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A Compendium of Research Publications **2024**



The National Institute of Engineering

(An Autonomous Institute under Visvesvaraya Technological University, Belagavi)



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THE NATIONAL INSTITUTE OF ENGINEERING

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2024**

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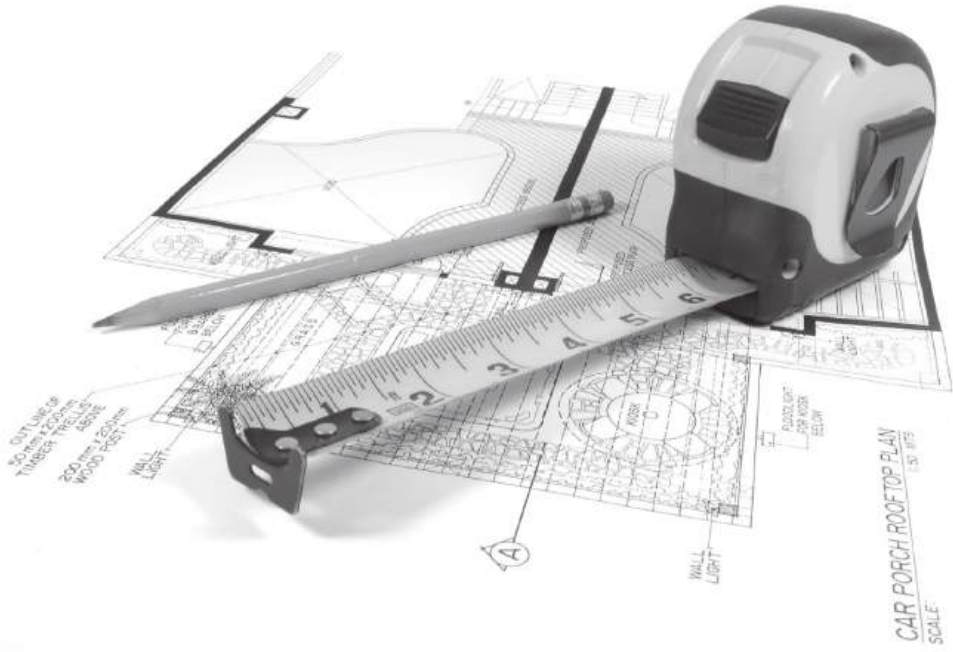
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ARTICLES	CIVIL	MECH	IPE	EEE	ECE	CSE	ISE	MCA	BASIC SCIENCE	LIB/STUDENTS	TOTAL
IC	26	8	1	3	10	2	7	1	5	--	63
NJ	1	--	--	--	2	--	--	--	1	--	4
IJ	19	25	8	8	14	9	3	--	67	--	152
BC	--	--	--	--		--	1	--		--	1
TOTAL	46	33	9	11	26	11	11	01	72	0	220

IC- International Conference, NJ- National Journal, IJ- International Journal,
B - Book Chapter

Department of Civil Engineering





Performance Evaluation of Fire Exposed RC Structure Using Pushover Analysis

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ABSTRACT

A rise in concern is observed to determine capacity of RC Framed structure to resist seismic forces, fire effect, along with gravity loads. The analysis of structure by considering fire effect requires consideration of thermal degradation and material non-linearity. In general, a finite element program is adopted to conduct structural fire analysis. However, application of finite element software is time consuming. Hence, in the present work, post-fire performance of structure to seismic forces is determined using ETAB software. The post-fire properties of structural elements are obtained using Wickström's empirical relationships. In the present work, RC building frame is designed as per Indian standard guidelines using linear static method by adopting gravity load, wind load, and seismic load. Further, the pushover analysis is carried out to RC framed structure by adopting displacement controlled methods until peak roof displacement is reached. Later, RC members are subjected to standard fire using Wickström's empirical relationship to obtain temperature isotherms. Further, 500 °C isotherm is used to obtain reduced cross section of the RC Frame members. Various fire spread scenarios were considered to determine the criticality of fire and seismic effect. It is observed that fire on the ground floor will greatly affect the structural performance of seismic loads.

**Full paper: Lecture Notes in Civil Engineering, vol. 457, pp 455-468, 2024*



Analysis and Design of Steel Skywalk Bridge

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ABSTRACT

Bridge, a Civil Engineering structure, used since ancient times for crossing any obstruction beneath it. From the past decades, bridges are constructed using different kinds of materials starting from wood to structural steel, which is now has become a large field of study at this period of time. Among different types of skywalk bridges fall under the special category, since it has to be specially designed both in architectural and structural point of view and are commonly used in hill stations and rocky areas as an attraction for visitors. Skywalks have the best features of a cantilever and allow to view both sides. In this present work, an innovative steel skywalk bridge is planned to construct by choosing a suitable viewpoint on Chamundi Hills, Mysuru based on the topography, slope, and its stability. Preliminary reconnaissance survey has been carried out. The objective of the present work is to find the framing system to support the cantilever skywalk at one location and also to find the optimum span and dimension of structural members. Skywalk for various cantilever projection is modeled in ETABS, and checked for criticality such as increase in deflection and moments' overall stability. For the three cases, key results such as cantilever deflection, bending moments in beams and axial forces in critical columns and bracings and finally, sway due to earthquake are presented. The case 3 is found to be efficient framing system, since cantilever moment is reduced to 82 kN m, and also side sway.

**Full paper: Lecture Notes in Civil Engineering, vol. 455, pp 105-114, 2024*



Effect of Polypropylene Planar Reinforcement on The Unconsolidated Undrained Behavior of Black Cotton Soil

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ABSTRACT

Black cotton soil is very compressible and cohesive with extremely low bearing capacity. This study's objective is to enhance the shear parameters such as the internal friction angle and cohesion of black cotton soil, thereby enhancing the bearing capacity of the soil. For the present study, soil sampling has been carried out near Kollegal, Karnataka. The coordinates of the site are 12° 08' 21.0" N and 77° 04' 59.0" E. The undisturbed and representative soil samples have been extracted from three different geographical locations at different depths. A detailed experimental study has been carried out to determine the physical, index, and engineering properties. Cohesion and the internal friction angle determined for the soil under consideration were 0.05 N/mm² and 0°, respectively. To increase the internal friction angle of soil, polypropylene planar reinforcements were introduced. Reinforcements were introduced. Unconsolidated undrained (UU) triaxial tests were conducted on planar reinforced soil. Reinforcements were introduced in the soil specimen with one, two, and three individual layers, and results demonstrate that cohesion was increased marginally to 0.057 N/mm², 0.059 N/mm², and 0.061 N/mm², and the internal friction angle was increased to 2.7°, 4.2°, and 6.6°, respectively.

**Full paper: Lecture Notes in Civil Engineering, vol. 478, pp. 117–130, 2024*



**Estimation of Groundwater Potential Zones in Southern Dry Agro-Climatic Area
Using Geoinformatics and AHP Technique**

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ABSTRACT

The world's demand for groundwater has been severely strained by overuse of groundwater and major climatic change over time. As the global need for drinking water for human consumption, agriculture, and industrial applications grows, so does necessity to assess groundwater. Due to the quick access to data, analysis, and knowledge, they give about resource for further improvement, GIS-based studies have grown in importance in groundwater research in recent years. In order to identify the groundwater potential zone of southern dry agro-climatic area of Mysuru and Mandya District, India, the current study has been carried out. A total of 15 theme layers were established and researched to help define groundwater potential zones. Depending on respective attributes and water potential capabilities, Analytic Hierarchy Process determines weights allocated to each class in all thematic layers. Utilizing data on groundwater prospects in area (CGWB), study's output was cross-validated, and total accuracy of methodology was 80.4%. The resulting groundwater potential zone was divided into three classifications: high, moderate, and low. According to the research, a moderate groundwater potential zone encompasses 65.8% of study area. There are zones with low and high groundwater potential in 6.75% and 27.43% of the area, respectively. The R^2 value of 0.8 further demonstrates that estimated groundwater potential index and groundwater level values in recommended AHP model are quite reliable in predicting the outcome. The demarcation of groundwater potential zones has been highlighted as a critical step towards achieving Sustainable Development Goals (SDG 6 and 13), contributing to the implementation of sustainable water and land management

**Full paper: Lecture Notes in Civil Engineering, vol. 450, pp. 185–200, 2024*



Seismic Soil-PILE-Structure Interaction Studies on High-Rise RC Framed Structure Resting on Pile Groups

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ABSTRACT

Infrastructure will play a vital role in the growth of developing nations like India. Pile foundations in soft soil deposits have increased significantly as a result of the scarcity of land and the need for high-rise structures. Soil-structure interaction is often omitted in conventional design practices considering the base as fixed, which can lead to an underestimation of forces and displacement throughout the system. This study aims to investigate the influence of the length of the pile to diameter ratio (L/d) and embedded length to length of pile ratio (L_b/L) incorporating soil-structure interaction (SSI) using a numerical tool SAP2000. The seismic analysis of a 25-storey high-rise building has been performed using response spectrum analysis for zone V as per IS 1893: 2016 to assess the seismic response of superstructure consisting of lateral displacement, inter-storey drift, base shear, and column moment. A parametric study has been carried out for different L/d and (L_b/L) ratios such as 30, 24, 20, and 0.042, 0.083, 0.125, and 0.167. The numerical results show that the pile foundation with less L/d and L_b/L ratio offers the least lateral deformation, inter-storey drift, base shear, and column moment.

**Full paper: Lecture Notes in Civil Engineering, vol. 476, pp. 13–27, 2024*



Assessment of Soil Loss in Wet Tropical Region: A Case Study in Kumaradhara Basin, Western Ghats, India

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ABSTRACT

Degradation of land resources and soil erosion are major issues affecting the productivity of the land. To design appropriate regional land management approaches using field data, an evaluation is a requirement to ascertain the extent and severity of soil degradation. Western Ghats of India is one of 34 global biodiversity hotspots, and habitat degradation has been causing havoc in this area for decades. The Kumaradhara River is a dominant part of wet tropical forested land on the Western side of the Western Ghats. The Hongadahalla and Kadumanehalla Rivers are tributaries of the Kumaradhara River. Mookanamane, Bidahalli, and Marenahalli are sub-catchments covering parts of the rivers Hongadahalla, and Kadumanehalla, having catchment areas of 41 km², 33 km², and 64 km², respectively. The primary goal of the current study is to use the Revised Universal Soil Loss Equation (RUSLE) and Geographical Information Systems (GIS) to estimate annual erosion rates and develop a soil loss map for the year 2021 for the mountainous watershed of Kumaradhara. The geo-environmental data were collected from Indian Meteorological Department, Earth Explorer, and the National Bureau of Soil Survey and Land Use Planning. The impacts of rainfall erosivity, soil erodability, slope length and steepness, cover management, and conservation practice variables on mean annual soil loss in the study were calculated using GIS data layers. The quantitative results and analysis of soil erosion estimated by the RUSLE model ranged from 29.56 to 7992.89 t ha⁻¹ year⁻¹ in Mookanamane, 25.6 to 20,494.12 t ha⁻¹ year⁻¹ in Marenahalli, and 21.6 to 15,265.25 t ha⁻¹ year⁻¹ in Bidahalli. It has been observed that the risk of soil erosion in forests is low in the study area, whereas the risk of soil erosion on barren land is moderate. The study results shall create terrain management and planning strategies in environmentally sensitive mountainous areas.

**Full paper: Advances in Science, Technology and Innovation, pp. 849–852, 2024*



An Experimental Study on The Structural Performance of Full Scale RC Beams Strengthened for Shear Using NSM GFRP Strips

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ABSTRACT

Degradation of land resources and soil erosion are major issues affecting the productivity of the land. To design appropriate regional land management approaches using field data, an evaluation is a requirement to ascertain the extent and severity of soil degradation. Western Ghats of India is one of 34 global biodiversity hotspots, and habitat degradation has been causing havoc in this area for decades. The Kumaradhara River is a dominant part of wet tropical forested land on the Western side of the Western Ghats. The Hongadahalla and Kadumanehalla Rivers are tributaries of the Kumaradhara River. Mookanamane, Bidahalli, and Marenahalli are sub-catchments covering parts of the rivers Hongadahalla, and Kadumanehalla, having catchment areas of 41 km², 33 km², and 64 km², respectively. The primary goal of the current study is to use the Revised Universal Soil Loss Equation (RUSLE) and Geographical Information Systems (GIS) to estimate annual erosion rates and develop a soil loss map for the year 2021 for the mountainous watershed of Kumaradhara. The geo-environmental data were collected from Indian Meteorological Department, Earth Explorer, and the National Bureau of Soil Survey and Land Use Planning. The impacts of rainfall erosivity, soil erodability, slope length and steepness, cover management, and conservation practice variables on mean annual soil loss in the study were calculated using GIS data layers. The quantitative results and analysis of soil erosion estimated by the RUSLE model ranged from 29.56 to 7992.89 t ha⁻¹ year⁻¹ in Mookanamane, 25.6 to 20,494.12 t ha⁻¹ year⁻¹ in Marenahalli, and 21.6 to 15,265.25 t ha⁻¹ year⁻¹ in Bidahalli. It has been observed that the risk of soil erosion in forests is low in the study area, whereas the risk of soil erosion on barren land is moderate. The study results shall create terrain management and planning strategies in environmentally sensitive mountainous areas.

**Full paper:* Lecture Notes in Civil Engineering, vol. 455, pp. 489–498, 2024



Urban Dynamics and Impact Assessment of Bengaluru “Mysuru Expressway Corridor

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ABSTRACT

The focus on the provision of basic amenities and infrastructure has been a major issue in urban planning because of urban growth and sprawl. It is one of the reasons that adversely contributes to the loss of natural resources and encourages unbalanced and uneven urbanization in developing nations like India. The government and planning authorities are increasingly considering regional development to accommodate the incursion of people into downtown urban areas therefore encouraging comprehensive, sustainable development. By a methodological approach and the use of multi-temporal satellite data, this study aims to explain the urban growth along the Bangalore–Mysuru motorway as influenced by the transportation corridor. The objective of the transport corridor development is to increase the efficiency of the corridor's transportation and logistics systems and to spur regional economic growth by taking advantage of better connectivity and transportation infrastructure. A transport corridor can help the region along the corridor achieve more sustainable and spatially balanced economic growth. To analyse the existing development pattern and provide a framework for predicting how land will be used in the future, land use mapping and related data are developed. Later for the analysis, a cellular automata-based model derives the name from the input layers utilized, namely Slope Land use Excluded Urban Transport Hillshade (SLEUTH) was performed to meticulously examine subdivision-level specifics of the area affected by the corridor. The results of this study will aid policymakers and planners in making choices about upcoming urban trends that support a more secure, healthy, efficient, sustainable, and livable urban ecosystem

**Full paper: Lecture Notes in Civil Engineering, vol. 450, pp. 519–533, 2024*



Effect of Bracings on the Performance of High-Rise Structure Considering the Influence of Earthquake

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ABSTRACT

India is divided into four seismic zones and about 60% of the land area is under Zones III, IV and V. Severe earthquakes being destructive can cause significant structural damage or even collapse. The structure with RC wall protects them from lateral loads. RC walls can be used in structures to prevent excessive displacement and, also damage caused by displacement. Among the damaged structures during an earthquake, there were some structures with RC walls. In order to investigate the behaviour of RC walls in high-rise structure with and without bracings and its influence on the earthquake response of the high-rise structure, a numerical model of G + 32 structure was stimulated using a numerical tool ETABS 2019. The results in terms of displacement, storey stiffness, storey drift and torsional irregularity were presented and compared for Zone-II and Zone-V. The study broadly reveals that the seismic response of the structure is predominant and RC wall with bracing is more significant for destructive earthquakes.

**Full paper: Lecture Notes in Civil Engineering, vol. 485, pp. 321–336, 2024*



Determination of Characteristic Water Contents of Fibre-Reinforced Expansive Soils A Fundamental Approach

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ABSTRACT

Conventionally, liquid, plastic, and shrinkage limits are considered as plasticity characteristics of natural fine-grained soils. Different approaches to estimating liquid limits itself demonstrate that the concept of a liquid limit and the mechanism governing it are not the same Sridharan and Prakash (Proc Inst Civ Eng Geotech Eng 143:235–240, 2000 [1]). In the present experimental study, five natural fine-grained expansive soils having liquid limit range (50–100%) were used. The three characteristic water contents, i.e. it was feasible to calculate the free swell limit (W_{FS}), setting limit (W_{SL}), and shrinkage limit for plain and fibre-reinforced expansive soils for different percentages by adjusting the initial water content. There are relationships between starting and final water contents as well as sediment volume and liquid limit. The experimental study's measurement of the equilibrium sediment volume shows good agreement with the established procedure for determining liquid limits. Using linear regression analysis, correlations were developed between index properties, plasticity characteristics with the compaction characteristics for varying water contents along the compaction curve for different energy levels.

**Full paper: Lecture Notes in Civil Engineering, vol. 476, pp. 41–52, 2024*



Evaluation of Surface Soil Moisture Using Remote Sensing and Field Studies

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ABSTRACT

Soil moisture (SM) is an important quantity to examine in terms of agriculture, meteorology, and hydrology to understand the evaporation cycle and drought mechanisms. This study aims to estimate surface soil moisture in arid areas using Sentinel-1A SAR data. In order to collect soil samples from sampling grids that are synchronized with Sentinel-1A passes, study area is divided into 80 grids, each measuring 10 m by 10 m. Six SAR images were collected from Copernicus Open Access Hub website. The vegetation index (NDVI) was calculated using a Sentinel-2A image. The SNAP software was used to process the SAR images, and R studio was used to extract NDVI values and backscattered energy of each sample grid. In this study, an empirical equation was developed to model surface soil moisture using the dielectric constant and backscattering coefficients. The performance of the model was assessed using statistical indicators such as the coefficient of correlation, Nash–Sutcliffe efficiency, and root mean square error, which yielded results of 0.85, 1.46, and 0.75, respectively.

**Full paper: Lecture Notes in Civil Engineering, vol. 450, pp. 215–229, 2024*



Studies on Flexural and Shear Bond Strength of Masonry Using Cementitious Grouting Materials as Mortar

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ABSTRACT

This paper presents an experimental investigation of the flexural and shear bond strength of the masonry prism. The masonry prisms were constructed in triplet prisms for the shear bond strength test and five levels of stack-bonded prisms for the flexural bond strength test. The bond characteristics of masonry depend on the mortar type and the surface texture of the masonry unit used. To increase the flexural and shear bond strength present work is carried out by using cement concrete bricks as masonry units and grouting materials as thin layered mortar. Most of the work is done on the conventional mortar of 10–12 mm thick however 1–5 mm thick masonry bond is not yet well researched, hence 5 mm thick mortar joint is used for both flexural and shear bond strength for 3, 7 and 28 days and is compared with conventional cement mortar of 1:3 ratio of 10 mm thickness. Reduction in the thickness of mortar joints helps in a faster rate of construction. The results reveal higher bond strength for cementitious grouting material as mortar.

**Full paper: Lecture Notes in Civil Engineering, vol. 455, pp. 479–487, 2024*



Study on Compression Strength of Masonry Prism Using Cementitious Grouting Material as Mortar

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ABSTRACT

Masonry constitutes masonry units and mortar. Masonry carries predominantly compressive forces and the compression strength of a prism mainly depends on the strength of the masonry units and it is less sensitive to the strength of the mortar. Literature reveals that the compression strength increases with an increase in bond strength. So an attempt is made to study the effect of an increase in the strength of mortar and bond strength by using commercially available cementitious grouting material as mortar in order to achieve the requirement. Five brick height masonry prisms corresponding to the height-to-thickness ratio (h/t) of 3.95 is used to ascertain the compressive strength at 3, 7, and 28 days. The mortar joint thickness was limited to 5 mm with grouting material as mortar, with the intention of faster construction. The compression test results are compared with the conventional mortar of 1:3. The results such as compressive load and strain were ascertained in the saturated condition. Masonry prism with conventional mortar showed more brittle failure than grouting material as mortar.

**Full paper: Lecture Notes in Civil Engineering, vol. 455, pp. 469–477, 2024*



**Evaluation and Prediction of Land Use and Land Cover Changes in The
Kumaradhara Basin, Western Ghats, India**

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ABSTRACT

Land use land cover (LULC) is considered as the most significant and obvious indicator of changes in ecosystems. An understanding of current and potential future development opportunities is provided through analysis on the spatiotemporal shifting patterns of LULC and simulation of future scenarios. Kumaradhara river flows in the Western Ghats in southern peninsular, India. It is the major tributary of the Netravathi river, and the catchment has numerous perennial streams and is dominated by dense evergreen forests with high conservation value. In the present study, an integrated approach of remote sensing and geospatial techniques is used to assess LULC changes for the period of 2010–2020, and prediction of future LULC change was carried out by ANN model using MOLUSCE plugin of QGIS for the year 2025. The results have shown that the build-up land has increased considerably, and forest has decreased which is evident from the increase in cultivated land. The predicted LULC showed an increase in built-up land and a significant transformation of barren land. The results of this study indicate significant changes in the LULC pattern.

Full paper: Lecture Notes in Civil Engineering, vol. 450, pp. 201–214, 2024



**Pull-Out And Rupture Behavior Of Geogrid Reinforcements In MSE Wall
Subjected To Seismic Conditions**

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ABSTRACT

Mechanically Stabilized Earth (MSE) walls are an alternative engineering structure to traditional reinforced concrete retaining walls with significant and adaptable height at a lower cost. The main objective of this study is to perform a detailed numerical analysis of the MSE wall for the effect of parameters such as reinforced soil, the vertical spacing between reinforcements, the tensile strength of reinforcement, surcharge magnitude, and wall height on the internal stability of MSE wall under the static and seismic loading conditions. The analysis has been carried out using the Geo-5 numerical tool to obtain the Factor of Safety (FS) against internal stability checks. Variations of FS against rupture and pull-out for reinforced blocks are compared for various parameters considered in this study. From the detailed parametric analysis for the internal stability of the MSE wall, it has been found that the rupture and pull-out resistance is higher for minimum vertical spacing. FS reduces as surcharge magnitudes increase. The pull-out resistance is substantially larger than the rupture resistance for higher wall heights. In clayey soil, the rupture is larger at the top layer than at the lower layers for a given wall elevation, yet pull-out is greater at the lower levels than at the top layers.

Full paper: Lecture Notes in Civil Engineering, vol. 364, pp. 231–249, 2024



Seismic Response Analysis of High-Rise Building Considering the Effect of Soil-Structure Interaction

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ABSTRACT

Due to the increased urbanization and land scarcity, the demand for the construction of high-rise structures has been developed in areas with less than ideal geotechnical requirements in earthquake-prone regions. The traditional approach of seismic analysis of structures assumes that the structure is fixed at its base, omitting the effect of soil-structure interaction. Therefore, the current research intends to investigate the impact of soil-structure interaction on high-rise structures considering two different types of foundations rested on soft soil using a numerical tool SAP2000. The seismic analysis of a 25-storey building has been performed using the time history method under four real earthquake records including Bhuj, Northridge, Chi-Chi Taiwan, and the Kobe earthquakes, respectively. The results for the structure resting on the raft and pile foundation are compared and evaluated in terms of maximum displacement, inter-storey drift, column moments, and base shear. The findings of the research inferred that the seismic response with regard to the variation of maximum displacement of the structure supported on raft foundation under the impact of Northridge earthquake is increased by 67.5% compared with the structure supported on pile foundation. When SSI was taken into account, the inter-storey drift values surpassed the maximum permitted values of 0.4 percent under Northridge, Chi-Chi, and Kobe earthquakes. The maximum base shear forces of the structure under the impact of 2001 Bhuj earthquake sustained by the pile foundation significantly increased by 71% when compared with the base shear of the raft foundation.

Full paper: Lecture Notes in Civil Engineering, vol. 485, pp 279–295, 2024



Assessment of Periphery Free-Standing Masonry Wall For Structural Safety And Integrity

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ABSTRACT

All around the world, free-standing stone walls are extremely common. They are widely used as private land, household gardens, and industrial and commercial premises barriers. Free-standing walls are built between pilasters, which are rectangular projectile columns made of masonry blocks that offer extra support to the filling wall and base. The pilaster is built at predetermined intervals throughout the wall's length and cantilevered up from the foundation. Masonry units that stretch horizontally between pilasters are known as fillers. Free-standing walls are generally subject to lateral loads such as wind loads, ground pressure, and so on. This research studies the prevalence of several forms of cracks in free-standing masonry walls, which are caused by vegetation growth, differential settling, and other factors that cause the failure of the compound wall. Every filler wall between the pilasters is measured and surveyed to determine its deflection and height from the foundation. More deflection is observed along the length of the free-standing wall in the mid-region between the pilasters, and we may compare the deflection by imagining the free-standing masonry wall with the pilaster using survey data. According to the findings of this study, the brick wall is deflected due to vegetation growth and foundation sinking, and weathering action leads the wall to expand and compress, creating fractures.

Full paper: Lecture Notes in Civil Engineering, vol. 455, pp. 95–103, 2024



Response Spectrum Analysis of High-Rise Reinforced Concrete Framed Structure Resting on Raft And Pile Foundation System

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ABSTRACT

Experiences from past earthquake witnessed spectacular collapse of high-rise reinforced concrete buildings in an over populated area with closely spaced structures. The present study investigates the effect of foundation types on seismic behavior of high-rise structures embedded in soft soil deposits using a numerical tool SAP2000. Firstly, the seismic analysis of the 25-storey reinforced concrete (RC) moment-resisting structure performed using response spectrum analysis as per IS 1893: 2016. Then, the seismic response of the superstructure is expressed in terms of maximum displacement, inter-storey drift (ISD), column moments, and base shear for the structure supported by raft and pile foundation are discussed and compared. This numerical study demonstrated that the type of foundation has a substantial effect on the seismic behavior of high-rise reinforced concrete structures considering soil-structure interaction.

**Full paper: Lecture Notes in Civil Engineering, vol. 485, pp 297–308, 2024*



Studies on the Behavior of Steel Fibre-Reinforced Concrete (SFRC) Under Monotonic Loading in Flexure: A Systematic and Simplified Finite Element Model for Assessing the Structural Performance

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ABSTRACT

The conduction of laboratory experiments on concrete is very costlier and time-consuming. Hence numerical simulation technique like Finite Element Analysis (FEA) which is used in industries and research centers to analyze the behavior of various structural components has made it possible to model and simulate the complex behavior of reinforced concrete elements. This paper presents a nonlinear Finite Element Analysis (FEA) carried out to simulate the load-deflection behavior of Control Concrete (CC) beam and Steel Fiber-Reinforced Concrete (SFRC) beams under monotonic loading in flexure. The objective of this study is to investigate and validate the load-deflection characteristics of M20 grade CC and SFRC beams with hooked-end steel fibers of aspect ratio 50 ($a/d = 50$) with steel fibre dosages of 1.0, 1.25, 1.5, and 1.75% of total volume of concrete. FE studies were carried out on both CC beam and SFRC beam which were analyzed using FEM software package ANSYS Mechanical APDL 2022 R2. From the FE analyses, load-deflection responses and crack patterns were obtained and validated with the referred experimental results. The load-deflection responses obtained from the FE studies showed good correlations with the experimental plots. Hence, modeling of SFRC beams can be adoptable in ANSYS and the proposed FE models were found to be reliable for analyzing the flexural behavior of SFRC member subjected to monotonic loading.

**Full paper: Recent Advances in Structural Engineering, vol. 455, pp 115 – 126, 2024*



FEM Modelling of Stabilization of Flexible Pavements with RBI Grade-81

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ABSTRACT

Due to the non-availability of coarse-grained soils in large quantities, it is imperative nowadays to use fine-grained soils for embankment-related work. The presence of clay minerals in fine-grained soils makes its behaviour more complex. Five expansive soils having different clay mineralogy were selected based on physical and index properties. RBI Grade-81 admixture is blended in different percentages of weight with the soils. The blended soils were kept for a maturation period for equilibration. Compaction tests were conducted (SP, RSP, MP and RMP) on the blended soils. The compaction characteristics of these soils that are maximum dry density (MDD) and optimum moisture content (OMC) were determined for various compaction energies, including standard Proctor (SP), modified Proctor (MP), reduced standard Proctor (RSP), and reduced modified Proctor (RMP). The soil compacted to different energy levels with reference to MDD and OMC was kept for the soaked condition. The CBR tests were conducted on the soaked soils. In the current experimental study, the compaction characteristics and CBR were linked with the index properties of soils. Regardless of the soils' clay mineralogy, the plastic limit can be better connected with compaction characteristics than the liquid limit. Reduction in thickness of pavement ranging from onefold to fourfolds was observed, for the compacted subgrade soils having different clay mineralogy blended with admixture, which saves associated time and cost. FEM modelling was carried out for different dynamic loading conditions with particular reference to material composition to compare the results of the experimental study.

**Full paper: Proceedings of the Indian Geotechnical Conference, vol. 3, pp. 213-225, 2024*



Hydraulic Conductivity of Compacted Fine-Grained Soils and Its Significance in Hydraulic Structures

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ABSTRACT

The permeability behavior of compacted fine-grained soils is of great practical importance. The permeability behavior of compacted kaolinitic soils and montmorillonite soils has been carried out for the present experimental study, for the IS light and heavy compaction energy levels. One-dimensional consolidation experiment has been carried out corresponding to $0.95\rho_{dmax}$ on dry side of optimum, optimum, and $0.95\rho_{dmax}$ wet of optimum moisture content, for the pressure ranging from 6.25 to 1600 kPa, and the consolidation parameters like C_v and m_v were compared for different energy levels and liquid limit. The soils compacted on dry side of optimum are exhibiting higher values of K than wet of optimum condition. Due to the influence of fabric on consolidation process, kaolinitic soils are having higher K than that of montmorillonitic soils, irrespective of the clay mineralogical composition. IS heavy compaction energy level gives lower value of K than light compaction energy level. The magnitude of computed K from the conventional equation is always lesser than the experimental one, and also, it was influenced by the clay mineralogical composition, for both low and high liquid limit soils.

**Full paper: Proceedings of the Indian Geotechnical Conference, pp. 241-253, 2024*



Mitigation of Micro and Macro-Landslides A Case Study

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ABSTRACT

Mass wasting or landslide under the influence of human activities is increasing very rapidly causing serious concern. Landslides not only impact catastrophic destruction of human life and property to the greatest extent leading to an increase in carbon footprint. Macro and Micro-landslides were frequently occurring in Kodagu district, Karnataka, India. In the present experimental study, undisturbed representative samples were collected from the six strategic landslide's locations (micro and macro). In situ and laboratory tests were conducted as per BIS specifications to determine in situ density, index properties, permeability, and shear parameters for different drainage soil samples for failure modes. Landslide failures at different sites were compared through the results obtained from numerical modelling. The analysis provides useful solutions to the causes of failure and preventive maintenance to be established in order to limit micro and macro-landslides to a minimum state thereby contributing to the societal requirements.

**Full paper: Proceedings of the Indian Geotechnical Conference, vol. 6, pp 153-165, 2024*



Parametric, Seismic and Static External Stability Analysis of Mechanically Stabilized Earth Retaining Wall

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ABSTRACT

Mechanically Stabilized Earth (MSE) walls are an alternative engineering structure to traditional reinforced-concrete retaining walls with significant and adaptable height at a lower cost. The main objective of this study is to perform a detailed numerical analysis of the MSE wall considering the effect of parameters such as reinforced soil, the vertical spacing between reinforcements, the tensile strength of reinforcement, surcharge magnitude, and wall height on the external stability of MSE wall under the static and seismic loading conditions. The analysis has been carried out using the Geo5 numerical tool to obtain the Factor of Safety (FS) against external stability checks. Variations of FS against overturning and sliding for wall-facing and reinforced blocks are compared for various parameters considered in this study. Also, Global Safety Factor (GSF) is analyzed using limit equilibrium methods. From the detailed parametric analysis for external stability of the MSE wall, it has been found that the GFS and the FS against overturning and sliding for wall facing are higher for minimum vertical spacing and greater reinforcement tensile strength. The increased surcharge magnitudes and wall heights reduce the FS. Reinforced soil with well-graded gravel has a significant effect on FS than clayey soil and poorly-graded sand.

**Full paper: Proceedings of the Indian Geotechnical Conference, vol. 7, pp 3-15, 2024*



Numerical Simulation of Triaxial Test to Study the Effect of Reinforcement in Enhancing the Shear Behavior of Black Cotton Soil

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ABSTRACT

Black cotton soil is a problematic soil in the field of construction due to its poor shear behavior. The main objective of this study is to analyze the shear parameters of reinforced black cotton soil numerically using SIGMA/W in the Geo Studio tool. The study has been carried out to investigate the shear parameters of considered soil for different layers of reinforcement. The necessary boundary conditions have been applied for the numerical model. The numerical analysis has been performed considering various stresses and forces such as deviatoric stress, vertical stress, confining stress, and backpressure. The result in terms of effective stress, major principal stress, minor principal stress, total stress, and pore water pressure is obtained. The results obtained from numerical simulation are compared with those of the experimental studies of black cotton soil. This study shows that the results are within the marginal limits.

**Full paper: Proceedings of the Indian Geotechnical Conference , vol. 10, pp 29-39, 2024*



Stabilization of Expansive Soils Using Industrial Wastes

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ABSTRACT

India is a vast country with several types of soil among which expansive soils constitute over an area of 546,000 km². Expansive soils consist of various clay minerals which enhance swelling and shrinkage characteristics that need to be treated with stabilizers to prepare it for constructional activities without causing any distress to structures founded on them in reality. Generation of industrial wastes produced by industries nowadays is increasing enormously and causing potential threat to the environment. In the present experimental study, natural expansive soils were procured from different locations in Karnataka having liquid limit range from 45 to 75%. A detailed study of index properties and compaction characteristics for IS light and heavy compaction of plain soils and soils replaced by design mix proportion of steel dust and sugarcane bagasse ash has been carried out. Correlations were established between the compaction, swelling, and shear strength characteristics with index properties using MLRA (multiple linear regression analysis). The MDD and UCS of blended soils were found to be higher than the plain soils, thereby achieving the design economics.

**Full paper: Proceedings of the Indian Geotechnical Conference, vol. 3, pp 187-199, 2024*



Swelling and Compaction Characteristics of Fibre-Reinforced Expansive Soils

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ABSTRACT

The foundations which were placed on problematic soils like expansive soils are causing the swell-shrink behaviour due to moisture changes and the structures built upon these soils are experiencing failures. There are multiple specified foundation approaches to address the swell-shrink issues brought on by these soils. The current study deals with the volumetric changes of natural fine-grained soils having varying liquid limits ($W_L = 58, 66, 74, \text{ and } 85\%$) blended with Recron 3s fibre (0.5, 1, 1.5, 2, 2.5, and 3%). Swelling potential (S_p) is compared with index properties (plasticity index and shrinkage index) with variation in fibre percentage. Swell pressure (S_w) tests were conducted by the constant volume method for the optimum fibre content having different compaction energy levels (IS light and heavy compaction). For soils having a liquid limit range of 58–66%, the S_i decreases and then has an increasing tendency. S_w was not affected to a greater magnitude by the inclusion of optimum fibre content, for varying energy levels compacted at OMC and MDD. Irrespective of the energy levels, an increase in the liquid limit of the soils causes an increase in the optimum fibre content (compacted at the maximum magnitude of MDD).

**Full paper: Proceedings of the Indian Geotechnical Conference, vol. 1, pp 65-80, 2024*



Retrieving Surface And Rootzone Soil Moisture Using Microwave Remote Sensing

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ABSTRACT

Soil moisture is one of the least monitored of all the hydrologic variables. It is greatly influenced by unpredictable and intermittent precipitation, varying evapotranspiration rates, heterogeneous soils, land cover, topography, and is extremely changeable in both space and time. The aim of this study is to retrieve surface and rootzone soil moisture in fallow land at a field scale using Sentinel-1A SAR data. The study explores the potential of obtaining surface soil moisture over fallow land at two different soil types from C-band SAR data. The study area consists of two plots having different soil types. The study area was divided into 80 grids, each measuring 10×10 m, to collect soil samples which are synchronized with Sentinel-1A passes. The soil moisture which are retrieved from plot 1 were used to develop the model. The developed model was validated in plot 2. In order to study the impact of soil moisture and dielectric constant on backscattering coefficients, a multiple regression analysis was used to create a semi-empirical model. Rootzone soil moisture retrieval model was developed by considering the backscattered coefficient, volumetric surface soil moisture as an independent variable and volumetric rootzone soil moisture as dependent variable. The predicted surface soil moisture using the regression model were identical to in-situ observed surface soil moisture, with R^2 of 0.77, RMSE of $1.31 \text{ m}^3/\text{m}^3$, and NSE of 0.75. The estimated rootzone soil moisture matches the in-situ observed rootzone soil moisture identically with $R^2 = 0.74$, RMSE = $1.23 \text{ m}^3/\text{m}^3$, NSE = 0.73. This study aids local farmers in their irrigation water management.

**Full paper: Journal of the Indian Society of Remote Sensing, vol. 52, no. 7, pp. 1415–1430, 2024*



Influence of Recron 3S Fibres on Consolidation Behaviour of Expansive Black Soils

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ABSTRACT

The soils that make up approximately 1/5th of the Indian sub-continent are expansive soils, which are the most difficult to work with. These soils swell and shrink, causing problems in the foundation structures. These problems can be resolved by several modification techniques. The present experimental study is to reduce foundation failures by reinforcing the fibres to the expansive soils. Two soils having extreme liquid limits of 58% and 85% in the range were selected and reinforced with Recron 3S fibres. The 1-D consolidation test was conducted for different energy levels with seating pressure of 6.25 kPa to 1600 kPa, which were compacted at MDD and OMC for both natural and reinforced soils. The findings of CV were estimated for various pressure ranges of plain and fibre-reinforced soils. The magnitude of CV increased with the addition of fibres and with an increase in pressure when compared with plain soils. The increase in Cv value for the fibre Blended expansive soils induces a significant change in the magnitude of elastic and plastic settlement of soils (the time rate of the settlement gets reduced), thereby achieving economy in terms of time and controlled engineering behavior

**Full paper: Civil Engineering and Architecture, vol. 12, no. 2, pp. 943-962, 2024*



Compression Curves and Compression Indices of Compacted Montmorillonitic and Kaolinitic Soils

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ABSTRACT

The engineering behaviour of fine-grained soils is a dominant function of their clay mineralogical composition. Based on their dominant clay mineralogical composition, the natural fine-grained soils may be grouped as montmorillonitic soils, kaolinitic soils and montmorillonitic-kaolinitic soils. This article presents the e -log σ' behaviour and compression indices of compacted montmorillonitic and kaolinitic soils at salient points along their compaction curves. It is shown that in spite of having almost the same liquid limit and or plastic limit, compacted montmorillonitic and kaolinitic soils exhibit vastly different e -log σ' behaviour and compression indices, irrespective of the placement conditions. It is illustrated that the compacted montmorillonitic soils exhibit higher compression indices than the compacted kaolinitic soils under any placement condition. The results from the present study are hoped to have practical values while selecting the type of soil and or placement conditions for better performance of geotechnical structures where compaction is preferred to be adopted.

**Full paper: Geotechnical and Geological Engineering, vol. 42, no. 1, pp. 755–765, 2024*



Examining the Effects of Vented Dams on Land Use and Land Cover in the Shambhavi Catchment: A Multitemporal Sentinel Imagery Analysis

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ABSTRACT

The rapid expansion of the global economy has given rise to concerning ecological consequences, notably a dramatic increase in land cover change (LCC). This section presents how to use the Google Earth Engine (GEE) cloud platform to explore the administrative divisions of the Southern Indian Dakshina Kannada (DK) district, which were chosen for their LCC susceptibility. Leveraging GEE, we generated a time series dataset tracking LCC over a 4-year period (2019–22). Our findings demonstrate an impressive overall accuracy (OA) of 96.30% for 2019 and 95.47% for 2022. A significant revelation in our study is the 13.64% reduction in forested areas, accompanied by a 0.68% increase in urban development within the district. This research attempt offers vital insights into the impact of dam construction on LCC, aiding informed decisions on water resource management. This research promotes a sustainable and ecologically conscious approach to holistic development in the study region and beyond.

**Full paper: Developments in Environmental Science, vol. 16, pp 431-454, 2024*



Thermal Performance of Residential Buildings at Different Locations

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ABSTRACT

The thermal dynamic thermal properties of the building envelop is an important parameter in thermal comfort studies. The present experimental study investigates the thermal performance parameters of the wall envelopes for the residential buildings at from different locations. The study involves actual field measurements of the buildings inside & outside wall surface temperatures. Time lag (TL) and Decrement factor (DF) are the major parameters that are being evaluated for building wall envelopes. The K-type thermocouple (as temperature sensor), integrated with microcontroller (Arduino) is used for acquiring data of measured temperatures from the building envelope. In addition to the temperature sensors, a Micro SD card adapter module (to store the surface temperature data) and a DS3231 RTC module (for date and timekeeping) have been used. As a result, the integrated device forms a low-cost data acquisition system (DAQ). The data is post processed for obtaining the time lag and decrement factor. The result shows that the time lag varies between 4.36 and 6.5 h and the decrement factor lies in the range of 0.213–1.750. These results help in understanding the thermal behavior of the building envelope in residential buildings.

**Full paper: Technologies for Sustainable Buildings and Infrastructure, vol. 528, pp 947–958, 2024*



Two-Dimensional Finite Element Modeling of Underground Tunnel and its Effects on Settlement of Adjacent Structures

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ABSTRACT

Due to rapid increase of the population in the urban areas, it is being inevitable to introduce metro rail network. These metro rail networks are constructed by tunneling in subsurface region due to the scarcity of surface land. In the presence of soft soil deposits many structures will be constructed over the deep foundations. There will be adverse effect on the adjacent structures and its foundations due to vibration developed during the boring of tunnels. Latitudinal and vertical shifts are very likely to result from excavation activities in soft soils. Hence, it is necessary to study the effect of tunneling on the adjacent structures in order to determine the settlement of surface and subsurface soil. The main objective of the study is to investigate the total settlement of surface and subsurface soil and its impact on the existing structures due to the excavation of tunnel. Analysis of vertical and lateral movement of soft soil due to excavation of tunnel is carried out by finite element modeling (FEM) using PLAXIS 2D. The results highlight the risks associated due to tunneling and its effects on the substructures of the adjacent buildings.

**Full paper: Technologies for Sustainable Transportation Infrastructures, vol. 529, pp 607-616, 2024*



Wind Analysis of Tall-Reinforced Concrete Chimney Considering the Effect of Soil Structure Interaction

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ABSTRACT

The dynamic interactions between tall chimney, underlying foundation, and the elastic soil beneath are the focus of this paper's thorough assessment. This collaboration, known as soil-structure interaction (SSI), is based on the interactions between the features of the chimney and the soil. For tall-reinforced concrete chimneys subjected to wind loads, soil-structure interaction (SSI) analysis is being carried considering the Raft foundation. Based on various material characteristics, three types of soil are taken into consideration in order to comprehend the significance of SSI. Chimneys of different elevations are selected for the parametric study. The raft thickness is being varied. Wind analysis is carried out in accordance with IS: 4998:2015, and the wind speed taken into account during the analysis is 55 m/s. The along-wind force and across-wind force is being calculated in the study. Three-dimensional finite element tool ABAQUS is used for the analysis based on the direct method of SSI. The lateral deflection and base moment of the tall chimney are evaluated through SSI analysis and compared with the response obtained from chimney with fixed base. Base moment decreases significantly with effect of SSI. Performance of chimney considerably depends upon the material characteristics of chimney, foundation and soil. When we considered the effect of SSI as height increases lateral deflection also increases due to flexibility of soil compared to fixed condition.

**Full paper: Technologies for Sustainable Transportation Infrastructures, vol 529, pp 629-641, 2024*



Analytical Study of Low-Speed Open Circuit Wind Tunnel Using Ansys Fluent

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ABSTRACT

Wind is an omnipresent natural element with which the structures must be in harmony during normal winds and also gusts. Civil engineering structures are stationary with respect to the ground. However, they are moving bodies with respect to the air. Thus, it becomes imperative for civil engineers to obtain wind pressure acting on a structure at various points of interest which has to be incorporated in the structural design. For simple geometry, one could infer the values offered in the respective national standards. However, for complex geometry one must resort to obtaining the values using open/closed circuit low speed wind tunnels. This study presents the dimensioning principles involved in an open circuit low speed wind tunnel and the bluff body to be introduced, various possible configurations of an open circuit low speed wind tunnel based on parametric study and an analysis performed using Ansys®–Fluent for a bluff body introduced in the wind tunnel. Ansys®–Fluent allows the user to realize the potential of obtaining results on a scale model even before physical model testing, thus, saving time and cost involved in physical testing of models. Obtaining precise results and using them in design will economize the structure and render sustainability. Static and dynamic pressure acting on the bluff body and the velocity of wind at various points of interest along the length of the wind tunnel are the findings of this analytical study.

**Full paper: Technologies for Sustainable Buildings and Infrastructure, vol. 528, pp 139–150, 2024*



Efficient Public Transport System Through Xbl Approach

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ABSTRACT

Indian cities are rapidly growing due to uncontrolled urbanization. In order to meet the traffic needs of these growing urban cities, the number of registered vehicles is also increasing. In these growing vehicles, major proportion includes private vehicles such as cars and two-wheelers. In India, vehicles are growing at a rate of 9.91 CAGR (considering year 2009–2019). A total of 295,772,000 vehicles were registered vehicles in the year 2019. Out of these, the number of private vehicles is 259,703,000 (87.80%) and the number of other vehicles is 36,069,000 (12.20%). This increasing proportion of private vehicles considerably influence the traffic system due to traffic congestion during peak hours, unsafe driving, speeding, illegal usage of pedestrian ways, and lack of lane discipline. In general, commuters prefer private vehicles for their daily travel needs as it is more convenient and time-saving. Promoting the use of the public transportation system is one of the effective approaches to minimizing traffic congestion. In order to shorten journey times and boost speeds, this may be accomplished through effective public transportation system. This study aims to assess the effects of Exclusive Bus Lane (XBL) on speeds and travel times. In order to do this, a road corridor in the city of Mysuru was chosen as the research region. Several simulations are conducted using the microscopic simulation program VISSIM, and the impact of dedicated bus lanes on the traffic characteristics is analyzed.

**Full paper: Technologies for Sustainable Transportation Infrastructures, vol. 529, pp 347-355, 2024*



Dynamics Analysis of Steel Framed Structure Under Different Damage Scenarios

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ABSTRACT

Bridges, buildings, dams, and pipelines are just a few examples of the complex engineering systems that sustain a society's economic stability and quality of life. These systems' proper inspection, monitoring, and maintenance become more crucial as they get older and degrade. In such case the probability of occurrence of damage is high. The early identification of structural damage is vital to avoid structural failure in case of extreme loading conditions, which undetected can result in catastrophic conditions. Hence, there is a need for assessment and study of behavior of the damaged structural elements or structures as whole in order to increase the safety and serviceability of any structure and to maintain structural integrity for longer period of time. This study aims to investigate the effect of damage location and severity in beams and columns of a multistory steel structure. Different damage scenarios, i.e., reduction in cross sectional area, stiffness, and Young's modulus are considered to introduce damage at different locations in beams and columns. In order to predict the critical location and severity of damage, modal analysis is carried out to find the dynamic behavior of damaged structures. The natural frequency and time periods are considered as dynamic response parameters. Further, lateral load analysis, i.e., equivalent static method is performed as per IS 1893 (Part-1): 2016 code provisions. From the results, it has been observed that there is a change in the natural frequency, member forces, and lateral displacements of the structural system with the introduction of damage of certain severity and at particular location.

**Full paper: Technologies for Sustainable Buildings and Infrastructure, vol .528, pp 367–375, 2024*



The Failure Behaviour of Concrete Cubes in Compression

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ABSTRACT

Concrete is a mixture of cement, fine aggregate, coarse aggregate, water and sometimes they use admixtures. After the concrete cube is cast and cured, the compression strength of the concrete is tested for 7, 14, and 28 days. The failure behaviour of concrete cubes depends on the type of material used, such as cement, aggregates, and so on. This study explains the concrete cube failure behaviour and what the reasons are for it. The failure behaviour differs for different cube sizes and shapes, and the failure of a concrete cube indicates whether the obtained failure is satisfactory or not. The actual failure of the concrete cube is an hourglass failure failures other than hourglass failure are due to eccentric loading, flaws in the testing apparatus, human errors, and so on. Concrete cubes can fail in a variety of ways, such as crushing, tensile cracks, edge failure, surface cracks, and so on. Moreover, failure may occur in the aggregates or interface of the concrete matrix. However, in this study, the failure behaviour observed differs for different cubes due to various factors influencing it.

**Full paper: Technologies for Sustainable Buildings and Infrastructure, vol. 528, pp 151–162, 2024*



Dynamic Analysis of Pile Foundations Under Liquefiable Soil

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ABSTRACT

A Pile foundation, a type of deep foundation, is a slender column or long cylinder composed of materials such as concrete or steel, holds the structure and transfers the load at a specified depth through end bearing or skin friction. The pile foundations fail when subjected to lateral forces coming from earthquake motions. The time-history analysis is done to a 10-storey moment frame resisting frame system with piled-raft foundation under liquefiable soil. The displacement and acceleration responses are drawn out from analytical study using FE software ETABS 18.0.2. An attempt is made in this study to analyze the behavior of pile foundations under liquefiable soil when subjected to different strong motions and for different methods of spring constants assigned to piles. The results extracted from the time-history analysis at critical location of piled raft. From the present study it is concluded that structures constructed under liquefiable soils are vulnerable to high magnitude earthquakes and pile foundations are necessary to maintain the overall stability of the structure.

**Full paper: Technologies for Sustainable Buildings and Infrastructure, vol. 528, pp 163–175, 2024*



An Experimental Study on Mechanical Behaviour of Concrete by Partial Replacement of Sand with Brick Fines

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ABSTRACT

Heat is one of the primary factors that causes concrete structures to deteriorate over time and enhance concrete's structural properties. In an experimental investigation, brick fines were substituted for sand at different percentages of 5%, 10%, 15%, and 20% to test the mechanical behaviour of concrete exposed to high temperatures. At 15% replacement of brick powder, the maximal strength at standard temperatures had attained. An optimal concrete and ordinary concrete had then been exposed for 2 h at temperatures ranging from 100°C to 600°C at 100°C intervals. The quality check and strength characteristics of replacement and conventional concrete were evaluated, including weight loss, Ultrasonic Pulse Velocity (UPV), rebound hammer, and compressive, tensile, and flexural strengths at ambient and high temperatures. The quality of concrete decreased with temperature increase because of crack development and incompatible deformation between aggregate and cement paste. The strength decreased with increased temperature because of calcium silicate hydrate (CSH) breakdown and capillary water evaporation. Furthermore, a particular temperature at which cracks appear in concrete specimens exposed to high temperatures had determined using Scanning Electron Microscopy (SEM) and Energy Dispersive Spectroscopy (EDS) analyses. The brick powder performed better in enhancing the concrete's strength characteristics after being heated.

**Full paper: Australian Journal of Structural Engineering, vol. 25, no. 2, 2024*



Dynamic Monitoring of Surface Soil Moisture Fluctuations Using Synthetic Aperture Radar and Data-Driven Algorithms

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ABSTRACT

The primary goal of the study is to employ Synthetic Aperture Radar (SAR) data and efficacy data driven approaches in modeling Surface Soil Moisture (SSM) of cultivable marginal bare fields. Three experimental test fields were selected which are basically cultivable but due water deficiency the fields are left bare. Samples for surface soil moisture, soil surface roughness and bulk density are collected from test fields in grid sampling manner in parallel with SAR data pass over study area. Sentinel-1 A data is pre-processed and each field sampling grid backscattering energy values are obtained. Surface roughness, dielectric constant and backscattered energy were used as input features to model SSM using Random Forest Regression (RFR), Support Vector Regression (SVR) and Back Propagation Artificial Neural Network (BPANN). We observed that BPANN outperformed SVR and RF by accurately predicting soil moisture with RMSE = 0.077 m³m⁻³, bias = 0.013m³m⁻³, and R = 0.94. This study sheds light on small scale agricultural lands which are deficient of water to support crop growth.

**Full paper: Applied Geomatics, 2024*

Effect of Sustained Elevated Temperature on Compression and Split-Tensile Properties of Concrete Made With Waste Foundry Sand

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ABSTRACT

Purpose

The aim of the current study is to inspect the influence of high temperatures on the compressive and split-tensile-strength (STS) of concrete mixtures produced by replacing natural river sand with waste-foundry sand (WFS) at 25%, 50%, 75% and 100%. When the experimental findings and the projected outcomes were compared by IS:456-2000 code equations, the STS results predicted by the suggested mathematical equations exhibit lower variations. It is proposed to employ the presented mathematical formulas to evaluate the STS of concrete cylindrical specimens at higher temperatures.

Design/methodology/approach

After fabricating, concrete mixtures were allowed to cure for 28 days. For the purpose of avoiding explosive spalling during the heating process, concrete samples are taken out from the curing chamber after 28 days and allowed to dry for two days. The manufactured concrete specimen is exposed to 100 °C, 200 °C, 300 °C, 400 °C, 500 °C and 600 °C temperatures for a duration of 2 h. After the specimens have cool down to room temperature (RT), the physical test, ultrasonic-pulse-velocity (UPV) test, compressive strength test and STS test are carried out.

Findings

With an increase in WFS content, concrete specimens' residue compressive-strength and STS decreases. The STS of samples declines as the WFS content rises with increase in temperature interval. According to the UPV test, the concrete samples quality is "good" up to 400 °C after 500 °C, it ranges from "doubtful to poor." The UPV values of various mixes declined as the temperature increased. Mass losses increase with exposure to greater temperatures and with an increase in the proportions of WFS in concrete specimens. For mixtures MWFS-0, MWFS-1, MWFS-2, MWFS-3 and MWFS-4 (0%, 25%, 50%, 75% and 100% WFS content), no cracks were present on any of the samples below 400 °C. Concrete surfaces start to show cracks whenever the intervals of temperature increase above 400 °C.

Originality/value

In this investigation, WFS elements are totally substituted for natural sand in concrete mixtures. The residue strength properties, including residual compressive strength and residual STS, were found to be lower after exposures to greater temperature when comparisons were made to referral mixtures. When comparing specimens' compressive strength, higher temperatures have more effects on the STS of samples with higher WFS contents.

**Full paper: Journal of Structural Fire Engineering, 2024*



Enhancing Road Safety Through Blackspots Mitigative Measures - A Review

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ABSTRACT

Precise identification of black spots can ensure the timely adoption of remedial measures to mitigate road accidents. The review of various trends of approaches towards identifying the black spots by studying the evolved-up techniques towards a pre-emptive investigation of crash events is the focus of the paper. This study contributes to briefing all the open research issues that existing researchers have merely explored. The paper also discusses addressing such open-end problems that offer more edge to the precise analysis of black spots, followed by a possible plan towards solving these issues to mitigate blackspots.

**Full paper: Sigma Journal of Engineering and Natural Sciences, vol. 42, no. 5, pp. 1670–1682, 2024*



Fatigue Analysis and Assessment of a State Highway Bridge on Hunsur-Mysore Road

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ABSTRACT

The work is concerned with the Concrete bridges, The study carried out involves a a RCC bridge on NH275, from Mysuru to Madkeri near Hunsur is chosen for further study. For this bridge, load data is collected so as to arrive at annualized traffic. Further cross sectional details are collected from records. Moving load analysis is carried out to determine the stress on the bridge. The parameters involved in LEFM are highly random and hence there is a significant uncertainty in quantifying the behavior under fatigue. To handle these uncertain random variables, the principles of structural reliability are put to use. The Reliability index (β) which is a measure of fatigue assessment is calculated using limit state formulation developed for Fatigue Reliability

**Full paper: International Journal of Mechanical Engineering, vol. 7, no. 2, 2022*



Granite Powder as Partial Replacement of Cement in M30 Grade Concrete Mix Using Is 10262:2019

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ABSTRACT

Purpose

This study aims at designing consistent and durable concrete by making use of waste materials. An investigation has been carried out to evaluate the performance of conventional and optimal concrete (including 5% GP) at high temperatures for different exposure times.

Design/methodology/approach

An experimental work is carried out to compare the conventional and optimal concrete with respect to weight loss, mechanical strength characteristics (compressive, tensile and flexural) after exposed to 100, 200 and 300 °C with 1, 2 and 3 h duration of exposure followed by cooling in furnace for 24 h and then air cooling.

Findings

The workability of granite powder modified concrete decreases as percentage of replacement increases. Compressive, tensile and flexural strengths all increased at 100 °C when compared to strength characteristics at normal temperature, regardless of the exposure conditions, and there was no weight loss noticed. For 200 and 300 °C, the strengths were decreased compared to normal temperature and an elevated temperature of 100 °C, as weight loss of concrete specimens are observed to be decreased at these temperatures. So, the optimum elevated temperature can be concluded as 100 °C.

Originality/value

Incorporating pozzolanic binder (granite powder) as cement replacement subjecting to elevated temperatures in an electric furnace is the research gap in this area. Many of the works were carried out replacing GP for fine aggregate at normal temperatures and not at elevated temperatures.

**Full paper: Journal of Structural Fire Engineering, vol. 15, no. 2, 2024*



Integrating Socio-Economic Variables in Urban Flood Damage Assessments: A Case Study of Bengaluru, India

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ABSTRACT

Urban flooding can lead to significant economic and social repercussions. To effectively understand and mitigate these impacts, conducting a flood risk assessment is crucial. This research focuses on evaluating flood damage in the flood-prone areas of the Koramangala-Challaghatta (KC) Valley in Bengaluru, India. The study involved surveying these regions to gather data on population characteristics, demographics, economic status, property details, and repair costs following a flood for both residential and commercial properties. Utilising Random Forest and multivariate regression analyses, the study identified the primary factors that influence flood damage. These factors were then employed to develop distinct flood damage functions for the residential and commercial sectors. The research underscores the vital role of flood depth in contributing to damage in both types of properties. It reveals that flood depth has a significant impact on structural damage as well as damage to the contents within these properties. Furthermore, a positive correlation was found between flood depth and residential property prices, indicating that more valuable properties in flood-prone areas are likely to incur more severe damage. Conversely, a negative correlation observed in the commercial sector suggests that higher property prices may be linked to better flood protection measures. These findings offer valuable insights that can assist policymakers and urban planners in making informed decisions. They highlight the importance of economic resilience in flood-prone regions and guide future flood risk management strategies.

**Full paper: Natural Hazards, November 2024*



Studies on the Behaviour of Steel Fibre Reinforced Concrete under Monotonic and Repeated Cyclic Stress in Tension

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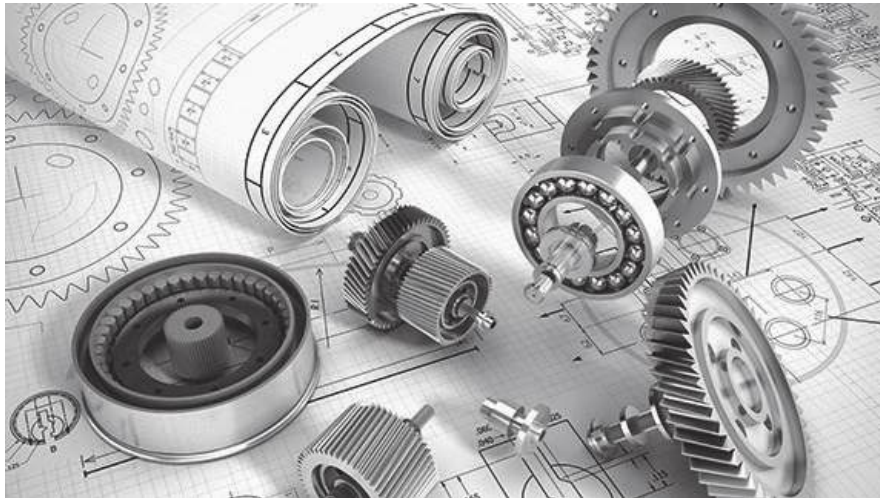
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ABSTRACT

Tensile characteristics of concrete could be studied under direct tension. This requires suitable testing facility and there exists difficulty in ensuring uniaxial tension throughout the test. The indirect tensile testing techniques are splitting tension test, modulus of rupture test and double punch test (DPT) to mention. DPT is a simple and reliable testing technique to study the tensile characteristics of SFRC. DPT has shown lesser coefficient of variation from among other indirect tensile testing methods. In the present study, the tensile behaviour of SFRC under monotonically applied load was investigated using DPT. Concrete of grade M25, with hooked end steel fibres of aspect ratio 50 (50 mm length and 1 mm diameter), comprising fibre volumetric proportions of 1.0, 1.25, 1.50, and 1.75 percent were considered. The stress-strain characteristics were compared using the theoretical equations proposed in the literature. For the case of 1.5 and 1.75% SF, the theoretical peak stress was found to be lower bound compared to that arrived experimentally. The studies carried by various researchers with respect to the behaviour of SFRC under monotonic and cyclic stress in tension are presented.

**Full paper: Innovative Infrastructure Solutions, vol. 9, no. 274, 2024*

Department of Mechanical Engineering





The National Institute of Engineering, Mysuru

Development of A Measure for Technological Capability in Small Firms: A Case Study of Bengaluru Aerospace Cluster

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ABSTRACT

Technological capability is vital for a firm to scout for new technology and adapt it to improve its products and services. Technological capability has been identified as the prominent factor in sustainability of firms. However, there is a dearth of quantitative methodologies, which can provide robust means for evaluating the effect variables have on acquisition and assimilation of technological capability. This paper outlines the development of a measure for technological capability. Technological capability will facilitate quantitative analysis to explore the aforementioned relationship. The proposed measure, named as technology index (TI), has been validated for content and construct. A case study has been presented, which showcases the use of TI to explore relationships based on a quantitative methodology.

**Full paper: AIP Conference Proceedings, vol. 3109, no. 1, 2024*



Barriers for Adoption of Green Hydrogen in Indian Transportation Sector: A Fuzzy ISM Approach

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ABSTRACT

The adoption of green hydrogen in India's transportation sector represents a promising solution to the country's energy challenges. However, various barriers hinder its large-scale implementation. This paper employs a fuzzy Interpretive Structural Modeling (ISM) approach to identify and analyze the barriers affecting green hydrogen adoption. The Structural Self-Interaction Matrix (SSIM) and Initial Fuzzy Reachability Matrix (IFRM) were used to assess direct relationships between barriers, while level partitioning and the final fuzzy reachability matrix provided a hierarchical structure. The fuzzy digraph visually mapped the relationships, and a cluster of barriers diagram identified clusters based on driving power and dependence. Key barriers, such as "Technological Immaturity," "Inadequate Regulatory Frameworks," and "Policy Inconsistencies," were identified as foundational challenges. Resolving these barriers will yield substantial positive effects across the network, streamlining progress in adopting green hydrogen in India's transportation sector. The analysis offers a strategic pathway for policymakers and stakeholders to prioritize interventions for this clean energy technology.

**Full paper: EDP Sciences, vol. 559, 2024*



Development of CNC Gantry Drilling Machine

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ABSTRACT

The rise of automation and computer control has brought about a revolutionary transformation in the realm of drilling machines, sparking the creation of various innovative designs tailored to meet specific industrial requirements. Surprisingly, there exists a notable dearth of comprehensive literature dedicated to gantry-type CNC drilling machines, despite their ready availability in the commercial sphere. This paper seeks to bridge this gap by introducing a pioneering approach that centers on the successful development of a CNC gantry drilling machine. The research underscores crucial considerations and optimization techniques aimed at achieving a structurally sound apparatus capable of both high-speed operation and pinpoint accuracy. This endeavor holds significant promise for the evolution of CNC gantry machining technology. Through the realization of a structurally robust CNC gantry drilling machine, built for swift operation and precision in positioning, this research aspires to propel the progress of CNC gantry machining technology. Rigorous scrutiny of the machine's components ensures its reliability and resilience under diverse loads. The efficient manufacturing processes employed during fabrication enhance productivity and cost-effectiveness. The results affirm its exceptional precision, with measured accuracy consistently achieving an impressive range of 15–20 μm .

**Full paper: Lecture Notes In Electrical Engineering, pp 101-112, 2024*



**Fault Classification in Rolling Element Bearing Based on Vibration Signature
Using Artificial Neural Network**

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ABSTRACT

In mechanical systems, the role of rolling element bearings is pivotal, as their vulnerability to various faults emphasizes the potential for performance decline, increased maintenance costs, and potentially catastrophic failures. To address these issues, this study focuses on leveraging Artificial Neural Networks (ANN) to improve the identification of faults in rolling element bearings through the analysis of vibration signatures. The vibration signals have been acquired from test bearings (both healthy and faulty) using the developed experimental setup. Statistical parameters have been extracted from the vibration data to create a comprehensive dataset for training, validation, and testing the ANN. By training the ANN with this dataset, the study establishes a reliable and automated system for the classification of faults in rolling element bearings. The outcomes are presented using confusion matrices, depicting correctly classified and misclassified instances. The training confusion matrix highlights a 90.5% accurate classification rate, while the test confusion matrix demonstrates 88.9% accuracy. The overall confusion matrix culminates in an 86.7% accurate classification. Finally, the developed ANN model has been validated by predicting the bearing conditions with unseen vibration data, achieving a 100% accurate prediction. This study contributes to advancing dependable and efficient fault detection systems, underscoring the potential of ANN in enhancing monitoring and maintenance strategies for rolling element bearings.

**Full paper: Lecture Notes in Electrical Engineering, pp 521-533, 2024*



Object Detection Using Tensorflow for Road Navigation: Enhancing Safety for the Visually Impaired

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ABSTRACT

Enhanced safety for individuals with visual impairments during driving is achieved through the application of machine learning techniques. Utilizing object identification methods like Faster R-CNN, R-FCN, and SSD, known for their accuracy in real-time applications, our study focuses on training models using diverse datasets, including COCO and KITTI, with the TensorFlow Object Detection API framework. The experiment reveals that SSD algorithms exhibit faster and more accurate object identification, contributing to improved accident prevention for blind individuals. Notably, this technology aids in determining the relative distance between vehicles, providing timely alerts to the user about approaching obstacles.

**Full paper: Lecture Notes in Electrical Engineering pp 209-220, 2024*



Predictive Maintenance of Gearbox: A Cost-Effective IoT Approach for Remaining Useful Life Estimation

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ABSTRACT

Rotating components, such as gearboxes, play a crucial role in various industrial applications by transferring speed and torque. Monitoring the health of gearboxes is essential to enhance productivity and reduce maintenance costs. This study focuses on predictive maintenance techniques for gearboxes, with a specific emphasis on calculating the remaining useful life (RUL) of the system. The primary objective of this research is to identify faults and estimate the RUL of gearboxes. Time domain data, obtained from gearboxes using NodeMCU (ESP8266), is utilized for RUL calculation. Real-time data is captured through the Internet of Things (IoT) platform called ThingSpeak. Machine learning algorithms implemented in MATLAB are employed to estimate the RUL. Notably, the wear along the face width yielded the maximum RUL in this investigation. The present research introduces a cost-effective and user-friendly IoT technique for predicting the RUL of gears. By employing IoT-based condition monitoring and predictive maintenance, industrial stakeholders can optimize maintenance schedules, minimize downtime, and reduce overall maintenance costs associated with gearbox failures.

**Full paper: Lecture Notes in Electrical Engineering pp 55–67, 2024*



**Semi-Automated Inkjet Marking System with Lead Screw Actuation for
Aerospace Components**

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ABSTRACT

The present research work aims to design and develop a highly efficient and precise semi-automated inkjet marking system catered to a diverse array of aerospace components. The system utilizes a dual-frame configuration, consisting of a vertical arm for the control system and a horizontal arm integrated with a 12 mm diameter stainless steel (SS 304) rod, manual handwheel, flange, and ball bearing (6301). This integration allows for controlled linear motion, enabling accurate positioning of the marking nozzle, effectively reducing manual effort, and expediting the marking process. An intelligent control panel is incorporated into the system, facilitating seamless data input, and enhancing overall productivity, quality control, and traceability in aerospace part marking. Through optimized part identification, the system ensures compliance with industry standards, thus streamlining efficient production processes within the aerospace industry. The resultant semi-automated inkjet marking system represents a significant advancement, offering manufacturers a cutting-edge solution to improve production efficiency and meet rigorous quality standards. Its potential to enhance traceability and overall manufacturing processes in the aerospace industry is noteworthy, promising a more productive and standardized approach to part identification.

**Full paper: Lecture Notes in Electrical Engineering pp 125–137, 2024*



Wildlife Intrusion Detection and Prevention in Farm Fields Using IoT Technology

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ABSTRACT

Agriculture plays a vital role in supporting economies worldwide, making it essential to address crop loss and protect farmlands from wild animal intrusions. This paper presents an innovative approach utilizing a Raspberry Pi-based system to monitor and detect animals and intruders in agricultural areas. The proposed system integrates the OpenCV module, camera, speaker, and online applications to achieve effective surveillance. The You Only Look Once (YOLO) object detection system, employing the single shot detection mechanism, is employed for real-time classification of animals and intruders entering farmlands. A smartphone application enables farmers to receive photographs of the detected entities. Additionally, an SMS notification is sent to the farmer using the Twilio online application. To ensure maximum accuracy, the captured images are transmitted to the registered phone numbers of farmers through the Telegram app. This allows farmers to promptly respond to potential threats and take appropriate actions. By leveraging the capabilities of the Raspberry Pi and the YOLO object detection system, the proposed integrated monitoring system offers an efficient and reliable solution for safeguarding agricultural areas.

**Full paper: Lecture Notes in Electrical Engineering pp 43-54, 2024*



DARSI: A Deep Auto-Regressive Time Series Inference Architecture for Forecasting of Aerodynamic Parameters

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ABSTRACT

In the realm of fluid mechanics, where computationally-intensive simulations demand significant time investments, especially in predicting aerodynamic coefficients, the conventional use of time series forecasting techniques becomes paramount. Existing methods prove effective with periodic time series, yet the challenge escalates when faced with aperiodic or chaotic system responses. To address this challenge, we introduce DARSI (Deep Auto-Regressive Time Series Inference), an advanced architecture and an efficient hybrid of Convolutional Neural Network (CNN) and Long Short-Term Memory (LSTM) components. Evaluated against established architectures (CNN, DLinear, LSTM, LSTNet, and PatchTST) for forecasting Coefficient of Lift (C_L) values corresponding to Angles of Attack (AoAs) across periodic, aperiodic, and chaotic regimes, DARSI demonstrates remarkable performance, showing an average increase of 79.95% in CORR, 76.57% reduction in MAPE, 94.70% reduction in MSE, 76.18% reduction in QL, and 75.21% reduction in RRSE. Particularly adept at predicting chaotic aerodynamic coefficients, DARSI emerges as the best in static scenarios, surpassing DLinear and providing heightened reliability. In dynamic scenarios, DLinear takes the lead, with DARSI securing the second position alongside PatchTST. Furthermore, static AoAs at 24.7 are identified as the most chaotic, surpassing those at 24.9 and the study reveals a potential inflection point at AoA 24.7 in static scenarios for both DLinear and DARSI, warranting further confirmation. This research positions DARSI as an adept alternative to simulations, offering computational efficiency with significant implications for diverse time series forecasting applications across industries, particularly in advancing aerodynamic predictions in chaotic scenarios.

**Full paper: Journal of Computational Science, vol. 82, 2024*



**An Empirical Model Integrating Dimensional Analysis and Box-Behnken Design
for Crack Detection in Rotor Fan Blades**

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ABSTRACT

Due to continuous operations and manufacturing errors, fatigue cracks can emerge after hours of service this causes a fan blade failure and potentially ruins an entire engine, turbo machinery, or rotating machinery of a similar kind. This paper focuses on the condition monitoring of the fan blade for detecting cracks occurring in these blades by analyzing the vibration responses. The mathematical formulation is carried out using the matrix method of dimensional analysis, which is dependent on the fundamental quantities of force, Length, Time, and Temperature (FLT θ) systems of units. Numerical analysis in ANSYS software is done to comprehend the blade harmonic response for the cracked blade condition. Experimentation is also carried out on Tiera fault simulation machinery equipment, where vibration responses are measured and analyzed for crack detection in the blades. The tests were performed for three different cracks of different lengths and analyzed by varying parameters such as load speed, for which experiments are planned using a Box-Behnken design method. The test results were confirmed with the model equations developed, and notable similarities were seen between the analytical, numerical, and experimental analyses. Thus, the proposed study will help detect the cracks in the blades, thus reducing the serious accidents or failure of the machinery.

**Full paper: FME Transactions, vol. 52, no. 1, pp 45-56, 2024*



AI-Enhanced Fault Diagnosis in Rolling Element Bearings: A Comprehensive Vibration Analysis Approach

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ABSTRACT

This research presents a comprehensive approach for bearing fault diagnosis using artificial intelligence (AI), particularly through the application of artificial neural networks (ANNs). By integrating these networks into vibration analysis, the approach aims to meet the critical need for prompt fault detection. The methodology comprises three key steps: vibration signal acquisition, feature extraction, and fault classification. Experiments were conducted to acquire vibration signals for the test bearings on a machinery fault simulator. Six time-domain features were extracted using MATLAB, creating a comprehensive dataset for training the ANN models with three algorithms: Levenberg-Marquardt backpropagation (LMBP), scaled conjugate gradient backpropagation (SCGBP), and Bayesian regularization backpropagation (BRBP). The BRBP algorithm achieved the highest correct classification rate (97.2%), followed by LMBP (90%) and SCGBP (83.6%). To evaluate their efficacy in bearing fault classification, these three networks were simulated, revealing that BRBP could predict all four classes of bearings with zero errors

**Full paper: FME Transactions, Vol.52, Issue No.3, pp.450-460, 2024*



Innovative Pedagogical Approaches for Diverse Learning Styles and Student-Centric Learning

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ABSTRACT

Amidst the aftermath of the COVID-19 pandemic, the landscape of education in India has undergone a profound transformation. Traditional methods of teaching and learning, once the bedrock of our educational system, now find themselves met with skepticism from both students and educational institutions. In response to this paradigm shift, this paper delves into the pressing need for a comprehensive overhaul of pedagogical methodologies within the context of engineering education in India. It emphasizes the pivotal role of education and pedagogy, advocating for a departure from conventional models towards a more learner-centric and adaptable framework, tailored to the nuances of the Indian education landscape. In this context, the paper sheds light on the intrinsic value of understanding diverse learning styles, particularly within the backdrop of a digitally driven era. The profound impact of digital platforms on modern education in India is explored, underscoring their potential to revolutionize and enhance the learning experience for Indian students. The paper further examines unconventional techniques that challenge the norms of education as conventionally understood, recognizing their potential to bridge the gap between students' expectations and institutional methodologies. Within the discourse of this paper, special attention is accorded to three distinctive non-conventional pedagogical approaches: 'Cyberhunt', 'Keyword Concept' and 'Role Switch Teaching'. These methodologies are scrutinized as quintessential examples of innovative strategies that can foster an intuitive and engaging learning environment within Indian classrooms. 'Cyberhunt' immerses students in experiential learning by assigning them virtual quests that mirror real-world challenges, thereby nurturing critical thinking and problem-solving skills tailored to the Indian context. Similarly, the 'Keyword Concept' approach capitalizes on cognitive associations to enhance memory retention and conceptual understanding, catering to the unique learning styles often found in India. Further, the innovative 'Role Switch' teaching methodology, which involves assigning students diverse roles in course delivery, was successfully implemented to further enrich the learning experience in the context of control engineering course

**Full paper: Journal of Engineering Education Transformations, vol 37, p 178, 2024*

Tribological and Vibration Characteristics of the Palm-Mineral Blend as a Sustainable Lubricant in Steel-Steel Contacts

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ABSTRACT

In the present work, experiments have been carried out to analyze the feasibility of utilizing individual sunflower oil (SFO), palm oil (PO), mineral oil (MO), blends of mineral-sunflower oil (MO:SFO), and mineral-palm oil (MO:PO) to lubricate the specimen mounted in four-ball tribometer. The tribological parameters such as friction coefficient, wear scar diameter (WSD), wear mechanism, and vibration characteristics were obtained from the ball specimen lubricated by using above mentioned oil samples as per ASTM D4172 standards. The experimental observations indicated that the MO:PO oil blend sample led to a decrease in friction coefficient about 35%, 20%, 6%, and 41% than that of individual MO, PO, SFO, and MO: SFO blends respectively. Further, MO:PO blend resulted a reduction in WSD about 94%, 95%, and 5% in comparison to PO, SFO, and MO: SFO samples respectively. The MO:PO oil blends showed a reduction in mass loss and vibration amplitudes by 6% and 5% respectively than that of PO oil lubrication. This is mainly credited to the synergic effect of fatty acid molecules and additives present in vegetable and mineral oils. The results obtained in the experimental investigation provided an insight to the suitability of MO:PO biobased lubricant in enhancement of tribological properties thereby minimizing the friction coefficient, WSD, and vibration response than that of individual PO, SFO and MO:SFO oil blend.

**Full paper: Biomass Conversion and Biorefinery , vol. 14, no. 13, pp 14107–14137.2024*



Interactive Design and Development of an Intelligent Vision-Driven 3d Printed Precision Sorting Mechanism for Silk Cocoons

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ABSTRACT

The design and implementation of a small-scale automated cocoon sorting system that utilizes a Raspberry Pi 3 B, a Raspberry Pi 5 MP camera, and machine learning algorithms trained on the Teachable Machine platform are presented in this research paper. Various hardware components were implemented in the system, including a 360-degree servo motor for controlling a rotating disk to feed cocoons, a 100 RPM DC motor for conveyor belt control, and an MG90 180-degree servo motor for final sorting. CAD models were designed using CATIA-V5 and 3D printed with PLA (Polylactic Acid) material to construct the prototype. The system operates with continuous monitoring by the Pi camera, which detects good and bad cocoons, utilizing a trained neural network model to classify the cocoons. Based on this classification, the sorted cocoons are directed to the appropriate destination by the 180-degree servo motor. By automating the cocoon sorting process, improvements in efficiency and accuracy in cocoon classification have been achieved.

**Full paper: International Journal on Interactive Design and Manufacturing, 2024*



Mechanical Properties and Analysis of Two-body Abrasive Wear Behaviour of Graphene Modified Carbon/Epoxy Composites Using Taguchi's Technique

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ABSTRACT

The present work emphasizes the effect of graphene nanoplatelets (G) filler loading on mechanical and abrasive wear behavior of carbon fibre reinforced epoxy (C/E) composites. Graphene nanoplatelets were mixed with epoxy framework using a temperature-controlled magnetic stirrer and then ultrasonically treated. The parameters considered for the abrasive wear study are the applied load in N (5, 10 and 15), abrading distance in m (75, 150, and 225) and weight percentage of reinforcement (0, 1, and 1.5). The incorporation of 1 wt. % G into C/E composites increases hardness by 14 % and interlaminar laminar strength by 19 % when compared to C/E composites. According to the Taguchi design of tests, a filler loading of 1 wt. % G, an abrading distance of 225 m, and an applied load of 15 N are ideal. Analysis of variance (ANOVA) was done to establish the dominant parameter, and the filler loading with abrading distance was shown to be significant. With 36.4 %, the filler loading had the biggest influence on the composite specific wear rate. The combination of filler loading with 1 wt. %, load of 15 N, and abrading distance of 225 m yields the lowest specific wear rate. The involved wear mechanisms during the abrasive wear process have also been explained with scanning electron micrographs.

**Full paper: Tribology in Industry, vol. 46, no. 1, pp 66-79.2024*



Effect of Al₂O₃ Reinforcement on Behavioural Characteristics of Aluminium Metal Matrix Nanocomposites

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ABSTRACT

The creation of new, cutting-edge materials is a need of the modern era. Owing to their light weight and favorable strength-to-weight ratio, researchers in this field are creating new alloys, composites, and nanocomposites. Researchers are interested in fabricating nanocomposite materials with improved characteristics. The synthesis of an alumina-reinforced nanocomposite is the main focus of the current effort. The work identifies how fabrication of a nanocomposite's mechanical and tribological characteristics is affected by nano-reinforcement. Adding 3 wt.% alumina nanoparticles to a material improves its compressive and tensile strengths by 209.99 MPa and 203.77 MPa, respectively. However, the A₃ sample composition has an improved impact strength of 78.7 Joule/cm² and a hardness of 56.66 HV. The EBSD examination of the same sample provides quantitative information on the fraction of low-angle grain-boundaries (LAGBs) and high-angle grain-boundaries (HAGBs). The fact that the percentage of LAGBs has somewhat decreased and the percentage of HAGBs has noticeably increased definitely supports the recrystallization process in this sample composition. The apparent as well as equivalent energy fracture toughness of the A₃ sample composition were both very high. They were measured in the range of 248.67 MPa√m and 309.79 MPa√m. Three body wear behavior test confirms minimum wear rate of A₃ sample composition 1.6×10^{-5} and 2.2×10^{-5} for 1 kg and 2 kg load.

**Full paper: Metallography, Microstructure, and Analysis vol. 13. pp. 462–477, 2024*



Superior Mechanical Properties of Aluminium Matrix Composites Fabricated Through Modified Matrix Encapsulated Feeding Method

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ABSTRACT

Aluminium matrix composites (AMCs) play a vital role in constructing aircraft, marine and automobile components. The major issue in manufacturing of AMCs through stir casting method is a localized ceramic particles agglomeration. In current research, metal castings have been prepared with 97.5 wt% of aluminium alloy (AA 7075) and 2.5 wt% of nano-alumina ($n\text{-Al}_2\text{O}_3$) particles through a modified matrix encapsulated feeding technique. The tensile strength, microhardness and dry sliding wear behaviour of $n\text{-Al}_2\text{O}_3$ reinforced AA 7075 composites were measured following ASTM standards. The ultimate tensile strength of the developed AMCs varies from 280 to 315 MPa, which is 12.5% higher than unreinforced AA 7075 alloy. Yield strength increases from 140 to 158 MPa, whereas microhardness of the composites increases from 138 to 210HV. Due to homogeneous distribution of $n\text{-Al}_2\text{O}_3$, the overall wear resistance of $n\text{-Al}_2\text{O}_3$ reinforced AA 7075 composites increases up to 90% as compared to unreinforced AA 7075 alloy. Also, the addition of $n\text{-Al}_2\text{O}_3$ particles marginally reduces the network of microcracks and deep furrows in the worn surface. The microstructural and elemental studies are also performed through scanning electron microscopy and X-ray diffraction.

**Full paper: Transactions of the Indian Institute of Metals.vol. 77, pp 707–716, 2024*



Effect of Acetone Treatment and Copper Oxide Coating on the Mechanical and Wear Properties of 3d-Printed Acrylonitrile Butadiene Styrene Structures

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ABSTRACT

3D-printed ABS samples are treated with acetone and coated with copper oxide (CuO) for varying durations to understand how these treatment processes affect their mechanical and tribological properties. Tensile strength, flexural strength, coefficient of friction, and wear of ABS were analyzed under various pre-treatment and coating conditions and it is proved that acetone treatment and CuO coating can be effectively used to tune such properties to meet desired specifications. For 3D-printed ABS structures, CuO coating significantly enhances their tensile strength without acetone treatment. Although acetone treatment reduces their tensile strength as demonstrated, CuO coating can increase it again which means their tensile strength can be tuned by using the two processes. Furthermore, both acetone treatment and CuO coating improve their flexural strength. Additionally, acetone treatment and CuO coating both decrease their coefficient of friction. FESEM and EDS analyses were conducted on the structures to analyze and verify their wear properties

**Full paper: Virtual and Physical Prototyping, vol. 19, no. 1, 2024*



Synthesis and Characterisation of Carbon Nanofiber-Wrapped Polyaniline and Polypyrrole Sensory Films in Polyester Resin for Strain Sensing

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ABSTRACT

Flexible wearable pressure sensors have received extensive attention in recent years because of the promising application potentials in health management, humanoid robots, and human machine interfaces. Among the many sensory performances, the high sensitivity is an essential requirement for the practical use of flexible sensors. Therefore, numerous research studies are devoted to improving the sensitivity of the flexible pressure sensors. The fiber assemblies are recognized as an ideal substrate for a highly sensitive piezoresistive sensor because its three-dimensional porous structure can be easily compressed and can provide high interconnection possibilities of the conductive component. Moreover, it is expected to achieve high sensitivity by raising the porosity of the fiber assemblies. In this paper, the three-dimensional reduced graphene oxide/polyolefin elastomer (RGO/POE) nanofiber composite aerogels were prepared by chemical reducing the graphene oxide (GO)/POE nanofiber composite aerogels, which were obtained by freeze drying the mixture of the GO aqueous solution and the POE nanofiber suspension. It was found that the volumetric shrinkage of thermoplastic POE nanofibers during the reduction process enhanced the compression mechanical strength of the composite aerogel, while decreasing its sensitivity. Therefore, the composite aerogels with varying POE nanofiber usage were prepared to balance the sensitivity and working pressure range. The results indicated that the composite aerogel with POE nanofiber/RGO proportion of 3:3 was the optimal sample, which exhibits high sensitivity (ca. 223 kPa^{-1}) and working pressure ranging from 0 to 17.7 kPa. In addition, the composite aerogel showed strong stability when it is either compressed with different frequencies or reversibly compressed and released 5000 times.

**Full paper: Advances in Materials and Processing Technologies, Polymers, pp. 01-12, 2024*



Evaluation of Fatigue Characteristics of 3D Printed/Composites Reinforced With Carbon Fiber Using Design of Experiments

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ABSTRACT

This study investigates the fatigue characteristics of 3D-printed composites made from polylactic acid (PLA) and acrylonitrile butadiene styrene (ABS), reinforced with carbon fiber. It involves designing and building a rotating bending fatigue machine, creating standard specimens via FDM, and applying DOE using Taguchi method. Standard specimens are subjected to cyclic loading with a print orientation of 0°, 45°/−45°, and 90°, motor speed and load. Materials such as PLA, ABS, PLA-CF, and ABS-CF are tested by maintaining a consistent layer thickness of 0.16 mm and 99.99% infill density while varying stress levels. PLA-CF outperforms PLA, ABS, and ABS-CF in fatigue life, with 0° print orientation exhibiting superior fatigue strength. Statistical analysis underscores the significance of print direction, material composition, and stress level. Additionally, the study aims to construct S-N curves for 3D-printed PLA/ABS composites with carbon fiber reinforcement, advancing our understanding of mechanical properties and print parameter optimization for enhanced fatigue performance in 3D-printed composites.

**Full paper: Polymers Composites, pp. 17134-17149, 2024*



Investigation of Tribological Properties of Mahua oil Mixed with Zinc Oxide Nanoparticles

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ABSTRACT

In today's paradigm petroleum and petro-based chemical products are being extracted and consumed at a substantial rate, proving to be hazardous and detrimental to the earth. Bio based resources are environmentally friendly, energy efficient, economical, and proved to be an alternative to the present mineral oils. This paper documents the research on naturally available mahua seed oil for bio-lubrication, its flash point and fire point, tribological properties namely coefficient of friction and wear scar diameter have been modified by the addition of zinc oxide (ZnO) nanoparticles in different concentrations by weight percentage (0.25, 0.50, 0.75, and 1.0). four-ball tester was used according to ASTM D-4172 standards (60 min under 40 kg running at 1200 rpm). Probe ultrasonicator was used for particle dispersion. It was found that 0.75 wt. % loading of ZnO in mahua oil resulted in a 57.14% drop of coefficient of friction, but a slight increase in the wear scar diameter of 30.60% was observed.

**Full paper: Tribology in Industry, vol. 46, no. 1, pp 48-55, 2024*



Influence of Mwcnts, ZNO, and Boric Acid Nanomaterial Blend on the Tribological and Thermal Properties of Lithium Grease

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ABSTRACT

The roller/ball bearing plays a crucial role in the power transmission of high-speed machines used in industrial applications. The inadequate lubricant at the contacting surfaces may cause bearing failure and lead to financial misfortune. Effective lubrication at the contacting surface is the only criteria to obtain significant bearing performance and enhance the life of the bearing. Therefore, in this paper, efforts have been carried out to enhance the tribological and thermo-physical properties of lithium by adding nanomaterials. Multi-walled carbon nanotubes (MWCNTs), zinc oxide (ZnO), and nanoboric acid (nBA) nanomaterials were used as an additive. The 52100 steel ball specimens were considered in the four-ball tribometer to analyze the friction coefficient, lubricant film strength, wear scar diameter (WSD), wear volume, and frictional power loss parameters. In addition, the thermal conductivity of base grease and nanoparticles added grease was assessed using a KD2 Pro thermal analyzer. The findings of the experimental investigations demonstrated that the enhanced thermo-physical characteristics of lithium grease-containing nanomaterials led to a significant decrease in wear and friction at the contact surfaces of the steel ball specimen. An optimum concentration of 0.75% MWCNTs was observed which resulted in 22.75% and 37.5% reduction in friction coefficient and WSD. Also, the surface roughness and wear volume were reduced 59% and 84.7% with MWCNTs blended grease in comparison with base grease.

**Full paper: Tribology International, vol. 192, 2024*



Tribological Behaviour of Short Carbon Fiber Reinforced Polyethersulfone Composites with Ptw Filler

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ABSTRACT

In various applications like bearings, gear pairs, and brake pads, understanding how polymer composites interact with harder counterparts during sliding motions is crucial. A challenge arises from the heat generated during sliding friction, which has the potential to raise the contact temperature. This temperature increase, if it exceeds the material's glass transition temperature, can compromise the thermal stability of the composites, leading to rapid material wear. In the present investigation, dry sliding wear test was performed on 25 wt.% of short carbon fiber (SCF) reinforced polyethersulfone (PES) composites filled with 2.5 and 5.0 wt.% of potassium titanate whisker (PTW) using pin-on-disc tribometer. Wear test was planned and executed according to the experiment design formulations obtained by central composite design method. Contact temperature at the interface between composite pin and steel disc was monitored with an infrared thermal camera. Wear resistance was found to increase with the addition of fibers and fillers. PTW filled composites exhibited minimum wear with maximum coefficient of friction. Morphology studies were carried out on worn surfaces of the composites using scanning electron microscope to identify and describe the mechanism of wear involved. This investigation sheds light on the intricate behavior of polymer composites during sliding interactions

**Full paper: Tribology in Industry, vol. 46, no. 2, pp 217-235, 2024*



Adhesive Wear Characteristics of Mono and Hybrid CF/Ep Composite with Nano-HAP Filler

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ABSTRACT

Composites materials with more than two reinforcing materials are called hybrid composites. Tailoring the composites by hybridizing fillers, fibers and matrix will yield better properties compared to mono-composites. Hence, an effort has been made in the current research work to develop carbon fiber epoxy hybrid nanocomposites, comprising different weight percentage of Hydroxyapatite (HAP) to evaluate the potential effects on tribological properties using two body sliding wear method. Taguchi technique (L 27 array) has been adopted to investigate the impact of parameters such as filler inclusion (0%, 1.5%, and 3%), load (30, 45, and 60 N), sliding velocity (1, 2, and 3 m · s⁻¹) and distance (1000, 2000, and 3000 m · s⁻¹) on wear loss of developed composite. It was observed that the combination of 1.5 wt% HAP composite showed the lowest Ks and the COF. The combination of 1.5 wt% HAP filler, 1 m · s⁻¹ sliding velocity, 45 N load and 3000 m sliding distance exhibited the lower Ks and COF of 0.44652 × 10⁻¹⁴ (m³ · Nm⁻¹) and 0.136 respectively. The significance of the parameters was assessed using analysis of variance, revealing that the filler's contribution significantly impacted wear resistance. Developed mathematical model using Regression analysis and the predicted values from K-Nearest Neighbors (KNN) have showed good agreement with experimental values. Micrograph images were captured to analyze the wear mechanisms evident on worn surfaces, revealing failure mechanisms such as extensive matrix damage, fiber exposure resulting from matrix removal, and fiber breakage.

**Full paper: Metal and Alloys Ceramics, vol. 34, 2024.*



Enhancement of Concrete Microstructure Using Graphene Oxide as a Cement Additive: An Experimental Study

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ABSTRACT

The current study investigates the graphene oxide's (GO) effect on the mechanical properties of standard concrete. To compare, conventional concrete was designed to attain a compressive strength of 30 MPa, and GO was added to create graphene oxide concrete. The workability and compressive strength of various concrete mixtures were evaluated, and the best mixture, GC2 (0.2% GO), demonstrated a compressive strength of 42 MPa and a flexural strength of 6.0 MPa after 28 days of curing. Additional analysis of GC2 using SEM, EDAX, and XRD revealed a more compact microstructure of hydration products. The results of this study suggest that the mechanical properties of concrete are enhanced by the inclusion of graphene oxide (GO).

**Full paper: Electronic Journals for Science and Engineering – International, vol. 24, no. 2, pp 38-42, 2024*



Recent Developments in Perovskite Materials, Fabrication Techniques, Band Gap Engineering, and the Stability of Perovskite Solar Cells

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ABSTRACT

Organic-inorganic hybrid metal halide perovskite solar cells (PSC) represent a novel class of optoelectronic semiconductors that have garnered significant attention from photovoltaic researchers globally. This is due to their continually improving efficiency, straightforward solution processing methods, use of lightweight and cost-effective materials, and other notable features. The advantageous properties of perovskite materials, such as superior charge transport, tunable band gap, and distinctive electronic structure, contribute to their appeal. Over the past 6 to 7 years, diverse device architectures and fabrication techniques for PSC have emerged, achieving an impressive power conversion efficiency (PCE) of 25.7%. This review article primarily focuses on recent advancements in PSC fabrication techniques, synthesis, device architecture, charge transport mechanisms, band gap engineering, and stability. Additionally, it provides a summary of recently reported materials used in various layers of PSC, including the perovskite layer, as well as electron and hole transport layers. Lastly, the article outlines the challenges faced in the development of PSC, offers recommendations, and suggests potential directions for future research to guide the field forward.

**Full paper: Energy Reports .vol. 11, pp 1171-1190, 2024*



Tribology of Ti₂/Cr₂ and (TiCr) 2AlC_x MAX Phase Ceramics

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ABSTRACT

The MAX phase ceramics namely Ti₂AlC_x, Cr₂AlC_x, and (TiCr) 2AlC_x were examined under dry sliding conditions against stainless steel ball at room temperature and 5 N applied normal load using a Ball-on-disk tribometer. At 5 N, 100 m sliding distance and 20 cm/s sliding velocity, Cr₂AlC_x, and (TiCr) 2AlC_x ceramic samples exhibited low specific wear rate (3.2×10^{-7} cm³/Nm and 4.2×10^{-7} cm³/Nm), while the coefficients of friction were 0.31 and 0.10, respectively. At 5 N, 100 m and increasing velocity from 5 cm/s to 20 cm/s, Ti₂AlC_x sample the coefficients of friction decreases from 0.25 to 0.14. The specific wear rate of Ti₂AlC_x sample was 6.7×10^{-7} cm³/N m at 5 N, 100 m and 5 m/s, and decreases with increasing velocity (3.3×10^{-7} cm³/N m at 20 m/s). The correlations between observed tribological properties and tribofilm characteristics were discussed.

**Full paper: Tribology in Industry, vol. 46, no. 3, pp 467-475, 2024*



Synergetic Effects of one and Two Dimension Nanofillers on the Mechanical Properties of Rubber Modified Epoxy Composites

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ABSTRACT

Graphene nanoplatelets (GnP), Multiwalled carbon nanotubes (M-cnT), and Halloysite nanotubes (HnT) exhibit a noteworthy synergistic impact in enhancing the mechanical properties of carboxyl-terminated butadiene-acrylonitrile-modified Epoxy (cr-Ep) nanocomposites. These nanofillers were incorporated into cr-Ep to form mono and hybrid nanocomposites. The introduction of 1-D M-cnT efficiently inhibits the stacking of individual 2-D GnP and HnT. A high contact area is created between the GnP/HnT with M-cnT and the cr-Ep matrix by the high strength and high aspect ratio of M-cnT, which can bridge neighboring GnP/HnT and prevent their aggregation. The mechanical properties of mono and hybrid nanocomposites were characterized in this study. The results showed that the mechanical properties of nanofiller reinforced cr-Ep composites were significantly improved. The tensile strength of GnP/cr-Ep and HnT/cr-Ep composites over the unfilled cr-Ep was only 24.5% and 20.5% higher, whereas the tensile strength of M-cnT/GnP/cr-Ep and M-cnT/HnT/cr-Ep composites was 39.5% and 27.6% greater than that of the cr-Ep alone. The M-cnT/cr-Ep and M-cnT/GnP/cr-Ep nanocomposites exhibited flexural strengths of 29% and 34.8%, respectively, significantly increasing over the unfilled cr-Ep. In addition, the flexural modulus of these nanocomposites has increased by 35.9% and 33.8%. Furthermore, compared to GnP/cr-Ep, HnT/cr-Ep and M-cnT/HnT/cr-Ep nanocomposite, M-cnT/cr-Ep and M-cnT/GnP/cr-Ep composite's Izod impact energy produced superior impact resistance. The distinct structures of M-cnT and GnP considerably improved the comprehensive performance of M-cnT and hybrid reinforced M-cnT/GnP into cr-Ep composites, and the insertion of these nanoparticles realizes the effective bonding between nanofillers and cr-Ep. This work offers a novel and practical method for improving the bonding between the nanofiller and the cr-Ep composite.

**Full paper: International Journal of Mechanical Engineering, vol. 11, no. 8, pp 21-31, 2024*



**Strain Hardening Behavior and Microscopic Fracture Mechanism in
Multidirectional Cryoforged Al 2014 Alloy**

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ABSTRACT

In the present work, Al 2014 alloy was subjected to multidirectional cryoforging (MDCF) and subsequently to annealing in the temperature range from 150 to 350 °C to investigate its influence on strain hardening behavior, macroscopic fracture mechanisms, and fracture toughness. The mechanical properties are correlated with the microstructural evolution after deformation and post-deformation annealing with the help of optical microscopy and transmission electron microscope (TEM) studies. Moreover, the process and annealed alloy's fracture mechanism is established using macrograph analysis and Scanned electron microscope (SEM) studies. The study reveals that the strain hardening ability, fracture mechanisms, and fracture toughness of the deformed and the post-annealed samples are influenced by the shear banding, combined recovery /recrystallization process, and evolution of second phase precipitates during annealing treatment at various temperatures. On investigating the tensile and fracture toughness properties, it was observed that these are retained up to the annealing temperature of 250 °C. In contrast, a significant drop in these properties was observed above this temperature. The macroscopic fracture mechanism of the multidirectional cryoforged (MDCFed) sample was dominated by shear fracture, while upon annealing, it gradually transformed to shear plus necking.

**Full paper: Journal of Materials Engineering and Performance, vol. 33, no. 12, pp 5963–5987, 2024*



**An Empirical Model Integrating Dimensional Analysis and Box-Behnken Design
for Crack Detection in Rotor Fan Blades**

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ABSTRACT

Due to continuous operations and manufacturing errors, fatigue cracks can emerge after hours of service this causes a fan blade failure and potentially ruins an entire engine, turbo machinery, or rotating machinery of a similar kind. This paper focuses on the condition monitoring of the fan blade for detecting cracks occurring in these blades by analyzing the vibration responses. The mathematical formulation is carried out using the matrix method of dimensional analysis, which is dependent on the fundamental quantities of force, Length, Time, and Temperature (FLT θ) systems of units. Numerical analysis in ANSYS software is done to comprehend the blade harmonic response for the cracked blade condition. Experimentation is also carried out on Tiera fault simulation machinery equipment, where vibration responses are measured and analyzed for crack detection in the blades. The tests were performed for three different cracks of different lengths and analyzed by varying parameters such as load speed, for which experiments are planned using a Box-Behnken design method. The test results were confirmed with the model equations developed, and notable similarities were seen between the analytical, numerical, and experimental analyses. Thus, the proposed study will help detect the cracks in the blades, thus reducing the serious accidents or failure of the machinery.

**Full paper: FME Transactions, vol. 52, no.1, pp. 45-56, 2024*



Effect of Surface Treated Nanofillers on Abrasive Wear of Carbon Fiber / Polyamide Blend Composites

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ABSTRACT

This work investigated the fabrication and wear behaviour of a carbon fiber reinforced polyamide (cf/PA) blend composite with silane-treated graphene and silica nanoparticles. Using an extrusion and injection molding process, four series of cf/PA blend composites with different concentrations of silica and graphene (0 to 3 wt%) were made from a polyamide blend consisting of PA6 and thermoplastic copolyester (80: 20). To evaluate two-body abrasive wear, 320 grit silicon carbide emery paper and a pin-on-disk wear test apparatus were utilized. The test results showed that the specific wear rate (SWR) decreased regardless of the type of nanofiller used. Tiny quantities of nanofillers treated with silane improve filler-matrix adhesion and increase the abrasion resistance of hybrid composites. The hybrid composite consisting of dual nanoparticles (each 1.5 wt%) into cf/PA revealed a significant decrease in SWR. To identify the wear mechanisms, a scanning electron microscope was used to study the worn surfaces of the selected composite samples. To sum up, the use of surface-treated nanofillers significantly enhances the abrasion resistance of cf/PA blend composites. The findings underscore the potential for further developments in composite material technology, which will have an impact on a variety of industries, including aerospace and automotive, where there is a growing need for materials that are both strong and lightweight.

**Full paper: Tribology in Industry, vol. 46, no. 4, pp 664-676, 2024*



Experimental Investigations on Thermo-Kinetic Properties of Ramie and Glass Fibre Reinforced Epoxy Hybrid Composites

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ABSTRACT

Epoxy matrix reinforced with natural fibres has attracted a great attention in several applications due to its cost efficiency and energy efficiency during fabrication. In this work, Eco-friendly, and green, Ramie fibres were used to develop hybrid composite laminates which can be used for engineering applications. The goal of this research work was to study the thermal properties of different wt% of the ramie and glass fibre composites when it is exposed to different heating rates of 5, 7.5 and 10 °C/min in a simultaneous Differential scanning calorimetry-Thermogravimetric (DSC-TGA) Analyser. Test samples were prepared using dry hand layup method and compression moulding. From the results of DSC and TGA, it was clear that addition of glass fibre resulted in enhanced thermal stability compared to the ramie-epoxy composite. TGA results shows that ramie and glass in the epoxy hybrid composites having 10 and 20 wt% fibres have highest onset temperature of 599 °C and lower wt% of residue. Subsequently, the thermo-kinetics study was done on the composition having 10 wt% ramie with 20 wt% glass fibres with different heating rate of 5, 7.5 and 10 °C/min heating rate. The effect of heating rate on the different hybrid samples was also investigated and it was found that there is shift in the decomposition temperature towards the higher side with increasing heating rate. The Flynnwall-Ozawa and Kissinger approaches were used to evaluate the kinetic parameters such as activation energy and pre-exponential component and the activation energy was found to have a value of 211 kJ/mol. This research work attempts to use both ramie fibre and glass fibre in plain woven form to develop a series of newer epoxy hybrid composite laminates. Ramie fibers provide best heat resistance, superior tensile strength, and modulus other than the jute, flex, hemp and sisal fibres. This property will help the hybrid composite materials made from ramie and glass fibres to have better thermal stability and heat resistance.

**Full paper: Springer Proceedings in Materials , vol. 60, pp 167-179, 2024*



Experimental Studies on the Physical and Mechanical Properties of Modified Silica/Graphene Reinforced Polyamide6/Copolyester Elastomer Blend Nanocomposites

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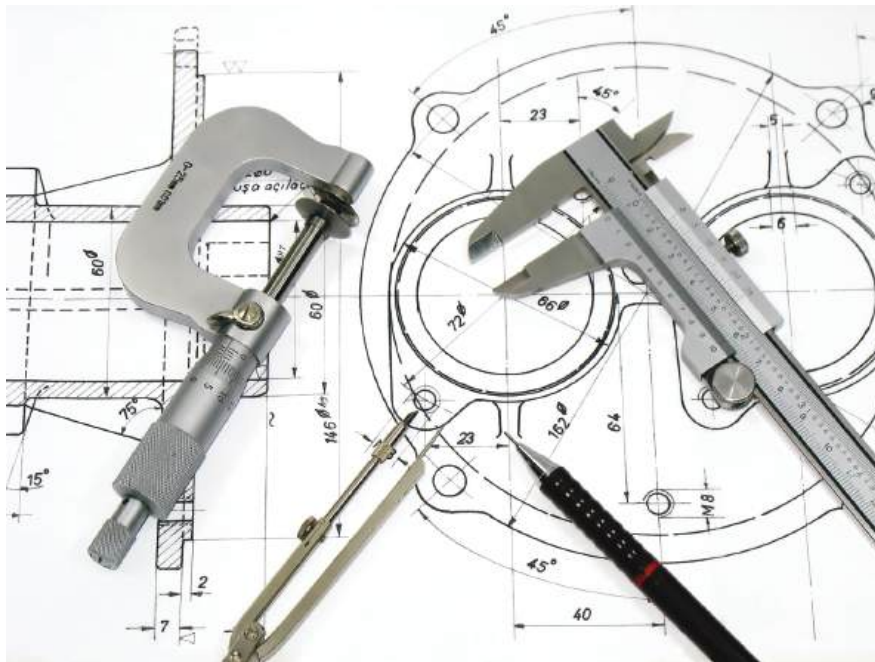
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ABSTRACT

Compatibility of epoxy extrusion and injection molding was used to create a series of polyamide6 (PA6)/ copolyester elastomer (CoPe)/nano-silica (nS) and graphene nanoplatelets (nG) composites. The impact of surface-modified nanofillers and loading on the composites' physical and mechanical properties were investigated. As a consequence, PA6/CoPe blend with silane-treated nS and nG composites had a slight drop in elongation but a significant gain in strength and modulus than PA6/CoPe blend. The interlaminar shear strength of the nG-filled PA6/CoPe blend was increased by up to 33.5%, a maximum of 37.55 MPa, with a 1.5 wt% nG loading. With the 1.5 wt% nG loading on the blend surface, the ep resin compatibilizer assisted in interfacial bonding between the matrix and nanoparticles. The impact strength of the PA6/CoPe blend was found to be greater due to the existence of a tougher PA6 matrix, which was subsequently increased by the addition of nS filler reinforcement in the PA6/CoPe/nS composite. The addition of 1.5 wt% of nG in PA6/CoPe blend improved the tensile strength and elastic modulus by 15.8% and 15.1% compared to PA6/CoPe blend, respectively. Scanning electron microscopic studies revealed that the composite had a continuous PA6 phase and a dispersed CoPe phase. The nS and nG particles were embedded in the PA6/CoPe blend exclusively at 1.5 wt% loading. Microstructure analysis reveals a strong contact between the silane-treated nS and nG and the polar PA molecules, and it may be responsible for the increased mechanical properties.

**Full paper: Polymer Engineering & Science, 2024*

Department of Industrial & Production Engineering





Modelling the Enablers of Lean and Agile Manufacturing for Sustainable MSMEs Supply Chain" An ISM Approach

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ABSTRACT

Following the COVID-19 pandemic outbreak, small companies especially coming under the category of micro, small, and medium enterprises took many measures due to their sensitivity to adverse effects on their supply chain compared to larger companies. Due to diverse nature of MSMEs, the relentlessness of the pandemic's impact on them varies extensively depending on their characteristics. Along with competitiveness, the positive impact on society and environment sustainability has become ambitiousness for the majority of MSMEs. Many researchers have proved that lean practices have been a proven strategy to achieve efficiency in entire supply chain and create leaner supply chain. Another strategy is agile which has a remarkable impact in creating highly reactive supply chain. To participate in this highly volatile market, not just being efficiency is enough but supply chain needs an added strategy of effectiveness. This study explores the enabler of Leagile principles in MSMEs supply chain which enable successful transitions to viable as well as sustainable supply chains. Through empirical investigation, critical success factors (enablers) for attaining both lean and agile were encountered. In light of these variables, the driving and dependent influences of the facilitators impeding the acceptance of Leagile in their supply chain are analyzed by ISM approach. Finally, a novel model (diagraph) for viable structured Leagile enablers is represented, which will support in transition to sustainable supply chain.

**Full paper: International Conference on Smart and Sustainable Developments in Materials , pp 175-181, 2024*



Fretting Wear Behavior on LPBF Processed AlSi10Mg Alloy for Different Heat Treatment Conditions

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ABSTRACT

To widen the industrial application of additively manufactured (AM) parts, the study of fretting wear behavior is essential, as it ensures the safety and reliability that drive innovation in design and materials. This study explores the fretting wear behavior of the as-built and heat-treated state of AlSi10Mg alloy fabricated, viz., laser powder bed fusion (LPBF). Initially, the as-built and T5, T6, and stress-relieved (SR) heat-treated samples were examined using scanning electron microscopy (SEM) to gain insights into the microstructural changes. The as-built samples exhibited a higher hardness level (135 HV) primarily due to the presence of very fine microstructure of the α -Al cellular matrix with embedded Si. The α -Al cellular structure dissolved with various heat treatments, and Si particles coarsened. The hardness decreased to 85, 79, and 67 HV for the T5, T6, and SR conditions, respectively. Subsequently, fretting tests were conducted on the samples, applying various normal loads of 10, 50, and 100 N. Further, the samples were characterized by the coefficient of friction (COF), worn surface morphology, and wear volume loss. The investigation showed that the as-built material showed less wear volume loss under all loading conditions than the heat-treated conditions. Furthermore, the T5 heat treated sample had a lower wear volume when compared to the T6 and SR heat-treated samples. The heat-treated sample exhibits compressive stress, whereas the LPBF processed, the as-built sample shows tensile stress

**Full paper: Journal of Materials Research and Technology, 2024*



Dark Channel Prior in Low Frequency Domain for Time-Efficient Single Image Dehazing

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ABSTRACT

Dehazing plays a vital role in enhancing the quality of outdoor images for computer-based applications. While dehazing algorithms significantly improve outdoor image quality for computer vision tasks, their effectiveness hinges on two crucial factors: 1. Speed of dehazing operations 2. Platform-agnostic nature of the chosen algorithm. This study introduces a novel Dark Channel Prior-Low Frequency Domain (DCP-LFD) method designed to effectively and efficiently eliminate haze from single hazy images. The method employs a hybrid strategy, combining DCP for haze reduction in the low-frequency domain and Soft-thresholding for enhancing high-frequency coefficients. This dual-pronged approach enables improvement of image quality in low and high-frequency domains, contributing to better dehazing outcomes taking less computation time. The proposed method's effectiveness is accessed using metrics like PSNR and SSIM, comparing its performance against state-of-the-art dehazing methods across five benchmark datasets: SOTS, RTTS and HSTS subsets from RESIDE, HazeRD, and Middlebury datasets. No-Reference Image Quality Assessments viz. BRISQUE and FADE are performed on RTTS and private dataset to objectively evaluate dehazed image quality. A comparison of dehazing time is executed, highlighting the method's proficiency in achieving faster results. This analysis accentuates the method's capacity to efficiently remove haze from outdoor images while emphasising its time-saving efficiency.

**Full paper: International Journal of Image and Data Fusion, 2024*



Novel Approach to Bio-Inspired Triboelectric Nanogenerators Employing Recycled Natural Fibres for Sustainable Energy Harvesting

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ABSTRACT

By leveraging nature's ingenuity and adopting a circular economy approach, bio-inspired triboelectric nanogenerators (TENGs) can not only generate clean electricity but also contribute to environmental stewardship and resource conservation. Herein, a novel approach to developing bio-inspired TENGs utilizing recycled natural fibres sourced from agricultural waste is reported. The potential of various natural fibres, including coco peat, sugarcane husk, pistachio shell, and flax shive, for integration into TENG applications is investigated. Natural fibres-based TENGs (NF-TENGs) comprising polyvinyl alcohol and the aforementioned agro-waste composites are fabricated using a straightforward solution casting technique. Structural, elemental, and interaction analyses of these fibres are systematically conducted using analytical techniques such as Scanning Electron Microscopy, Energy Dispersive X-ray Spectroscopy, and Fourier Transform Infrared spectroscopy. Electrical characterizations, encompassing voltage, current, and determination of optimal load resistance, along with device stability assessments, are performed on the NF-TENGs. Furthermore, the optimized NF-TENG, composed of flax-seed husk, is demonstrated for powering small-scale electronics including charging electrolytic capacitors, LEDs, and functioning as a self-powered biomechanical sensor. This research marks a significant advancement in sustainable energy technologies by harnessing the latent potential of agricultural waste-derived natural fibres.

**Full paper: Sensors and Actuators A: Physical, 2024*



Relative Depth Prediction of Objects in Hazy Images Using Depthmap and Object Detection

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ABSTRACT

The ability to establish the relative distances of objects in a single image is essential for many computer vision applications, including scene understanding, augmented reality, and robotics. In this study, we present a method that combines object detection and depth maps to provide an estimate of the relative depth of objects within an image. First, we locate and identify objects within the image using a state-of-the-art object identification model, which yields a set of bounding box coordinates, then estimate the monocular depth maps using a deep learning model. The estimated depth map statistics are used to determine the average depth value of each object enclosed within the bounding box. This data is utilized to estimate the relative distance of objects in the scene. The level of closeness is measured by comparing the average depth value of the objects with a hyper-parameter. An object with average depth value higher than the hyper-parameter is closer to the camera, whereas an object with an average depth value lower than the hyper-parameter is farther away from the camera. We have categorized the relative depths of objects into four levels on the basis of the average depth value's correlation to the hyper-parameter. Experimental evaluations on standard and real-time datasets have shown that the proposed strategy is effective and precise, emphasizing its potential applicability in several computer vision areas.

**Full paper: International Journal of Intelligent Systems and Applications in Engineering, vol. 12, no. 1, pp 267-276, 2024*



Characterization of Fracture Toughness Properties of Coir Fibre Reinforced Polypropylene Composites

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ABSTRACT

This study investigates the production and assessment of fracture toughness in Polypropylene (PP) composites reinforced with different weight fractions of treated and untreated coconut coir fibres. The potential of natural fibres, especially those obtained from agricultural waste like coconut coir, to create lightweight, affordable, and environmentally friendly composite materials has drawn attention. In the study, coir fibres were cleaned and chemically treated with NaOH before being incorporated into PP using injection moulding and extrusion techniques. According to ASTM guidelines, composites with 10%, 20%, and 30% coir fibre concentrations underwent Single Edge Notched Bend (SENB) testing to determine their fracture toughness. The fracture toughness of composites containing 10% and 20% untreated coir fibres was found to be higher than that of pure PP, but composites containing 30% untreated and all treated coir fibres showed reduced fracture toughness. The best composite, with 20% untreated coir, showed the best mix of fibre content and material performance, emphasizing how chemical treatment hurt fibre brittleness and the composites' overall ability to support loads. The potential of untreated natural fibres to improve composite materials for industrial applications-particularly in the automotive industry-is highlighted by this study.

**Full paper: Journal of Mines, Metals and Fuels, 2024*



Characterization of Mechanical Properties of Coconut Coir Fibre Reinforced PLA Composites

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ABSTRACT

This study examines the biodegradable and fracture toughness of Polylactic Acid (PLA) composites supplemented with coir fibres at different fibre weight fractions. Sustainable composite materials are made by combining fibres from coconut coir with PLA, a biodegradable polymer sourced from renewable resources. To improve their characteristics, the fibres are treated with sodium hydroxide, and twin-screw extrusion and injection moulding are used to create the composites. According to ASTM standards, tensile, impact, and flexural strength tests show that untreated coir fibre reinforced PLA composites have higher tensile and impact strengths than pure PLA, whereas treated fibres offer marginal increases at particular weight fractions. As fibre content rises, flexural strength often falls; untreated composites outperform treated ones in this regard. These results demonstrate the potential of PLA composites reinforced with coir fibre as greener substitutes for traditional polymers, with prospective uses in structural contexts where mechanical integrity and biodegradability are essential.

**Full paper: Journal of Mines, Metals and Fuels, 2024*



Coir Fiber-Filled Polylactic Acid Composites: Study of Fracture Toughness and Biodegradable Property

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ABSTRACT

In this study, coconut coir fiber reinforcing was used to create biodegradable polylactic acid (PLA) composites. To make composite plates in response to the growing demand for eco-friendly materials, this study evaluates the load-bearing capability of treated and untreated fiber-filled PLA composites. A single-edge notch bending (SENB) test sample was used to assess the fracture toughness of these composites. Furthermore, a systematic weight reduction analysis over time is employed to assess the biodegradability of the composites. The untreated fiber-filled composite materials have a greater capacity to withstand loads because of their increased biodegradability at larger weight fractions. The fracture toughness performance and environmental effects of poly lactic acid composite materials filled with coconut coir are discussed in this study, highlighting the materials' potential as sustainable resources for a range of uses. The findings suggest that the treated 10-weight percentage of coir-filled PLA composites exhibited maximum fracture toughness (FT) values.

**Full paper: International Conference on Smart and Sustainable Developments in Materials- 2024*



Effect of Ceramic Boron Carbide Particles Addition on the Mechanical and Microstructural Characteristics of Al7020 Alloy Composites

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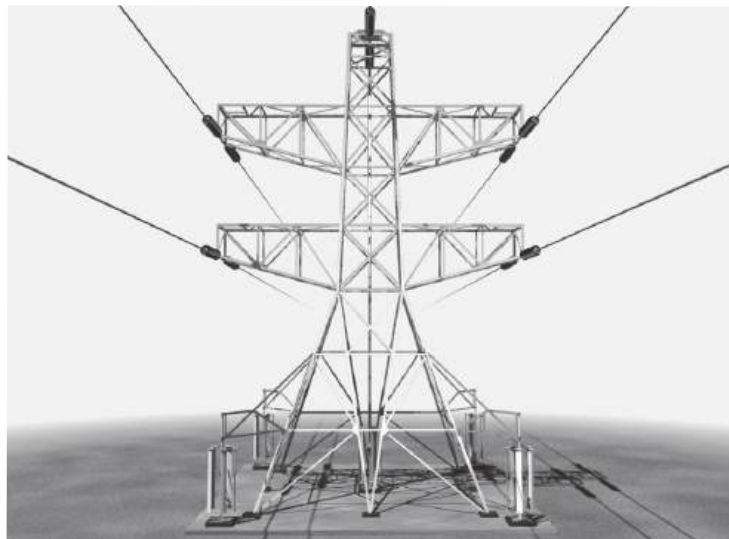
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ABSTRACT

The aerospace and automotive engineering industries are seeing a growing need for materials that are both lightweight and very durable. This increased demand has prompted the development of innovative metal matrix composites based on aluminum. The current study aimed at developing and characterization Al7020 metal matrix composites by reinforcing micro boron carbide particles, Al7020/B₄C MMCs are fabricated by stir casting method by varying the boron carbide particles in wt.% (0, 2, 4, 6, and 8wt. %). Lastly, the prepared samples were subjected to tensile, compression, hardness, and fracture toughness tests to evaluate the impact of B₄C particles on density, mechanical, and microstructural parameters. By incorporating B₄C particles into the Al7020 alloy, the experimental results demonstrated that metal matrix composites exhibited enhanced ultimate tensile strength, yield strength, hardness, and compression strength. In addition, the lowest density, highest toughness, and superior micrograph were observed in Al7020/B₄C MMCs with 8 wt. % reinforcement of B₄C particles with a minor decrease in elongation.

**Full paper: Mechanics of Advanced Composite Structures, 2025*

Department of Electrical & Electronics Engineering





Automatic Load Frequency Control of Multi Area Power system using Hybrid Technique

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ABSTRACT

In a two-area power system, with random change in load demand, the frequency varies. Load frequency control (LFC) is to minimize the transient variations and also to make sure that the steady state error is zero. To achieve this, automatic load frequency controlling strategies with Fuzzy-ANN controller are proposed. The Real time data used in this study collected from Southern Load dispatch Center, Power Grid corporation of India limited Bengaluru. The effectiveness of the controller are validated by performance parameter assessment. The development and simulation of power system components, test systems and proposed controller is modelled using MATLAB-SIMULINK Environment. The results found satisfactory and compared with other techniques.

**Full paper: 5th International Conference for Emerging Technology (INCET), 2024*



Capacity Estimation in Automotive Battery Management Systems with Intelligent Techniques

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ABSTRACT

The urgency of addressing global warming has made electric vehicles and lithium-ion batteries key to sustainable transportation. Efficient battery management, notably through Battery Management Systems (BMS), is crucial for battery longevity. BMS calculates State of Charge (SOC) and State of Health (SOH), ensuring optimal battery performance and longevity, as they determine the remaining charge and health status, critical for preventing overcharging and extending battery life. For achieving accurate estimations, data-driven approaches have demonstrated notable efficacy. Among them, Neural Networks and Fuzzy Logic are frequently utilized techniques. This paper focuses on evaluating the capacity estimation methods for Li-ion batteries, employing both Neural Network and Fuzzy Logic methodologies, with the primary aim of ascertaining which approach proves more efficacious. The investigation encompasses both techniques to gain insights into their respective capabilities in estimating Battery Capacity. Our findings indicate that the Neural Network method stands out as the superior choice for battery capacity estimation. This conclusion is substantiated by the observation that the root mean square error associated with the ANN method is significantly lower when compared to the Fuzzy Logic method. Furthermore, we implemented these methodologies using the MATLAB tool.

**Full paper: International Conference summit on Artificial Intelligence, vol 1259, pp 137-147, 2024*



Design and Development of Reversible Comparator Circuit using Qiskit

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ABSTRACT

Quantum computing is at the leading edge of advanced technology that uses quantum phenomena such as entanglement and super position to solve complex problems. One of the main application is to built comparator circuit to do arithmetic operations at stipulated time. Based on this our research is to propose the design and implementation of one-bit and two-bit quantum comparators using IBM Qiskit, which is formly compared with classical comparator. Also this work represents a comprehensive overview of the techniques required to optimize and design quantum comparator circuits using real quantum simulators. The results obtained from simulation promises the comparison accuracy with classical results. From the circuit designed it is inferred that the hardware complexity is very much reduced compared to classical comparator, which are tabulated in terms of number of quantum gates. The proposed method can further be extended to generate higher order comparator circuits. These results may form the basis for further research and development that will support the advancement of quantum computing and algorithms.

**Full paper: International Conference on Signal Processing, Computation, Electronics, Power and Telecommunication, IConSCEPT Proceedings, 2024*



Enhancing Smart Grid Security with SHA-SARIMAX: Identifying and Restoring Corrupted Files from FDIA

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ABSTRACT

The smart grid is a promising solution for modernizing electrical power systems in a digital world. However, cybersecurity threats pose significant risks to the grid's integrity and resilience. False Data Injection Attacks (FDIA) have shown serious risks to disrupt the power system infrastructure. SHASARIMAX is a novel framework designed to address these challenges by combining distinct elements of Secure Hash Algorithm-256 (SHA256) and SARIMAX. Cryptographic hashing techniques and advanced modelling of SHA-SARIMAX actively detect and recover corrupted values in time series datasets affected by FDIA. This approach detects and recovers corrupted values in time series datasets affected by FDIA, leveraging cryptographic hashing techniques and advanced modelling. The proposed framework achieves a 99.90% accuracy rate from the original corrupted data. Thus, the SHA-SARIMAX demonstrates its applicability and suitability for implementation within smart grids, specifically for addressing the recovery of original data from the corrupted data affect

**Full paper: IAENG International Journal of Computer Science, vol. 51, no. 8, pp 1112-1121, 2024*



Improved Performance of Li-Ion Battery Feeding SRM Drive Using PSO-Based Speed Control and Torque Ripple Minimisation with FOPID Controller

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ABSTRACT

Switched reluctance Motor (SRM) drives provide several advantages over other electric drive systems, making them one of the finest options for EV applications. Its excellent qualities are the robust design, double saliency, fault tolerance, and ability to withstand the heat of SRM drives. In this article, a SRM powered by 18,650 Li-ion battery modules with the purpose of optimising their performance is addressed. In order to minimise torque ripple (Tr) and provide an exact speed response in SRM, this article mainly presents a speed controller (Nc) and current controller (Ic) technique. The accurate speed control and torque ripple (Tr) reduction of a SRM is controlled using the particle swarm optimisation optimisation technique (PSO) with speed and current control mechanisms. The FOPID Nc in the outer loop and Ic in the inner loop, respectively, are regulated, as are the 3- \emptyset , 6/4 SRM turn-on (T_{O}), and turn-off (T_{F}), angles. The torque ripple (Tr) coefficient and fitness function (FF) of the PSO algorithm are observed to be lower when compared to other optimisation methods found in past studies. These results were compared with existing optimisation methods, such as the SHO, LUS, GA, and Ant-Lion algorithms, show that a cascaded fractional order PID(FOPID) controller offers better speed, current, and torque responses, as well as smaller current and torque ripples, under numerous different load and speed conditions. Under all load conditions, it has been demonstrated that the PSO-FOPID controller has the best speed response and minimal torque ripples when compared with other optimisation techniques. Based on the research results, it is possible to conclude that PSO-FOPID-based speed controllers increase SRM drive performance by minimising torque ripple, lower rise time, and settling time due to their high exploitation capacity.

**Full paper: Australian Journal of Electrical and Electronics Engineering, 2024*



Experimental Analysis on the Impact Behaviour of Graphite-Filled Glass Fibre Reinforced Epoxy Composites Subjected to Sea Water Ageing and Notch Depth

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ABSTRACT

The present investigation focusses on the analysis of effect of notch depth and sea water ageing on the impact behaviour of glass fibre reinforced epoxy composites filled with graphite particulates as the secondary reinforcement. The laminates of epoxy composites with different compositions are developed by varying graphite filler in the volume proportion of 0%, 4% and 8% vol. The epoxy composites fabricated are subjected to ageing in water for different time durations of 50 h, 100 h and 150 h. The specimens subjected to ageing are tested for impact strength according to ASTM D256 at different notch depth varying from 1 mm–4 mm in steps of 1 mm. It is evident from the experimentation that increase in impact strength is obtained for epoxy composites with increase in addition of graphite filler. It is observed that sea water aged specimens with 4-mm notch depth have resulted in enhanced impact strength of about 51% compared to 1-mm notch depth.

**Full paper: Journal of The Institution of Engineers (India): Series D, vol. 105, no. 2, pp 969-974, 2024*



Particle Swarm Optimization Technique for Speed Control and Torque Ripple Minimization of Switched Reluctance Motor Using PID and FOPID Controllers

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ABSTRACT

Switched Reluctance Motors has become one of the best solutions for EV applications because of its numerous benefits over other electric drive systems. Its excellent qualities are the robust design, double saliency, fault tolerance, and ability to withstand the heat of SRM drives. In order to minimize torque ripple and provide an exact speed response in SRM, this article mainly presents a speed and current control technique. The accurate speed control and torque ripple reduction of a SRM is controlled using the particle swarm optimization technique (PSO) with speed and current control mechanisms. The PID and FOPID speed controllers in the outer loop and current controller in the inner loop, respectively, are regulated, as are the 3-, 6/4 SRM turn-on (α), and turn-off (β), angles. The results were compared with existing optimization methods such as the SHO, LUS, GA, Ant-Lion, NSGA-II, MOLGSA, GSA, Hybrid MOLGSA, and RGA-SBX algorithms, show that a cascaded Fractional order PID(FOPID) controller offers better speed, current, and torque responses, as well as smaller current and torque ripples, under numerous different load and speed conditions. Under all load conditions, it has been demonstrated that the PSO-FOPID controller has the best speed response and minimal torque ripples when compared to the PSO-PID controller.

**Full paper: International Journal of Information Technology, Springer, vol. 16, no. 2, pp 1181-1201, 2024*



Frequency Stability of a Wind-based Energy System by Virtual Inertia Controller of an Inverter Connected to Grid

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ABSTRACT

The dwindling inertia of the power system due to the incorporation of renewable energy sources is a vital concern. This is the genesis of the frequency volatility in a system. A non-linear controller formulated on fuzzy logic has been developed for mimicking the operation of a synchronous generator. This non-linear controller is proficient in utilizing the energy present in the rotating blades of the wind turbine and nourishing the requisite quantity of inertia in the system ensuring the alleviation of the frequency variation issues. The system's improved behavior is evaluated with this innovative controller in comparison with a traditional PD/PID controller for various transients such as sudden addition, deletion of large loads, and faults.

**Full paper: IETE Journal of Research, vol. 70, no. 3, pp 3134-3149, 2024*



Performance Evaluation of Ultra-Low Power ADCs in Energy Harvesting Systems

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ABSTRACT

Quality healthcare has become more relevant than ever before in the history of humanity. There is an ardent need to develop affordable remedies in the healthcare sector. The contemporary market landscape insists that all upcoming designs are low power and portable. This necessity peaked during the COVID-19 pandemic. In any biological data acquisition/monitoring system, the signals are continuous. These analog signals are usually amplified, filtered and converted into digital codes for ease of further processing. Thus making an Analog to Digital Converter (ADC) an integral part of every bio-medical data acquisition system. Successive Approximation Register (SAR) ADCs have many potential biomedical applications due to their ability to accurately convert analog signals into digital form. SAR ADCs used in biomedical applications include Electroencephalography (EEG), Electromyography (EMG), Electrocardiography (ECG), Blood glucose monitoring, and Magnetic Resonance Imaging (MRI). These versatile ADCs are essential components in advancing healthcare technology facilitating accurate diagnosis and treatment. The proposed ADC consumes low power and, hence, is suitable for mobile healthcare devices.

**Full paper: SSRG International Journal of Electrical and Electronics Engineering, vol. 11, no. 8, pp 226-235, 2024*



Collaborative evaluation of SoC, SoP and SoH of lithium-Ion Battery in an Electric Bus through Improved Remora Optimization Algorithm and Dual Adaptive Kalman Filtering Algorithm

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ABSTRACT

Many countries are switched to electric vehicles (EVs) for public transportation, which increases the adoption of electric buses. Batteries are the key component in battery-operated electric vehicles and must be monitored for the system to operate efficiently. This work has proposed a joint estimation method to examine the battery states. The lithium-ion battery (Lisingle bondB) is initially designed through a first-order RC equivalent (FO-RC) circuit. To optimize the modelling parameters of a battery, an improved remora optimization algorithm (IROA) is proposed in this work. After detecting the optimum values for the parameters, the SoC is evaluated by a dual adaptive Kalman filtering algorithm (DAKF). Then the SoH is estimated based on the predicted SoC of a battery, whereas the SoP is evaluated by considering current and voltage constraints during battery operation. After that, the battery's remaining useful life (RUL) is examined based on the estimated SoC. The proposed work is implemented on the MATLAB platform, and the results will be validated under varying operating conditions. The comparative analysis shows that the IROA provides optimum parameters near the actual parameters' actual values, thereby improving the prediction accuracy of battery states.

**Full paper: Journal of Energy Storage, vol. 79, 2024*



ANFIS-MPC-Based DSTATCOM Control in Microgrid Environment for Power Quality Improvement

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ABSTRACT

This paper presents a comprehensive study of different control techniques to improve the power quality in Microgrids. Microgrid promote the integration of renewable energy, Integration of microgrid to the main grid and operating it in the islanded mode can cause power quality issues during grid changeover and load changes. Power quality issues can be effectively compensated with devices such as DSTATCOM, which will be connected in parallel at PCC (Point of common coupling). DSTATCOM is a shunt-connected device connected through VSC to control Voltage sag, swell, and THD. In this work, the Power quality is observed at load in grid-connected mode and islanded mode with and without DSTATCOM connected in parallel at PCC. The second part presents an overview of different control theories with different control techniques. In the third part, the modified ANN Fuzzy (ANFIS)MPC-based control is proposed, this method overcomes the problems of oscillations of weight and low convergence. The proposed method is simulated in MATLAB/Simulink, under different modes of operation and loading conditions. The results obtained through simulations were found to meet the power quality standards.

**Full paper: S N Computer Science, Springer vol. 5, no. 7, -2024*

**Department
of
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Land Use and Land Change Detection of the Ecosystem by Processing Sentinel Images

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ABSTRACT

The change is an indication of progress. The society is undergoing rampant transformation due to advancement in technology and schemes initiated by the government. However, progress in all sections of the system is preferable to balance the ecosystem. To ensure this, regular monitoring is imperative. The study aims at change detection in various areas of land features such as built-ups, agriculture land, crop area, water bodies, and plantation regions. The area in Ramanagara district of Karnataka is selected as a study area as it has seen rapid growth in industrial hubs consequently in expansion of residential areas and thereby affecting agriculture activities. The land change detection is estimated for a period of seven years using Sentinel remote sensing images and machine learning algorithm and index-based method. The results indicate decline in vegetation index and expansion of built-up area.

**Full paper: Data Science and Applications, Vol. 821, pp 259-271, 2024*



Cost Effective Fi-Wi Using Optimal ONU Placement: A Performance Analysis of Modified Whale Optimization Algorithm

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ABSTRACT

Fibre Wireless (Fi-Wi) access technology integrates the existing broadband access technology and wireless access technology to fulfil the users' demand for better Internet speed in "anytime anywhere" approach and cost-efficient manner. It is designed to make the best use of their advantages in terms of vast bandwidth, mobility, and cost effectiveness. However, there remain there remain several open and challenging issues that require concentrated research efforts to build such an access technology. ONU placement problem is one among these issues as ONU placement in FiWi plays a critical role in overall network deployment cost and resource optimization. In this work, we present performance analysis of modified wale optimization algorithms by considering different of scenarios for ONUs and wireless routers in a FiWi network. We also compare present throughput gain for the algorithms under varied ONU and router deployment.

**Full paper: AIP Conference Proceedings, vol. 3122, no. 1, 2024*



Electrocardiogram Pulse Wave Analysis for Holistic Cardiovascular Assessment

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ABSTRACT

This paper introduces an innovative approach to non-invasive heart health assessment by integrating pulse data obtained from the human wrist with machine learning techniques. Drawing inspiration from ancient Ayurvedic techniques like Nadi Pariksha, we analyze pulse characteristics such as shape, intensity, and frequency to deduce potential health conditions, offering tailored treatment approaches. Employing portable pulse data capturing instruments in non-hospital settings, we relay the collected data to a model of machine learning that applies pattern analysis for classifying health conditions. By extrapolating insights from diverse datasets, we enhance the accuracy and applicability of our model's classifications.

**Full paper: IEEE International Conference on Information Technology, Electronics and Intelligent Communication Systems (ICITEICS), 2024*



Design and Development of a Functional CANSAT Model for Atmospheric Data Collection

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ABSTRACT

This paper presents the design and development of a functional Can sized Satellite(CANSAT) prototype focused on acquiring atmospheric data while demonstrating the feasibility and effectiveness of miniaturized satellite systems. The prototype incorporates a telemetry system for data collection and transmission to a ground station, employing reliable wireless communication protocols for real-time monitoring. Controlled velocity descent is achieved through careful parachute dimensioning and the integration of servo-actuated PID(Proportional-Integral-derivative) controlled fins for precise orientation control. The successful implementation of this prototype serves as a proof-of-concept for future miniaturized satellite missions, showcasing its capabilities in telemetry, communication, and controlled descent.

**Full paper: IEEE Space, Aerospace and Defence Conference (SPACE), 2024*



A Compact and Low Power Memristor Based 8-Bit Digital to Analog Converter for Hearing Aid Devices

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ABSTRACT

Hearing aid consists of amplifiers, data converters, signal processing unit and an output driver circuit. This paper focuses on the design of low power and compact 8-bit digital to analog converter (DAC) architecture for hearing aids. To achieve better power and area efficiency, resistors in DAC are replaced with memristors which are connected in series-parallel combination to obtain the required resistance value. In this work, 8-bit memristor DAC along with class D power amplifier to drive a load of 32Ω is characterized in the Cadence Virtuoso using gpdk 90 nm. The proposed 8-bit DAC design achieves a signal-to-noise ratio (SNR) of 47.91 dB, a spurious free dynamic range (SFDR) of 54.65 dB, and a power consumption of $9.89 \mu\text{W}$ for a capacitive load of 1 pF. More than 40 % area reduction and drastic reduction in power consumption is observed in proposed DAC when compared to the existing DAC

**Full paper: IEEE International Conference on Electronics, Computing and Communication Technologies (CONECCT), 2024*



An Experimental Study of Relay-Assisted LoRa Communication Using UAVs for IoT Applications

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ABSTRACT

In this paper, we consider a long range (LoRa)based unmanned aerial vehicle (UAV)-assisted relay, and study its performance in terms of optimal UAV placement and signal strengths. Our test configuration consists of LoRa modules mounted on top of a hexacopter, demonstrating improved mobility and versatility for various uses. We demonstrate that flying a UAV in proximity of either the LoRa transmitter or receiver is optimal in terms of received signal strength indicator (RSSI) metric. Further, our experiments indicate that the presence of a relay significantly enhances the received RSSI, in comparison with non-line-of-sight communications. Our results demonstrate that UAV-based relaying with LoRa increases the range of data transmission, while providing dependable, affordable, and lowpower communications which is useful in internet-of-things (IoT) applications using UAVs

**Full paper: IEEE International Conference on Electronics, Computing and Communication Technologies (CONECCT), 2024*



3D-Printing Technology: A Review

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ABSTRACT

The process of digital fabrication, commonly known as 3D printing, involves gradually adding materials to a geometric representation to produce actual items. The advantages of 3D printing for industrial use include little material waste, simple manufacturing, minimal human participation, minimal post-processing, and energy efficiency. In this study, we provide insights on the development of 3D printing, its history, current state, uses, and potential future directions. There is a detailed explanation of various materials that work with each sort of 3D printing procedure

**Full paper: Second International Conference on Intelligent Cyber Physical Systems and Internet of Things (ICoICI), pp 528-532, 2024*



Design and Development of Electrical System for Retrofitting a Turning Centre

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ABSTRACT

The design and implementation of retrofitting machines eliminate the need for skilled individuals to operate machinery manually. Due to the lengthy machining process, retrofit applications can be completed on traditional lathes. Further, the outcome of this traditional lathe operation depends on the operator's skill. Retrofitting these ancient, out-of-date lathe machines involves employing electrical, programming software, power electronics, and other appropriate control technologies. G-codes and M-codes are created while designing parts using CAD/CAM software, which also allows for 3D modeling and other CNC programming. These programs are run line-by-line. As a result, batch manufacturing will be simpler and take less time to complete, increasing the quantity of items.

**Full paper: International Conference on Robotics, Control, Automation and Artificial, pp 209-221, 2024*



Model Predictive Controller Based Virtual Inertia Controller for Enhancing the Frequency Stability of Microgrid

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ABSTRACT

The power system network is getting integrated with a large number of renewable energy resources with the help of power electronics, which reduces the total inertia and the frequency stability of the network. The employment of virtual inertia controllers with the help of power electronic converters, energy storage systems, and modern control systems address this problem. A model predictive controller can be used for this purpose, which has the abilities of future predictions of the perturbations in the network, rapid dynamic reaction, and robustness to disruption and uncertainty. Model predictive controller-based virtual inertia controller is designed to emulate suitable inertial power into the network using a feed-forward regulation technique to eliminate the disturbance from load changes and renewable energy penetration. The performance of the proposed controller is validated using simulations under various transient conditions, for a single area power system having large penetration of renewable energy sources.

**Full paper: Intelligent Control, Robotics, and Industrial Automation, Proceedings of International Conference, RCAAI, 1220 LNNE, pp 181-195, 2024*



**Use of Rain/Humidity Sensors for Rider Safety Against Harsh Weather
Conditions and Pothole-Ridden Road**

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ABSTRACT

Technology has had a significant impact on the auto industry recently. Two-wheelers are the primary emphasis of our project. We have a designed strategy to protect the rider against recent dramatic changes in weather conditions using rain/humidity sensors, which open the canopy when a specific temperature is reached depending on the climate, the proposed work is carried out. This canopy offers protection to the rider from rain and high levels of humidity. The radar system sensors are being used to implement the additional feature of obstacle detection. These sensors inform the rider when they spot a pothole or hump up ahead. Both of these implementations make use of programming and Arduino. In this paper, both the rain/humidity sensors and radar system offer automated control shade from intense sunlight and rain at an affordable cost.

**Full paper: AIP Conference Proceedings, vol. 3131, no. 1, 2024*



**Development of an Intelligent Control Strategy for a Hybrid Energy System
Integrated With the HEV Drive**

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ABSTRACT

Efficient and accurate performance of a control system plays a major role in developing an energy-efficient intelligent control system (ICS) for the Grid-connected Hybrid Electric Vehicle (HEV) applications. The ICS constitutes the control of hybrid energy split among the renewable sources (PV and Fuel Cell), HEV drive control is achieved by controlling the grid-connected inverter and bi-directional DC-DC converter. MPPT is designed in ICS to extract the maximum amount of power from solar PV. RESS control provides the maximum amount of extracted energy from PV and FC. In this proposed system, a bi-directional DCDC converter along with the storage system is designed to transfer energy in forward and reverse directions from source to storage element and storage element to load end in the process of charging and discharging of the battery which constitutes the bidirectional energy transfer. In addition to these control operations, ICS provides HEV drive control by controlling the grid-connected inverter. The operation of the developed ICS is compared with the conventional controllers and the results show that the proposed system with ICS is highly efficient than conventional controllers. The proposed system is tested with a three-phase load and HEV drive, both speed and torque controls are performed for the grid-connected HEV drive, and the system is tested with the different standard drive cycles.

**Full paper: IETE Journal of Research, vol. 70, no. 3, pp 3067-3086, 2024*



Adaptive Channel Equalization for Digital Communication with Tunicate Swarm Algorithm

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ABSTRACT

In wireless communication systems, the information is transferred as digital symbols that get affected by noise interference while transmitting through the wireless channel. In today's world, the increased demand for rapid data transmission rates leads to more inter-symbol interference in the received signal. To diminish the effects of inter-symbol interference, adaptive channel equalization is utilized in digital communication. In this paper, the inter-symbol interference effect in the finite impulse response channel is reduced in terms of an adaptive equalizer method. The weights/coefficients of the equalizer are optimized through a tunicate swarm algorithm. Channel equalization involves optimizing the channel coefficients to mitigate the impact of inter-symbol interference. This equalization process can be viewed as an iterative optimization task, aimed at lessening the mean square error among the transmitted signal and the equalizer's output. The implementation of the proposed method is executed using MATLAB software. We assess its effectiveness through a comparative analysis, considering metrics such as mean square error, learning rate, bit error rate, convergence rate, and computational time. Furthermore, we conduct a comparative evaluation with other optimization approaches, including the Bat Algorithm, Slime Mould Algorithm, and Harris Hawks Optimization Algorithm. This comparison demonstrates the superiority of the proposed algorithm over traditional optimization techniques.

**Full paper: IETE Journal of Research, vol. 70, no. 10, pp 7630-7647, 2024*



Performance Evaluation of Parametric and Non-Parametric Machine Learning Models Using Statistical Analysis for RT-Iot2022 Dataset

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ABSTRACT

With the vast growth of the Internet of Things (IoT) applications, the number of devices connected to the IoT is increasing exponentially. On the other hand, cybercriminals are generating sophisticated new cyber attacks to exploit IoT devices. However, conventional Intrusion Detection Systems (IDS) that rely on an alert-based approach fail to detect these novel attacks. Machine Learning (ML) based IDS has the potential to spot even small mutations and new threats. This study investigates the statistical tests like Kolmogorov-Smirnov (KS) test, skewness test, kurtosis test, Pearson's Correlation Coefficient (PCC) and Information Gain Ratio techniques on the recently introduced RT-IoT2022 dataset. The aim is to determine the optimal machine learning algorithms for detecting vulnerabilities within this dataset. The results of skewness and kurtosis tests identify the features having outliers and the KS test indicates that the proposed dataset exhibits non-parametric characteristics. Subsequently, Pearson's Correlation Coefficient (PCC) and Information Gain Ratio techniques are applied to analyze the correlation between features and the categories of the target attacks. Further, parametric and non-parametric ML models are tested to validate the results of statistical tests. With the non-parametric Decision Tree algorithm achieving the highest accuracy of 99.85% among all other models, we conclude that non-parametric ML models are optimal for detecting mutant vulnerabilities.

**Full paper: Journal of Scientific and Industrial Research, Vol. 83, no. 8, pp 864-872, 2024*



RMDNet-Deep Learning Paradigms for Effective Malware Detection and Classification

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ABSTRACT

Malware analysis and detection are still essential for maintaining the security of networks and computer systems, even as the threat landscape shifts. Traditional approaches are insufficient to keep pace with the rapidly evolving nature of malware. Artificial Intelligence (AI) assumes a significant role in propelling its design to unprecedented levels. Various Machine Learning (ML) based malware detection systems have been developed to combat the ever-changing characteristics of malware. Consequently, there is a growing interest in exploring advanced techniques that leverage the power of Deep Learning (DL) to effectively analyze and detect malicious software. DL models demonstrate enhanced capabilities for analyzing extensive sequences of system calls. This paper proposes a Robust Malware Detection Network (RMDNet) for effective malware detection and classification. The proposed RMDNet model branches the input and performs depth-wise convolution and concatenation operations. The experimental results of the proposed RMDNet and existing DL models are evaluated on 48240 malware and binary visualization image dataset with RGB format. Also on the multi-class maling and dumpware-10 datasets with grayscale format. The experimental results on each of these datasets demonstrate that the proposed RMDNet model can effectively and accurately categorize malware, outperforming the most recent benchmark DL algorithms.

**Full paper: IEEE Access, vol. 12, 2024*



Quantum Machine Learning for Support Vector Machine Classification

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ABSTRACT

Quantum machine learning aims to execute machine learning algorithms in quantum computers by utilizing powerful laws like superposition and entanglement for solving problems more efficiently. Support vector machine (SVM) is proved to be one of the most efficient classification machine learning algorithms in today's world. Since in classical systems, as datasets become complex or mixed up, the SVM kernel approach tends to slow and might fail. Hence our research is focused to examine the execution speed and accuracy of quantum support vector machines classification compared to classical SVM classification by proper quantum feature mapping selection. As the size of the dataset becomes complex, a proper feature map has to be selected to outperform or equally perform the classification. Hence the paper focuses on the selection of the best feature map for some benchmark datasets. Additionally experimental results show that the processing time of the algorithm is considerably reduced concerning classical machine learning. For evaluation of quantum computation over the classical computer, Quantum labs from the IBMQ quantum computer cloud have been used.

**Full paper: Evolutionary Intelligence, vol. 17, no. 2, pp 819–828, 2024*



Spotting Congenital Heart Diseases Using Palm Print Based on Faster R-CNN and Spatial Method

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ABSTRACT

This paper proposes a machine learning method to detect congenital heart diseases (CHDs) using a palm pattern known as axial triradius. This article spreads light on three things. First, Faster R-CNN Inception v2 has been used to identify triradii on the palm image. Secondly, a novel spatial method has been proposed to select leftmost, rightmost and axial triradii. Finally, the angle at axial triradius has been calculated on the palm images of healthy people and of patients suffering from tetralogy of Fallot (TOF), atrial septal defect (ASD), ventricular septal defect (VSD) and coarctation of aorta (CoA). The result shows that the proposed method can be used as a screening method to predict CHDs.

**Full paper: International Journal of Medical Engineering and Informatics, vol. 16, no. 1, pp 56-70, 2024*



A Survey on Wireless Sensor Network (Applications and Architecture)

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ABSTRACT

Proliferation of the wireless sensor network is due to the advancement in wireless networks, information technologies, miniaturisation of sensors as well as convergence of MEMS technology, wireless communication and digital electronics. These wireless networks interface the physical world to the computing (virtual) world. In recent years, the availability of smaller, cheaper and intelligent sensors on a large scale has motivated the deployment of sensors in various applications such as smart city, smart home, smart grid, automated vehicles, etc. The sensor plays an important role in internet of things. This survey reports current research activities, applications, characteristics, architecture and case study of WSNs. In addition to this open research issues/problems are discussed. The aim is to present a comprehensive study of the literature on several aspects of wireless sensor network such as application and architecture.

**Full paper: International Journal of Communication Networks and Distributed Systems, vol. 30, no. 2, pp 136-201, 2024*



Developing a Deep Learning and Reliable Optimization Techniques for Solar Photovoltaic Power Prediction

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ABSTRACT

Due to its significant solar energy generation, solar PV power facilities have recently been utilized. Although PV power stations are highly preferable, the state's fundamental drawback is that its output current qualities are unpredictable. Consequently, to ensure a balance and complete functioning, it would be crucial to build systems that allow accurate future projections of solar PV production in the short or medium term. Research postulates a strategy for using deep learning to estimate the short-term electricity generated by solar photovoltaic facilities. This study offers a novel method for predicting photovoltaic systems output power utilizing a Hybrid Deep Neural Network framework, making significant advancements in the field of deep learning applications to transmission system prediction issues. CNN and LSTM are combined in the postulated HDNN paradigm. Traditional deep learning techniques are employed in the initial stage. The effectiveness assessments of these techniques are instead presented in greater detail after they have been trained using firefly optimization techniques. The method with the highest reliability is chosen out of all the techniques used in previous research. Deep learning and power efficiency create a combination that appears to have a successful future, predominantly in improving sustainable management and the digitalization of the electrical sector.

**Full paper: Electric Power Components and Systems, 2024*



Collaborative Filter Paradigm to Remove Noise in MRI Modality: Application to Diffusion Weighted Images

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ABSTRACT

Denoising volumetric data is essential for improving data quality and facilitating accurate analysis, interpretation, and diagnostic capabilities in various fields, including medical imaging, scientific visualization, and engineering simulations. This article proposes a BM4D, an expansion of the BM3D filter designed specifically for volumetric data. This unique approach combines grouping and Collaborative Filtering (CF) principles. It entails grouping dimensionally similar patches into a $(d + 1)$ -dimensional array, then processing them collectively in the transform domain. Unlike BM3D, where basic data patches are pixel blocks, BM4D uses voxel cubes combined into a Four-Dimensional (4-D) "Group." This 4-D transformation takes advantage of local correlations inside each voxel cube as well as non-local correlations between matching voxels from other cubes. This produces a highly sparse spectrum within this group, allowing for effective signal-to-noise distinction via coefficient reduction. Estimates for each grouped cube are received after applying the inverse transformation, which is then adaptively mixed at their original positions. The proposed algorithm's performance is assessed in the context of denoising volumetric data corrupted by Gaussian and Rician noise. Experimental results showcase BM4D's outstanding denoising capabilities, establishing its effectiveness in the domain of volumetric data denoising and positioning it as a cutting-edge solution.

**Full paper: International Journal of Electronics and Communication Engineering, vol. 11 no. 5, pp 59-68, 2024*



Achieving Optimal Scalability Network and Deployment Cost, and Improving Network Performance Based on Traffic Prediction in Fiwi Network

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ABSTRACT

The Fibre Wireless (FiWi) access network is a next generation (NG) access network that is designed for high data rate, broadband multiple services, scalable bandwidth, and flexible communication. The reason for the increased demand for bandwidth is due to applications that are being implemented by services such as smart grid (SG), smart cities (SC), and the Internet of Things. As a result, issues related to the planning and scalability of the communications infrastructure has become the focus of interest. Thus, there is need for designing cost-effective large-scale FiWi networks considering the rise in user groups demand for more bandwidth. This paper proposes two optimization algorithms to provide cost-effective scalability and network performance based on dynamic resource allocation for FiWi network.

**Full paper: International Journal of Intelligent Systems and Applications in Engineering, vol. 12, no. 9, pp 475-482, 2024*



Mathematical Model Enhancing Flash Memory Reliability Through DFT-Driven Error Correction Coding

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ABSTRACT

Flash memory, ubiquitous in diverse electronic devices, confronts persistent challenges stemming from inherent errors that jeopardize data integrity. This research situates itself at the intersection of these challenges and advancements, proposing an inventive error correction coding framework that harnesses the unique capabilities of analysis with a hybrid error control coding (HECC) approach. In the proposed work, a mathematical model aimed at enhancing the flash memory by identifying the error pattern within the pages using the discrete fourier transform (DFT). By incorporating distinctive DFT mathematical properties, the proposed technique intends to improve flash memory error correction beyond traditional methods. The flash storage defect detection and rectification results with hybrid error correction coding achieved bit error rate (BER) of $4.3e-6$, latency 14.1, mean 15.1 and standard deviation 1.0. Error correction efficiency 98% and storage overhead 10%. With this approach results are significantly improving the error correction efficiency, reduce storage overhead and enhanced adaptability to diverse error patterns.

**Full paper: Indonesian Journal of Electrical Engineering and Computer Science, vol. 35, no. 3, pp. 1468, 2024*



Exploring the Landscape of Dysarthric Speechrecognition: A Survey of Literature

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ABSTRACT

Automatic speech recognition (ASR) is a valued tool for individuals with dysarthria, a speech impairment characterized by various pathological traits that differ from healthy speech. However, recognizing dysarthric speech, which is spoken by individuals with speech impairments, poses unique challenges due to its diverse characteristics such as rugged pronunciation, loudness that varies at different intervals, speech that has lot of delays, pauses that are unpredictable, excessive nasal sounds, explosive pronunciation, and airflow noise. The survey reveals the various models for dysarthric speech recognition. Deep learning technologies, unfurls an improved ASR performance leaps and bounds breaking the fluency and pronunciation barriers. Various feature extractions and identification of different types of dysarthria, including spastic, mixed, ataxic, hypokinetic, and hyperkinetic are explored. The performance of contemporary deep learning approaches in dysarthric speaker recognition (DSR) is tested using various datasets to determine accuracy. In conclusion the most effective DSR strategies are identified and areas for future investigation is suggested. However, speaker-dependent difficulties restrict the generalizability of acoustic models, and a lack of speech data impedes training on large datasets. The study throws light on how the effectiveness of ASR for dysarthric speech can be improved and further areas of research in the area are highlighted.

**Full paper: Indonesian Journal of Electrical Engineering and Computer Science, vol. 36, no. 2, pp 826-836, 2024*



Recent Advances and New Concepts in Methane Storage and Transportation

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ABSTRACT

Price escalation accompanied by adverse climatic implications of depleting fossil fuels demands inexorable switch to sustainable energy alternatives. A precipitous transition from conventional to renewable energy is unrealistic and demands a smooth transition phase of implementation. The transition fuels serve as a conduit between conventional fossil fuels and renewable energy sources, facilitating the move toward a more sustainable energy system. Methane is a prospective transition fuel with lowest CO₂ emission due to its minimum carbon-to-hydrogen ratio. However, the conventional methane storage and transportation strategies are economically unviable for remote stationary as well as long-range vehicular applications. Safe methane storage and transportation is inevitable as release of this highly potent greenhouse gas leads to far-reaching environmental concerns. This underscores the requirement of sophisticated technologies to enhance the effectiveness, capacity, and safety of methane storage, thereby accelerating a smooth shift towards a sustainable and conscious energy framework. The chapter comprehends the mechanism of advanced methane storage methodologies like adsorbed natural gas storage, hydrate natural gas storage, and adsorption-hydration hybrid (AHH) storage for remote and transportation applications. Among the advanced pathways, AHH is identified as a promising technology with further research explorations to transmute laboratory initiatives to real-life implementations.

**Full paper: Advances and Technology Development in Greenhouse Gases: Emission, Capture and Conversion, pp. 323-354, 2024*



P-DNN: Parallel DNN based IDS Framework for the Detection of IoT Vulnerabilities

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ABSTRACT

The rapid growth of the Internet of Things (IoT) in our daily life has recently received attention from hackers in releasing novel attacks. This is because the existing traditional Intrusion Detection System (IDS) uses an alert-based approach that cannot detect new emerging attacks, making it unfeasible for devices with limited resources. The study presents the deployment of a Parallel Deep Neural Network (P-DNN) IDS framework to improve the detection rate and resource constraint issues. To validate the framework for detecting the latest IoT vulnerabilities, we generated a proprietary dataset created under the IoT environment. The experimental results reveal that the P-DNN IDS framework proposed in this study outperformed the K-nearest Neighbour (KNN), Support Vector Machine (SVM), and Naive Bayes algorithms with respect to performance metrics. In addition, a comparative analysis of the P-DNN framework with Snort and Suricata IDS results demonstrates a significant reduction in CPU consumption, memory utilization, and processing time. The results of this investigation indicate that the deployment of the P-DNN framework has the capability to detect vulnerabilities in resource-constraint IoT environments effectively.

**Full paper: Security And Privacy, vol.7, no. 1, 2024*



Secure Data Transmission In Power Systems Using Blockchain Technology

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ABSTRACT

Recent advances in intelligent systems have significantly improved power management, load distribution, and resource management capabilities, far beyond past constraints. Despite these gains, the development of internet-connected technology has brought various vulnerabilities, leading to negative results. The integration of intelligent technology has unintentionally offered chances for hackers to enter networks and modify data sent to central systems for analysis. One of the most serious risks is the false data injection attack (FDIA), which may drastically impair analytical outcomes. Previous research has shown that standard approaches for recovering data affected by FDIA are unreliable and inefficient. This paper investigates the use of the proof of stake (PoS)

consensus method in this framework improves data integrity and makes it easier to identify illegal changes. Participating nodes may reject or change block transactions, ensuring the ledger's correctness. Our results show that the PoS consensus method is exceptionally successful in creating and adding transactions to the blockchain. Furthermore, the PoS mechanism's simplicity in block formation enhances both time and energy efficiency, resulting in considerable benefits in operational performance.

**Full paper: International Journal of Electrical & Computer Engineering , vol. 14, no. 6, pp 617-625, 2024*



Simulation-Based Effective Comparative Analysis of Neuron Circuits for Neuromorphic Computation Systems

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ABSTRACT

The spiking neural networks (SNN) that are inspired by the human brain offers wider scope for application in the growth of neuromorphic computing systems due to their brain level computational capabilities, reduced power consumption, and minimal data movement cost, among other advantages. Spike-based neurons and synapses are the essential building blocks of SNN, and their efficient implementation is vital to their performance enhancement. In this regard, the design and implementation of spiking neurons have been the major focus among the researchers. In this paper, functioning of different leaky integrate fire (LIF)-based spiking neuron circuits like frequency adaptable CMOS-based LIF, resistor-capacitor-based (RC) LIF, and volatile memristor-based LIF are subjected to comparison. The work mainly focuses on revealing analysis of spike duration and amplitude, number of spikes produced during excitation period, threshold operation, field of application, and various other significant parameters of aforementioned neuron circuits. Extensive simulations of these circuits are carried out utilizing the Cadence Virtuoso simulation environment in order to validate their behavior. Further, a brief comparative analysis is executed considering into account the attributes like circuit complexity, supply voltage, firing rate, membrane capacitance, nature of input/output, refractory mechanism, and energy consumption per spike. This work seeks to assist researchers in selecting an appropriate LIF model to efficiently construct memristors and/or non-memristors based SNN for certain application.

**Full paper: Neurocomputing vol. 614, 2024*

Department of Computer Science & Engineering





End To End Model to Reduce the Inference, Jamming, and to Increase the Trust from the Compromised Secondary Nodes in Cognitive Radio Networks

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ABSTRACT

Wireless technology has advanced dramatically in recent years. Multimedia applications have exploded in popularity over wireless networks. The demand for radio spectrum has expanded as the demand for large capacity for multimedia applications has grown. The traditional fixed spectrum assignment approach has been challenged by the shortage of radio spectrum. As a result, Cognitive Radio (CR) has arisen as a new unique option for addressing spectrum underutilization by allowing users to access unused spectrum bands on the fly. In cognitive radio networks, radio spectrum scarcity, spectrum access, signal interference, security at various layers, trust, jamming, and spectrum management have all become key issues. Proposing a unique approach to address the interference problem produced by secondary nodes that have been hacked. To fulfil the need, we develop a mathematical modelling of the system that incorporates intelligence in the SU to cope with intelligent jammer. Intelligent jammer is cognitive in nature, having the ability to learn, to reason and to adjust its strategies against SU for maximum damage to the CRN. Many researchers have been working on reducing inference and the effect of jamming in the network. But still it is not resulted with the proper solution for the jamming problem in cognitive radio wireless sensor network. Hence proposing the methodology aiming to minimize the effect of Jamming in Cognitive Radio Wireless Sensor-Networks. At the end, the proposed research is aiming to solve the security problem to increase the trust in the cognitive radio network. The secondary users must be able to detect and forecast spectrum holes in the CR environment. The overall result shows the improved network performance by reducing the inference, jamming, spectrum sensing and trust issues in cognitive radio network.

**Full paper: International Conference on Intelligent and Innovative Technologies in Computing, Electrical and Electronics (IITCEE), 2024*



Implementation of Chrun Rate Prediction System using Machine Learning

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ABSTRACT

In the Telecommunication and entertainment Industry, customer churn detection is one of the most important research topics that the company must deal with retaining on-hand customers. Churn means the loss of customers due to existing offers from the competitors or maybe due to network issues. In these types of situations, the customer may tend to cancel the subscription to a service. The Churn rate has a substantial impact on the lifetime value of the customer because it affects the future revenue of the company and the length of service. Due to a direct effect on the income of the industry, the companies are looking for a model that can predict customer churn. The model developed in this work uses machine learning techniques. By using machine learning algorithms, we can predict the customers who are likely to cancel the subscription. Using this, we can offer them better services and reduce the churn rate. These models help telecom services to make them profitable. In this model, we used Logistic Regression, Random Forest, and SVM for churn rate prediction.

**Full paper: 15th International Conference on Advances in Computing, Control, and Telecommunication Technologies, ACT, vol. 1, pp 1031-1037, 2024*



An Enhanced Process Scheduler Using Multi-Access Edge Computing In an Iot Network

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ABSTRACT

Multi-access edge computing has the ability to provide high bandwidth, and low latency, ensuring high efficiency in performing network operations and thus, it seems to be promising in the technical field. MEC allows processing and analysis of data at the network edges but it has finite number of resources which can be used. To overcome this restriction, a scheduling algorithm can be used by an orchestrator to deliver high quality services by choosing when and where each process should be executed. The scheduling algorithm must meet the expected outcome by utilizing lesser number of resources. This paper provides a scheduling algorithm containing two cooperative levels with an orchestrator layer acting at the center. The first level schedules local processes on the MEC servers and the next layer represents the orchestrator and allocates processes to nearby stations or cloud. Depending on latency and throughput, the processes are executed according to their priority. A resource optimization algorithm has also been proposed for extra performance. This offers a cost-efficient solution which provides good service availability. The proposed algorithm has a balanced wait time (Avg) and blocking percentage (Avg) of 2.37ms and 0.4 respectively. The blocking percentage is 1.65 times better than Shortest Job First Scheduling (SJFS) and 1.3 times better than Earliest Deadline First Scheduling (EDFS). The optimization algorithm can work on many kinds of network traffic models such as uniformly distributed and base stations with unbalanced loads.

**Full paper: International Journal of Computer Network and Information Security, vol. 16, no. 4, pp 130-143, 2024*



Hcbil-DMN: An Effective Food Infestation Detection from Stored Food Grains Using Deep Learning Model

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ABSTRACT

Food Infestation Detection is more important for food safety and health concerns. It is a challenging task to separate the grains into infested or non-infested. It is found that in the existing system, there is no effective approach for the early detection of pest populations and for classifying crops as infested or non-infested. Therefore, the identification and categorization of early-stage grain infestations is in high demand. To address the above problem, this research presents a better technique for detecting and classifying infested and non-infested grains. Initially, the maize, wheat and olive image datasets are collected, which are then pre-processed using data normalization and adaptive wiener filtering (AdwF) approach to improve the excellence of the input images. Image quality helps in achieving better performance and also helps in analyzing the quality of food grains effectively. Feature extraction is done using the Dense Residual Pyramidal Dilated Convolution Network (DR-PDCNet) technique, and feature selection is done using the Linear Discriminant Coati Optimization (LD-CoA) algorithm. The Hybrid Convolutional Bi-LSTM based Deep Maxout Network (HCBiL-DMN) model is used to detect the infected food grains in the preserved food grains with high accuracy. This research explores the potential and future possibilities for using technology to ensure the quality, assessment, and monitoring of nutritional grains during storage. The performance results are achieved with 98.3% accuracy, 99.12% recall, 98.65% precision, 98.02% MCC, and 99.32% F1 score.

**Full paper: Multimedia Tools and Applications, June 2024.*



Energy and Delay Aware Routing Model for Smart Crop Monitoring Application Using Internet of Things

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ABSTRACT

The adoption of modern technology into farming has seen significant expansion to enhance the quality and quantity of crop production. In this research work, wireless sensor networks (WSNs) and the Internet of Things (IoTs) are integrated to provide a real-time crop monitoring system to farmers. Usually, battery-powered IoT devices equipped with sensors like temperature, humidity, motion sensors, etc. are placed across agriculture areas for real-time monitoring of crops and cattle. In improving energy efficiency and reducing delay clustering multi-hop routing has been used with good effect; However, the existing methods failed to enhance network lifetime and target coverage due to failure in addressing load-balancing and hotspot problems. In addressing research problems this paper presents an Energy and Delay Aware Routing (EDAR) scheme for heterogenous WSN-IoTs leveraging unequal grouping of networks and adoption of multipath routing for provisioning IoT applications. The simulation outcome shows the EDAR model achieves very good performance in terms of throughput and lifetime performance with minimal delay and communication overhead.

**Full paper: Computers and Electrical Engineering, vol. 116, 2024*



Insight of Recent Artificial Intelligence-Based Strategy to Effectively Screen COVID-19

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ABSTRACT

The recent era of pandemic by corona virus disease (COVID-19) has witnessed a faster evolution of various technological solution to thwart the life-threatening situation. The most important step was to select a faster mode of screening COVID-19 using chest x-ray (CXR) which could be actually ten folds faster than conventional invasive screening methods. However, the method of determining the presence of COVID-19 from CXR is critically challenging owing to the dynamic and complex nature of disease. Such problem is attempted to be solved by harnessing the potential of artificial intelligence (AI). Hence, this paper contributes towards discussion of most recent and current implementation strategies formulated by AI models towards diagnosing COVID-19. The study outcome of this paper yields an interesting learning outcome to show that AI models' adoption is increasing in faster pace and yet challenges do exist till date. The outcome of study will assist in better adoption of AI models towards screening COVID-19.

**Full paper: IAES International Journal of Artificial Intelligence, vol.13, no. 3, pp.2482-2489, 2024,*



Hybrid Neural Network Method Using Aquila Optimization Algorithm for Detection of Lung Cancer in CT Images

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ABSTRACT

The existence of a lung nodule implies the existence of lung cancer. The classification of lung nodules as benign or malignant has frequently been done using deep convolutional neural networks (DCNNs). The five-year rate of survival of lung cancer must be increased with early pulmonary nodule diagnosis. To aid radiologists in diagnosis, numerous computer-aided diagnosing (CAD) techniques have been developed for nodule detection. Deep convolutional neural networks (CNNs) are typically utilized to detect regions of the primary pulmonary nodules without taking into account nodule's surrounding tissues. In this work, a semi-supervised neural network is developed for early detection of pulmonary nodules with global optimization using Aquila optimizer (AO) performed on LIDC-IDRI dataset. The proposed model delivers qualitative results on comparing with existing methods achieving 98.23% of accuracy, 98.1% of sensitivity, 97.67% of specificity and 97.9% of precision.

**Full paper: SN Computer Science, vol. 5, no.7, 2024*



Optimization Enabled Deep Learning Method in Container-Based Architecture of Hybrid Cloud for Portability and Interoperability-Based Application Migration

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ABSTRACT

Virtualisation is a major part of the cloud as it permits the deployment of several virtual servers over the same physical layer. Due to the adaption of cloud services, the count of the application running on repositories increases, resulting in overload. However, the application migration in the cloud with optimal resource allocation is still a challenging task. The application migration is employed to reduce the dilemma of resource allocation. Hence, this paper proposes a technique for portability and interoperability-based application migration in the cloud platform. The cloud simulation is done with the Physical Machine (PM), Virtual Machine (VM), and container. The interoperable application migration is provided using the newly devised Lion-based shuffled shepherd (Lion-SS) optimisation algorithm. The Lion-SS algorithm combines the shuffled shepherd optimisation algorithm (SSOA) and the Lion optimisation algorithm (LOA). The new objective function is devised based on predicted load, demand, transmission cost, and resource capacity. Besides, the prediction of the load is performed using Deep long short-term memory (Deep LSTM). The proposed technique obtained the minimal load of 0.007 and resource capacity of 0.342.

**Full paper: Journal of Experimental & Theoretical Artificial Intelligence, vol.36, no. 7, pp 985-1002, 2024*



A Methodological Approach to Select a Suitable Azodicarbonamide Based Airbag Gas Generant

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ABSTRACT

Azodicarbonamide (ADC) based airbag gas generants with various potential oxidizers, including (1) $C_2H_4O_2N_4/KNO_3$ (2) $C_2H_4O_2N_4/NaNO_3$ (3) $C_2H_4O_2N_4/Sr(NO_3)_2$ (4) $C_2H_4O_2N_4/Ba(NO_3)_2$ (5) $C_2H_4O_2N_4/KIO_4$ and (6) $C_2H_4O_2N_4/NaIO_4$ were thoroughly tested to identify the best mixture for a real-time ballistic application. The evaluation of the gas generant mixtures is carried out based on the performance properties such as quantity of oxidizer decomposed (in g) to give 1 g of O_2 , residual mass % of the mixture, density of the oxidizer, oxygen balance percentage for the oxidizer, adiabatic flame temperature, onset temperature, activation energy, pre-exponential factor, critical ignition temperature, change in enthalpy, change in entropy, impact sensitivity and friction sensitivity of the gas generant mixtures. Using the TOPSIS methodology, a systematic approach was developed for the first time to determine the best suitable airbag gas generant for real-time ballistic application by taking into account all of these properties. TOPSIS findings revealed that the preferred order of the airbag gas generant mixture is $C_2H_4O_2N_4/KIO_4 > C_2H_4O_2N_4/NaIO_4 > C_2H_4O_2N_4/KNO_3 > C_2H_4O_2N_4/NaNO_3 > C_2H_4O_2N_4/Sr(NO_3)_2 > C_2H_4O_2N_4/Ba(NO_3)_2$. A similar methodology can also be used to discover the best fuel/oxidizer mixture for any other composition.

**Full paper: Combustion Science and Technology, vol. 196, no. 15, 2024*



A Novel Multi-Modal Approach that Fuses Dermoscopic Images with Thermal Imaging in Pre-Emptive Identification of Diabetic Foot Ulcers (DFUs)

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ABSTRACT

This research presents an innovative multi-modal approach that integrates dermoscopic imaging with thermal imaging data to enhance in pre-emptive identification of DFUs. The proposed methodology leverages the high-resolution visual details of dermoscopic images alongside the temperature distribution data captured by thermal imaging to create a comprehensive diagnostic tool. This fusion of modalities aims to address the limitations of each individual imaging technique – where dermoscopic imaging lacks thermal insights and thermal imaging lacks detailed surface information – thereby improving the early detection and diagnostic accuracy of DFUs. The approach employs an InceptionV3-based CNN combined with a SVM classifier to analyze the fused images. The integration of CNN and SVM enhances the model's capability to differentiate between healthy skin and early-stage ulcers. Numerous tests using the available datasets showed that the multi-modal fusion greatly improves the classification performance, achieving an accurateness of 97.1% and an overall accuracy of 97.3%. This research contributes to the field by providing a more accurate and early detection method for DFUs, potentially reducing the risk of severe complications such as infection and amputation.

**Full paper: SN Computer Science, vol. 5, no. 8, 2024*



An Optimized Wasserstein Deep Convolutional Generative Adversarial Network Approach for the Classification of COVID-19 and Pneumonia

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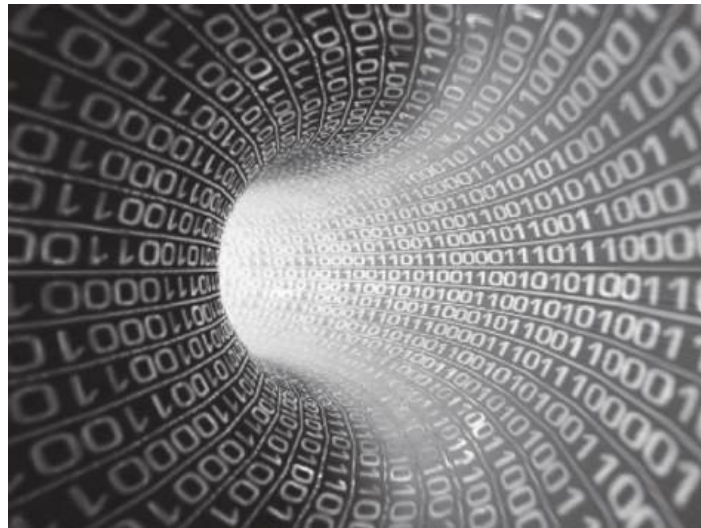
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ABSTRACT

In the context of diagnosing lung disorders like bacterial and viral pneumonia and COVID-19, the challenge of sample scarcity often results in imbalanced datasets, making reliable forecasting difficult. To address this, an Optimized Wasserstein Deep Convolutional Generative Adversarial Network Technique was proposed for the Classification of COVID-19 and Pneumonia (CCP WDCGAN-SOA). The proposed approach utilizes CT scan and X-ray images from two datasets: the COVID-19 Posterior-Anterior Chest Radiography Images Curated Dataset and the COVID QU-Ex Dataset. Due to the imbalance in these datasets, a Label Correlation Guided Borderline Oversampling (LCGBO) method was introduced to balance the classes effectively. Following data balancing, the images undergo pre-processing using Multimodal Hierarchical Graph Collaborative Filtering (MHGCF) for resizing. Subsequently, the processed images are fed into a Wasserstein Deep Convolutional Generative Adversarial Network (WDCGAN) optimized with the Seasons Optimization Algorithm (SOA) to enhance classification accuracy for COVID-19 and pneumonia. The implementation in MATLAB demonstrates that the CCP-WDCGAN-SOA technique significantly outperforms existing methods. Specifically, the proposed approach achieves improvements of 21.5 %, 23 %, and 22.5 % in accuracy, 12.3 %, 17.5 %, and 14 % in recall, and 22.3 %, 27.5 %, and 24 % in specificity compared to DC-CXI-CoviXNet, CPD-CXI-CNN, and ADC-CXI-DFFC Net using the COVID-19 Posterior-Anterior Chest Radiography Images Curated Dataset. Additionally, the proposed method shows gains of 21.52%, 27.05%, and 23.24% in accuracy, 23.71%, 26.45%, and 21.74% in recall, and 28.61%, 22.15%, and 26.44% in specificity over ASC-CXI-LRANet, RCP-MIA-CNN, and AQCD-CR-GAN using the COVID-QU-Ex Dataset.

**Full paper: Biomedical Signal Processing and Control, vol. 100, 2024*

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Digital Analysis of Brain Tumor using Image Processing and Machine learning

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ABSTRACT

The computerized examination of brain tumors is critical in the early and correct diagnosis of neurological illnesses. This study proposes a new approach that combines image processing techniques and machine learning algorithms for the automatic detection and categorization of brain tumors in medical pictures. The proposed system uses advanced image processing algorithms to enhance and preprocess magnetic resonance imaging (MRI) scans of the brain. Preprocessing processes include noise reduction, contrast enhancement, and segmentation to extract the regions of interest. Following that, a feature extraction procedure is used to extract significant features from the preprocessed pictures, collecting key properties indicative of tumor existence and type. During the machine learning phase, a robust classification model is trained on a broad collection of annotated brain images.

**Full paper: Grenze International Journal of Engineering & Technology (GIJET), 2024*



Enhanced Sarcasm Detection using Grey Wolf Optimizer with Deep Learning on Social Media

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ABSTRACT

A linguistic expression, Sarcasm generally conveys the opposite meaning of what had been said in words, which makes it a complex process for the machines to find out the real meaning. It is mainly depends on the context, making it hard for computation task and is largely defined by the inflexion with which it is spoken, with suggestion of irony. Furthermore, sarcasm express the negative sentiments using positive word, enabling it to confuse sentiment analysis (SA) model. Sarcasm detection is a crucial challenge in natural language processing (NLP), which is required for good understanding to serve as an interface for mutual interaction between humans and machines. This article develops an Enhanced Sarcasm Detection using Grey Wolf Optimizer with Deep Learning (ESD-GWODL) technique on social media. The major intention of the ESD-GWODL method is to detect and classify sarcasm on social media. To accomplish this, the ESD-GWODL technique applies data pre-processing to transform the input data into relevant format. Besides, TF-IDF model can be used to extract word embedding. To detect and categorize sarcastic texts, the ESD-GWODL technique applies long short-term memory (LSTM) model. The ESD-GWODL technique utilizes GWO algorithm for hyperparameter tuning purposes in order to boost the sarcastic text detection. The experimental evaluation of the ESD-GWODL technique is tested using sarcasm dataset. The obtained values infer that the ESD-GWODL technique has resulted in boosted detection results.

**Full paper: Second International Conference on Intelligent Cyber Physical-2024*



Identification of Counterfeit Products Using Blockchain in E-Commerce

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ABSTRACT

Numerous applications have been developed using Blockchain in recent years as its popularity has grown. Any application that uses Blockchain technology as part of its architectural model guarantees the integrity of its data. Using a decentralized Blockchain system to verify drugs, companies, and brands can prevent counterfeiting while reducing costs at the same time. This paper presents a secure Blockchain-based model to counterfeit fake products in the market. A key is generated for each product, which is stored in the Blockchain. This key will also be fed into a QR code which will be attached to each product. This model uses a QR code-based approach to verify the truthfulness of the product by searching the Blockchain. As the Blockchain is immutable in nature, the data cannot be breached or modified. Also designed is an accompanying web-based application to implement this approach and discusses the software implementation process where the application scans the product code and confirms whether the given product is fake or not.

**Full paper: International Conference On Innovative Computing And Communication, pp 465-182– 2024*



LVC MOS18, transmitter, driver, level up shifter, Schmitt trigger, level down shifter and ESD Protection.

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ABSTRACT

The fast development in the use of computer networks raises concerns about network availability, integrity, and confidentiality. This requires network managers to use various types of intrusion detection systems (IDS) to monitor network traffic for unauthorized and malicious activity. An intrusion is a malicious breach of security policy. As a result, an intrusion detection system monitors network traffic flowing through computer systems to look for malicious actions and recognized dangers, providing alarms when it detects them. Mining approaches can be highly useful in the development of an intrusion detection system. In order to detect intrusions, network traffic might be categorized as normal or anomalous. After examining over twenty-five studies, we chose the top three classification algorithms in our paper: Logistic Regression, Naive Bayes, and SVM. This study compares the top three classification algorithms based on their performance criteria to determine the best suited method available.

**Full paper: 15th International Conference on Advances in Computing, Control, and Telecommunication Technologies, ACT, vol. 1, pp 945-951, 2024*



Machine Learning based Framework to Predict the Bitcoin Price

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ABSTRACT

Bitcoin has recently attracted a lot of media and public attention as a result of its recent price boom and crash. Similarly, numerous researchers have explored many aspects influencing the Bitcoin price and the patterns underlying its fluctuations, specifically utilizing various machine learning methods. In this work, authors investigate and analyze various cutting-edge machine learning algorithms for Bitcoin price prediction, such as a logistic regression and a long short-term memory (LSTM) model. Although LSTM-based prediction models outperformed other prediction models for Bitcoin price prediction (regression), a simple profitability analysis revealed that classification models were more effective than regression models for algorithmic trading. Overall, the suggested ML learning-based prediction models performed similarly. This work performs an in-depth investigation on the evolution of Bitcoin, as well as a thorough review of several machine learning methods used for price prediction. It's included is a Bitcoin price prediction. The Existing work fails to predict day to day bitcoin price changes. And has given less accuracy compared to the proposed work. Authors have overcome this limitation in the proposed work by predicting the day to day BTC price for the upcoming month.

**Full paper: Grenze International Journal of Engineering & Technology (GIJET), 2024*



Plant Disease Prediction along with Preventive Measures

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ABSTRACT

The increasing frequency and severity of plant diseases pose significant threats to global food security and agricultural sustainability. This research paper addresses the urgent need for an integrated framework that combines machine learning algorithms and preventive measures to mitigate the impact of plant diseases. The study explores the development of a predictive model to forecast potential outbreaks. Its machine learning algorithms analyze datasets, learning patterns that are often imperceptible to the human eye enabling it to diagnose multiple diseases affecting various plants. The paper also investigates the implementation of preventive measures. The paper offers a comprehensive framework for early detection and proactive management of plant diseases. Ultimately, this research seeks to pave the way for a more resilient and efficient agricultural ecosystem in the face of evolving challenges posed by plant diseases.

**Full paper: Grenze International Journal of Engineering & Technology (GIJET), 2024*



WanderMate - Design and Development of Web Application to Enhance Travel Experience

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ABSTRACT

In the contemporary era, modern travelers seek not only to reach their destination but also to foster connections, personalize their experiences, and access reliable information. WanderMate is an all-encompassing web application meticulously crafted to streamline and enrich the travel experience for its users. It functions as a platform, where users can not only find travel companions but also discover new destinations. Tailoring its offerings to the preferences of its users, the platform provides personalized recommendations. Users can personalize and tailor or improve their profiles by adding details about their travel interests, preferences, and past travel experiences. They can effortlessly connect with like-minded travel companions or join existing travel groups for their upcoming trips. By leveraging the platform's search feature, users can connect with others with similar travel plans. Furthermore, a built-in messaging system facilitates seamless communication and coordination among fellow travelers, aiding in uncovering hidden gems and sidestepping common travel pitfalls. Ultimately, WanderMate strives to be the primary destination for travelers in search of companionship, advice, and valuable insights for their next adventure. With its user-friendly interface, the application fosters exploration, connection, and the creation of unforgettable travel experiences.

**Full paper: Grenze International Journal of Engineering & Technology (GIJET), 2024*



A Simplified Classification Computational Model of Opinion Mining Using Deep Learning

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ABSTRACT

Opinion and attempts to develop an automated system to determine people's viewpoints towards various units such as events, topics, products, services, organizations, individuals, and issues. Opinion analysis from the natural text can be regarded as a text and sequence classification problem which poses high feature space due to the involvement of dynamic information that needs to be addressed precisely. This paper introduces effective modelling of human opinion analysis from social media data subjected to complex and dynamic content. Firstly, a customized preprocessing operation based on natural language processing mechanisms as an effective data treatment process towards building quality-aware input data. On the other hand, a suitable deep learning technique, bidirectional long short term-memory (Bi-LSTM), is implemented for the opinion classification, followed by a data modelling process where truncating and padding is performed manually to achieve better data generalization in the training phase. The design and development of the model are carried on the MATLAB tool. The performance analysis has shown that the proposed system offers a significant advantage in terms of classification accuracy and less training time due to a reduction in the feature space by the data treatment operation.

**Full paper: International Journal of Electrical and Computer Engineering (IJECE)- 2024*



Millets Industry Dynamics: Leveraging Sales Projection and Customer Segmentation

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ABSTRACT

Millets delves into the dynamics of the millets industry, with a particular focus on sales projection and customer segmentation as strategic levers for growth. The research commences with an in-depth analysis of the millets market, encompassing production patterns, consumption trends, and emerging market opportunities. It explores the diverse range of millets varieties, their nutritional profiles, and the factors driving consumer preference. By understanding the market landscape, the study identifies key trends and challenges shaping the industry. A core component of this research is the development of a robust sales projection model. Employing advanced statistical and data-driven techniques, the model forecasts future sales based on historical data, market trends, and relevant economic indicators. The model incorporates factors such as consumer demographics, purchasing behavior, and competitive landscape to provide accurate and actionable insights. Customer segmentation is another critical aspect of the study. By applying clustering and profiling methodologies, the research identifies distinct customer segments based on factors such as age, income, dietary preferences, and purchasing habits. This segmentation enables a deeper understanding of customer needs and preferences, facilitating targeted marketing strategies and product development. The integration of sales projection and customer segmentation empowers businesses to make informed decisions, optimize resource allocation, and enhance overall market performance. By aligning product offerings and marketing efforts with customer segments, companies can achieve higher customer satisfaction, increased market share, and improved profitability. This research contributes to the growing body of knowledge on the millets industry by providing valuable insights into market dynamics, sales forecasting, and customer segmentation. The findings offer practical guidance for industry stakeholders, including farmers, processors, retailers, and policymakers, in navigating the evolving millets landscape. By leveraging the potential of sales projection and customer segmentation, the millets industry can unlock new opportunities and achieve sustainable growth.

**Full paper: SN Computer Science , vol.5, no. 1063, 2024*



Transfer Learning Based Facial Emotion Recognition

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ABSTRACT

The efficiency and accuracy of facial emotion detection imparts on mental health monitoring through Transfer Learning with Facial Emotion Recognition (FER). The Transfer Learning has a resource-efficient and robust solution through FER which has advancing capabilities and FER categorises human emotions through the facial expressions in the images or video sequences. This study explores an advanced FER methodology by utilizing the ResNet-Convolutional Block Attention Module, deep Convolutional Neural Network, known for its depth and enhanced attention mechanisms. The model was pretrained on ImageNet, was fine-tuned to classify facial emotions using the FER+ dataset, augmented with preprocessing techniques to enhance robustness and accuracy. A multi-step methodology, starting with data augmentation employed to diversify the training data and overcome overfitting. The study focuses on the ResNet-CBAM architecture, rigorously fine-tuning its hyperparameters and experimenting with the Adam optimizer method. The model achieves a single-network accuracy of 83.74% on FER+ dataset. The findings suggest that the model, with appropriate fine-tuning, can serve as a powerful tool for emotion recognition applications. This research contributes to the growing body of knowledge on deep learning for FER, offering insights into model optimization. The proposed method offers a scalable and efficient solution suitable for real-time emotion recognition, with potential applications in affective computing, psychological research. This study demonstrates the effectiveness of ResNet-CBAM in FER, highlighting its potential for various real-world applications.

**Full paper: SN Computer Science, vol.6, no.35, 2024*



The National Institute of Engineering, Mysuru

Proceedings of the First Artificial Intelligence Summit on Smart Sustainable Society

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ABSTRACT

About this book

The book includes proceedings of AI Summit 2023: Towards a Smart Sustainable Society which serve as a collaborative platform for diverse communities to address and resolve societal challenges using Artificial Intelligence. This book enables experts and researchers to evaluate the advantages of AI-driven technological transformations. It covers an extensive array of topics in artificial intelligence and machine learning, including deep learning, image processing, convolutional neural networks, advanced neural networks, sensors, Internet of Things (IoT), and genetic algorithms.

**Full paper: Book Chapter*

Department of P. G. Studies (MCA)





Breast Cancer Data Augmentation with Detection Using CNN Model in Deep Learning

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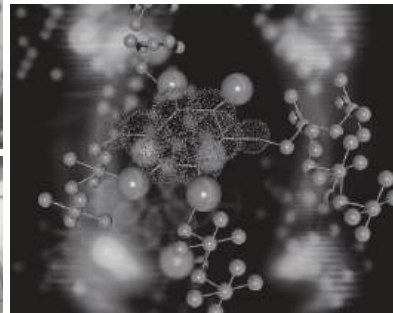
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ABSTRACT

Breast Cancer remains a critical global health issue, underscoring the importance of early detection for improved patient prognosis. This paper presents pilot studies employing Deep Learning techniques particularly Convolutional Neural Networks (CNN) to classify Breast Cancer histopathological images from the publicly available BC Histopathological Image Classification (BreakHis) dataset. The work aims to enhance the robustness and generalization of the model by focusing on CNN models and leveraging Data Augmentation (DA) techniques such as rotation, flipping, and scaling the training dataset. The CNN model trained on the augmented dataset demonstrates promising sensitivity and accuracy in Breast Cancer detection. The proposed work not only advances Deep Learning based Breast Cancer detection but also underscores the significance of DA in mitigating the scarcity of medical images for training. Ultimately, these findings have implications for early Breast Cancer diagnosis, potentially improving patient outcomes and saving lives.

**Full paper: International Conference on Power Engineering and Intelligent Systems (PEIS)*

Department of Basic Sciences





Structure Property Relations in Chitosan Based Nanocomposite Films Using WAXS Techniques

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ABSTRACT

In this research, nanocomposite (NC) films comprising chitosan with 20% weight glycerol have been reinforced using three different types of nanoparticles – TiO_2 , Ag, and Fe_2O_3 at concentrations of 1%, 3%, and 5% by weight, respectively, in various combinations. The characteristics of these NC films have been compared with those of both pure chitosan and chitosan containing 20% weight glycerol. The incorporation of nanoparticles significantly altered the mechanical and barrier properties of the chitosan films. Notably, the tensile strength have experienced an increase ranging from 22% to 84%, while the water vapour transmission rate (WVTR) decreased by 16% to 56%, depending on the nanoparticle dispersion under consideration. The chitosan 3% Fe_2O_3 NC film have exhibited the lowest WVTR value and the highest tensile strength when compared to the chitosan/3% Ag NC film. The minimum WVTR value has been observed in the chitosan/3% Fe_2O_3 NC film compared to the chitosan film. The materials and their composites have been analyzed using wide-angle x-ray diffraction patterns to calculate microcrystalline characteristics. To explore the microstructural behaviour of the chitosan and TiO_2 , Ag, Fe_2O_3 composites and establish a connection with physical characteristics such as tensile strength and percentage elongation, an exponential asymmetric column length distribution function approach has been employed. *Full paper: Indian Journal of Chemical Technology*

**Full paper: Indian Journal of Chemical Technology, vol.31, no. 2, pp 248-256, 2024*



A New Thiadiazole-Triazine Derivative: Structural Investigation, DFT Studies, ADME-T Analysis and SARS-Cov-2 Activity by Docking Simulation

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ABSTRACT

The present work involves the synthesis of thiadiazole-triazine derivative 7-[2-(4-bromophenyl)ethenyl]-3-tert-butyl-4H-[1,3,4]thiadiazolo[2,3-c][1,2,4]triazin-4-one (**TCA3**) and spectroscopic characterization is done using NMR and X-ray diffraction techniques. The single crystal X-ray diffraction study unravels the 3D structure of the compound **TCA3**. The compound crystallizes in the monoclinic crystal system with the space group $P2_1/c$. The crystal structure analysis revealed that various CH...O, CH...N, and CH...Br interactions are responsible for crystal packing. Furthermore, Hirshfeld surface analysis has been performed to visualize and analyze the intermolecular interactions observed in the crystal structure. Energy framework analysis was used to explore the molecular architecture in the crystal, and to calculate the molecular interaction energies of the compound **TCA3**. DFT calculations have also been carried out to explore the various physicochemical properties of the compound like HOMO-LUMO energy gap of the molecule, reactive sites present in the molecule using MEP analysis. The energy gap of the molecule is found to be 4.592 eV. Also, to know the strength and nature of intramolecular interaction energy using RDG analysis. Finally, the potential inhibitory activity of the titled compounds and their drug-likeness are demonstrated by ADME-T calculations. Further, The structure-activity relationships established through molecular docking studies showed that the compound **TCA3** strongly binds to the receptors Mpro (-8.2 Kcal/mol) which confirm its inhibition activity against COVID-19.

*Full paper: *Journal of Molecular Structure*, vol. 1317, 2024



Ordering Self-Assembly Structures via Nsingle bondH...S and Br...S interactions in (E)-2-(4-bromobenzylidene)Hydrazinecarbothioamide : Insights From Crystallographic and Computational Study

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ABSTRACT

In this research paper, the compound (E)-2-(4-bromobenzylidene)hydrazinecarbothioamide (NC2) was synthesized and characterized by spectroscopic techniques and crystal structure was elucidated using single crystal X-ray diffraction method. The Hirshfeld surface analysis revealed the relative contributions of different intermolecular interactions to crystal packing, while the 2D fingerprint plots provided a visual representation of the intermolecular interactions via the surface area corresponding to each type of interaction. The findings revealed that the crystal packing of the molecule is mostly determined by H...H, C-Br...S and NH...S interactions. We investigated the structural and electronic properties of the compound NC2 using density functional theory (DFT). The optimized geometry, total energy, HOMO-LUMO gap, and vibrational spectra were calculated at the ω B97X/6-311+G(d,p) level of theory. The calculated results showed that the molecule has a stable geometry with a trans-conformation. The HOMO-LUMO gap of 3.813 eV indicates that the molecule has moderate stability. The nature of noncovalent interactions are investigated using the methods reduced density gradient (RDG) and topology analysis like quantum theory of atoms in molecules (QTAIM) proposed by Bader et al. The compound NC2 is found to adhere to the Lipinski's rule of five and exhibit good pharmacokinetic properties.

**Full paper: Journal of Molecular Structure, vol. 1310, 2024*



A Novel Pyrazole Derivative as COVID-19 Main Protease Inhibitor: Synthesis, Quantum Computational Studies, Pharmacokinetic Properties, Drug Likeness, Molecular Docking and Dynamics Simulation; A CADD Approach

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ABSTRACT

2-(3-bromo-1-(3-chloropyridin-2-yl)-1H-pyrazol-5-yl)-8-methyl-4H benzo[*d*][1,3]oxazin-4-one (2-BCBO) compound, was synthesized by the reaction of 3-bromo-1-(3-chloropyridin-2-yl)-1H-pyrazole-5-carboxylic acid in acetonitrile and methane sulfonyl chloride. The monoclinic crystal structure in C2/c space group of the compound was unveiled through single-crystal X-ray diffraction studies. A prediction model was employed to investigate the influence of intermolecular contacts on molecular packing in the crystalline phase. The model incorporated both Hirshfeld surface and 2D fingerprint models to gain a comprehensive understanding of the strength of these contacts. The calculation of the total interaction energy was conducted by utilizing the three-dimensional molecular energy frameworks and further, employed density functional theory to examine molecular orbital characteristics and key factors associated with chemical reactivity. The application of topological analysis techniques, such as QTAIM and NCI, provided further insight regarding the attraction and repulsive interactions shown by the molecule. The pharmacokinetic properties of the 2-BCBO molecule have also been examined using ADMET analysis, which is important in drug discovery and development. In addition, the molecular docking study to determine the inhibitory effect of the investigated ligand on the main protease of new coronavirus (COVID-19), followed by molecular dynamics simulations, and it is found that both the results are in good agreement. The 2-BCBO could be accepted as a lead molecule to treat the coronavirus.

**Full paper: Chemical Physics Impact, vol. 8, 2024*



Multicomponent Synthesis, Structural and Molecular Dynamics Simulation Studies of A Novel Spirooxindole Derivative

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ABSTRACT

The 4'-(4-chlorobenzoyl)-3, -(2,6-dichlorophenyl)-1'-methylspiro(indole-3,2'-pyrrolidin)-2(1H)-one (SOD1) compound has been synthesized and the single crystals are grown by the slow evaporation method using ethanol. Initially, FT-IR and NMR (^1H and ^{13}C NMR) spectroscopic studies were used to confirm the structure of the compound. Single crystal X-ray diffraction data were used to determine the solid state structure of the grown single crystals. The title compound SOD1 crystallizes in the orthorhombic space group *Pbca*. The crystal packing analysis of the compound shows that distinct hydrogen bonding intermolecular interactions construct the 22(12), 22(8), and 12(8), supramolecular synthons to stabilize the packing modes. The propensity of intermolecular interactions is quantified by the Hirshfeld surface analysis, 2-D fingerprint plots and enrichment ratio analysis. Further, the 3-D packing topology of the molecular fragments is visualized through energy frameworks, which reveal the predominance of dispersion energy over other interaction energies. The optimized structure's geometric parameters were computed using DFT calculations using B3LYP/6-311+G(d,p) basis set and compared with the crystal structure parameters obtained by the X-ray diffraction studies. To explore the anticancer activity of the spiro compound, molecular docking with the 6FS1 protein was performed and the binding score of -7.7 kcal/mol was observed. Further, the binding interaction was explored by the dynamics simulation studies.

*Full paper: *Chemical Physics Impact*, vol. 8, 2024



Unraveling the Crystal Structure, Stability and Drug Likeness Of 1,3,4-Oxadiazole Derivatives Against Myelofibrosis: A Combined Experimental and Computational Investigation

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ABSTRACT

Herein, we report the synthesis and characterization of novel 1,3,4-oxadiazole derivatives, 2-methoxybenzyl 5-(4-chlorophenyl)-1,3,4-oxadiazole-2-carboxylate (**C1**) 2-methoxybenzyl 5-(2-chlorophenyl)-1,3,4-oxadiazole-2-carboxylate (**C2**), and methoxybenzyl 5-(3-chlorophenyl)-1,3,4-oxadiazole-2-carboxylate (**C3**) obtained through desulfurative cyclization reaction. The compound **C2** was crystallized, and its crystal structure was elucidated using single-crystal X-ray diffraction technique. The Hirshfeld surface analysis was carried out to analyze, visualize and globally appreciate the weak interactions involved in crystal packing. These analyses were complemented by Quantum Theory of Atoms In Molecules (QTAIM) and Reduced Density Gradient (RDG), which allowed us to decipher the nature and types of attractive forces that contribute to maintain the crystal structure of the titled compound. Moreover, the ADME profile of the compound was predicted to assess its drug likeness. Finally, *in silico* studies were performed to explore the binding affinity of the compounds (**C1-3**) against Myelofibrosis through molecular docking and molecular dynamic simulations.

*Full paper: *Journal of Biomolecular Structure and Dynamics*, 2024



Gamma-Ray Interaction Studies of Concrete with Waste Glass Fillers

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ABSTRACT

In the present work, the efficacy of waste glass as fillers in concrete for gamma-ray shielding has been studied. Glass fillers of 0, 15, 30, 45, and 60% concentrations have been incorporated into the concrete mixture. The attenuation measurements were performed using gamma spectrometer with NaI(Tl) detector at 511, 662, 1173, and 1332 keV gamma energies. Gamma-ray shielding parameters, such as the mass attenuation coefficient (μ/ρ), are determined for all filler concentrations. The mass attenuation coefficient of the prepared samples was found to be varied from 0.081 to 0.088, 0.071 to 0.088, 0.05 to 0.058, and 0.05 to 0.055 (cm^2 per g) for 511, 662, 1173, and 1332 keV gamma energies, respectively. It was observed that experimentally determined (μ/ρ) values were in very good agreement with theoretical values calculated from EDAX data. Furthermore, it was observed that (μ/ρ) showed an increasing trend with an increase in filler concentration, which is attributed to the increase in the shielding property of the material. Therefore, the glass-concrete composite can be accustomed to reduce the intensity of gamma radiation.

**Full paper: Radiation Protection Dosimetry, vol.200, no. 11-12, pp 1224-1227, 2024*



Synthesis, Crystal Structure, Hirshfeld Surface Analysis, Energy Frameworks, and DFT Calculations Of (2e)-3-(Dimethylamino)-1-[5-Methyl-1-(4-Nitrophenyl)-1h-1,2,3-Triazol-4-Yl]Prop-2-En-1-one

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ABSTRACT

A novel triazole derivative was synthesized and characterized by various spectroscopic techniques such as FTIR, NMR and single crystal X-ray diffraction study. The title compound crystallizes in the triclinic space group and exhibits inter-molecular hydrogen bonds of the type C-H...O and C-H...N. Hirshfeld surface analysis shows that the major intermolecular interaction is mainly due to H...H contacts. DFT calculations were performed to study their electronic properties. QTAIM and NCI studies were used to investigate the weak interactions in five triazole derivatives including the title compound.

**Full paper: Molecular Crystals and Liquid Crystals, vol. 768, no. 6, 2024*



Study on Polymer Composites with Glass for Gamma Ray Shielding

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ABSTRACT

The shielding of gamma radiation is of the utmost importance in industries, such as nuclear power plants, medical imaging, and space exploration. For the purpose of shielding objects in such an environment, it is essential to design materials with flexibility as well as high shielding capability. In order to enhance the radiation attenuation effectiveness of polymers, such as polyvinyl alcohol (PVA), glass has been blended with varying percentages. The fabricated composite has been subjected to gamma-ray interaction studies. The radiation shielding parameter, such as mass attenuation coefficient (μ/ρ), has been determined for various energies, such as ^{137}Cs (661.6 keV) and ^{60}Co (1173 and 1332 keV). It is observed that the PVA composite with glass exhibits improved gamma radiation shielding properties compared to PVA. Therefore, the present work paves the way for the utility of PVA polymer with glass, offering a cost-effective and sustainable approach to gamma radiation shielding in radiation environments.

**Full paper: Radiation Protection Dosimetry, vol. 200, no. 11-12, pp 1233-1236, 2024*



Gamma-Ray Shielding Characteristics of Concrete Containing Different Percentage of Ceramics for Different Energies

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ABSTRACT

To shield people from dangerous gamma radiation, it is imperative to fabricate inexpensive and environmentally friendly materials. In the present work, suitability of concrete with various % concentrations of ceramics as gamma-ray shielding material has been studied. In this regard, concrete mixture using M-sand and cement with ceramic as filler in different concentrations has been prepared. The mass attenuation coefficients of the prepared samples were measured for different concentrations of ceramics such as 15, 30, 45 and 60%. The mass attenuation coefficients, half value layer (HVL) and tenth value layer (TVL) of the prepared samples were determined using gamma-ray spectrometer with NaI(Tl) detector at 511, 661.6, 1173, 1332 keV gamma energies. Experimentally obtained mass attenuation coefficients varied from 0.080 to 0.090, 0.074 to 0.086, 0.056 to 0.072 and 0.054 to 0.055 cm² g⁻¹ at 511, 662, 1173 and 1332 keV, respectively. Therefore concrete mixture with ceramics filler could be a promising shielding material than the bare concrete.

**Full paper: Radiation Protection Dosimetry, vol. 200, no. 11-12, pp 1153–1157, 2024*



A Comprehensive Analysis of the Molecular Packing in the Crystal of (4-Methoxyphenyl) Methyl 4-(4-Chlorophenyl)-1,3-Thiazole-2-Carboxylate: Insights of X-Ray Crystallography and DFT Analysis

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ABSTRACT

The novel thiazole derivative (4-methoxyphenyl)methyl 4-(4-chlorophenyl)-1,3-thiazole-2-carboxylate (**w26**) was synthesized by the condensation reaction (CR) and spectroscopically characterized. The 3D structure of the compound was determined using the single crystal X-ray diffraction method. The compound (**w26**) crystallizes in the monoclinic crystal system in the space group C2/c. The supramolecular synthons constructed by strong hydrogen bond interactions play a major role in the supramolecular self-assembly of molecules in the solid state. In the structure, both Intermolecular and intramolecular hydrogen bonds of the type C

H...O were observed along with C—H... π and π ... π interactions. Hirshfeld surface analysis has been performed to assess the various intermolecular interactions in **w26** that drive the self-assembly of molecules in crystal lattices. Prediction model like 2D fingerprint model was performed to understand the intermolecular interactions responsible for molecular packing and the strength of molecular packing in the crystal. The geometrical optimization of structure was done by electronic structure method using density functional theory (DFT), to identify the active sites and to explore the chemically reactive parameters of the molecules. Simulating the frontier molecular orbitals (FMO) in gas-phase provides insights into the energy gap (4.169 eV) and chemical stability. Molecular Electrostatic Potential (MEP) surfaces were performed to get additional insights into charge distribution, intra-molecular, inter-molecular interactions, and stabilization energies. A non-covalent interaction plot was carried out to investigate the nature and strength of the vdW interactions.

*Full paper: *Journal of Molecular Structure*, vol. 1319, no. 2, 2024



**Rationalizing the Stability and Noncovalent Interactions of N-(Benzo[D]
[1,3]Dioxol-5-Ylmethyl)-2-(Methylthio)Thiazole-4-Carboxamide: Insights from X-
Ray Structure and QTAIM Analysis**

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ABSTRACT

A novel thiazole derivative, N-(benzo[d][1,3]dioxol-5-ylmethyl)-2-(methylthio)thiazole-4-carboxamide was synthesized and the structural interpretations were accomplished unambiguously by single crystal X-ray diffraction study. Structure investigation revealed that the crystal packing is stabilized by C H...N, and N H...O intermolecular interactions. Hirshfeld surface analysis used to explore the quantitative details of noncovalent interactions which are responsible for the crystal packing. The 3D energy framework, interaction energies and lattice energy of the compound were computed. Density functional theory (DFT) calculation was also employed to study various physicochemical properties of the compound. Quantum theory of atoms in molecules (QTAIM) analysis have been performed to study the intra and intermolecular interactions present in the thiazole derivative and also validate with the experimental results.

**Full paper: Journal of Molecular Structure, vol.1319, no. 2, 2024*



Electrochemical Investigation of Fe₃O₄/TNT/PANI Composites for Enhanced Supercapacitor Applications

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ABSTRACT

In this study, a hydrothermal method was employed to fabricate a composite incorporating iron oxide (Fe₃O₄), titanium dioxide nano tubes (TNT), and polyaniline (PANI). An extensive structural examination of the synthesized composite was carried out using Scanning Electron Microscopy along with elemental mapping, and spectroscopic techniques such as Fourier-transform infrared and X-ray diffraction. Galvanostatic charge/discharge and cyclic voltammetry (CV) measurements were conducted to assess the electrochemical properties of the synthesized materials including Fe₃O₄, Fe₃O₄/TNT (FT), and Fe₃O₄/TNT/PANI (FTP). These findings indicate that the incorporation of FT and PANI results in an increase in specific capacitance, transitioning from Fe₃O₄, TNTs, and FT to the conductive polymer composite FTP. Currently, efforts are directed towards further developing the FTP device for potential use in supercapacitors. The CV analysis demonstrates that specific capacitance elevates with potential across various potential windows. Specific capacitance of FTP obtained to be 542 Fg⁻¹ at 2 mA. Although capacitance retention improves gradually over few cycles, it has not yet achieved the optimal stability required for supercapacitor applications. Future research will focus primarily on enhancing the stability and overall performance of the composite materials developed.

**Full paper: Journal of Materials Science Materials in Electronics, vol. 35, pp 595, 2024*



Synthesis of Novel Chromeno-Tethered Imidazolone Scaffold through one Pot Sequential Multicomponent Reaction Mediated Cyclization: A Structural Computational and in Silico Investigation

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ABSTRACT

A novel chromeno imidazole-based derivative was synthesized and characterized using single crystal X-ray diffraction technique. The MCR strategical methodology followed by the cyclization and the SN_2 mechanism resulted in the formation of chromenoimidazolone molecular scaffold. The structural analysis revealed that the structure crystallizes in $P1\bar{1}$ space group and was stabilized by intra and intermolecular interactions. The dihedral angle of 82.85° indicated the non planarity of the molecule. The molecular interactions exhibited by the crystal structure were analysed by the Hirshfeld surface analysis and the H...H interactions was found to be major contributor to the overall interactions of the compound with the percentage contribution of 52.3%. The theoretical investigations were carried out using density functional theory calculations to predict various electronic properties of the compound. The HOMO-LUMO energy gap of the compound is found to be 1.4534 eV for alpha and 3.9367 eV for a beta spin. The MEP analysis revealed that the C = O exhibit the highest negative electrostatic potential with the value of -0.064 a.u. indicating its nucleophilic nature. Further, natural bond orbital analysis revealed that the $LP(1) \rightarrow \pi^*$ interaction demonstrates the highest stabilization energy of 53.49 kcal/mol.

The results of the molecular docking analysis of the compound against 6FS1 protein showed a docking score of -7.4 kcal/mol, indicating the potential of the compound to be a good anti-cancer agent. Further, the findings of the molecular docking were substantiated by the molecular dynamics simulation studies which showed very good stability of the protein-ligand complex.

**Full paper: Journal of Molecular Structure, vol. 1320, 2025*



Synthesis, Spectroscopic Characterization, DFT Calculations, in Silico-ADMET and Molecular Docking Analysis of Novel Quinoline-Substituted 5H-Chromeno [2,3-B] Pyridine Derivatives as Antibacterial Agents

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ABSTRACT

A convenient, straightforward, and effective one-step reaction for the synthesis of a three-component compound of biologically relevant novel 2,4-diamino-5-(8-hydroxyquinolin-7-yl)-5H-chromeno[2,3-b] pyridine-3-carbonitrile derivatives was designed and synthesized. The synthesis was developed by the reaction between salicylaldehyde **1**, 8-hydroxyquinoline **2**, 2-aminopropene-1,1,3-tricarbonitrile **3**, and the catalytic amount of triethylamine in ethanol at 78 °C. This methodology has many beneficial features, including the use of inexpensive and non-hazardous starting materials, single-flask reactions, optimized reaction conditions, the termination of intermediate isolation, easy workup, reducing organic waste products, being chromatography-free, and decreasing the reaction time along with quantitative yields with high functional group tolerance. A proposed mechanism with supporting experimental data is presented, including ¹H NMR, ¹³C NMR, 2D NMR (HMBC, COSY, HSQC), mass, and IR spectroscopy, which are used to characterize the complete derivatives. All synthesized compounds were evaluated in vitro for their antibacterial activities against *Bacillus subtilis*, *Staphylococcus aureus*, *Escherichia coli* and *Pseudomonas aeruginosa* bacterial strains via the agar-well diffusion method compared with the reference drug gentamicin. The data indicated that compounds **4A**, **4F**, **4G**, **4J**, and **4K** consistently demonstrated strong antimicrobial activity against Gram-positive and Gram-negative bacteria. Furthermore, a molecular docking investigation was carried out to gain insight into the binding mode of the most promising compounds via the crystal structure of the *S. aureus* DNA gyrase complex with ciprofloxacin (PDB ID: 2XCT). Density functional theory (DFT) calculations were performed to determine the various molecular properties of the synthesized novel 2,4-diamino-5-(8-hydroxyquinolin-7-yl)-5H-chromeno [2,3-b] pyridine-3-carbonitrile derivatives (4A-4M). On the basis of the reactive sites explored by the molecular electrostatic potential maps, the antibacterial activities of the compounds were screened.

*Full paper: *Molecular Diversity*, 2024



Structure-Property Relationship of Two Gamma-Lactam Derivatives: Hirshfeld Surface Analysis, DFT, and Molecular Dynamics Simulations

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ABSTRACT

Complete structural and non-covalent interactions of **2a** and **2b** are examined by single crystal X-ray diffraction and computational studies. Hirshfeld surface analysis showed differences in the relative contribution of non-covalent interactions of **2a** and **2b**. Fingerprint plots recognize the major contribution of H··H contacts in **2a** and **2b**. Density functional theory using implicit solvation models, the energy gap of the frontier molecular orbitals found to be 4.624 eV in **2a** and 4.264 eV in **2b**. Docking studies predicted that **2a** and **2b** have suitable structures to target Human Topoisomerase II Alpha, which was further validated using MM/GBSA and MDSs studies.

**Full paper: Chemical Physics Letters, vol. 857, 2024*



Exploration of Crystal Structure, Supramolecular Organization, and Computational Studies of a Novel Pyrazole Derivative: A Structural and Theoretical Perspectives

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ABSTRACT

An eminent challenge in contemporary medicine and pharmacy is the identification of powerful, biologically active, and benign anti-COVID drugs. The objective of this work is to synthesize 3-chloro-1-(3-chloropyridin-2-yl)-1H-pyrazole-5-carboxylic acid to investigate its properties using different spectroscopic methods. The crystal structure of the compound is determined using single-crystal X-ray diffraction methodology. Hirshfeld surface analysis was employed to evaluate the impact of intermolecular interactions on crystal packing. The interactions were visually depicted using 2D fingerprint plots, which highlighted the specific surface area associated with each interactant. Indications suggest that the crystal packing is mostly governed by C-H...O and N-H...O interactions, resulting in the formation of S(7) self-motif and R₄⁴(24) synthon, which greatly improve crystal stability. Density functional theory (DFT) was employed to better examine the structural and electrical characteristics. Computations were conducted at the 6-311+G(d,p) level to determine the optimal geometry, total energy, HOMO-LUMO gap, and vibrational spectra. The results showed a HOMO-LUMO gap of 3.092 eV, suggesting a moderate amount of stability. Bader et al. employed reduced density gradient (RDG) techniques and topological analysis, taking into account the quantum theory of atoms in molecules (QTAIM), to examine noncovalent interactions. Additionally, the molecule satisfies Lipinski's rule of five and exhibits encouraging pharmacokinetic activities. Additional in-silico investigations, including molecular docking, were conducted on the SARS-CoV-2 spike protein variation to assist in the advancement of enhanced vaccines and therapeutics.

**Full paper: Journal of Molecular Structure, vol. 1321, no. 5, 2025*



Exploring the Structural Intricacies of 1D HOF in a Novel Hydrazone Derivative Exhibiting Anticancer Potential: A Crystallographic and Computational Approach

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ABSTRACT

This study provides a detailed structural investigation of 5-(diethylamino)-2-hydroxyphenylmethylidenebenzohydrazide (H1B), using both experimental techniques and computational methods to explore its non-covalent interactions and potential anticancer properties. Through single crystal X-ray diffraction, we determined that H1B crystallizes in the monoclinic system, revealing significant intermolecular interactions which contribute to the stability of a 1D hydrogen-bonded organic framework (HOF). Hirshfeld surface analysis quantified the role of these interactions, showing the dominance of van der Waals forces, while void analysis gave insights into the crystal's structural integrity and mechanical stability. DFT calculations gave us a deeper look into the electronic structure of the molecule, especially the HOMO-LUMO gap, which points to its high chemical reactivity and potential to interact biologically. The NBO analysis further highlighted how charge transfer within the molecule helps stabilize it, particularly through hyper conjugative interactions. In addition, molecular docking studies predicted a strong binding affinity between H1B and the JAK2 Kinase protein, supporting its potential anticancer activity, which was further validated by molecular dynamics simulations over a 100 ns period. These findings collectively underscore the structural and biological relevance of H1B, positioning it as a promising candidate for anticancer applications.

**Full paper: Journal of Molecular Structure, vol. 1322, no. 3, 2025*



In Silico Studies of Thiazole Derivative towards its Potential use against SARS-Cov-2: An Intuition from an Experimental and Computational Approach

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ABSTRACT

The N-(4-methoxyphenyl)-4-phenylthiazole-2-carboxamide (TT7) obtained via cyclization of methyl 2-((4-methoxyphenyl)amino)-2-oxoethanedithioate with α -haloketone and then characterized by ^1H NMR and ^{13}C NMR spectroscopy, and single crystal X-ray diffraction method. Weak intermolecular interactions like C H...O, C H... π , C O... π , and π ... π interactions help to stabilize the compound TT7. The weak interactions formed in the solid structure of the compound TT7 were meticulously investigated using theoretical approach like Hirshfeld surface analysis using crystallographic information file (.cif). Further, the density functional theory calculations have been performed to obtain the optimized geometry of the structure, and to explore the electronic properties of the molecule. The charge distribution on the molecular surface is analyzed by the molecular electrostatic potential (MEP) map. QTAIM and RDG analyses were done to explore the weak interactions (intramolecular) in the compound TT7 in the gaseous phase. The compound TT7 displayed good in silico results against SARS-CoV-2 main protease. Molecular docking study on SARS-CoV-2 virus major protease (PDB IDs: 6LZE and 6LU7) shows higher docking scores. Molecular dynamics simulations confirmed the inhibitory action of the newly synthesized compound (TT7). The binding free energy and contributed energies were determined using the MM-GBSA technique. The 6LU7-ligand complex has the highest binding free energy, with considerable contributions from covalent and van der Waals interactions.

**Full paper: Journal of Molecular Structure, vol. 1322, no. 3, 2025*



Structural Elucidation, Hirshfeld Surface, DFT, Molecular Docking and Molecular Dynamics Studies of a Novel Thiazole Derivative as Anti-Cancer Drug

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ABSTRACT

Detailed structural and non-covalent interactions in the novel thiazole derivative *benzyl 4-(4-chlorophenyl)thiazole-2-carboxylate (6a)* has been synthesized and characterized by spectroscopic characterizations like ^1H NMR and ^{13}C NMR, and single crystal structure analysis. Its results were compared with the previously reported similar thiazole derivative (*4-methoxyphenyl)methyl 4-(4-chlorophenyl)-1,3-thiazole-2-carboxylate (6b)*. The crystal structure analysis revealed that C-H.....O, hydrogen bonds involved in stabilizing the crystal packing. The differences and similarities in the relative contribution of non-covalent interactions in **6a** and **6b** compounds are compared using the Hirshfeld surface analysis and 2D fingerprint plots. The binding energies of specific molecular pairs and dimers have been investigated using pair-wise interaction energy calculation. The hierarchy and supramolecular architecture of intermolecular interactions are visualized through energy frameworks. Geometric parameters of the optimized structure were determined using DFT calculations on the B3LYP/6-311++G(d,p) basis set and compared to X-ray diffraction data. Molecular docking with the 6FS1 protein revealed a binding score of **6a** is -6.7 kcal/mol, and **6b** is -6.5kcal/mol indicating potential anticancer action for the thiazole compound. Furthermore, the binding interaction was investigated using dynamics modelling simulations. Further in vitro and in vivo analysis will help in the exploration of the inhibition activity of the ligand with the protein.

*Full paper: *Journal of Molecular Structure*, vol. 1324, 2025



Identification and Detection of Leaf Miner, Pests Infestation in Cucurbitaceae Family in Real Time Infield Scenarios using YOLOv5s Object Detection Model

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ABSTRACT

This study contributes to technological developments in precision agriculture by developing a YOLOv5s-based model with a high F1 score and mAP, highlighting its potential for real-world use in wax gourd plants. In precision agriculture, early disease identification is crucial for effective harvesting. The present research focuses on the creation and evaluation of a YOLOv5s-based model for detecting pests and leaf miner infections in wax gourd plants in real time infield conditions at various stages of plant growth. Using a dataset of over 2000 samples collected in a variety of in-field settings, the model was trained for 200 epochs with a low learning rate (0.00001) and a batch size of 32. The achieved F1 score of 0.96 demonstrates the model's remarkable combination of precision and recall, ensuring precise disease detection. Furthermore, a mean Average Precision (mAP) greater than 0.45 demonstrates the model's proficiency in precise leaf localization and overall detection ability. The model's ability to detect numerous occurrences of disease in different leaves simultaneously is a crucial strength, reflecting the complexities common in real-world agricultural scenarios. The dataset's quantity and diversity help the model be robust and generalizable across diverse infection types and growth stages.

**Full paper: 11th International Conference on Computing for Sustainable Global Development, INDIACom 2024*



A Novel Approach For Tomato Quality Evaluation: Computer Vision In Maturity Assessment And Disease Detection

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ABSTRACT

Tomatoes (*Solanum lycopersicum*) are one of the most widely consumed fruits globally. Fruit maturity and disease estimation is a critical factors in determining its quality and marketability. Traditional maturity assessment requires huge labor, slow, subjective, and time-consuming activities. To address these challenges, the agriculture industry is subjected to automation using computer vision models. Accurate prediction of tomato maturity and diseases is important to decide on harvesting time. Several features such as color, shape, texture, and size are considered to predict the different maturity stages of fruits using deep learning and machine learning models. Assessing the maturity level and disease detection in the early stage of tomatoes is crucial. The proposed work explores the application of the VGG16 architecture for tomato maturity classification and disease detection. The study leverages transfer learning with VGG16 focusing on feature extraction and model optimization to achieve accurate classification. The datasets used in this work are self-created using the images that are collected from agricultural farms. The dataset consists of image samples of six different maturity stages and diseased fruit images. The experiment results in an accuracy range between 95%-99% for six maturity stages of tomatoes and disease prediction resulted in 90%-97% accuracy.

**Full paper: 5th International Conference for Emerging Technology, INCET 2024*



Development and Experimental Characterization Study of Cesium Doped Zinc Oxide Polymer Conductive Films for Sensing Applications

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ABSTRACT

In this research study we report the successful preparation of cesium doped zinc metal oxide nanoparticles by solution combustion technique further incorporated into polyurethane films synthesized from bio-degradable castor oil, for study of piezo-conductive property. The composite films prepared with filler weight percentages of 0.5, 1.0, 2.0 and 4.0 are studied for structural, mechanical, thermal, electro-mechanical and weatherability properties. Studies revealed successful formation of urethane links and good dispersion of nanoparticles in the prepared films. Films under tensile and compression loading showed promising electro active results with maximum volume conductivity values of $1.226E^{-7}Scm^{-1}$ at 30N compression load. The developed films show good compatibility to be employed in corrosive and acidic environments with safe working temperature upto 160°C.

**Full paper: Journal of Physics: Conference Series, vol. 2748, no. 1, 2024*



Early-Stage Disease Prediction In Chilli Plant Using YOLO Models

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ABSTRACT

Agriculture is an important component of every country's economy, supplying the necessary resources to farmers and their families. The livelihoods of farmers are greatly threatened by crop diseases, which highlights the importance of early identification of diseases in chilli plants at the right stage of growth is crucial for timely fertilizer recommendation. This paper presents an intelligent transfer learning technique to detect thrips and viruses in chilli plants in the early stages of development. Stage-by-stage datasets are collected from chilli plant orchards around Mysore district, Karnataka, to carry out the training using the YOLO model. The dataset consists of three growth stages of chilli plants (15, 25, and 35 days) that are captured in diverse environmental settings with multiple-resolution smart phones. The annotations are created for the diseases healthy, viruses, and thrips at leaf level from whole plants for all three stages. Hyperparameters such as learning rate, the learning optimization algorithm, batch size, epochs, and loss functions are employed to fine-tune the YOLO v5, v6, and v7 models. To achieve high generalisation and reduce overfitting, a weight decay (weight_decay) of 0.0005 is employed. From the evaluation, it was noticed that YOLOv7 outperformed other YOLO models. A mAP score of 0.80 is achieved in stage 1, 0.82 in stage 2, and 0.73 in stage 3 with minimal validation loss and remarkable inference speed.

**Full paper: 2nd IEEE International Conference on Advances in Information Technology, ICAIT - Proceedings, 2024*



Intelligent Techniques for Nutrition Level Prediction in Guava Plants

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ABSTRACT

Guava, a valuable tropical fruit crop, faces significant defect challenges due to diseases. Manual disease checks are time-consuming and error prone, leading to delayed action. Our research focuses on image processing to quickly and accurately identify guava diseases using deep learning approach with the help of Guava leaf images. This automation minimizes human intervention, enhances accuracy, and aids disease prevention. Early detection of these diseases improves crop quality and sustainability while reducing pesticide use. This Deep learning-driven approach aims to benefit farmers, consumers, and global food security by advancing guava farming practices. By using the YOLOv8 object detection model for 6 classes, we got an accuracy of 87.97%.

**Full paper: Asia Pacific Conference on Innovation in Technology, APCIT, 2024*



Robust PVA-MWCNTS-Based Triboelectric Energy Harvesting Device: Self-Powered Smart-Door Technology

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ABSTRACT

Triboelectric nanogenerators (TENGs) are emerging as promising solutions for mechanical energy harvesting from various environmental sources, offering a pathway toward self-sufficient power generation. The present research demonstrates the feasibility and effectiveness of the polyvinyl alcohol (PVA)-multi-walled carbon nanotubes (MWCNTs) composite as a tribopositive material for designing robust TENG. Through comprehensive evaluations, the dispersion of MWCNTs in PVA is confirmed. MWCNTs-based TENGs are fabricated in a vertical contact-separate configuration for harnessing mechanical energy effectively. The device's performance metrics including output voltage, current, power generation, and durability, are investigated. The device with 1.6 wt% MWCNTs fillers exhibits a performance enhancement in voltage and current. The optimized MWCNTs-based TENG attains its maximum power of 542 μW at 30 $\text{M}\Omega$ load resistance, showcasing its potential for powering small-scale electronics. Furthermore, possible applications and implications of integrating self-powered smart-door systems are demonstrated. This can be implemented in various real-world scenarios, such as residential buildings, commercial establishments, and public facilities.

**Full paper: Surfaces and Interfaces, vol. 51, 2024*



Facile Green Synthesis of Lanthanum Oxide Nanoparticles: Their Photocatalytic and Electrochemical Applications

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ABSTRACT

Green synthesis is a reliable way to synthesize metal oxide nanoparticles (NPs) without affecting the environment. Plant extracts act as reducing agents that favor the synthesis of NPs. In this study, jackfruit aqueous extract was used as a fuel in the solution combustion synthesis of lanthanum oxide (La_2O_3) NPs. X-ray diffraction (XRD) confirmed the formation of the hexagonal structure of La_2O_3 NPs. The scanning electron microscope (SEM) and energy dispersive X-ray (EDS) spectrum confirm the needle-shaped morphology and purity of the La_2O_3 NPs, respectively. Furthermore, La_2O_3 was utilized as a photocatalyst for the photodegradation of methylene blue dye under visible light radiation, demonstrating high efficiency within 90 min of light irradiation. The electrochemical characteristics of La_2O_3 were studied using a carbon paste electrode in a 0.1 M HCl solution. These La_2O_3 samples exhibited superior sensitivity in cyclic voltammetry tests towards the detection of ascorbic acid and lead nitrate. Consequently, La_2O_3 holds potential for applications in electrochemical sensor technology.

**Full paper: Journal of Materials Science: Materials in Electronics, vol. 35, no. 18, 2024*



Hydrothermal Synthesis of Γ -Bi₂MoO₆ Nanostructures: Efficient Material for Photocatalytic Dye Degradation and Impedance Studies

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ABSTRACT

The goal of this research is to synthesize bismuth molybdate (γ -Bi₂MoO₆) nanoparticles via hydrothermal approach which involved the use of bismuth nitrate and ammonium molybdate as a precursor. The resultant product was undergoing spectroscopic characterization techniques to understand the properties of γ -Bi₂MoO₆ NPs. Additionally, the absorbance and band gap of the bismuth molybdate nanoparticles were measured using a UV-visible spectrophotometer. According to the results obtained by the band gap, the calculation is around 2.4 eV. The photocatalytic efficacy was investigated using methylene blue (MB) dye by utilizing a visible light source for 2 h. The formation of hydroxyl radicals is the responsible species for degradation confirmed by the scavenger analysis. The reusability and photostability were determined by recycling studies. According to the degradation efficiency calculation, about 93.4% MB dye was effectively degraded by the synthesized bismuth molybdate. Furthermore, the electrochemical impedance analysis revealed the capacitance of the bismuth-modified electrode.

**Full paper: International Journal of Ionics – The Science and Technology of Ionic Motion (Ionics) vol. 30, no. 5, pp. 2901 – 2913, 2024*



Inorganic Metal Oxide-Reinforced Polymer-Based Flexible Inorganic Nanocomposite for UV Shielding Applications

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ABSTRACT

This investigation reveals the successful incorporation of strontium-doped thorium oxide (SrThO₃) NPs into polyvinyl alcohol (PVA) polymer nanocomposites. The fabrication process of these PVA nanocomposites entails utilizing varying amounts (0.5, 1.0, 2.0, and 4.0 wt%) of SrThO₃ nanofillers through a straightforward solution casting technique. The microstructure and overall structure of the resulting polymer nanocomposites were analyzed using powdered x-ray diffraction for crystalline structure and Fourier transform infrared (FTIR) spectroscopy for molecular composition. The introduced SrThO₃ nanofiller demonstrates a strong affinity for the hydroxyl groups present in the PVA polymer, a phenomenon validated through FTIR spectroscopy. In order to comprehend the impact of doping, the surface morphology of the PVA polymer nanocomposites underwent examination via scanning electron microscopy. The absorption and transmission of light were quantitatively assessed using UV-visible spectroscopy. The excitation and emission behaviors of electrons in both the PVA and SrThO₃-doped PVA nanocomposites were scrutinized through photoluminescence spectroscopy. Furthermore, the extent of UV light absorption was investigated by studying the degradation of methylene blue dye, a substance known for its sensitivity to UV light. Results indicate that the intentional incorporation of SrThO₃ NPs significantly enhances UV stability.

**Full paper: Journal of Applied Polymer Science, vol. 141, no. 33, 2024*



Synergistic Effects Of Rgo Functionalization In Nanocomposite-Based Triboelectric Nanogenerators For Enhanced Energy Harvesting

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ABSTRACT

Enhancing the performance of triboelectric nanogenerators (TENGs) by integrating advanced energy materials is crucial for broadening their applications. In this study, the tribo-positivity of polyvinyl alcohol (PVA) is physically tailored by doping with functionalized reduced graphene oxide (FrGO) into the polymer matrix, aiming to design high-performance TENGs. The pristine PVA and -OH, -COOH, and -NH₂ FrGO nanocomposite with varying filler quantities (0–2 wt/wt%) are subjected to various characterizations for elucidating structural, surface and electrical properties. Further, electrical measurements of as-fabricated FrGO-TENGs revealed a notable increase in both voltage and current with increasing filler quantities. Interestingly, the NH₂ FrGO-TENG shows maximum electrical output compared to -OH and -COOH FrGO-TENGs. Also, the open-circuit voltage (V_{oc}) and short-circuit current (I_{sc}) of NH₂ FrGO-TENG are about 10 and 17 times more than that of pristine PVA-TENG. This substantial improvement is attributed to the extensive hydrogen bonding between the PVA-NH₂ FrGO. Furthermore, the practical utility of the optimized device is demonstrated by showcasing its ability to power LEDs, digital timers, and commercial capacitors through a rectifier bridge. Thus, the results proved the potential of incorporating -NH₂ FrGO into PVA as a synergistic material for sustainable and improvised energy harvesting, owing to opening new avenues for self-powered applications.

**Full paper: Sensors and Actuators A: Physical, vol. 370, 2024*



Phyto-Mediated Facile Synthesis of ZnO Nanoparticles: Enhanced Photocatalysis, Biological, and Electrochemical Properties

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ABSTRACT

In the present work, zinc oxide nanoparticles (ZnO NPs) were prepared via a simple and eco-friendly combustion method employing *Cleome gynandra* seed extract as a fuel. The synthesized ZnO NPs were characterized by X-ray diffraction (XRD), scanning electron microscopy (SEM), energy dispersive X-ray studies (EDX), Fourier-transform infrared spectroscopy (IR), Raman spectroscopy, and UV spectroscopy (UV-Vis). XRD confirmed the crystalline nature of the material with a hexagonal wurtzite structure having an average crystallite size of 28 nm. SEM images confirm the formation of spherical with agglomerated forms of ZnO NPs. FTIR spectrum shows the band at 580 cm^{-1} due to the vibrational mode of Zn-O bending. The band gap of the ZnO was found to be 3.00 eV. Photocatalytic activity of ZnO NPs was assessed using methylene blue (MB) dye under UV light irradiation, demonstrating an admirable 94% degradation around 120 min. The electrochemical studies of the ZnO-modified carbon paste electrode exhibit superior oxidation and reduction potential and also show promising electrode material for H_2O_2 and ascorbic acid sensors. Further, these NPs also exhibit antioxidant and antimicrobial properties and are biocompatible with lymphocytes. Therefore, the synthesized material has good photocatalytic, electrochemical, antibacterial, and antimicrobial properties.

*Full paper: IONICS, vol. 30, no. 10, pp. 6611–6629, 2024,



Green Synthesis of Bismuth Vanadate Nanostructures for Efficient Photocatalytic and Biological Studies

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ABSTRACT

In the current investigation, BiVO_4 nanoparticles were prepared via a simple combustion approach followed by annealing at 400°C using rain tree pod extract. The physicochemical and morphological features were examined through spectroscopic techniques. Optical studies were carried out using a UV-visible spectrophotometer, revealing a bandgap of 2.4 eV. Photocatalytic efficiency was assessed through degradation studies using methylene blue (MB) dye under visible photon irradiation, demonstrating an impressive 94 % degradation rate. Consequently, this synthesized bismuth vanadate serves as an outstanding photocatalyst under visible irradiation. Furthermore, these nanoparticles exhibited favorable responses in antifungal, antibacterial, and molecular docking studies. Bismuth vanadate nanoparticles had substantial antifungal efficacy, with the Bi_2 version successfully suppressing *Aspergillus Niger* at a 50 % concentration. At 100 mg/ml, Bi_2 showed a 6 mm zone of inhibition against Gram-positive *Staphylococcus aureus* and a 5 mm zone against Gram-negative *Escherichia coli* for antibacterial evaluation. The protein 7BLY and Bismuth vanadate had four hydrogen bond interactions and a strong binding affinity, as shown by molecular docking, of -5.0 Kcal/mol. Therefore, bismuth vanadate nanoparticles synthesized through green methods show promise in combating fungal and bacterial infections, as well as potential applications in various fields.

**Full paper: Nano-Structures & Nano-Objects, vol. 39, 2024*



Red-Emitting 4-Methyl Coumarin Fused Barbituric Acid as an Electrochemical Sensor for Catechol Detection and Probe for Latent Fingerprints

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ABSTRACT

Herein, we have reported a red-emitting 4-methyl coumarin fused barbituric acid azo dye (**4-MCBA**) synthesized by conventional method. Density functional theory (DFT) studies of tautomer compounds were done using (B3LYP) with a basis set of 6-31G(d,p). NLO analysis has shown that tautomer has mean first-order hyperpolarisabilities (β) value of 1.8188×10^{-30} esu and 1.0470×10^{-30} esu for azo and hydrazone forms, respectively, which is approximately nine and five times greater than the magnitude of urea. **4-MCBA** exhibited two absorption peaks in the range of 290–317 and 379–394 nm, and emission spectra were observed at 536 nm. CV study demonstrated that the modified **4-MCBA**/MGC electrode exhibited excellent electrochemical sensitivity towards the detection of catechol and the detection limit is 9.39 μ M under optimum conditions. The **4-MCBA** employed as a fluorescent probe for the visualisation of LFPs on various surfaces exhibited Level-I to level-II LFPs, with low background interference.

**Full paper: Luminescence vol. 39, no. 7, 2024*



Exploring Potential Applications of α and β Polymorphs of Bi₂O₃ Nanoparticles

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ABSTRACT

In this investigation, we successfully synthesized bismuth oxide (Bi₂O₃) nanoparticles (NPs) via simple combustion method using *Artocarpous heterophyllus* (Jackfruit) extract as fuel. Both α and β polymorphs of bismuth oxide NPs was prepared using same *Artocarpous heterophyllus* fuel but there is a variation in the addition of fuel in the range of 1 mL–6 mL. The prepared NPs were characterized by utilizing spectroscopic techniques. The photocatalytic efficiencies were found to be 84 %, 93 % for both α , β forms respectively. Methylene blue dye exhibits effective degradation for β -phase compared to α -phase. Furthermore, Electrochemical impedance spectroscopy and sensing (CV) activities were performed. The bismuth oxide modified electrodes exhibits better sensing activity towards dopamine, ascorbic acid, lead nitrate, and results obtained from EIS data revealed the super capacitor characteristics of Bi₂O₃ nanoparticles. This extensive investigation assessed the effectiveness of *Aspergillus Niger*-fighting drugs, as well as the antibacterial effects of synthesized nanoparticles on *Staphylococcus Aureus* and *Escherichia Coli*. Measurements of optical density were used to establish the MIC values for antifungals. The protein 4XUY has a strong binding affinity of -6.4 Kcal/mol, with four important hydrogen bond interactions (LYS51, HIS84, ASN131, and GLU238) revealed by molecular docking research. These results expand our knowledge of the therapeutic uses of bismuth oxide nanoparticles by highlighting their potential as effective antibacterial agents and by providing insightful information about how they work against pathogenic microorganisms.

*Full paper: *Chemistry Select*: vol. 9, no. 21, 2024



Topogeofusion: Integrating Object Topology Based Feature Computation Methods Into Geometrical Feature Analysis To Enhance Classification Performance

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ABSTRACT

This study used smartphone captured RGB images of gooseberries to automatically sort into standard, premium, or rejected categories based on topology. Main challenges addressed include, separation of touching or overlapping fruits into individual entities and new method called 'TopoGeoFusion' that combines basic geometrical features with topology aware features computed from the fruits to assess the grade or maturity. Quality assessment helps in grading the fruit to determine market suitability and intelligent camera applications. Computer Vision-based techniques have been applied to automatically grade the quality of gooseberries as standard, premium, or rejected according to fruit maturity. Smartphone-captured images of 1697 Indian Star Gooseberries are contributed to the study. This work acquired images consisting multiple fruits with overlapping and non-overlapping boundaries for concurrent quality assessment. Multiple classifiers such as Random Forest, SVM, Naive Bayes, Decision Tree, and KNN were applied to grade the gooseberry fruit. Random Forest classification with a fusion feature model resulted in an accuracy of 100 % towards reject, standard, and premium classes for test sets with four training strategies. The proposed segmentation model proves reliable in fruit detection & extraction with an average mAP of 0.56, resulting in an acceptable model for grade assessment. The study highlights the effectiveness of TopoGeoFusion in automating the grading process of gooseberry fruits using topologically computed features. The developed models exhibit high accuracy and reliability, even in challenging scenarios such as overlapping and touching fruits. The method provides the technique to detect and extract the occluded objects and compute the features based on the partial object's topology.

**Full paper: Methodx, vol. 13, 2024*



Green Synthesis of M-Lavo4 Nanoparticles Using Costus Igneus Leaves Extracts and Its Photocatalytic and Electrochemical Applications

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ABSTRACT

Monoclinic lanthanum vanadate ($m\text{-LaVO}_4$) was synthesized using a facile combustion method, with ammonium metavanadate and lanthanum nitrate serving as precursors. Spectroscopic techniques were employed for the characterization of the synthesized $m\text{-LaVO}_4$ nanoparticles. Furthermore, $m\text{-LaVO}_4$ was utilized as a photocatalyst for the photodegradation of methylene blue dye under visible light radiation, demonstrating high efficiency within 90 min of light irradiation. The electrochemical characteristics of $m\text{-LaVO}_4$ were studied using a carbon paste electrode in a 0.1 M HCl solution. These $m\text{-LaVO}_4$ samples exhibited superior sensitivity in cyclic voltammetry tests at different scan rates when ascorbic acid and lead nitrate were utilized as analytes. Consequently, $m\text{-LaVO}_4$ holds potential for applications in electrochemical sensor technology.

*Full paper: IONICS, vol. 30, no. 6, pp. 3443–3454, 2024



Investigating the Annealing Effects on the Performance of Polyvinyl Alcohol-Graphite-Based Triboelectric Nanogenerator

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ABSTRACT

Annealing plays a crucial role in enhancing the performance, stability, and durability of triboelectric nanogenerators (TENGs). By carefully controlling the annealing parameters, the material properties can be optimized and improve the overall efficiency of TENG devices for various practical applications. Herein, graphite (Gr) embedded polyvinyl alcohol (PVA) composite films are prepared by a solution casting technique and subjected to annealing at various temperatures below the glass transition temperature (T_g) of PVA. The annealed effects are thoroughly examined through characterizations involving PXRD, SEM, EDS, FTIR, and TGA. Subsequently, TENGs are fabricated utilizing the annealed composite films as the tribopositive material, polypropylene as the tribonegative material, and the impact of annealing on the device performance is investigated. At an annealing temperature of 80°C, the PVA-Gr TENG exhibited notably higher output voltage (V_{oc}) and short-circuit current (I_{sc}) of 200.24 V and 12.68 μ A, respectively. In addition, the PVA-Gr TENG successfully charges electrolytic capacitors, powers a digital watch, operates a humidity and temperature sensor, and lights a series of green LEDs. Thus, the present study highlights the significant impact of annealing on the performance of PVA-Gr TENG, leading to enhanced output power and stability.

**Full paper: Sensors and Actuators A: Physical, vol. 372, 2024*



Multifunctional Citral-Tryptamine Conjugated Silver Nanoparticles (CT@AgNPs): Antibacterial, Cytotoxicity, and Sensor Application

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ABSTRACT

The present study reports the synthesis of multifunctional silver nanoparticles using citral-tryptamine (CT@AgNPs). In this approach, synthesis of citral-tryptamine-based Schiff base (CT) was characterized using various spectral studies such as NMR, FT-IR, and LCMS. The various biological properties were investigated using ADME, Bioactive, and molecular docking analysis of CT compound. Interaction and binding affinities toward protein IDs 6SJA and 3DAQ were significant. Silver nanoparticles were synthesized by reduction method using CT compound and confirmed by XRD, EDX, SEM, and DLS analysis. Herein, CT@AgNPs have an average diameter of 52 nm. The silver nanoparticle exhibited enhanced antibacterial activity against methicillin-resistant *Staphylococcus aureus* (MRSA) the MIC value is $15 \pm 0.50 \mu\text{g/mL}$. These nanoparticles showed remarkable toxic effect against *SiHa* cervical cancer cell line, and obtained IC_{50} value is $100 \mu\text{g/mL}$. Additionally, we propound the rapid, sensitive, and cost-effective electrochemical approach for detection of nitrite with linear dynamic range of 0.4 to 4.0 mM with a lower detection limit of 0.4 mM. These results advocate promising antibacterial and anticancer properties of CT@AgNPs for futuristic therapeutics and sensor application.

*Full paper: *Bio Nano Science*, vol. 14, pp. 5106–5121, 2024



Biogenic Synthesis of Linivo4 Nanoparticles for the Evaluation of Photocatalytic and Electrochemical Applications

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ABSTRACT

In this present work, lithium nickel vanadate nanoparticles (LiNiVO_4 NPs) were synthesized by solution combustion method. Here, jackfruit seed extract is employed as a fuel for the synthesis. These nanoparticles were characterized by various spectroscopic techniques. X-ray diffraction (XRD) studies confirm the inverse spinel structure of LiNiVO_4 NPs. The scanning electron microscopy (SEM) images represent the agglomerated and clustered-like structure of NPs. Energy dispersive X-ray (EDX) spectrometry shows the existence of vanadium, nickel, and oxygen elements. Also, Ni and V are present in the average ratio of 1:1. The UV-visible spectral analysis indicated absorption bands at 465 and 728 nm, corresponding to a band gap energy of 2.2 eV. The vibrational analysis of the NPs was confirmed through IR and Raman spectroscopy, with a new peak observed at 1036 cm^{-1} indicating the bond interaction of $\text{Li}^+\text{-O-V}$ in the FTIR analysis. Further, LiNiVO_4 NPs exhibit good photocatalytic activity for the degradation of methylene blue (MB) dye under visible light irradiation. And the percentage of degradation efficiency is 91.77 around 180 min. The photocatalytic activity was due to the production of OH radicals during photo irradiation on LiNiVO_4 NPs. The effect of different parameters on photocatalytic activity was also studied in detail, including dye concentration, catalytic quantity, pH variation, scavenger activity, and recycling of the catalyst. Electrochemical impedance spectroscopy analysis revealed lower charge transfer and good ionic conductivity of LNV NPs, and it is also suitable for supercapacitor preparation.

**Full paper: IONICS, vol. 30, pp. 6575–6589, 2024*



Polyvinyl Alcohol-Based Economical Triboelectric Nanogenerator for Self-Powered Energy Harvesting Applications

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ABSTRACT

Triboelectric nanogenerators (TENGs) have emerged as a promising alternative for powering small-scale electronics without relying on traditional power sources, and play an important role in the development of the internet of things (IoTs). Herein, a low-cost, flexible polyvinyl alcohol (PVA)-based TENG (PVA-TENG) is reported to harvest low-frequency mechanical vibrations and convert them into electricity. PVA thin film is prepared by a simple solution casting technique and utilized to serve as the tribopositive material, polypropylene film as tribonegative, and aluminum foil as electrodes of the device. The dielectric-dielectric model is implemented with an arch structure for the effective working of the PVA-TENG. The device showed promising electrical output by generating significant open-circuit voltage, short-circuit current, and power. Also, PVA-TENG is subjected to a stability test by operating the device continuously for 5000 cycles. The result shows that, the device is mechanically durable and electrically stable. Further, the as-fabricated PVA-TENG is demonstrated to show feasible applications, such as charging two commercial capacitors with capacitances 1.1 and 4.7 μF and powering green light-emitting diodes. The stored energy in the 4.7 μF capacitor is utilized to power a digital watch and humidity and temperature sensor without the aid of an external battery. Thus, the PVA-TENG facilitates ease of fabrication, robustness, and cost-effective strategy in the field of energy harvesting for powering lower-grid electronics by demonstrating their potential as a sustainable energy source.

**Full paper: Nanotechnology, vol. 35, no. 3, 2024*



An Effective Approach to Improve Photocatalytic Dye Degradation and Electrochemical Properties of MoO₃ Nanoparticles

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ABSTRACT

This research introduces a pioneering, straightforward, and cost-efficient technique for producing molybdenum oxide nanoparticles. These nanoparticles underwent thorough characterization processes. To evaluate their effectiveness as photocatalysts, a series of experiments were carried out utilizing methylene blue as a representative pollutant and subjecting them to visible light irradiation. The findings showcased the favorable efficacy of the photocatalyst in breaking down methylene blue. Through UV-visible analysis, a bandgap value of 2.46 eV was determined. A comprehensive exploration was undertaken to gauge the impact of various factors such as dye concentration, catalyst quantity, and pH variation on the photocatalytic performance. The nanoparticles' capacity to decompose methylene blue under visible light served as a metric for their photocatalytic prowess, resulting in a remarkable removal efficiency of 97%. These outcomes underscore the promising potential of the synthesized MoO₃ nanoparticles in serving as effective photocatalysts.

**Full paper: IONICS, vol. 30, no. 6, pp. 1-12, 2024*



Synthesis Of Citral-Tryptamine Fused Selenium Nanospheres (CT@Senp's) And Exploration Of Their Anticancer, Antibacterial, And Electrochemical Sensor Applications

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ABSTRACT

A broad spectrum of antibiotics with multiple mechanisms of action is urgently required to combat the growing public health threat posed by drug-resistant pathogenic microorganisms. Biomedical researchers have concentrated on creating novel antibacterial and anticancer therapies due to the limited availability of conventional antibacterial and anticancer medications. In this study citral-tryptamine molecule was synthesized and characterized using ¹HNMR, ¹³CNMR, LCMS and FT-IR spectral techniques and various biological properties of synthesized molecules were investigated using several *in silico* approaches such as molecular docking, ADME, PASS analysis and bioactive score. Using citral-tryptamine molecule, selenium nanoparticles (CT@SeNP's) were synthesized and characterized using different spectral and imaging techniques such as UV-Visible spectra, SEM, FTIR, EDX, XRD and DLS. EDX and mapping were used to investigate the relevant atoms and their distribution. Three significant signals from the EDX corresponding to C atom (15.4 %), along with signals from the Se atom (80.9 %) and the N atom (3.7 %). CT@SeNP's showed excellent antibacterial property against MRSA. The minimum inhibitory concentration of CT@SeNP's was found to be 20±0.36 mm with a good zone of inhibition in a dose dependent manner. CT@SeNP's was treated with both normal and cervical cancer cell lines such as SiHa to investigate the dose optimization and cytotoxicity by MTT assay. The nanoparticle showed an IC₅₀ value is 0.68 μM and the data strongly suggested that CT@SeNP's could have a high potential in future medication development against MRSA and cervical cancer cells. The proper development and manufacturing of electrocatalytic nanomaterials are essential for enhancing the performance of non-enzymatic electrochemical sensors. The electrochemical sensing of H₂O₂ was enhanced by nanocomposite CT@SeNPs, which have a low detection limit of 60.96 nM and can detect H₂O₂ in a wide range of concentrations, from 25 μM to 250 μM. Thus, an efficient sensing platform for non-enzymatic H₂O₂ detection was discovered by this investigation.

*Full paper: *Journal of Molecular Structure*, vol. 1310, 2024



Electricity out of Electronic Trash: Triboelectric Nanogenerators From Discarded Smartphone Displays For Biomechanical Energy Harvesting

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ABSTRACT

In the context of escalating electronic waste (e-waste) generated by the rapid evolution of electronic devices, particularly smartphones/mobiles, the imperative for effective e-waste management to mitigate adverse environmental and health consequences has become increasingly apparent. Herein, novel mobile phone-based triboelectric nanogenerators (M-TENGs) are fabricated from discarded smartphone displays of eight different brands (B1-B8) for harvesting electrical energy. Analytical characterization techniques such as SEM and EDS are employed for morphological investigation. The triboactivity and tribonegativity of the smartphone display layers are confirmed using the FTIR technique and test materials. The percentage tensile strength of the selected triboactive layers is measured to assess the mechanical durability. The electrical measurements are performed for all eight M-TENG devices, notably the device constructed from B8 smartphone display layers outperforms other brands by generating about three and five times higher voltage and current than the M-TENG device composed of B1 layers. Further, the optimized device is subjected to frequency, force, and stability tests, and also the impact of fluctuating humidity on the device performance is analyzed. Moreover, the M-TENG demonstrates its versatility by efficiently charging commercial electrolytic capacitors, powering LEDs, and effectively harvesting biomechanical energy. Thus, the present study represents a significant step towards mitigating the challenges posed by electronic smartphone waste disposal while simultaneously offering a viable pathway to harvest electricity and power a variety of applications.

**Full paper: Waste Management, vol. 178, pp 1-11, 2024*



Green Synthesis of Zinc Vanadate Nanoparticles: A Promising Material For Photocatalysis And Electrochemical Sensing

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ABSTRACT

Green combustion synthesis emerges as a transformative methodology, melding sustainability with functionality to engineer advanced materials for photochemical and electrochemical applications. Nano-based cadmium sensors revolutionize pollution detection, enabling real-time, on-site analysis and thereby mitigating cadmium's detrimental impact on ecosystems. In this view, $Zn_3(VO_4)_2$ (ZNV) nanoparticles were successfully synthesized using the eco-conscious, tender jackfruit-mediated solution combustion method. Various spectroscopic techniques were employed to characterize the nanoparticles (NPs) and confirm their surface morphology and structural properties. X-ray diffraction studies confirmed that the prepared ZNV NPs had an orthorhombic crystalline structure with a crystallite size of 26 nm. The shape of the ZNV NPs was evaluated using a scanning electron microscope. The functional groups and elemental composition were elucidated through Fourier transform infrared spectral studies and energy-dispersive spectroscopy. Furthermore, ZNV was utilized as a photocatalyst for the photodegradation of methylene blue (MB) dye under visible light radiation, demonstrating high efficiency within 90 min of light irradiation. A sensitive ZNV-modified glassy carbon electrode platform has been used for sensing cadmium up to the lower level concentration ($20 \mu\text{M}$). The sensitivity of the developed system was $4.06 \text{ E-}8$, exhibiting superior sensitivity in cyclic voltammetry tests. Consequently, ZNV holds potential for environmental monitoring and electrochemical sensor technology. Zinc vanadium oxide (ZnV_2O_6) exhibits superior catalytic performance due to its unique crystalline structure, which enhances the efficiency of chemical reactions compared to other materials.

**Full paper: IONICS, vol. 30, pp 6667-6680, 2024*



Flower Extract–Polyvinyl Alcohol-Based Biocomposites for Sustainable Food Packaging Applications

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ABSTRACT

The proliferation of single-use plastics has led to widespread pollution and ecological harm, prompting a concerted effort to develop sustainable alternatives. Among them, biocomposite plastic films have emerged as a promising solution for food packing applications. Herein, the preparation of polyvinyl alcohol (PVA) biocomposite films incorporating *Clitoria ternatea* (CT) flower extracts is reported. The obtained films are subjected to various analytical techniques. Fourier transform infrared spectroscopy analysis reveals the intense peak of hydrogen bonding at 3321 cm^{-1} in the composite film. CT-PVA films possess less opacity and UV light-blocking capabilities. The PVA-CT films are examined for water absorption, UV barrier, soil degradability, and water-soluble properties, greater propensity to dissolve in water during the water absorption test is noticed. Enzymatic oxidation followed by hydrolysis of functional groups enhances the soil degradation rate in biocomposite films. Further, the colorimetric study of CT-PVA solution at different pH shows colored CT-PVA films. From the results and observations, the CT-PVA biocomposite film (8 mL) proves to be a promising candidate for utilization in the food industry as a packaging material.

- **Full paper: Physica Status Solidi (A) Applications and Materials, vol. 221, no. 12, 2024*



Green Luminescent Cs₄PbBr₆@PVDF Polymer Nanocomposite-Based Hybrid Nanogenerator For Self-Powered Photosensor

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ABSTRACT

The exploration of innovative materials and their integration into mechanical energy harvesters represents a crucial step in addressing futuristic energy requirements. In the present work, 0D-cesium lead bromide (Cs₄PbBr₆) perovskite is synthesized by a modified re-precipitation technique and purposed as a dopant in polymer at an active layer of nanogenerators due to its well-defined rhombohedral crystal structure and high charge carrier mobility. The prepared Cs₄PbBr₆ are embedded into a polyvinylidene difluoride (PVDF) polymer matrix to complement the piezo-tribo properties with synergetic effect of the materials (PVDF and 0-D Cs₄PbBr₆). The successful synthesis of Cs₄PbBr₆ and nanocomposites with varying filler quantities of Cs₄PbBr₆ (0.00, 0.25, 0.50, 1.00, and 2.00 wt/wt%) are associated with analytical characterizations viz, TEM, P-XRD, SEM with EDS and electrical properties. The perovskite-based hybrid nanogenerators (P-HNGs) were fabricated and electrically optimized, which reveals the enhancement performance. Interestingly, the device with 2.00 wt/wt% Cs₄PbBr₆ witnessed greater peak-peak voltage and current of about 3.27 and 3.59 folds higher than the pristine polymer. Further, the device is used to power LEDs, charge capacitors, and operate a digital calculator. In addition, the photoluminescent property of the perovskites is brought into the practical application as a self-powered UV-photosensor using a UV light chamber. Overall in this research work, the employability of green luminescent Cs₄PbBr₆ is studied in the area of mechanical energy harvesting that paves the way towards research and innovation in perovskite-based self-powered technologies.

**Full paper: Materials Today Chemistry, vol. 39, 2024*



BiVO₄ nanoballs: a simple precipitation pathway, promising electrochemical sensor, and photodegradation under visible light

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ABSTRACT

A highly efficient monoclinic bismuth vanadate (BiVO₄) photocatalyst was synthesized using a simple, inexpensive, and straightforward precipitation approach. The structure, morphology, composition, and crystal structures were meticulously characterized through various spectroscopic techniques. A scanning electron microscopic images represent the nano-sized ball (NB) like structure of bismuth vanadate nanoparticles. Photocatalytic efficiency was assessed through degradation studies using methylene blue (MB) dye under visible light irradiation, demonstrating an impressive 93% degradation rate. The electrochemical behavior of the bismuth vanadate modified carbon paste electrode exhibits excellent response to dopamine, ascorbic acid, and lead nitrate analytes. Dopamine sensing gives oxidation and reduction peaks at 0.193 V and - 0.092 V, respectively. The presence of ascorbic acid and lead nitrate oxidation and reduction peaks were shifted to 0.361 V and 0.304 V means more positive side as well as here no reductions peaks were observed. Nevertheless, the evaluations of electrochemical impedance studies demonstrate the supercapacitive capabilities of BiVO₄ NBs. Therefore, the synthesized material acts as a good photocatalyst, sensor and heavy metal detector.

**Full paper: IONICS, vol. 30, no. 5, pp. 2819–2838, 2024*



Facile Green Synthesis of α - Bi_2O_3 Nanoparticles: its Photocatalytic Electrochemical Sensing of Lead and Ascorbic Acid

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ABSTRACT

In the field of industrial waste treatment, there is a growing need for innovative approaches to combat environmental issues effectively. In this study, bismuth oxide nanoparticles were successfully synthesized using a cost-effective and environmentally friendly green combustion method. Following synthesis, standard characterization techniques were employed to reveal the properties of the α - Bi_2O_3 nanoparticles. X-ray diffraction analysis indicated an average crystalline size of ~ 29.5 nm, while scanning electron microscopy provided insights into their morphology. Evaluation of the photo-catalytic degradation efficiency of α - Bi_2O_3 nanoparticles using methylene blue dye as the test substrate showed promising results, with efficiencies of 83 %, 89 %, and 91 % achieved under varying conditions of dye concentration, catalyst load, and pH. Furthermore, electrochemical analyses were conducted using lead nitrate and ascorbic acid, exploring concentrations ranging from 0.1 mM to 0.6 mM. Through cyclic voltammograms and electrochemical impedance spectroscopy, the specific capacitance of the electrode and the sensing capabilities of the nanoparticles were examined. These comprehensive analyses not only highlighted the photo-catalytic capabilities of α - Bi_2O_3 nanoparticles but also demonstrated their potential in electrochemical applications, indicating their versatility in addressing diverse environmental challenges. The meticulous exploration and characterization efforts aim to advance sustainable waste treatment methods, contributing to a cleaner and healthier environment.

**Full paper: Nano-Structures & Nano-Objects vol. 38, 2024*



Food Additives and Their Determination By Surfactant-Based Electrodes

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ABSTRACT

Food additives represent all trace substances utilized in food and its processing to enhance the durability and standard quality, preserve the flavor, improve the stability of the product, and regulate the smell and color. Inappropriate utilization of food additives may seriously affect human health. Consequently, developing a selective and sensitive method for the determination of these food additives is vital. Electrochemical methods offer various advantages such as high sensitivity, speed, and low running cost and investment. In addition, surfactant-based modified electrodes are used as significant sensors for the determination of food additives. In this chapter, various food additives and their advantages and disadvantages are discussed and the different surfactant-modified electrodes employed for the determination of food additives in real samples are presented.

**Full paper: Surfactant Based Electrochemical Sensors and Biosensors, pp. 387-414, 2024*



Robust Ag-Co Bimetallic Nanoparticles: Dual Role in Catalytic and Triboelectric Performance

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ABSTRACT

Bimetallic nanoparticles are of great significance in numerous areas due to their unique properties and diverse applications. In the present study, silver (Ag) and cobalt (Co) monometallic nanoparticles (MNPs) and AgCo bimetallic nanoparticles (BNPs), are synthesized using a simple wet chemical route. Various analytical techniques are adopted for the confirmation of the BNPs. Powder X-ray diffraction (PXRD) analysis revealed the formation of FCC-structure. Transmission Electron Microscopy (TEM) micrographs confirmed the bimetallic nature and Janus structure. The synthesized nanoparticles exhibit higher catalytic activity for degrading 4-nitrophenol dye. Recognizing the potential of metal nanoparticles to significantly boost the efficiency of triboelectric nanogenerators (TENG), the synthesized AgCo bimetallic nanoparticles are incorporated into polymer matrix to meticulously analyze the impact on the triboelectric performance. Interestingly, TENG with a higher composite quantity of 8 ml BNPs exhibited greater performance, generating an output voltage of about 270.52 V and a current of 5.24 μ A. Hence, the procured synergistic BNPs show their promising avenue towards both water treatment and energy harvesting applications.

**Full paper: Materials Research Bulletin, vol. 180, 2024*



Facile and Green-Assisted Synthesis of V₂O₅ Nps and Investigated Their Multifunctional Activities

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ABSTRACT

This work reports the synthesized V₂O₅ nanoparticles (Nps) using a simple combustion method with *Cleome gynandra* seed extract as fuel. Several analytical tools were used to characterize the synthesized Nps, including X-ray diffraction (XRD), scanning electron microscopy (SEM), energy dispersive X-ray (EDX), transition electron microscopy (TEM), UV-Vis spectroscopy (UV-Vis), Raman spectroscopy, and Fourier transform infrared spectroscopy (FTIR). SEM analysis confirms the needle-like and rectangular wire structures of the V₂O₅ Nps. The bandgap energy was found to be 2.28 eV, indicating the semiconducting nature of the synthesized nanoparticles. Furthermore, the V₂O₅ nanoparticles were used as photocatalysts for the degradation of methylene blue dye under visible light illumination. The V₂O₅ Nps exhibited 89% performance in the decomposition of methylene blue (MB) dye after 180 min of irradiation. Cyclic voltammetry studies demonstrated superior oxidation and reduction reaction of the V₂O₅ Nps using 1 M KCl as an electrolyte in a three-electrode system at a scan rate of 10 to 50 mV/s. The lower charge resistance of the V₂O₅ Nps was explained by electrochemical impedance spectroscopy (EIS). Additionally, the V₂O₅ Nps showed promise as an electrode material for ammonia and ethanol biosensors. These Nps also exhibited antioxidant and antimicrobial properties and were biocompatible with lymphocytes.

*Full paper: IONICS, vol 30, pp. 8687-8701, 2024



Infield Disease Detection in Citrus Plants: Integrating Semantic Segmentation and Dynamic Deep Learning Object Detection Model for Enhanced Agricultural Yield

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ABSTRACT

Simultaneous and dynamic detection of diseases from infield images of citrus plants is the primary objective of this investigation. Refraining from discarding the disease-related issues would reduce agricultural yield and production, resulting in significant crop loss and economic instability. Computer Vision offers an inexpensive and efficient solution for detecting and predicting multiple diseases from infield images of citrus plants in various stages of plant growth. This study aims to perform simultaneous detection and prediction of cankers, mites, and nutritional deficiencies from infield images of citrus plants. For this purpose, over 4914 samples are annotated that are obtained from 441 image samples collected from orchards of citrus plants. Initially, the input image is subject to preprocessing followed by segmentation of prominent leaf regions and disease prediction. Contributions investigated in this work are two-fold: a deep semantic segmentation model named Dynamic U-Net is employed to extract prominent regions of interest, and a dynamic, lightweight object detection deep learning model for predicting diseases. From experimental outcomes, the segmentation efficiency is found to be 89.07% foreground accuracy, 0.7881 of IoU, and 0.9188 of the Dice coefficient. The object detection performance is quantified using the mapped metric, resulting in 0.85, 0.71, 0.64, and 0.27 efficiency concerning plant diseases, cankers, mites, and nutritional deficiency. As per the findings, the proposed approach is an effective solution to perform automated detection and prediction from infield images of citrus plants.

**Full paper: Neural Computing & Applications, vol. 36, pp. 22485–22510, 2024*



Biogenic Synthesis of LaMnO_3 Perovskite Nanoparticles: Enhanced Photocatalytic Activity For Water Purification

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ABSTRACT

The LaMnO_3 nanoparticles were successfully produced using the solution combustion method followed by calcination at $500\text{ }^\circ\text{C}$. Various spectroscopic techniques were utilized to analyze the nanoparticles and verify their surface characteristics and structural properties. X-ray diffraction studies confirmed that the synthesized LaMnO_3 nanoparticles possessed an orthorhombic crystalline structure, with a crystallite size of 30 nm. The morphology of the LaMnO_3 nanoparticles was determined using scanning electron microscopy which are cube shape. Fourier transform infrared spectroscopy and energy dispersive spectroscopy were employed to identify the functional groups and elemental composition, respectively. Additionally, LaMnO_3 was employed as a photocatalyst for degrading methylene blue dye under visible light exposure, exhibiting high efficiency of 99% within 90 min of irradiation.

Full paper: Journal of Materials Science: Materials in Electronics , vol. 35, no. 2190, 2024



Copper Selenide as A Facile Nanomaterial for Triboelectric Nanogenerator: Self-Powered Braille Code Keyboard

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ABSTRACT

The development of triboelectric nanogenerators (TENGs) for sustainable energy harvesting has garnered significant interest, especially in integrating advanced materials to enhance device performance and exploring applications. Herein, the present study investigates the use of copper selenide (Cu_2Se) as a robust material for TENGs fabrication. Cu_2Se nanorods are synthesized using a facile hydrothermal method and subsequently embedded in a polyvinyl alcohol (PVA) matrix to form a nanocomposite, which is then utilized as tribopositive film. The procured Cu_2Se and nanocomposites with varying filler quantities (0.1, 0.2, 0.4, and 0.8 wt%) are analyzed using powder X-ray diffraction, scanning electron microscopy, dielectric measurements, Fourier transform infrared spectroscopy, and ultraviolet-visible spectroscopy to evaluate their structural, morphological, dielectric, and optical properties, and their impact on TENG performance. Interestingly, the device with 0.2 wt% Cu_2Se generated peak-to-peak voltage and current of 394.35 V and 83.45 μA respectively, which is about 2.5- and 41-times higher output compared to pristine PVA-TENG. Integrating Cu_2Se as filler enhances charge generation, transfer, and retention, due to increased surface roughness, and ability to facilitate better charge separation within the polymer matrix leading to more efficient energy conversion in TENGs. In practical demonstration, the optimized PVA@ Cu_2Se -TENG is employed as a self-powered Braille keyboard to generate electrical signals from mechanical interactions, offering a promising solution for energy-efficient, user-friendly Braille technology. Thus, the current study highlights the synergistic effects of integrating Cu_2Se with polymer, resulting in enhanced triboelectric performance for innovative energy harvesting applications and self-powered sensory devices.

**Full paper: Chemical Engineering Journal, vol. 500, 2024*



Electrifying Waste Textiles: Transforming Fabric Scraps Into High-Performance Triboelectric Nanogenerators for Biomechanical Energy Harvesting

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ABSTRACT

Textiles are an integral part of daily life globally, but their widespread use leads to significant waste generation. Repurposing these discarded fabrics for energy harvesting offers a sustainable solution to both energy demand and textile waste management. In this study, Textile-based Triboelectric Nanogenerators (T-TENGs) were developed using recycled cloth as tribopositive layers and polyvinyl chloride (PVC) film as the tribonegative layer, with aluminum foil tape serving as electrodes. Five different recycled textiles were evaluated, and Scanning Electron Microscopy (SEM) and Energy-Dispersive X-ray Spectroscopy (EDS) analysis revealed a correlation between yarn structure and carbon content, leading to enhanced triboelectric performance. Silk-based TENG (S-TENG) demonstrated the highest output, with 320.76 V and 8.73 μA , while exhibiting stable performance over 10,000 cycles. Practical applications were explored by integrating T-TENGs into shoe insoles for energy harvesting during walking and jumping, with rayon-based TENG generating up to 208.52 V on a PVC coil mat. This work highlights the dual benefits of waste reduction and sustainable energy applications, making a compelling case for advanced technologies where recycled textiles function as frictional materials to harvest mechanical energy from human motion and convert it into electrical energy for use in flexible sensors and wearable devices.

**Full paper: Waste Management, vol. 190, pp 477-485, 2024*



Facile Green Preparation of ZnFe₂O₄ Nanoparticles Using Papaya Leaf Extract for Electrochemical Detection of Acetaminophen in Zerodol P and Dolo Drops

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ABSTRACT

This study reports the green synthesis of ZnFe₂O₄ nanoparticles using a papaya extract by combustion method with papaya leaf extract as a fuel. Structural, physical and chemical properties of the nanoparticles were characterized using advanced spectroscopic and analytical techniques, such as X-ray powder diffraction (XRD), energy dispersive X-ray spectroscopy (EDX) and mapping, scanning electron microscopy (SEM), UV-Vis absorbance spectroscopy (UV-Vis), transmission electron microscopy (TEM) and dynamic light scattering (DLS). Development of eco-friendly electrochemical sensor for detection of AC drug. Electrochemical assessment of drug was done using bare GCE and drop casting GCE/ZnFe₂O₄. The electrochemical study revealed that ZnFe₂O₄ nanoparticles facilitated electron transfer, resulting in enhanced redox peak currents and reduced peak potentials. The GCE/ZnFe₂O₄ sensor exhibited a low detection limit of 0.5274 μM and a broad linear response range from 0.1 to 40 μM. In real sample analysis, the sensor demonstrated good recovery rates, indicating its accuracy in detecting and quantifying AC in pharmaceutical samples, such as Zerodol P and Dolo drops. Additionally, the sensor displayed acceptable reproducibility, stability, selectivity, sensitivity and reliability towards AC. The study underscores the effectiveness of ZnFe₂O₄ nanoparticles in enhancing the electrochemical performance of sensors, contributing to advancements in sensor technology for pharmaceutical analysis.

**Full paper: IONICS, vol. 30, no. 12, pp. 8617–8617, 2024*



Moo2 Nanostructures Synthesized Via Hydrothermal Method For Enhanced Methylene Blue Decontamination

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ABSTRACT

Photocatalysis is one of the potential techniques to degrade organic pollutants in the environment. Currently, one of the most interesting research areas in the development of high-performance photocatalysts. Hence, in this work, we used jackfruit extract to synthesize MoO₂ nanoparticles (NPs) through a straightforward and affordable hydrothermal technique for the first time. MoO₂ has gained attention for use as a host material in electrochemical supercapacitors, lithium-ion batteries and capable of degrading organic molecules. X-ray diffraction (XRD), scanning electron microscopy (SEM), energy-dispersive X-ray spectroscopy (EDS) and UV-Vis spectroscopy were used to characterize the prepared MoO₂ nanoparticles. We observed a band gap of approximately 2.35 eV, indicating that they are active photocatalysts. The photocatalytic properties of the MoO₂ nanoparticles were evaluated using Methylene blue (MB) dye under visible light. The MB dye degraded up to 92% in 180 min in the presence of MoO₂ nanoparticles. The rate kinetics of MB on the prepared nanoparticles shows pseudo second-order kinetics. Recyclability tests demonstrated the excellent photostability of the MoO₂ nanoparticles. Furthermore, they function as an excellent material for supercapacitor preparation and serve as biosensors.

**Full paper: IONICS, vol. 30, no. 12, pp. 8713–8726, 2024*



A Biomimetic Ant Silk Fiber-Based Triboelectric Nanogenerator: Toward Advanced Tactile Sensing Technology

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ABSTRACT

Integrating bio-inspired materials into TENGs marks a significant step toward sustainable and eco-friendly energy harvesting systems, with promising applications in robotics, wearable electronics, and human-machine interfaces. In the present study, a biomimetic triboelectric nanogenerator (TENG) is fabricated from a rare silk fiber mat (SFM). The robust properties of SFM are attributed to proteins secreted by weaver ant larvae, which are rich in amine and hydroxyl groups. The chemical resistance and structural integrity of the SFM are confirmed using characterization techniques such as scanning electron microscopy, energy dispersive X-ray spectroscopy, and Fourier transform infrared spectroscopy. SFM is employed as the tribopositive material and is paired with polyurethane as the tribonegative material, which efficiently generates an output voltage of 160.47 V, current of 33.58 μA , and peak power of 15.15 mW at a load resistance of 30 M Ω . The SFM-TENG is capable of powering 80 green LEDs, charging capacitors, has wind sensitivity, and functions as a self-powered touch sensor, generating distinguishable electrical signals in response to various materials and individual touches. Thus the current work expands the scope of biomaterials, offering practical advancements in developing energy-harvesting devices for self-powered tactile sensors.

**Full paper: Sustainable Energy & Fuels, 2024*



A Review on Synthesis And Applications of Versatile Nanomaterials

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ABSTRACT

As an emerging science now, scientists are attracted toward nanomaterials because of their nanosize, surface area, tunable band gaps, surface morphology as well as potential applications in medicine, medical devices, textile industries, electronic devices, coating industries, and other industries. Herein, we have explained the stable and efficient synthesis protocols and different applications of nanomaterials. This comprehensive review, we feel, will provide insight into the hydrothermal method, sol-gel synthesis, sonochemical method, microwave irradiation method, chemical vapor deposition as well as their various applications. The exceptional properties of nanomaterials make them superior over traditional materials. Therefore, nanomaterials will have a wider application prospect in the future. Research on nanomaterials is significant for the development and application of materials science.

**Full paper: Inorganic and Nano-Metal Chemistry, vol. 54 no. 10, pp. 942-971, 2024*



Characterization and DFT Investigation Of CuWO₄@CMC/PVA Composite with Down Conversion Ability

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ABSTRACT

This study focuses on the synthesis of CuWO₄ nanoparticles using a simple hydrothermal method and their incorporation into carboxymethyl cellulose (CMC) and polyvinyl alcohol (PVA) polymer blend through the solution casting method, resulting in CuWO₄@CMC/PVA polymer nanocomposites with varying CuWO₄ concentrations (0.0, 0.5, 1.0, 2.0, and 4.0 wt/wt%). Rietveld refinement of XRD data was performed to assess the phase purity of CuWO₄ nanoparticles and found to possess triclinic unit cells. Furthermore, the microcrystalline properties of the prepared nanocomposites were also evaluated. The surface topography of the CuWO₄@CMC/PVA nanocomposite was examined using AFM to assess its morphological features and surface roughness, while FE-SEM and SEM were employed for microstructural analysis to evaluate the morphology of nanoparticles and their distribution in the polymer matrix. The interaction between the CuWO₄ nanoparticles and the polymer matrix was rationalized using FTIR spectroscopy, complemented by DFT and TDDFT studies. Additionally, thermal properties such as melt properties and thermal stability were investigated through DSC and TGA respectively. While water contact angle measurements were utilized to assess wettability and surface energy. Optical properties such as absorbance, absorption coefficient, energy band gaps (direct and indirect), refractive index, optical conductivity were analysed and found that there was a monotonic decrease in the band gap as the nanoparticles concentration increases. Photoluminescence spectroscopy was used to analyse emission properties to understand the nanocomposites' and potential for photovoltaic and UV-blocking applications.

**Full paper: Journal of Molecular Structure, vol. 1325, 2024*



Enhanced Charge Carrier Separation In Stable Type-I CoNi₂S₄/MoS₂ Nanocomposite Photocatalyst For Sustainable Water Treatment

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ABSTRACT

This study investigates a Type-I CoNi₂S₄/MoS₂ (CM)nanocomposite as an efficient photocatalyst for sustainable water treatment. Combining the catalytic stability of CoNi₂S₄ with the superior light absorption of MoS₂, the nanocomposite exhibits enhanced photocatalytic performance. Structural analysis through X-ray diffraction (XRD) and high-resolution electron microscopy (HREM) confirmed the successful formation of the CoNi₂S₄/MoS₂ heterojunction. The bandgap of the 25 % CoNi₂S₄/MoS₂ composite was tuned from 2.2 eV to 2.0 eV, improving visible light absorption. Photoluminescence (PL) and UV analyses demonstrated reduced electron-hole recombination, contributing to the composite's enhanced activity. Under visible light, the CoNi₂S₄/MoS₂ photocatalyst achieved complete MB dye degradation within 90 min, outperforming other samples. The efficient charge separation in the heterojunction, with electrons moving from MoS₂ to CoNi₂S₄ and holes in the opposite direction, was key to its superior photocatalytic efficiency. This makes CoNi₂S₄/MoS₂ a promising material for environmental applications.

**Full paper: Journal of Physics and Chemistry of Solids, vol. 198, 2024*



Green Synthesis of Bismuth Tungstate Nanoparticles, Evaluation of Their Applications Favouring Photocatalytic and Bio-Sensing

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ABSTRACT

Green chemistry gives us the chance to prevent the negative effects. Green nanotechnology has an enterprising effect on the nanomaterials or the design of the product by removing or lowering pollution, which means that it remediates the existing environmental problems, and also it is a cost-effective environmentally friendly method. The excellent resources for the production of greener biomaterials are plants. In this work main purpose of research is to account for the studies on the green synthesis of $\text{Bi}_{12}\text{W}_2\text{O}_{27}$ nanoparticles and their multifunctional activity. Tender jackfruit extract was used in different volumes as fuel, synthesized materials were subjected to various characterization techniques like powder X-ray diffraction, Fourier transform infrared spectroscopy, field emission scanning electron microscopy, energy-dispersive X-ray spectroscopy, ultraviolet-visible absorption spectroscopy. The X-ray diffraction patterns showed the tetragonal nanocrystalline structure with a crystallite size of 13.57 nm. The Fourier transform infrared spectrum represents the characteristic Bi-O, W-O, and W-O-W stretching vibration bands. UV-Vis spectra show the absorption peak at 359 nm and the band gap was found to be 2.75 eV. The scanning electron microscope images reveal the morphology of $\text{Bi}_{14}\text{W}_2\text{O}_{27}$ nanomaterials, the energy-dispersive X-ray spectroscopy showed the percentage purity of the nanomaterial. Further, photodegradation of MB dye was investigated successfully under a visible light source, it shows the degradation efficiency of 92.65% within 180 min. The same $\text{Bi}_{14}\text{W}_2\text{O}_{27}$ nanomaterials were subjected to photoluminescence analysis and it is confirmed that nanomaterials emit broad blue light under 385 nm excitation. Further, $\text{Bi}_{14}\text{W}_2\text{O}_{27}$ exhibits electrochemical activity and material is examined for biosensor activity using dopamine as analyte and response was good, hence the material is novel in its structural parameters and further electrochemical impedance spectroscopy analysis confirms it can also be used for supercapacitor applications.

**Full paper: Inorganic and Nano-Metal Chemistry, vol. 54, no.10, 2024*



Metal(II) Complexes as Potential Anticorrosion and Antifouling Agents- A Review

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ABSTRACT

The reason for this view is to introduce a number of novel anticorrosion and antifouling agents that are friendlier to the environment in diverse situations. These days, the use of metal complexes plays an essential and vital role in anticorrosion activity due to free electron pairs. Inhibitor adsorbed on the surface of the metal in the form of a wall, which performs an imperative role in putting a stop to the corrosion activity and consequently inhibits the cathodic and anodic reactions. Advanced factors like electrochemical impedance study, weight loss, adsorption isotherms, and thermodynamic parameters were elaborated here. The current review addressed the presence of heteroatoms like oxygen, nitrogen, sulfur, and π electron clouds in conjugation and the inhibitory competence of metal complexes, which is greatly appreciable. We focused on the study of new complexes that are more potent in antifouling activity.

**Full paper: Novel Anti-Corrosion and Anti-Fouling Coatings and Thin Films, 2024*



Optical, Electrical, And Biological Properties of PVP-PVA/Ca-Doped CoO Nanocomposites for Opto-Electronic And Biological Applications

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ABSTRACT

Herein, we report the synthesis of calcium-doped cobalt oxide (Ca-CoO) nanocomposites using the simple and effective solution combustion method, and casting of polyvinyl pyrrolidone and polyvinyl alcohol (PVP-PVA) was done by solution intercalation method. Here, 0.5, 1.0, 2.0, and 4.0 wt% of nanofillers were introduced to polymer host. Polymer nanocomposites (PNCs) were subjected to various characterizations, where Fourier transform infrared spectroscopy (FTIR) reveals the positive interaction between the added nanofillers and polymer blends meanwhile, scanning electron spectroscopy (SEM) analysis reveals the morphological behavior and particle size of 100–140 nm which was confirmed using DLS study. The PNCs reveal the steep UV absorption behavior using the optical absorbance study, while optical and electrical parameters were evaluated as they support the scope of engineering, the band gap, and dopant-dependent optical properties. The band gap energies were decreased from 5.0 to 3.60 eV as the weight % of nanofiller was increased. Dielectric properties along with AC conductivity were increased as the weight percentage of nanofiller increases. Additionally, PNCs were tested for the production of citric acid using *Aspergillus niger*, which shows that an increase in the wt% of PNCs increases citric acid production and 4% PNCs yields 17.0 g/L.

*Full paper: *Ionics*, vol. 30, no. 10, pp 6393–6403, 2024



Polyaniline-Doped Textile-Based Triboelectric Nanogenerator: Self-Powered Device for Wearable Electronics

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ABSTRACT

The emergence of wearable electronics in contemporary lifestyles has spurred the need for smart fabrics capable of harnessing biomechanical energy. In the present study, a flexible polyaniline-doped textile-based triboelectric nanogenerator (PT-TENG) is designed to harvest low-frequency mechanical vibrations and convert them into electricity. For the device fabrication, five different textile fabrics are doped with conducting PANI, which is utilized as the tribopositive material, PVC thin film as the tribonegative material, and Al foil as electrodes. The PT-TENG works in vertical-contact separation mode, devised in arch structure for easy and complete contact between the working layers. Interestingly, the device featuring a PANI-doped silk fabric generated the highest output voltage of 257.68 V and a current of 5.36 μA , respectively. Additionally, the PT-TENG exhibits mechanical durability and electrical stability during continuous 7000 cyclic operations. Furthermore, the PT-TENG showcases practical applications such as charging commercial capacitors, powering green LEDs and smartwatches, and as a self-powered touch sensor. Thus, the PT-TENG offers a facile fabrication process and robustness, highlighting its potential for sustainable energy harvesting in wearable electronics.

**Full paper: Applied Research , vol. 4, no. 1, 2024*



Quantitative Investigation Of The Nature Of Non-Covalent Interactions In 2-((Benzo[D][1,3]Dioxol-5-Ylmethyl)Amino)-N-Phenyl-2-Thioacetamide: Insights From Crystallographic, DFT Analysis, Molecular Docking, And Molecular Dynamics Simulation

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ABSTRACT

The aim of this work was to synthesise the novel compound 2-((benzo[d][1,3]dioxol-5-ylmethyl)amino)-N-phenyl-2-thioacetamide (P1) using the reflux method with ethanol as the solvent. The obtained product is characterised by single-crystal XRD analysis. All various contacts like intra and intermolecular found in P1 were determined by the X-ray diffraction technique performed on single crystals. On the other hand, the optimisation of P1 was accomplished by the DFT/ ω B97XD method at the 6-311 + G(d, p) level. Furthermore, the electrostatic potential of the molecule (MEP), and global reactivity descriptors were analysed to gain a better understanding of the electronic properties and the active sites of P1. The Quantum Theory of Atoms in Molecules (QTAIM) and non-covalent interactions-based density of regional indicator (DORI) analyses were utilised to examine the intermolecular interaction energies and strength and nature of van der Waal's interactions. A computational analysis employing molecular docking simulations was conducted to explore the potential binding interactions between the synthesised compound P1 and the target proteins, specifically SARS-CoV-2 receptor protein (PDB ID: 6LU7) and breast cancer protein (PDB ID: 3HB5). In addition, molecular docking studies are validated by the molecular dynamics simulation studies.

**Full paper: Molecular Physics, 2024*



Structure Elucidation and Computational Studies of The Thiazole Derivative Against SARS-Cov-2 Virus: Insights From XRD, DFT, Molecular Docking, and Molecular Dynamics Simulation

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ABSTRACT

The present work is focused on the crystal structure, Hirshfeld surface, Density Functional Theory (DFT) studies of thiazole derivative *N-benzyl-4-(4-bromophenyl)thiazole-2-carboxamide (TT4)*. The crystal structure has been determined using single crystal X-ray diffraction analysis, which shows that the compound crystallizes in the monoclinic crystal system with space group $P2_1/c$. C-H \cdots O type of hydrogen bond interaction is responsible for the crystal packing in crystal. The molecular geometry optimization was performed by DFT calculations. The 2D scattered plot was generated by Reduced Density Gradient (RDG) analysis, which divulge the weak and noncovalent interactions in the compound **TT4**. *In silico* studies were carried out to delve into the binding pattern of the **TT4** compound against SARS-CoV-2 proteins using molecular docking and molecular dynamics simulation. Finally, the binding free energy and the contributed energies were derived using MM-GBSA approach. The 7K40-ligand complex showed the highest binding free energy, and among all other interactions, the contributions of the covalent binding and van der Waals energy were found to be significant.

Full paper: Journal of Molecular Structure, vol. 1322, 2024



Synthesis And Characterisation of Biodegradable Polyurethane/CuS Nanocomposites for Agricultural Application

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ABSTRACT

Polyurethane (PU) is one of the important industrial polymers. PU and its composites can be used in different applications. This paper examines the potential of PU/copper sulphide (CuS) nanocomposites (NCs) for application as green mulching films in agriculture. Castor oil-based PU NCs were fabricated by varying the CuS concentration viz., 0.0%, 1.0%, 2.0%, 4.0% and 8.0%. The NCs were characterised for microcrystalline nature by X-ray diffraction, Fourier transform infrared spectroscopy used for examining spectral characteristics, morphological assessment by scanning electron microscopy and elemental analysis by energy-dispersive x-ray Spectroscopy. The NCs were characterised for tensile properties, which revealed that a 4% PU/CuS nanocomposite (NC) exhibited high elongation at break of 399.72 MPa, suitable for mulching applications. Thermogravimetric analysis was used to examine the thermal stability and degradation. The chemical resistance and water absorption were evaluated in various atmosphere. The biodegradability was investigated through the soil and cow dung burial test. The pot study experiment is conducted to investigate the effect of NC on growth rate of the plants, which showed that beans treated with PU/CuS NC showed a 43% increase in height within 7 days and a 32% increase within 35 days, with an increase of about 62.5% in leaf width within 7 days and continues to increase until the 35th day and shows considerably more branches and stem diameter than the control. This work concludes that PU/CuS NCs have high potential as green mulching films for application in agriculture.



Unveiling The Multi Functionality Of CeCuIn₂O₅ Nanoparticles: A Promising Approach For UV-Light Photocatalysis, Electrochemical Sensing And Antibacterial Applications

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ABSTRACT

CeCuIn₂O₅ trimetallic oxide nanoparticles (CCI NPs) were synthesised in the current work and examined for antibacterial activity against Methicillin Resistant *Staphylococcus Aureus* (MRSA), photocatalytic degradation of malachite green (MG) and electrochemical sensing of sodium nitrite. The physicochemical characteristics of the CCI NPs were analyzed using XRD, SEM, EDX, UV-vis and DLS method which depicts the morphology, crystalline nature and particle size synthesised CCI NPs. With a linear range of 0.8-4.8mM, the glassy carbon electrode (GCE) modified CCI NPs demonstrated an outstanding electrochemical response for sodium nitrite (NaNO₂). In addition, the synthesized CCI NPs showed high photocatalytic activities for the degradation of MG dye in water. It indicates the CCI NPs material produces hydroxyl ($\cdot\text{OH}$) and superoxide (O_2^-) radicals for MG degradation when exposed to UV light, also showed an efficiency of 89.6% towards the degradation of Malachite Green. Carried out the dose-dependent method to the standard antibiotic streptomycin at 10 g/disc (5, 7, 15, 20, 25 & 30) with a zone of inhibition (ZOI) of 25.27-45.27±0.09 in mm CCI NPs showed excellent antibacterial activity against MRSA in a dose-dependent method. As a consequence, it was found that CCI NPs are an effective multifunctional material that can be scaled up for the quantification of NaNO₂, photocatalytic dye degradation of malachite green, and antibacterial activity against MRSA.

*Full paper: *Analytical and Bioanalytical Electrochemistry*, vol. 16, no. 9, pp 830-845, 2024



Dynamical Steady Carreau Fluid With Heat Generation and Porosity Effect In A Suspension of Hybrid Solid and Dust Particles

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ABSTRACT

Hybrid nanofluid is a superior working fluid that is considered as appropriate for variety of applications, including machine cutting, engine applications, automobile cooling, photovoltaic thermal management, electronic component thermal management, and solar collectors. With the motivation these application, magneto hydrodynamic Carreau fluid is explored in this study when graphene and titanium hybrid nanoparticles with heat generation and porosity are taken into account. Titanium alloy nanoparticles combined with base water are used to simulate the process. Titanium is utilized in the military and aerospace because it is strong and lightweight. It is also employed in biology as an anti-microbial, anti-biotic, and anti-fungal agent. The ensuing collection of governing equations (P.D.E.) is changed into an assortment of O.D.E. with the use of an appropriate similarity transformation. This O.D.E. is then solved by implementing the Runge-Kutta shooting method. Graphs have been used to study variation behavior accurately. Local Nusselt number and Friction factor were examined for different kinds of physical factors. We concluded after the debate that, the influence of porosity or heat generating parameter improves temperature profile. When porosity effect is applied, velocity profile is reduced, and temperature profile is increased by amplifying porosity effect.

**Full Paper: Numerical Heat Transfer, Part B: Fundamentals, 2024*



Dynamics of Brownian Motion and Nonlinear Mixed Convective Conditions on Thermophoretic Slip Flow Embedded With Non-Fourier Flux

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ABSTRACT

In this paper, the importance of mass and heat transfer characteristics of mixed convective conditions on nonlinear free convection flow embedded with non-Fourier flux and thermal radiation is numerically investigated. A partial Casson slip and mixed impact of thermophoresis and Brownian motion is considered at the elastic surface. To change the highly nonlinear partial differential equations into ordinary differential system, we used the similarity transformations and then the shooting method is employed to solve resulting equations. The significance of various physical parameters on the velocity, concentration and temperature profiles are investigated for both negative value of ferromagnetic interaction ($\beta_1 = -0.21 = -0.2$) and positive value of ferromagnetic interaction ($\beta_1 = 0.21 = 0.2$). The governing physical aspects of coefficient of skin friction, the Sherwood and Nusselt numbers are obtained for various embedded parameters. Our findings concluded that the ferromagnetic interaction is positive and then more mass transfer rate is identified compared to the negative value of ferromagnetic interaction, but whereas in friction and heat transfer rate, it was completely mixed sense (i.e., different effects have different results). Brownian motion has less Nusselt number values in positive ferromagnetism compared to negative ferromagnetism and quite opposite behavior is observed in the presence of thermophoresis, this happened due to nonlinear flux and buoyancy.

**Full Paper: International Journal of Modern Physics B, vol. 38, no. 10, 2024*



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On the Derivatives of Eta Quotients of Level Eighteen

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ABSTRACT

Z. S. Aygin and P. C. Toh have developed a technique using the theory of modular forms to determine all the eta quotients whose derivative is also an eta quotient up to level 36. The aim of the present paper is to develop a theory for level 18 eta quotient identities and derive all the identities of Aygin and Toh of level 18 by using this theory.

**Full Paper: Mathematical Notes, vol. 116, pp 322-327, 2024*



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