3RD PAK-TURK INTERNATIONAL CONFERENCE ON EMERGING TECHNOLOGIES IN THE FIELD OF SCIENCES AND ENGINEERING

9-10, JUNE 2020

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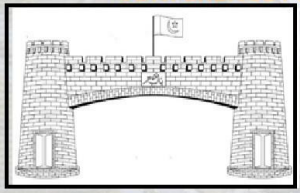

ORGANIZED BY
GHULAM ISHAQ KHAN INSTITUTE OF ENGINEERING SCIENCES AND TECHNOLOGY

3rd Pak-Turk International Conference on Emerging Technologies in the field of Sciences and Engineering
(9-10th June, 2020)

Organized by: Ghulam Ishaq Khan Institute of Engineering Sciences and Technology

Inauguration Program Schedule

9th June 2020 (Tuesday)		
10:00-10:05 AM	Opening and Recitation of a few verses from the Holy Quran	
10:06-10:10 AM	National Anthems Pakistan and Turkey	
10:11-10:15 AM	Theme and History of the Conference	Prof. Dr. Jameel-Un Nabi Pro-Rector (A) & Conference Steering Committee Chair
10:16-10:20 AM	Welcome Speech	Mr. Jehangir Bashar, Rector GIK & Patron-in-Chief
10:21-10:25 AM	Message by Turkish Ambassador	
10:25-10:35 AM	Address by the Chief Guest	Prof. Dr. Fazal Ahmad Khalid, SI
10:36-10:55 AM	Featured Keynote Talk1	Prof. Dr. Fazal Ahmad Khalid, SI
10:56-11:15 AM	Featured Technical Talk2 Stephen Hawking: Contribution to Humanity	Dr. Khalid Saifullah
11:16-11:35 AM	Featured Technical Talk3 AI for everyone	Dr. Yasar Ayaz

Keynote Addresses
&
Technical Talks

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Prediction of Geometric Shapes for even-even Ti, Cr, Fe Nuclei within the Interacting Boson Model (IBM)

Mahmut Boyukata[1,*], Gül Çakır[2], Yeşim ŞAHİN[2], Jameel-Un Nabi[3]

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Topi 23640, Swabi, Khyber Pakhtunkhwa, Pakistan

Abstract— The proton-neutron quasi particle random phase approximation (pn-QRPA) and interacting boson model-1 (IBM-1) was used for the description of some nuclear properties for even-even nuclei as reported in Refs. [1-3]. More recently, even-even chromium isotopes have been investigated within both pn-QRPA and IBM-1 models to see the effect of deformation parameters (β) on Gamow-Teller (GT) strength distributions and electron capture cross-section (ECC) for Cr isotopes[4-6]. The aim of this study is to expand the previous work on Cr isotopes to their neighbouring Ti and Fe isotopes. First, we calculate their energy levels by using the constructed Hamiltonian of IBM-1 model. This Hamiltonian includes the appropriate parameters for the given nuclei. These free parameters is used as constant and can be fitted from the experimental data taken from the National Nuclear Data Centre (NNDC). Later, the formalism of the potential energy surfaces (PES) can be formed according to the employed Hamiltonian having common constants. Finally, the geometric shapes of the given nuclei can be envisioned by plotting the energy surfaces in the space of the deformation parameters (β,γ). Moreover, this talk also includes some results of the recent applications [1-6] in the different mass regions of the nuclear chart.

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Gravastars

Muhammad Sharif

Abstract— This talk investigates the effects of charge on a peculiar stellar object, known as gravastar in curvature-matter coupling gravity. This stellar object is also known as an alternative to a black hole and is expressed by three different domains named (i) the interior domain, (ii) the intermediate shell and (iii) the exterior domain. In the interior domain, we assume that pressure is equal to negative energy density which leads to the existence of a repulsive force on the spherical shell. The intermediate shell consists of ultra-relativistic plasma and pressure which shows a direct relation with energy density and counterbalances the repulsive force applied by the interior domain. The exterior vacuum spherical domain is taken to be the de Sitter space-time illustrated by the Reissner-Nordstrom metric. We conclude that non-singular solutions of charged gravastar with various physical properties such as length, energy, entropy and equation of state parameter are physically consistent.

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Optical Fiber Cavities with Ultrasensitive Detection Schemes for Liquid Sensing Applications

Imran Cheema,
Department of Electrical Engineering, LUMS

***Abstract*—** Optical cavities are highly attractive for ultrasensitive applications as light can interact with a sample numerous times. There are various modalities for realizing optical cavities such as whispering gallery mode (WGM) cavities, free space mirror cavities, and fiber Bragg gratings based cavities. On one hand, WGM cavity sensors require state-of-the-art fabrication facilities and expensive experimental equipment and on the other hand, free space cavities are not suitable for liquid sensing applications as these become unstable and their mirrors degrade due to presence of liquid inside the cavities. Therefore, fiber cavities are ideal candidates for realizing liquid phase applications especially in low resource settings. In a fiber cavity, one can monitor its resonant wavelength or ring down time as a function of a sensing event. We have developed a novel detection scheme of applying phase shift cavity ring down spectroscopy (PS-CRDS) to fiber cavities for determining ring down time for sensing applications.

In our novel PS-CRDS detection scheme, we inject a sinusoidally modulated light into a fiber cavity. The output light of the cavity has a phase shift, which is directly related to the ring down time of the cavity. In our sensor, we built the fiber cavity by utilizing fiber Bragg gratings. We taper the sensing area of the cavity to expose the fiber core for interaction of the electromagnetic field with an analyte. For minimizing non-specific binding, we functionalize the tapered portion to attract a particular analyte. We also package the tapered fiber portion in a disposable fluidic chip. The application of PS-CRDS then induces a phase shift in the output light as a binding event occurs in the sensing area. The phase shift is then correlated with the amount of binding event.

We have used our novel PS-CRDS fiber sensor platform for detecting aflatoxin M1 (AFM1) in a sample for addressing milk contamination sensing applications. For AFM1 detector, we demonstrate the detection limit of 50ng/L that exceeds the current European and American AFM1 detection limits. The sensitivity of the sensor is 28.8^{o}/ppb. To address water contamination sensing applications, we have utilized our sensor for detecting arsenic and fluoride in drinking water samples as per the WHO limits.

The aforementioned milk and water contamination sensing applications are based upon single fiber cavity. In order to improve the performance of the sensor we came up a novel way of cascading two fiber cavities to exploit the Vernier effect. In this multicavity regime, our proposed sensor can reach the detection limit of 10^{-8}/refractive index units.

In the long-term, we anticipate that that our prototype water and milk contamination sensors will lead towards a device similar to the commercial glucometer that can be easily operated by non-specialists. We also expect that R&D activities in our group will lead towards a universal commercializable solution that may be extended for not only biosensing applications but also to detect contamination in a wide range of liquids including cooking oil, juices, and medicines.

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Nano-scale deposition of metal oxides and metal sulfides for multiple advance energy applications

Muhammad Abdul Basit[1],[2], §, #

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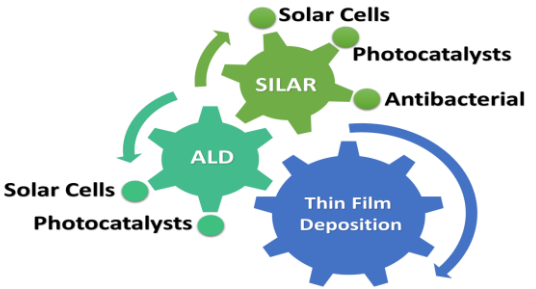
[2]Department of Advanced Materials Engineering, Hanyang University (HYU), Ansan 15588, Republic of Korea

Abstract— Thin film deposition technology has been an attractive solution for enhancing the physical and chemical properties of substrate materials since long. However, with the emergence of nanomaterials and nanotechnology, the need and complexity of thin film deposition has increased by many folds. At the one hand, researchers are dealing with substrates of geometrically intricate nature. While on the other hand, nanoscale deposition and/or deposition on nanoscale particles is emerging as diverse solution for developing efficient materials for optical, photovoltaic and photocatalytic applications etc. In this regard, wet-chemical methods such as successive ionic layer adsorption and reaction (SILAR) and high-tech thin film deposition methods (e.g. atomic layer deposition ~ ALD) are unique due to their surface-controlled reaction and diversity of process. Both these techniques have been successfully employed to enhance the performance of conventional nanoscale materials and devices. In particular, the deposition of TiO_2 and ZnO thin-shell on SiO_2 by ALD resulted optoelectronic improvement in quantum-dot-sensitized solar cells (QDSCs) and dye-degradation of Rhodamine B dye respectively. Moreover, deposition of In_2S_3 and CdS/PbS QDs separately enhanced the performance of QDSCs, while similar nanocomposites have been used for antibacterial performances as well. Both these methods, their uniqueness and relevant research results from our research groups will be summarized.



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Statistical approach for hypernuclei formation at relativistic hadron and ion collisons

Nihal BUYUKCIZMECI
Selcuk University, Department of Physics, 42130 Konya TURKEY

Abstract— I will discuss statistical disintegration of nuclear and hypernuclear systems in relativistic hadron and ion collisions. The hyperon binding energies can be effectively evaluated from the yields of different isotopes of hypernuclei. We suggest a new double ratio method, which allows to extract the hyperon binding energies (including in multistrange nuclei) from the analysis of the relative yields of hypernuclei. For our calculations, we have used statistical multfragmentation model version which is modified for Lambda hypernuclei. The double ratio method can also be applied for multi-strange nuclei, which binding energies were very difficult to measure in previous hypernuclear experiments. These novel calculations would be the pioneering for the extraction and analysis of future hyperon experiments such as GSI/FAIR and NICA.

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An Automation System with Intelligent Production Scheduling and Cable Colors Detection for Cable Manufacturing in Automotive Industry

Dr. Dogan

Abstract— Different types and colors of cables are used in the car electronics. Each cable is mainly produced using copper, PVC and masterbatch raw materials. Because the raw materials are valuable, cable production is a very expensive process. Cable production on the other hand is a complex and sensitive process. Due to the misuse of the raw materials or the inaccurate scheduling of the work plan, miles of cable and raw material can be scrapped. Therefore, high-tech software and hardware are required to successfully perform cable production. In this presentation, A cable production automation system for Nursan Kablo Donanımları A.Ş (Nursan Cable Equipment Inc.) will be mentioned. More than six thousand cables with different types and colors can be produced in the factory. There are 7 different PVC types, hundreds of different types of copper and 16 different color masterbatches used in production. Before the proposed system, because of using false raw materials the miles of cable scrap were formed in each year. With our system which has machine integration and barcode-based quality control and poka-yoke systems, the waste of cable scrap is minimized. On the other hand, producing the cable with true color is very curial in cable manufacturing. However, when the cable producer machine is not loaded with the correct job sequence, color distortions occur during color (cable) transitions. Scheduling of the job orders correctly is a time consuming and complex process. This can be done manually in about one hour by professional operators. Our system which is using iterated greedy search algorithm, the optimum scheduling and transfer jobs to the machine can be realized within one minute. Thus, both the amount of scrap was reduced and the production capacity of company is increased. In addition, the actual colors of the cables produced can be determined by the developed system. For this purpose, a device with 360-degree detection capacity with image processing techniques during the high-speed production of cables is manufactured by us and integrated into the system. Consequently, all cable manufacturing process can be controlled with the developed system. It is expected that the net annual profit will be more than $ 200,000 due to the reduction in the amount of cable scrap and the increase in the production capacity.

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Technological developments for efficient quantum opto-electronic devices using molecular beam epitaxy

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LHO, School of Physics and Astronomy, University of Southampton, Southampton, UK

Abstract— Major challenges for the realization of second generation quantum revolution are associated with the implementation of high performance quantum light sources, which needs to be scalable, controlled, and economically feasible as well. An essential element in coming age of long-distance quantum cryptography along with safe and fast information processing are single photon emitting devices. Such devices require not only high rate and low $g^{(2)}(0)$ values, but also have to be implemented in already existing telecommunication networks for wide spread applications. Currently there are various approaches to single photon source (SPS), emitter or detector, which have shown to emit in 900 nm, 1350 nm and 1550 nm wavelength. To address above-mentioned and other applications in quantum optoelectronics, thorough understanding of materials of choice is fundamental aspect, which are continuously under investigation.

For SPS among the various material platforms, single In(Ga)As quantum dots (QDs) in photonic microstructures are prime candidates. They can promote close to unity quantum efficiencies, offer a very good suppression of multi-photon emission and incorporated into nanostructured environments to facilitate efficient light extraction from the high index host material. In my talk, fabrication of a variety of group III-V materials QDs[1,2], Quantum wells, microcavities[3,4,5] and nanowires grown by molecular beam epitaxy will be discussed. Optimization of growth parameters for achieving the desired structures, leading to the enhancement of the device performance will be presented.

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Elliptic Curves: Geometry and Applications

Dr. Umar Hayat

Abstract— After introducing elliptic curves, I will explain certain geometric structures on them. In particular how the structure of a group make them special in the theory of curves. In the end, I will discuss applications of cubic curves in diverse fields such as cryptography and wave mechanics. My focus will be generation of random numbers and classification of Rossby wave triads using certain classes of cubic curves.

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Investigation of Fermi Beta Transitions in Some Deformed Krypton (Kr) Isotopes

Necla Çakmak[1], Serdar Ünlü[2], Hasan Ali Aygör[3], Cevad Selam[3]
Karabuk University, Department of Physics, Karabuk-Turkey
Mehmet Akif Ersoy University, Department of Physics, Burdur-Turkey
Mus Alparslan University, Department of Physics, Mus-Turkey

Abstract— Pyatov's method has been applied to investigate Fermi beta transitions in some deformed Krypton (Kr) isotopes. This self-consistent method, which was used to study the isobar analogue states in the spherical odd-odd nuclei, has to date not been applied for the isobar analogue states in deformed nuclei. The nucleon-nucleon residual interaction has been included so that the broken isospin symmetry in the mean field approximation has been restored and the strength parameter of the effective interaction has been taken out to be a free parameter. The energies and wave functions of the isobaric analogue excitations have been obtained within the framework of the pn-QRPA method. The probability of the isospin mixing in the ground states and the centroid energies of the isobar analogue resonance have been presented and the deformation effects on these quantities have been quantified.

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Beyond mean-field dynamics of quantum many-body systems

Bulent Yilmaz
Karabuk University, Department of Physics, Karabuk-Turkey
Mehmet Akif Ersoy University, Department of Physics, Burdur-Turkey
Mus Alparslan University, Department of Physics, Mus-Turkey

Abstract— Time-dependent Hartree-Fock as well as density functional theory are widely used mean-field (MF) approximations in various fields of physics such as nuclear, atomic, condensed matter, and chemical physics. Even though MF approximation is quite successful in reproducing the evolution of one-body observables, it underestimates the quantum fluctuations of these observables which hamper its use for long-time evolutions. A beyond mean-field approach called stochastic meanfield (SMF) approach which incorporates the initial quantum fluctuations into the dynamics is introduced to overcome some shortcomings of the MF approximation. Applications of the SMF approach on exactly solvable models as well as on mass transfer in heavy-ion reactions are performed and the results are discussed.

Parallel Session I: Physics and Material Science

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Neutrino energy loss rates due to $^{66-71}$Ni in stellar matter

[1]**Jameel-Un Nabi[1,a], Ramoona Shehzadi[2,b] and Fakeha Farooq[3,c]**
GIK Institute of Engineering Sciences and Technology, Topi 23640, Khyber Pakhtunkhwa, Pakistan
[2,3]Department of Physics, University of the Punjab, 54590 Lahore, Pakistan

Abstract— Rates for (anti-)neutrino energy loss on nickel isotopes, due to interactions involving weak decays ($\beta^{\pm}$-decay and lepton captures) are regarded as having fundamental importance during late evolutionary stages of massive stars. These rates substantially affect the leptonic ratio (Y_e) of stellar interior. For the densities less than 10^{11} g/cm^3, weak processes produce (anti-)neutrinos which cause reduction in the stellar core's entropy. In this paper, rates for neutrino and anti-neutrino energy loss on nickel neutron-rich isotopes ($^{66-71}$Ni) have been presented. Rates for energy loss have been determined by applying the deformed pn-QRPA model. The ranges for temperature and density, have been used to determine the rates, are from 0.01 to 30 (10^9 K) and 10^1 to 10^{11} (g/cm^3), respectively. Our computed rates for energy loss, at higher temperature regions, are enhanced in comparison with previously reported rates of Pruet and Fuller (PF).

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Radiative capture of proton by 13C at low energy

Abdul Kabir[1], B.F. Irgaziev[2] and Jameel-Un Nabi[3]
GIK Institute of Engineering Sciences and Technology, Topi 23640, Khyber Pakhtunkhwa, Pakistan

Abstract— Radiative capture $p + {}^{13}\mathrm{C} \rightarrow {}^{14}\mathrm{N} + \gamma$ at energies of astrophysical interest is one of the important process in the CNO cycle. We focus the reader's attention on the possibility of describing this reaction within the framework of a single-particle potential model even when the reaction has a resonant characteristic. The partial components of the astrophysical S-factor are calculate for electric dipole transition. The calculated value of S-factor is in good agreement with experimental data both at low and high energy from the resonance position.

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Fabrication and characterization of methylene blue based sensors

Asad Ullah Khan[1,a] and Muhammad Tahir[2,b]

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[2]Department of Physics, Abdul Wali Khan University, Mardan 23200, Pakistan

Abstract— Methylene blue (MB), a small organic molecule, was used as an active layer to fabricate temperature and humidity sensors. For measuring the sensing properties of the fabricated devices, their capacitance was measured as a function of temperature and humidity. The response and recover times were measured. The morphology and ultraviolet (UV-vis) studies of the MB thin film were also carried out.

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Investigating the wet-chemical growth of CdS quantum-dots on metal-sulfide interfacial layers deposited by ALD

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[2]Department of Materials Science and Engineering, Institute of Space Technology, Islamabad 44000, Pakistan

Abstract— Owing to their unique and tunable optoelectronic characteristics, Quantum-dots (QDs) are considered as the most efficient nanoscale materials for various advanced applications including solar cells. Expansive and technologically complicated photovoltaic devices such as thin film solar cells and/or dye-sensitized solar cells are under-replacement solely due to the evolution of QDs, introducing newer family of solar cells including perovskite and QDs-sensitized solar cells (QDSCs). The technological progress of these devices is so far slow and a lot of optimization is required regarding the optimal deposition and energy harvesting of QDs without detrimental electronic issues of back-transfer of charge carriers and electron-hole recombination. In this work, we have focused the issue of lower energy harvesting in thin films deposited by wet-chemical methods such as successive ionic layer adsorption and reaction (SILAR) by introducing atomic layer deposited (ALD) ZnS, SnS and MoS_2 IL on TiO_2-deposited Si-wafer. The aim was to in-depth analyze the nucleation and growth trend in QDs, considering CdS as a reference material owing to its stability for atomic force microscopic (AFM) examination. It was deduced that all metal-sulfide layers deposited by ALD enhance the deposition of CdS QDs and can prove beneficial for optoelectronic devices incorporating QDs, however their increased deposition is importantly classified in terms of coverage and size of QDs, differently. Considering the results of our study it will be beneficial for optimizing the QDs based devices in general and CdS QDSCs, in particular.

Parallel Session II: Computer Sciences & Engineering

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On Board Intelligence for Public Transportation in Developing Countries using IoT

Abdul Rehman, Tariq Mumtaz
1Data Communications & Control (Pvt) Ltd, Pakistan.
2Habib University, Pakistan.

Abstract--- This study is carried out for indigenous development of an ITS (Intelligent Transportation System) device aimed particularly for public transport buses in the developing countries with poor infrastructure and unaccountable transportation services. The developed system uses IoT technology, smart sensing hardware and open source software in order to achieve commercial scalability by government and transportation authorities in such countries. The proposed device essentially collects and store data from the bus fleet and communicates the information to a central server from which software applications for passengers and transport operators are developed accordingly. The device functionality is divided into three categories which are Environment Sensing, Vehicle Management and Safety. With the help of acquired data carbon footprints, fuel consumption, vehicle health, predicting the driver behavior, forecasting of rush-hours and vehicle maintenance requirements can be estimated. The device is packaged into a box with proper considerations of reliability in terms of power, weather proofing, storage and cabling. The proposed device will allow the passengers, especially in developing cities, to plan their journeys ahead of time and provide a holistic decision support system to the transport authorities.

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Home Security and Automation Based on Internet of Things: A Comprehensive Review

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Abstract — The current trends of research are focused on the use of the Internet of Things (IoT) for various real-time applications. IoT is a type of "universal global neural network" and very common because of its benefits in smart application trends over traditional communication trends. Information is now accessible much easily because of the internet and inexpensive. So security and automation become a need of every department and organization. The main objective of this study is to overcome the different face detection approaches in the IoT domain and their application in the automation of smart home devices. However, this review concludes the constraints and gaps of existing published work related to the current topic and point towards feasible future research directions. Furthermore, we have discussed possible challenges of large data processing, as well as communication and automation protocols by applying different sensors, other hardware, and their interoperability. Similarities and differences of various key factors are presented in tables in terms of the proposed model, technology, application, software, user interface, algorithm, hardware, and purpose, etc. In this study, we also discussed the pros and cons of various facial detection approaches and gaps of IoT in home automation. We suppose that this review will be a solid base for future researchers in the field of automation and facial detection in IoT

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Data Visualization, Classification and Method Selection Based on Artificial Neural Network

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GIK Institute of Engineering Sciences and Technology, Topi, Pakistan

Abstract: Data visualization techniques are used as a tool for data exploration and visual analysis. The most appropriate visualization technique selection for a particular dataset that meet user needs is not arbitrary. In this paper, a formal visualization method based on Artificial Neural Network (ANN) and meta-data of the dataset to be visualized is proposed. A new dataset, consist of meta-data and most suitable visualization, is built from the contemporary research in the field. In this work we used 8 popular data visualizations techniques, namely, pie chart, parallel coordinate histogram, line chart, scatter plot, linked graph, tree-map and map. The dataset is used to train and test neural network to find most optimum architecture. Several metrics are used to measure and evaluate the performance of neural network. We also compared the neural network model with Support Vector Machine (SVM) and k-Nearest Neighbor (k-NN) and the results show that ANN outperforms both classifiers. This performance and the evaluation assessment show that our ANN model is able to automatically select visualization technique with significant accuracy.

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Network Application Classification Using Deep Learning Algorithm in Software Defined Networks

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Abstract: Network application classification is quintessential for a wide range of network operations, network security monitoring, misconfiguration, and intrusion detection in network. Network application classification has the ability to solve fundamentals to numerous network management activities. As the popularity of software-defined network (SDN) is evolving technology and a suitable environment for easily applying in an efficient monitoring policy. In SDN architecture, the control plane separates from forwarding devices and making networks programmable. The emergence of deep learning methods and SDN provides a new way for application classification. In this study, a deep learning-based application classification method is proposed that can classify network traffic affectively. The experimental setup confirms that, the proposed model achieves a better classification accuracy of 99.10% using a convolutional neural network (CNN).

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Sign Language Translation in Urdu-Hindi Through Microsoft Kinect

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Abstract: Communication is the foremost and basic necessity of a person, and the ability to speak without any problem is a boon; nevertheless, woefully we have often seen people around us who are the victim of speech and/or hearing impairments. Thus, the 'Sign Language' (SL) appears as an alternate standard language that is globally understood and adopted by the deaf community. Though SL is a communication tool but, in practice, we still see, most of the normal people do not understand the SL properly, thus, it is again a problem in communication between a speech/hearing impaired and normal persons. In this regard, many research attempts have been made to resolve this problem via wearable technology and other different paradigms of computational solutions. However, almost all of them focused on English or western languages, which provide a trivial resolution for the people of the Indian subcontinent. Thus, in this paper, we propose a solution to address this issue by employing Kinect Motion Sensor for detecting the signs (in SL) through hand movements and gestures and translating them in Urdu/Hindi language, which is readable and audible to normal persons. The proposed system is developed on a feature-based model; hence, we stored signs in a dictionary/training set for the development of the baseline system; however, the users can customize the system by adding their sign patterns in the future.

Parallel Session III: Electrical Engineering

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Cost-effective, Reliable, and Precise Surface Mount Device (SMD) on PCBs

Bakhtawar Iftikhar[1], Mustafa Asif Malik[1], Salman Hadi[1], Omar Wajid[1], Muhammad Nadeem Farooq[2], Muhammad Muqeet Rehman[1,*], Ahmad Kamal Hassan[1]

[1]Department of Electrical Engineering, Ghulam Ishaq Khan Institute, Swabi, Pakistan

[2]Cheif Executive Officer, SPUD Energy, Pakistan

Abstract—Automated Pick-and-Place (P&P) machines offer a new prospective for the assembly of Surface Mount Devices (SMDs) on Printed Circuit Boards (PCBs), owing to their advantages of time-effectiveness and precision. SMDs are widely used to improve production efficiency and reduce common defects. However, these machines are quite expensive and not easily available for the local market. This study is based on the design of a P&P machine model that incorporates principles of machine learning theory. The model has been developed in such a way that it can be introduced to the local market in a more cost-effective manner without compromising on its precision and accuracy.

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Effect of Load and Fuel Price Variation on Genco Agent in Day Ahead Auction

Nisha Hareem, Kashif Imran and Abdul Kashif Janjua

Center for Advanced Studies in Energy National University of Science and Technology (NUST) Islamabad, Pakistan

Abstract— In electricity markets, participants undertake distributed decision making under dynamic environment. Agent based modeling and simulation is suitable for analysis of such distributed decision making. Self-centric GenCo agents have a chance to learn from results of day-ahead auction and adjust their bids for the next day. Reactive reinforcement learning algorithms have capabilities to learn optimal response of GenCo agents to dynamic conditions of day-ahead auction. This paper explores change in convergence behavior of learning algorithm when market environment was made more dynamic, by introducing stochastic load profiles and variable generation cost coefficients, to model load variability and fuel price changes in real world markets. The results show that as variation in load profile increases, algorithm generally take more days to converge but average number of simulation runs that converge remain within a small range. As fuel price variation increases, convergence becomes tough and gets delayed but a greater number of simulation runs achieve convergence.

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Techno-Economic Analysis of an Off-Grid Eco-Friendly Flywheel Based Bicycle Generator

Arsal Mehmood1*, Faraz Baig2, Muhammad Ammar Jatt3, Huzaifa Hassan4, Muhammad Saad Khan5, Suhail Shaikh6, Dr. Nayyar Hussain Mirjat7, Prof. Dr. Zubair Ahmed Memon8 1,2,3,4,5,6,7,8

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Abstract— According to the Global Long-Term Climate Risk Index (CRI) 2020 by the German Watch, Pakistan is 5th among 10 countries affected most by climate change. Global warming and scarcity of Conventional resources are becoming major problem in the current scenario. Pakistan's most of the energy is generated using conventional sources, these sources are responsible for pollution and global warming which ultimately result in climate change. That's why today we need alternative nonconventional sources which are eco-friendly and sustainable. Solar and other renewable source are various forms of energy which are used alternatively today. One such source is Human Power, as it is an endless source of energy which has been wasted while workout. In this paper, a prototype modelling of an OFF-Grid Green Energy Harvesting Flywheel

Parallel Session IV: Chemical Engineering

3rd Pak-Turk International Conference on Emerging Technologies in the field of Sciences and Engineering
(9-10th June, 2020)

Data Based Sensing of Shale Oil Yield in Oil Shale Retorting Process

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Abstact—Oil shale is sedimentary organic rocks that are being converted in to useful shale oil and shale gas. North American regions, Canada and China are exploring the oil shale reserves to accommodate the depletion of natural oil and gas resources. Oil shale retorting technology is being utilized to convert the shale rocks into shale oil and shale gas. The major product is oil that is further treated to convert it into gaseous form. In this study, machine learning techniques like ensemble learning (least square boosting and bagging) and artificial neural network (ANN) are employed for data sensing of oil shale retorting process and being compared. Data is generated for ensemble models through MATLAB-Excel-Aspen interfacing. The proposed framework shows that ANN provides higher accuracy as compare to other models for oil shale retorting process for efficient oil recovery.

Parallel Session I: Civil Engineering

3rd Pak-Turk International Conference on Emerging Technologies in the field of Sciences and Engineering
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Effect of Different Grades of Carbon Black on Compressive Strength of Mortar

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Abstract—The progress in the field of additives also upgraded the construction field. Use of additives plays the key role in improving the different properties of cement mixes. They are being used in the fields of strength, structural health monitoring and durability etc. Carbon Black (CB), one of additives, attracted the researchers in the field of health monitoring but very less research has been done on their effect on the strength of the cement mortar composites. In this research different grades of CB has been studied to find an optimum grade for the strength of CB based cement composites. The compressive strength behavior of three grades of CB (N330, N550 and N660) has been studied by replacing cement content by 5%, 7.5%, 10%, 12.5% and 15% by weight. Compressive strength was investigated at the age of 14, 28 and 120 days. The result showed that the compressive strength of CB based cement composites was more than control mix at the age of 28 and 120 days.

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Effect of temperature on behavior of concrete with e-waste as partial replacement of aggregates

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Abstract—Plastic waste is an environmental hazard due to its low biodegradability and minimal recycling (only around 7% globally). With the ever-increasing advancement of technology, the proportion of electronic waste (E-waste) is also increasing significantly. This is specially an important issue for developing countries where most of E-waste is dumped now a days. Building and construction industry, on the other hand, account for almost 40% of energy related CO_2 emissions globally and is also responsible for depleting natural resources. Recycling of E-waste as an alternative construction material has the potential to address these issues. Past studies have explored the mechanical properties of plastic concrete and found that a 20% replacement of aggregates is feasible with some reduction in compressive strength. One important aspect of plastic concrete is its thermal properties and resistance to fire. The current study is focused on the fire resistance of concrete made with E-waste as partial replacement of aggregates i.e. coarse and fine aggregates. The concrete specimens were heated at 150^{o} C and 300^{o} C for 1 hour and the effect of fire on the mechanical properties of plastic concrete are explored and recommendations are presented regarding the decrease of strength properties due to fire.

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Investigation of Structural Application of Lightweight Aggregate Concrete

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Abstract - Lightweight aggregate concrete mixtures incorporating 0, 10, 20 and 30 weight percent replacement of normal-weight aggregate with lightweight aggregate were tested at 7, 28, and 56 days of concrete age for compressive strength, and at 28 and 56 days for flexural and split tension strengths of concrete. Durability test aimed at determining the volume of permeable voids and moisture sorption of concrete mixtures was carried out at 90 days of concrete age. Similarly, density of hardened concrete mixtures was tested at 90 days of concrete age. Comparison of the test results showed that compressive, flexural, and split tension strengths of concrete mixtures reduced with increase in the percent replacement of normal-weight aggregate with lightweight aggregate. However, the mix with 20% weight replacement of normal-weight aggregate with lightweight aggregate showed satisfactory strength characteristics meeting the requirements of structural concrete. Furthermore, it was observed that volume of permeable voids and hence moisture sorption in lightweight aggregate concrete reduced as the percent replacement of normal-weight aggregate with lightweight aggregate was increased pointing at the enhanced durability of the lightweight aggregate concrete mixtures. As expected, significant reduction in dry density of hardened concrete is realized when lightweight aggregate is used as partial replacement of normal-weight aggregate. Reduced density of lightweight aggregate concrete mixtures is viewed as major source of economical design of structural members as the lower concrete density will result into reduction of self-weight of the structural members allowing for the design of these members with smaller cross sections and hence economical design.

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Predicting compressive strength of CRM samples using Image-processing and ANN

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Abstract—Quality of concrete is majorly ascertained through its compressive strength which has significant role in the stability of concrete structures. In this study, techniques of artificial intelligence artificial neural network (ANN) and image processing (IP) was used to predict the compressive strength concrete (fc) with cement replacement material (CRM) i.e. Fly Ash (FA) and Silica Fumes (SF). 18 concrete cylinders were cast with different mix ratio and with different % of CRM. Half of them tested in compression in laboratory and other halves were cut into three slices of each for IP. Images were obtained using DSLR camera under defined conditions to extract the features. Based on these parameters ANN modeling was performed for predicting fc. Comparison of experimental results and ANN results (R = 0.9865) proved ANN models can be used as prediction tool for compressive strength of concrete.

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Appraisal of Stone Processing Industry Wastage as an Admixture for Soil Improvement

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Abstract— Removal and replacement is technique being employed for the projects encountered with A-6 or A-7-5 types of Soils, but it require extra financial support along with requirements of considerable time for its implementation. The current research work explore in-situ improvement of such soils using marble stone dust as an admixture. Marble stone dust was added in variable percentages (0%,5% and 10%) and the resulting effect was assessed by comparing index properties, Engineering properties and shear strength parameters. The soil properties considerably improved with the addition of marble stone dust. The outcome of the study established the suitability of proposed admixture for the in-situ improvement of soil. It may not only reduce the cost of the projects but also shorten the time consumed for the soil improvement.

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Experimental Study of Railway Bridge Scouring And Proposal of Remedial Measures-A Casen Study of Bridge Number 30, Harrow River.

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Abstract— Bridges are one of the most integral transportation components for connection of remote parts worldwide. The concern of every engineer is with their stability and collapse. One of the issues with bridge stability is bridge pier scouring in perennial and inundation canals as well as rivers, If not properly monitored and precautionary measures not adopted, it can result into bridge collapse. This paper makes an attempt to study the heavy bridge scouring in Railway Bridge (bridge # 30) on Harrow River located at downstream of Khanpur Dam, Pakistan. The study is carried out experimentally on scaled down model of bridge to study the behavior and patterns of scouring in the river bed during and after floods in two phases including 1) investigating the causes of scouring 2) provision and analysis of suitable remedial measures. The scouring that occurred in lab model matched the field patterns. Baffle walls and weir were provided separately as remedial measure but the former failed under initial watering while weir provided on downstream side reduced scouring by 95%

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Mechanical Properties of Concrete with E-Waste as Partial Replacement of Natural Aggregate

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Abstract— Concrete is a fundamental constitute of construction industry across the globe. The bulk of concrete is made up of aggregates, hence structural behavior of concrete significantly relies on the quality and properties of aggregates. Natural resources are depleting due to continuous production of concrete resulting in stringent environmental impact. To endeavor this challenging situation, several studies have been conducted to opt the sustainable and eco-friendly by-products generated by automobiles, packaging industries, electronics goods etc. as alternative construction material**.** This paper presents partial replacement of natural aggregates with plastic aggregates and the effect of plastic aggregates on fresh and hardened properties of concrete. Three replacement percentages are adopted which are 10%, 15%, 20%. Also, silica fume is used in three percentages to enhance the properties of concrete with plastic aggregates. Effects of these parameters on the strength properties of concrete are discussed in detail and the suitability of recycling electronic waste in construction industry is discussed.

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Effect of Fines on the Engineering Properties of Lawrencepur Sand

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Abstract—A lot of work has been done to study the effect of different parameters on the engineering properties of clean sand and a clear understanding exists about role of these parameters. Keeping in view the presence of fines with sands at construction sites, some researchers have studied the effect of fines on engineering properties of their local sands and have obtained different trends with different optimum percentages. In this study, Lawrencepur sand is used and effect of fines having same mineral composition is studied. From the results, it is found that fines increase cohesion, decrease internal friction angle, whereas a transition has been observed in dry density and optimum moisture content values.

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Impact of Collar and Roughness on Bridge Pier Scouring

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Abstract— Local scouring is one of the main causes of bridge failure across the world. Bridge failure causes interruption of social interaction, economical loss in the form of repairing and in severe case the loss of lives. In this research work oblong shape collar having width 2.5 times the diameter of pier and gravels roughness with size; d50=6.32mm are used as a countermeasure on plain circular shape pier. Both the collar and pier roughness were tested on the circular shape pier at different flow rate and corresponding scouring was measured by using point gauge. All the experiments were carried out in a laboratory flume having width, length and depth is 0.96m, 20m and 0.75m respectively. The results exhibited that 55.10% scouring is reduced with the presence of oblong shape collar on pier and 22.40% scouring is reduced with pier roughness. It is concluded that pier with collar was found to be effective scouring reducer as compared to pier with roughness.

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Investigating the Permeability of coarse and fine asphalt mixtures

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ABSTRACT-A study has been conducted to investigate the drainability of four different types of asphalt mixtures that are used for pavement surface layers. These mixes include SP-A, MS-2B ,NHA-A and NHA-B gradation . One type of Bitumen are used as ARL and two types of aggregate source are used as Margalla and Uban Shah. Four types of permeability apparatus are used as Italian (6inch dia), European (5inch dia), in situ-permeameter (4 inch dia) and water pressurized permeameter ese devices work on falling head principles. The focus is given to determine the effect of different NMAS on permeability and permeameters cogency and viability. The study reveals that increase in void size with random formation of increased structural connections increase the permeability. If size of permeability apparatus increases its permeability also increases and also if pressure is applied its permeability increases .While NHA A is more permeable as compared to other permeable asphalt mixes. While NHA B mixes offered less permeability while NHA A offered more permeability , due to specific gradation. Study reveals that permeability is dependent on interconnection of air voids, sample size gradation and head pressure.

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Effects of Combined Use of Metakaolin, Silica fume and Coconut Fibers on Different Properties of Cement Composite

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Abstract—This research work presents the effects of combined use of metakaolin, silica fume and coconut fibers on different properties of cement mortar composites. The proportion of 0.8:0.2:1 (Cement: Pozzolans: Sand) was kept fixed with water to binding materials ratio varies from 0.35 to 0.60 depending on the coconut fibers content to fulfil the need of workability requirements. In this study total 180 specimens of various sizes were casted in two different phases, in phase-I, 54 specimens each nine specimens of the same percentage of 20% cement replaced with silica fume and metakaolin were casted for maximum compressive strength to get optimum value for metakaolin and silica fume combination. In phase-II, further 126 fibers reinforced mortars specimens were casted with optimum value of metakaolin and silica fume obtained in phase-I with varying content of coconut fibers 0%, 3%,6%,9%,12% and 15% by weight of binder and replacing the composition of sand. The samples were then investigated for compressive strength, modulus of rupture (MOR), water absorbing capacity and moisture content at 7day, 14day and 28day curing age.

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Impact of aging and moisture damage on bond strength of asphalt mixture

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Abstract— Bond strength in asphalt mixture should be adequate throughout the service period of a pavement for better performance. Bitumen due to some external factors, such as temperature and heat changes its capacity to resist moisture damage and bonding properties due to aging. To analyze the effect of aging on bond strength of asphalt mixture, binder is aged using the rolling thin film oven test (RTFOT) and pressure aging vessel (PAV). Dynamic Shear Rheometer (DSR) is used to check the stiffening of the virgin binder compared to aged binder. Bitumen Bond Strength (BBS) and Rolling Bottle Test (RBT) is performed to check the interaction between binder and aggregate as a result of aging of binder. BBS test on virgin and aged binder is performed at 24 hours of dry and wet conditioning. BBS test results have shown an improvement in Pull of tensile strength (POTS) after RTFOT and PAV aging at 24 hours of dry and wet conditioning. In dry conditions virgin and RTFOT aged binder follows cohesive nature of failure and PAV aged binder follows adhesive failure pattern. In wet conditions cohesive nature of failure is observed in virgin, RTFOT and PAV aged binder. RBT results have shown increase in percent retained coating of binder after RFTFOT and PAV aging. It is found that aging increases the resistive property to moisture damage and bond strength of binder.

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Developing Non- Linear Relationship Among Factors Affecting the Rutting Susceptibility of Asphalt Mixtures Using Two Parameter Weibull Distribution

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Abstract— This paper illustrates a novel approach to determine the probabilistic rutting in asphalt mixtures based on Weibull distribution statistical approach. In this paper, thirty wearing course asphalt mixtures prepared using different binder grades and aggregate sources, are analysed. Cooper Wheel tracker Test (CWTT)and Asphalt pavement analyser (APA) have been used to ascertain the rutting potential of asphalt mixtures with varying binder grade and aggregate source. Mixtures are then ranked based on their rutting susceptibility. The obtained data is processed using two parametric Weibull approach. Scale and shape parameters are figured out by multiple regression technique. Test results are analysed using goodness of fit test. Results indicate that rut depth predicted from two parameter Weibull distribution technique corelates well with the actual rut depth with R^2 value of 0.88 for both cooper wheel tracker and asphalt pavement analyser test. It has been found that Weibull distribution bests fit the NHA-A, NHA-B and SP-B graded mixtures with NRL 60/70 at 50◦C. A good correlation has been observed between Cooper Wheel tracker and Asphalt pavement analyser as translated by R2 of 0.86.This research is important in a sense that several agencies have adopted rutting as a failure criteria for flexible pavements. By mathematically modelling the rutting response, predicting the rutting behaviour of mastics becomes simpler and more efficient in approach.

Parallel Session II: Mechanical Engineering and Energy Systems

3rd Pak-Turk International Conference on Emerging Technologies in the field of Sciences and Engineering
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Critical Study on Design of High-Speed Weapon Capable Drone and Advancements in Drone Technology

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Abstract— In the last couple of decades, drone technology has advanced a lot and has become a branch of keen interest for students and research organizations. With these advancements, several new profiles and platforms for drones have been developed ranging from the military application to surveillance, reconnaissance, and agricultural purposes. This paper is an effort to study the multiple drone platforms available with a detailed study on quad-copter or quad-rotor. Quad-rotors are being frequently used by various researchers as this platform has a better tendency of performing tasks because of efficient and stable design configuration. The current utilization of this platform and its potential for Killer Drones is also discussed. The paper also covers multiple concepts approaches for damping or restricting motion due to the impact of fire from weapon mounted on a drone. The paper includes a feasibility study of these initially selected concepts i.e. varying propeller RPM of quad-copter for balancing the impact of weapon, use of damping mechanical structure & damping Fluid to reduce the impact and use of 3-D gimbals to constraint motion and stabilize Drone. The paper investigates the feasibility of all available platforms and mentioned approaches to predict the most appropriate combination for High-Speed Weapon Capable Killer Drone

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Solar Thermal Opportunities And Challenges In Pakistan

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Abstract—In June 2018, the power deficit in Pakistan hit a record high of 9000 MW. Although alarming, it is not unprecedented due to past trends of exponential population growth, inadequacy of conventional energy sources to meet demand and lack of technological advancements. This represents an urgent and unavoidable need to turn to alternate renewable energy sources such as solar, wind and hydroelectric power. This paper aims to explore the possibilities presented by solar energy to solve the power crisis. This technology can be used to generate electricity which can then be used in different thermal applications. This paper presents a detailed discussion regarding these technologies, the institutions working in this field and scheme of solar thermal plants as per energy needs of Pakistan.

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Investigation of Sensors & Actuators based on Hankel Singular Values

Dr. Sheharyar Malik
Instructor, Institute of Applied Technology

Abstract—The work presented here proposes a method to rank the efficiency of the actuators and sensors for the attenuation of excited structural modes. Aeroelastic wing designed with multiple control surfaces and equipped with sensors at different locations is used as a test case. A unifying theme to this work is the application of Hankel Singular Values (HSV), an analytical approach applied to the experimental data conducted during the Ground Vibrational (GVT) and Wind Tunnel (WT) tests. Modal information gathered from experimental results is used to define actuator/sensor relationships, once the mode of interest is decided then the sensor and actuator location is determined to effectively cater the structural vibrations, it paves the way for the design of specific performance metrics. The research will add redundancy to the available set of instrumentation by paving the way for the dedicated use of control surface for the stable flight mechanics or flight dynamics instability. The results presented here are supported by Power Spectral Densities (PSD's) and band pass filters.

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(9-10th June, 2020)

Stress Analysis of Composite Leaf Spring – Comparative Approach

Dr. Sheharyar Malik
Instructor, Institute of Applied Technology

Abstract—Automobile manufacturers are focusing on weight reduction for saving natural resources and enhancing the fuel efficiency; automobiles are sharing almost half of fuel consumption around the world. The leaf spring is one of the main candidates for the weight reduction in an automobile as they cannot be replaced and still holds it worth although many shocks absorbing devices are in the market these days. This paper is aimed to present the comparative study of steel and composite leaf spring with the later type having the same eometrical characteristics of steel leaf spring. Validations are carried out by modeling steel leaf spring on ANSYS & comparing it with analytical results. The results showed that the stresses in composite leaf spring are 64.8% lower than the stresses in the steel leaf spring for the same dimensions. The results for deflections showed also good agreement with analytical results and a decrement of 51.3% is found for deflection in composite leaf spring. This methodology helps us to reduce the weight of weight of leaf spring by approximately 74.39% without compromising on allowable stresses and thus also increasing strain energy of the particular leaf spring case.

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Paint Spraying Robotic Mechanisms: A Comparative Study

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Abstract: This paper presents comparative study between two different painting robotic mechanisms. The paper highlights the difference between the operating time and other conditions to achieve the same objective. Paint spraying mechanism is discussed thoroughly and discussions were made based on both mechanisms.

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Measurement of Thermal Conductivity of Copper Metal Foam Saturated with Phase Change Material

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Abstract— Heat transfer and storage properties are important characteristics of the phase change material (PCMs) which perform a major role in the storage system of thermal energy. The minimum thermal conductivity of phase change materials significantly lowers its performance in terms of energy storage and release rate. Metal foam can be used to increase the low thermal conductivity of the paraffin. In this research work, the thermal conductivity of the phase change material was increased by using the metal foam paraffin composite. The heat transfer enhancement of the paraffin metal foam composite was studied in comparison to pure paraffin. The infiltration technique was used to infiltrate the paraffin in the metal foam. The result showed that the thermal conductivity of the composite was enhanced as compared to pure paraffin. Thermal conductivity and porosity of metal foam have an inverse relationship with each other. The maximum thermal conductivity of 8.6 (W/m.K) has seen at a porosity of 0.90.

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Temperature Control of Battery using Phase Change Material Infiltrated in Metal Foam

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Abstract--- Energy plays a significant aspect in the advancement of nation both socially and financially. Utilization of energy from renewable source is the main research focus in order to reduce dependency on conventional fuels. Keeping in view the fact, battery hybrid vehicles are rapidly replacing conventional vehicles. Lithium ion battery is an integral part of battery electric vehicles due to their high energy and power density. Their efficiency is affected due to rise in temperature of battery pack. An effort is made to maintain battery within permissible temperature limits. In current study efficient thermal management (graphene coated nickel foam paraffin composite) are examined experimentally for highly powered Li-ion batteries. Experimental model carries six Panasonic 18650B 3400 mAh lithium ion energy cells which were connected in series. Four other thermal management modes were compared, and their results were evaluated. By utilizing graphene coated nickel foam paraffin composite, 34% reduction in temperature of battery pack is achieved. While 1% decreases in temperature of battery enhances the life of battery for two months. So, graphene coated nickel foam paraffin composite is feasible option to maintained battery temperature within permissible limits.

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Energy Improvement Strategies in Coal Fired Chain Grate Boiler.

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Abstract---Properties of coal are characteristics which perform an essential role in the boiler energy system. Boiler efficiency increase when the less calorific values of coal is used for burning. Addition the size of coal has the significant effect on the combustion process as well as in the performance of the boiler efficiency. In this paper, the production of steam in chain grate boiler against different gross calorific values of coal were experimentally examined. The behaviors of coal combustion and steam production at different gross calorific values of coal was studied. At the lowest gross calorific value of coal, production of steam increases and also attain the highest efficiency of boiler. A comparative analysis of coal and steam is made. The mass of steam produced and the mass of coal combustion is experimentally considered. Experimental results show that a minor development in the productivity of the boiler with the lowest gross calorific value of coal increases the efficiency of the boiler by 10-15% and also get the highest heating capacity of coal.

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Hybrid Thermal Management of Heating Element using Forced Air Convection and Phase Change Material Soaked in Copper Foam

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Abstract---The current study includes the comparison of hybrid thermal management system designed for heating element with active and passive thermal management system. The effectiveness and usefulness of hybrid thermal management system is evaluated and compared experimentally. All the experiments are performed under constant ambient temperature of 25^{o}C. It can be concluded from experimental results that alone active and passive thermal management system is not sufficient to keep the temperature of heating element within the safety limits. Moreover, combination of active and passive thermal management system gives more Steady temperature distribution and have the ability to maintain the temperature of heating element for long time interval as compared to active as well as passive thermal management system.

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Comparative Analysis of Temperature Excursion Hybrid Techniques for Electronic Devices

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Abstract—Phase Change Materials (PCMs) are becoming popular in thermal management of electronic devices for their safe operation and to prevent premature failure. PCMs have high latent heat of fusion but low thermal conductivity. High latent heat enables them to absorb a large amount of heat from the hot surfaces during their phase transition. In this experimental study, a hybrid thermal management system using copper foam with PCM and forced air convection is designed and tested experimentally. Copper foam and forced air convection is aimed to enhance the thermal conductivity and to improve the temperature uniformity within the PCM. The results are then compared with two other modes of cooling, pure PCM and composite PCM (copper foam along with PCM). Results indicate that addition of air as cooling medium reduces the temperature of the electronic device compared with the other two patterns. They hybrid system appeared to be 25.6% more effective than pure PCM and 15.6% more effective than the composite PCM.

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A finite element analysis of transportation bridges under flexural load

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Abstract—Beams are extensively used in the construction of bridges, high-rise buildings, architectural structures, railways and extend to smaller applications such as aerial and ground vehicles. It is vital that the beam theory is completely understood and correctly applied for true analysis so that the desired structure is safely produced. Over the last decade, leap in the advancement of ground transport has come from the development of new, high-speed infrastructure for trains and motorcars. For smooth running of traffic and covering land-based barriers, many bridges have been made which are under extensive load due to heavy traffic. Present study has aimed to represent the loading conditions of a bridge with a suitable model to solve for deflection and stresses induced on bridge structures and their supports using finite element analysis. FEM is a powerful tool that helps to solve the complex equations governing the physical phenomena. Analysis of bridges under flexural loads can be adequately modeled as a beam element with the weight of cars as a distributed load. Condition of the bridge is considered under maximum loading during rush hours, which would yield the conservative results. Calculations of loads has been carried out for 2-D problem, using an effective in-house algorithm based on FEM and developed on MATLAB software. Results of this paper can be used for verification of similar studies in which commercial software, analytical and experimental methods are used for the solution of problem. Calculation of loads assist in initial material selection early in the design process.

3rd Pak-Turk International Conference on Emerging Technologies in the field of Sciences and Engineering
(9-10th June, 2020)

Implementation of Differential Transform Method (DTM) for Large Deformation Analysis of Cantilever Beam

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Abstract. Large deformation of a cantilever beam is an eminent structural analysis and engineering problem. A non-linear differential equation governs the problem of large deformation of beams. It has many important applications scientific and engineering fields. It is quite intricate and complex to find a closed-form or an exact solution for such a problem. It is relatively easier to use analytic expressions for calculations than numerical or experimental analysis. Large deformation analysis has always been an active area of research for researchers. The main focus of this research is to implement a new method namely Differential Transformation Method (DTM) for non-linear beam problem analysis. DTM is quite reliable and efficient in giving an approximate analytical solution to beam problems. Moreover, it is a new application for DTM. Hence, the primary purpose of this work is to evaluate the utility of the method for solution of beam problem. DTM yields a 2-point boundary value problem. It is based Taylor's series expansion. DTM helps to calculate the deflection angle and horizontal as well as vertical displacements of a cantilever beam, experiencing large deformation, in an explicit analytical form. Mathematical formulation code will be developed using MATLAB. Variation of rotation angle at free end will be analysed using different number of terms used and values of non-dimensional load "β". Results of DTM prove the method to be quite effective and suitable for predicting solutions to non-linear beam problems. Therefore, DTM can be used for widespread applications for new, emerging and complex engineering problems.

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Indigenous Design and Development of Split Hopkinson Pressure Bar (SHPB) test setup for characterization of materials at high strain Rates

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Abstract— This paper presents design and development of split Hopkinson pressure bar (SHPB) indigenously for testing of different materials at high deformation rate. SHPB is capable to measure the deformation rate 100 $^{s-1}$ to 2,000 $^{s-1}$, by maintaining the uniform and uni-axial stress in the samples. SHPB apparatus consist of the mechanical components, support structure, bars supports and the incident and transmission bars, striker bar, gas gun, piston and rod assembly. The momentum trap system is used to absorb the energy in the form of friction and heat. All components are designed, manufactured, calibrated and assembled to test the samples. Results obtained at high deformation rates are used to characterize samples of different materials by converting in the form of strain, strain rate and stress amplitude in samples.

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Reverse Engineering of a Small Turbo Jet Engine

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Abstract— This document is intended as an introduction to a process of analytical solution of a micro turbojet engine required for reverse engineering of the engine to be used in the construction of a UAV. The unit is comprised of a centrifugal compressor, an annular combustion chamber and a radial turbine. The process involves four major steps. First is the calculation of the basic performance parameters in terms of Thrust, EGT (Exhaust Gas Temperature), RPM (Revolution Per Minute), compression and temperature ratios across the compressor and turbine, thermal efficiency, propulsive efficiency, overall efficiency, specific thrust, specific fuel consumption etc at on nominal design point. Secondly the same performance analysis will be carried out at off nominal design point. Third step is the thermodynamic cycle analysis of the engine. Lastly in the end we will be validating the calculated parameters of the engine on a turbo machinery software like GasTurb v12.

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Design of rocket assisted takeoff for target drones

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Abstract—Conventional runway takeoff is not available in many situations especially for small drones in inhospitable terrain. In that case one may resort to catapult launch system or zero length rail launch system in which rocket motor is used to launch the aircraft in a very short distance. The aim is to design a small rocket motor using easily available propellant for launching drones in a very short distance. The rocket's motor sizing, nozzle and structure will be designed and trajectory and stability will be analyzed

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An Overview of Stability and Performance Analysis of Hybrid Vertical Take-off and Landing Unmanned Aerial Vehicle

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Abstract—Hybrid vertical takeoff and landing unmanned air vehicles are nowadays under consideration because of their longer range, take-off and landing ability at any desired point and cruise capabilities. In this paper, different types of such vehicles and their configurations are explained. The flight regime of these vehicles is divided into three categories, that is, vertical take-off, transition and cruise flight. In addition, aerodynamic analysis of different hybrid vertical takeoff and landing unmanned aerial vehicles including tilt-wing, the tilt-rotor unmanned air vehicles and a separate lift and thrust unmanned air vehicles (having rotors at the mid-span of the wing) have been explained. In most of the cases, essential aerodynamic characteristics are obtained from the six-degree freedom of equations derived from Newton's second law of motion and computational fluid dynamics. Since the two main parameters in hover mode are thrust co-efficient and the inflow ratio. Therefore equations for the calculation of these parameters are given in the paper. This paper also gives an overall brief of the methods used for the calculation of stability and performance parameters in both the hover and forward flight mode.

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Self-cleaning of glass surface to maximize the PV cell efficiency

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Abstract—Photovoltaic (PV) modules are widely used for harnessing solar energy which ensure maximum output when their glass surface is clean. However, PV modules are open to dust, grime and other contaminations which get deposited on their surface causing reduction in transmittance and hence their efficiency reduces. It is therefore required to clean the glass surface of PV modules time to time either manually by labor or using some special arrangements such as automated systems. However, these techniques are either laborious or require extra energy. Therefore, another solution to offset such complications is to use chemical coatings which ensure self-cleaning of glass surface by increasing water contact angle. In the present study, two types of water repellent chemicals (such as trimethylchlorosilane and hexamethyldisilazane) have been used to coat the glass surface using dip coating technique. The performance of such coated glass slides has been investigated using some important characterization techniques, such as finding transmittance by spectrophotometer and measuring water contact angle using a high resolution camera. Moreover, the self-cleaning effect has been observed using a microbalance to measure dust on coated glass exposed to open atmosphere and compared with uncoated glass. The results revealed that these coatings have increased the water contact angle up to 149% which reduces friction between the glass surface and water droplets. Moreover, the friction reduction helps in mobility of water droplets which in turn can easily carry out dust along with them, thus improving the efficiency of PV module.

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Passive Thermal Management of Lithium Ion Batteries using Metal foam Saturated with Phase Change Material

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Abstract—Li-ion battery pack utilized in the Electric vehicles (EVs) and Hybrid electric vehicles (HEVs) require a very effective thermal management system (TMS), to keep the working temperature of the battery pack in the safe range. In this research, a passive thermal management system (PTMs) is developed by utilizing unique composite (Aluminum foam and paraffin wax) to maintain the operating temperature of highly powered li-ion batteries. Comparison has also been made with three other cooling modes i.e. nickel foam-paraffin, natural air-circulation and phase change material (Paraffin wax). The results signify that the safety requirements of the lithium-ion battery cannot met through natural air circulation as a cooling mode. After using aluminum foam/paraffin composite as medium of cooling, results show a decrease of 32.6% in the temperature comparing with natural air cooling, 5.1% by nickel/paraffin composite as a medium of cooling and 11.8% in comparison to the pure PCM at 2C discharge rates.

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Novel Simplified Blade Hub Line Optimization of High-Pressure Ratio Centrifugal Compressor Design Using Numerical Simulations

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Abstract—The focus of this research is to numerically investigate the effect of blade hub line variation on the performance (Total pressure-ratio and Isentropic-Efficiency) of centrifugal compressor from stall to choke to study the operating range and stall margin. An optimization technique is carried out in which the meridional profile hub line is modified and compared with the high Mach number SRV2 compressor designed and fabricated by DLR (German Aerospace Center). Numerical simulations showed significant increase in the stall margin and operating range by bargaining on pressure ratio and isentropic efficiency. Reynolds Averaged Navier Stokes (RANS) based k-ε model is used to predict turbulence using numerical simulations. The value of Y plus for the structured mesh near the boundaries is kept 35. Blade hub line being the important parameter, has substantial performance improvement of centrifugal compressor. The novel design improved the stall margin by 44 percent while operating range from stall to choke has been upgraded by 7.5 percent.

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Closing Schedule

10th June 2020 (Wednesday)		
02:30-03:00 PM	The Physics Nobel Prize 2019 (Featured Keynote)	Prof. Dr. Asghar Qadir
03:01-03:30 PM	Laser Driven Proton Acceleration: An overview (Keynote)	Prof. Dr. Fida Yunus Khattak
03:31-03:40 PM	Recap and Conference Statistics	Dr. Zahid Halim Conference Secretary
03:41-03:45 PM	Concluding Remarks	Mr. Sardar Amin ullah Khan Pro-Rector (A&F)
03:45-03:51 PM	Message by Turkish Ambassador	H.E. Mr. Ihsan Mustafa Yurdakul
03:51-03:53 PM	Thought sharing by Turkish Speakers	Prof. Dr. Mahmut Boyukata
03:54-03:57 PM	Thought sharing by Turkish Speakers	Prof. Dr. Nihal BUYUKCIZMECI
03:58-04:02 PM	Thought sharing by Turkish Speakers	Dr. Necla Çakmak
04:03-04:06 PM	Thought sharing by Turkish Speakers	Dr. Doğan Aydın
04:07-04:10 PM	Thought sharing by Turkish Speakers	Dr. Bulent Yilmaz
04:10-04:20 PM	Best research papers (Third, Second, and First) announcement	Rector GIK Institute, Conference Patron-In-Chief
04:20-04:30 PM	Vote of Thanks	Rector GIK Institute, Conference Patron-In-Chief