wheeled, two-two connected by means of frames, connected to the body by a differential mechanism. In this way, four wheels are always in contact with the ground. Frames combine with a linear actuator to provide lateral stability of the vehicle body. At the same time, a connection has been established between the differential mechanism and the body with the stepper motor. This connection ensures full balance. The vehicle automatically controls the engines using inputs from the IMU sensor. It can also be controlled remotely using the smartphone app. In this study, the physical model of an unmanned ground vehicle with adjustable active suspension was designed and its prototype was produced. In addition, kinematic and dynamic models of the vehicle were introduced and motion simulation was performed in Matlab / Simulink environment. Finally, the performance of the prototype vehicle produced has been tested on different grounds.

KEYWORDS - Unmanned Ground Vehicles, Active Suspension, Transformable Robot, Artificial Intelligence