Sl. No.	IIT Ropar - Publications Digest 8, 2021 List of Recent Publications with Abstract Coverage: August, 2021
1.	3D Polarized Field-Forming for Mitigation of Angular Misalignment Problem in Microwave Power Transfer Systems VK Srivastava, S Kumar, A Sharma - IEEE 19th International Symposium on Antenna Technology and Applied Electromagnetics, 2021 **Abstract**: This paper addresses the angular misalignment problem in the far-field Microwave Power Transfer systems operating at 5.8GHz using the proposed 3D polarized field-forming technique. A 3D rotating E-field is generated by using a distributed antenna system to achieve this objective. The system is analyzed to understand the effect of 3D rotating E-field in comparison to the 2D E-field (circular polarization). The analytical results are verified using a commercial simulator and prove the potential of the proposed 3D polarized field-forming technique to achieve an orientation-insensitive MPT system to power a freely rotating receiver node.
2.	A constant-factor approximation algorithm for red-blue set cover with unit disks RR Madireddy, A Mudgal - International Workshop on Approximation and Online Algorithms: Approximation and Online Algorithms, Part of the Lecture Notes in Computer Science book series, 2021 **Abstract**: The main contribution of this paper is the first constant factor approximation algorithm for red-blue set cover problem with unit disks. To achieve this, we first give a polynomial time algorithm for line-separable red-blue set cover problem with unit disks. We next obtain a factor 2 approximation algorithm for strip-separable red-blue set cover problem with unit disks. Finally, we obtain a constant factor approximation algorithm for red-blue set cover problem with unit disks by combining our algorithm for the strip-separable problem with the results of Ambühl et al. [1]. Our methods involve a novel decomposition of the optimal solution to line-separable problem into blocks with special structure and extensions of the sweep-line technique of Erlebach and van Leeuwen [9].
3.	A Fairness Conscious Cache Replacement Policy for Last Level Cache KK Dutta, PN Tanksale, S Das - Design, Automation & Test in Europe Conference & Exhibition , 2021 **Abstract**: Multicore systems with shared Last Level Cache (LLC) possess a bigger challenge in allocating the LLC space among multiple applications running in the system. Since all applications use the shared LLC, interference caused by them may evict important blocks of other applications that result in premature eviction and may also lead to thrashing. Replacement policies applied locally to a set distributes the sets in a dynamic way among the applications. However, previous work on replacement techniques focused on the re-reference aspect of a block or application behavior to improve the overall system performance. The paper proposes a novel cache replacement technique Application Aware Re-reference Interval Prediction (AARIP) that considers application behavior, re-reference interval, and premature block eviction for replacing a cache block. Experimental evaluation on a four-core system shows that AARIP achieves an overall performance improvement of 7.28%, throughput by 4.9%, and improves overall system fairness by 7.85%, as compared to the traditional SRRIP replacement policy.

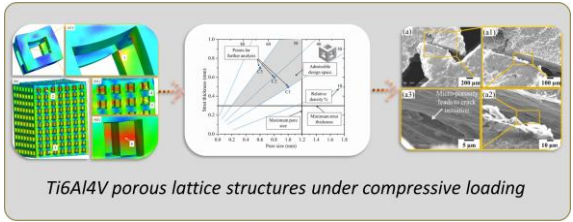|	
4.	[A Novel Fault Tolerant Smart System for BLDC motor based Electric Vehicles](#) AK Mohapatra, AVR Teja - IEEE International Conference on Industrial Technology, 2021 **Abstract**: This paper presents a generalized smart Fault Detection (FD) and Gate Pulse Correction (GPC) system to enhance the BLDC drive system's reliability to the binary hall sensor faults. Therefore, this drive system ensures a continual motor run if one of the hall sensors gets damaged. The whole drive control system is a simple digital logic circuit. The drive system with the proposed control scheme is simulated in MATLAB/Simulink environment first and extended to hardware. And the corresponding results are presented.
5.	[A policy based framework for quality of service management in software defined networks](#) P Kamboj, S Pal - Telecommunication Systems, 2021 **Abstract**: Growth in multimedia traffic over the Internet increases congestion in the network architecture. Software-Defined Networking (SDN) is a novel paradigm that solves the congestion problem and allows the network to be dynamic, intelligent, and it centrally controls the network devices. SDN has many advantages in comparison to traditional networks, such as separation of forwarding and control plane from devices, global centralized control, management of network traffic. We design a policy-based framework to enhance the Quality of Service (QoS) of multimedia traffic flows in a potential SDN environment. We phrase a max-flow-min-cost routing problem to determine the routing paths and presented a heuristic method to route the traffic flows in the network in polynomial time. The framework monitors the QoS parameters of traffic flows and identifies policy violations due to link congestion in the network. The introduced approach dynamically implements policy rules to SDN switches upon detection of policy violations and reroutes the traffic flows. The results illustrate that the framework achieves a reduction in end-to-end delay, average jitter, and QoS violated flows by 24%, 37%, and 25%, respectively, as compared to the Delay Minimization method. Furthermore, the proposed approach has achieved better results when compared to SDN without policy-based framework and reduced end-to-end delay, average jitter, and QoS violated flows by 51%, 62%, and 28%, respectively.
6.	[A Systematic Review of Real-time Fine-needle Aspiration Biopsy Methods for Soft Tissues](#) R Nadda, AK Sahani, R Repaka - IETE Technical Review, 2021 **Abstract**: Fine needle aspiration (FNA) biopsy is a painless, consistent, less expensive, and ordinarily secure clinical technique in diagnosing cancer, lymph, nodules, and other tumors. The present study concentrates on various improvements and advances made in previous years to enhance the accuracy, sensitivity, and specificity for real-time FNA biopsy, leading to modern techniques to needle aspiration technology. A brief review of preliminary research articles on FNA biopsy is done, and the background details of FNA biopsy are examined. FNA biopsy is an effective cytological method with adequate diagnostic precision, while primarily implemented in prostate and lung cancer cases.
7.	[A Task-Based Dimensional Synthesis of an Upper-Limb Exoskeleton: A Hybrid Configuration](#) S Gupta, S Gupta, A Agrawal, E Singla - Machines, Mechanism and Robotics: Part of the Lecture Notes in Mechanical Engineering book series, 2022 **Abstract**: This paper deals with the human-robot compatibility issue of upper-limb exoskeleton through a dimensional synthesis problem. The work is a contribution to solving misalignment. In this paper, the objective is the task-based dimensional synthesis of a wearable upper-limb exoskeleton for emulating natural human motion. A planar hybrid architecture is used for the purpose, with a four-bar connected to another four-bar in series. The task is selected based upon the

	standard rehabilitation exercises, only for the planar motion (parallel to sagittal plane). To achieve the proposed objective, the work has consisted of the formulation and solving of a constrained optimization problem, with reachability, design limits and solution continuity as constraints. Genetic algorithm is used for problem-solving. The results are detailed for proposed manipulator for the upper-limb exoskeleton, showcasing variation in design limits and constraints.
8.	Ab initio characterization of N doped T-graphene and its application as an anode material for Na ion rechargeable batteries N Yadav, TJD Kumar - Sustainable Energy & Fuels, 2021 **Abstract**: Tailoring 2D materials to tune their electrochemical characteristics for application as functional materials brings about a major breakthrough in optoelectronics. In this study, we report a novel material designed by heteroatom doping, N doped T-graphene, implementing a first principles approach in density functional theory. The structural and geometrical parameters are established by ab initio simulations. Having confirmed the static and dynamic stabilities, the monolayer is further identified to be metallic in electronic behavior. Heteroatom doping imparts competitive adsorption sites on the monolayer surface for Na ion adsorption, which is systematically studied for interaction possibilities. Moreover, the electron density modulation in the monolayer owing to alkali ion adsorption is well monitored. To identify the material's potential for an anode in Na ion batteries, the energy barrier and storage capacity are evaluated. The low diffusion barrier (0.5 eV) in addition to high storage capacity for Na ions (754 mA h g−1) implies better adsorption/desorption rate kinetics. On top of it, the monolayer possesses a voltage of 0.26 V, which categorizes it to be amongst the best materials as an anode for sodium ion rechargeable batteries.
9.	An Estimate of Heat Generation, Electric, and Magnetic Parameters from Temperature Fields in Porous Fins for Electronic Cooling Systems R Das, B Kundu - IEEE Transactions on Components, Packaging and Manufacturing Technology, 2021 **Abstract**: In the present investigation, a numerically driven direct and inverse study is conducted for the simultaneous prediction of the internal heat generation, electric field, and magnetic field strengths in porous pin fins from the surface temperature profile in electronic cooling applications. Consideration under imposed electrical and magnetic fields along with all modes of heat transport is given. Initially, duly-verified forward solutions are generated for the calculation of the temperature profile, and subsequently, three unknown parameters are predicted at the same time using the inverse methodology assisted by the artificial bee colony (ABC) algorithm. Here, numerical case studies have been presented to discover a suitable relation between the three parameters estimated by the ABC methodology. The current research envisages that even though a wide range of probable parametric combinations exist sustaining the prescribed thermal profile, however, the magnetic field parameter mostly governs the thermal phenomenon, while, the effect of mutual interplay among the electrical field and internal heat generation parameters is responsible for the temperature distribution under a given measurement error. Even with the influence of random perturbations, the ABC-assisted inverse methodology is observed to precisely simulate and determine the required thermal criterion and establish the available thermal field within the 4.55% error margin. Toward meeting a necessary heat transfer rate from porous pin fins, the proposed strategy is claimed to be valuable for appropriately controlling the electric and magnetic fields along with the indefinite state of interior heat generation rate.

10.	[An IGA based nonlocal gradient-enhanced damage model for failure analysis of cortical bone](#) A Soni, A Negi, S Kumar, N Kumar - Engineering Fracture Mechanics, 2021 **Abstract**: The fracture behavior of a cortical bone is significantly affected by its hierarchal structure and a high degree of material anisotropy. Recently, continuum damage models have proven to be an effective tool to characterize such kind of material behavior. However, these models suffer from drawbacks such as mesh dependency, spurious damage growth, and incorrect prediction of damage initiation during the initial stage of loading process. To this end, the objective of this work is to develop a nonlocal gradient-enhanced damage model in an isogeometric setting to predict the fracture behavior of a cortical bone. The numerical framework is formulated considering an additional diffusion equation in conjunction with the standard equilibrium equation. The material is assumed to be transversely isotropic to incorporate the anisotropy in damage evolution. The versatility of the proposed framework is tested by solving problems for different modes of fracture. For numerical simulations, samples are taken from different quadrants of bovine cortical bone, and the effect of anisotropy on the damage characteristics of the bone are investigated.
11.	[Analysis of Snow Dynamics in Beas River Basin, Western Himalaya Using Combined Terra–Aqua MODIS Improved Snow Product and in Situ Data During Twenty-First Century](#) DK Singh, HS Gusain, SK Dewali, RK Tiwari … - Water, Cryosphere, and Climate Change in the Himalayas: Part of the Geography of the Physical Environment book series, 2021 **Abstract**: Study of snow dynamics is an essential parameter for scientific studies such as climate change, cryospheric hazard mapping, energy budget assessment, management of water assets, etc. In this paper, an analysis of snow dynamics in the Beas river basin, Western Himalaya, India has been carried out using Moderate Resolution Imaging Spectroradiometer (MODIS) satellite images and in situ data during more than a decade winter period (November–April) from 2003–2017. MODIS sensor images and 8-days composite snow products have large uncertainty in mountain regions because of cloud cover and sensor limitation. Therefore, in this paper, a combined Terra–Aqua MODIS satellite-derived improved snow product version 6 (MOYDGL06*) has been used for the estimation of snow cover area (SCA) during the years 2003–2017. SCA in the study area varied from ~19% (November, 2016) to ~98% (February, 2015) during the era. It was found that SCA and total precipitation are decreasing at the rate of 3.2 km^2 and 64.7 cm, while the mean temperature is increasing at the rate of 0.16 °C, respectively, for the period 2003–2010. However, a similar trend was found during 2010–2017, SCA and total precipitation are decreasing at the rate of 25.39 km^2 and 44.9 cm, while the mean temperature is increasing at the rate of 0.35 °C, respectively. The satellite-extracted SCA trend was in correlation with in situ observed climate parameters. Moreover, SCA variability has been explored for different winter season months. The paper highlights the decreasing SCA and total perception trend, while increasing mean temperature trend during the twenty-first century and indicates that climate change is probably one of the major factors.
12.	[Analytical Modeling of Machining Forces and Friction Characteristics in Ultrasonic Assisted Turning Process](#) J Airao, CK Nirala - Journal of Manufacturing Science and Engineering, 2021 **Abstract**: Intermittent cutting characteristics of Ultrasonic assisted turning (UAT), Compared to conventional turning (CT), has shown a significant enhancement in the machinability of hard-to-cut materials. The enhancement in machinability is associated with machining forces and friction characteristics of the process. The present article covers an analytical approach to predict the output responses such as machining forces and friction characteristics in UAT and CT processes. Specific

cutting energy (SCE) for a particular work-piece material was considered to predict the output responses. The predictions were made by considering the conventional machining theories. Experiments for the UAT and the CT of SS 304 were carried out to validate the predicted model. The results from the analytical model showed that the shear angle increases and the tool-workpiece contact ratio (TWCR) decrease with an increase in amplitude and frequency of vibration. The results obtained from the analytical model were found to be in close agreement with the experimental ones, with an approximate error of 2-20%.

13.	[Anatomical variation in intracortical canal network microarchitecture and its influence on bone fracture risk](#) P Uniyal, P Sihota, K Tikoo, N Kumar - Journal of the Mechanical Behavior of Biomedical Materials, 2021 **Abstract**: Intracortical canals are a major contributor to cortical bone porosity and influence its mechanical response. Canal networks act as stress concentrators and the magnitude of which depends on the size and spatial distribution of canals. In the present study, we investigated site-dependent variation in intracortical canal network morphological indices and their effect on the mechanical response of bone. For this, mid-diaphysis of rat tibia bones were scanned using high-resolution micro-CT and morphological indices were measured for four main anatomical sites-anterior, posterior, medial and lateral. Further, a micro-finite element (μFE) model was developed to quantify the stress concentration regions in different cortices. The fracture risk was assessed using an effective strain approach. Results show that canal porosity, canal orientation and canal length are site-dependent whereas canal diameter and canal number density are independent of the site. The lateral cortex has significantly higher porosity compared to the posterior cortex ($p < 0.05$). The orientation of canals is found significantly different between endosteal and periosteal regions for anterior and medial quadrants. Canals are inclined at higher angles with bone axis in the endosteal region as compare to the periosteal region. The μ-FE results show that the regions with higher effective strain are concentrated around the canals. Further, failed element volume per unit bone volume is found highest for medial cortex whereas lowest for posterior cortex. The higher failed volume is associated with more radial canals in the medial cortex as compare to other cortices. The linear regression analysis shows that the volume of overstrained elements strongly depends on canal orientation ($R^2 = 0.73$, $p < 0.0001$) and canal porosity ($R^2 = 0.61$, $p < 0.0001$). The findings from this study suggest that along with vascular canal porosity, canal orientation and canal diameter can further improve the bone fracture risk assessment.
14.	[Anomalous elasticity and plastic screening in amorphous solids](#) A Lemaître, C Mondal, M Moshe, I Procaccia, S Roy… - Physical Review E, 2021 **Abstract**: Amorphous solids appear to react elastically to small external strains, but in contrast to ideal elastic media, plastic responses abound immediately at any value of the strain. Such plastic responses are quasilocalized in nature, with the "cheapest" one being a quadrupolar source. The existence of such plastic responses results in screened elasticity in which strains and stresses can either quantitatively or qualitatively differ from the unscreened theory, depending on the specific screening mechanism. Here we offer a theory of such screening effects by plastic quadrupoles, dipoles, and monopoles, explain their natural appearance, and point out the analogy to electrostatic screening by electric charges and dipoles. For low density of quadrupoles the effect is to normalize the elastic moduli without a qualitative change compared to pure elasticity theory; for higher density of quadrupoles the screening effects result in qualitative changes. Predictions for the spatial dependence of displacement fields caused by local sources of strains are provided and compared to numerical simulations. We find that anomalous elasticity is richer than electrostatics in having a

	screening mode that does not appear in the electrostatic analog.
15.	Between Maternity and Autonomy: Radical Mothering in Mona Simpson's Anywhere but Here S Krishna, S Chatterjee - Critique: Studies in Contemporary Fiction, 2021 **Abstract**: This essay argues that Mona Simpson's Anywhere but Here (1986) sustains a path breaking debate on maternity vis-à-vis female autonomy. It examines how in a narrative spatiotemporally located in America's Midwest during the conservative eighties, the nurturing and selfless maternal figure of white middle-class Christian homes is replaced by a self-seeking maverick, Adele, who uncompromisingly embodies the hopes and aspirations of the contemporary everywoman. By underscoring how Adele rejects domesticity, rewrites male quest narratives, and survives her ambitious journeys with the help of the bond she shares with her daughter, Ann, this essay claims that Simpson's fictional mother radically subverts all conventional caregiving practices. Further, by highlighting the seemingly conflicting discourses of maternity and autonomy which characterize Adele, this essay with the help of matricentric feminist theorists and post-Freudian psychoanalysts establishes that Anywhere but Here redefines not only the mother-child bond but also the maternal figure to engender a compelling narrative on women's empowerment that resonates deeply with current conversations surrounding motherhood.
16.	CO_2 Laser Cutting of Thin Glass Sheet Under Different Ambient Conditions S Prakash, CK Nirala - Lasers in Engineering, 2021 **Abstract**: This work investigates the CO_2 laser cutting of 1 mm thin glass sheets under different ambient conditions. Glass sheets are one of the most favourable material for many microfluidic devices, optical applications, automotive parts, etc. Thermal energy coming out from the CO_2 laser beam initiated thermal cracks in the glass. A controlled thermal crack can help in cutting of glass sheets accurately. In this work, CO_2 laser processing of glass sheets under different ambient conditions has been performed and compared. Experiments were conducted while keeping the glass sheets in open air and under a water layer of 1 mm with different laser parameters such as laser power, cutting speed and number of passes. Output parameters were evaluated using optical microscopy. Number of crack sites and cut quality were compared in open air and under water CO_2 laser processing.
17.	Compensated non-linear root water uptake model and identification of soil hydraulic and root water uptake parameters I Sonkar, S Sudesan, HP Suryanarayana Rao Kotnoor - Irrigation and Drainage, 2021 **Abstract**: The improvement in soil and root parameterization is a key to enhance the root zone moisture depletion pattern prediction capability. In the present study, a new compensated non-linear root water uptake (RWU) model is developed to analyse moisture flow under various crop growth and soil conditions. This is achieved by introducing a water stress index in the calibrated non-linear RWU model that takes care of RWU compensation. The present study also deals with the identifiability of soil hydraulic and RWU parameters using soil moisture and percolation data with an inverse approach. For parameter estimation, the numerical model has been coupled with a genetic algorithm-based optimizer. The efficacy of the coupled simulation-optimization model is tested for wheat (Triticum aestivum) crops grown in loamy, sandy clay loam, and sandy loam soil. The study shows that the RWU is less sensitive to soil moisture dynamics in sandy loam soil due to predominant vertical flow. Further, these parameters were estimated for four major Indian crops, that is, berseem (Trifolium alexandrinum), wheat, maize (Zea mays), and pearl millet (Pennisetum glaucum). In soils of higher hydraulic conductivity, the inverse approach was found to be ill-posed in estimating RWU and soil parameters using only soil moisture information. Hence, for such soils,

	both soil moisture and percolation data are necessary for estimating these parameters uniquely.
18.	Controlling Spread of COVID-19 Using VANETs V Sethi, S Pal - IEEE International Conference on Communications, 2021 **Abstract**: COVID-19 is spreading at an exponential rate and declared as 'Pandemic' by the World Health Organization (WHO). The only way of controlling its spread is 'social distancing' among the human beings. Apart from human beings, it can also spread through other objects such as metals and plastics which are used in public passenger buses, cars and trains. Studies reveal that the COVID-19 virus can stay on metallic things for 2-5 days. This makes traveling more difficult for regular employees to their workplace. Also, due to increasing number of COVID-19 patients, it is very difficult for a patient to find the required resources at hospitals. In this paper, we propose a VANET-IoT framework for detection of COVID-19 exposure in various entities such as vehicles. A vehicle is said to be virus-exposed if it carries any COVID-19 positive patient. We develop an Android application 'Corona Assistant' for travelers to find all virus-exposed vehicles and chose virus-free vehicle for traveling. In addition, a hospital recommendation system (HRS) is developed inside the 'Corona Assistant' application. HRS helps the COVID-19 positive patient to select the nearby hospital based on available resources.
19.	Copper-MWCNT Composite: A Solution to Breakdown in Copper Interconnects B Kumari, S Pandranki, M Sahoo, R Sharma - IEEE 21st International Conference on Nanotechnology (NANO), 2021 **Abstract**: In this work, Cu-MWCNT composite is recommended as a potential solution to diminish breakdown in copper interconnects caused due to self- heating. Cu-MWCNT composite is less affected by temperature variation as compared to copper interconnect by 33%. To support this deduction, lateral temperature profiles of copper and Cu-MWCNT composite are compared which shows that copper interconnect reaches a higher temperature point due to self-heating as compared to Cu-MWCNT composite interconnect. Delay in Cu-MWCNT composite interconnect turned out to be lesser than copper interconnect. Also, increase in the fraction of MWCNT in Cu-MWCNT composite (FMWCNT) leads to decrease in delay. Cu-MWCNT composite with higher FMWCNT experiences lesser Noise Delay Product (NDP) among all the alternatives which makes it most advantageous in terms of signal integrity. NDP of Cu-MWCNT composite interconnects are almost constant with increase in temperature making it immune to thermal effects. MWCNT has the highest reliability in terms of breakdown power (PBD) while 1 mm long Cu-MWCNT composite (with FMWCNT=0.6) when compared to copper has 61% improvement in breakdown power. Cu-MWCNT composite interconnect is much better than copper interconnect specially for longer wire and higher FMWCNT in terms of NDP/PBD ratio. Our analysis recommends long Cu-MWCNT composite (with FMWCNT>0.6) interconnects to replace copper interconnects as a solution to increased self-heating in copper leading to its breakdown and also improvement in signal integrity aspects.
20.	Cubic Lattice Structures of Ti6Al4V under Compressive Loading: Towards Assessing the Performance for Hard Tissue Implants Alternative S Dhiman, M Singh, SS Sidhu, M Bahraminasab… - Materials, 2021 **Abstract**: Porous Lattice Structure (PLS) scaffolds have shown potential applications in the biomedical domain. These implants' structural designs can attain compatibility mechanobiologically, thereby avoiding challenges related to the stress shielding effect. Different unit cell structures have been explored with limited work on the fabrication and characterization of titanium-based PLS with cubic unit cell structures. Hence, in the present paper, Ti6Al4V (Ti64)

cubic PLS scaffolds were analysed by finite element (FE) analysis and fabricated using selective laser melting (SLM) technique. PLS of the rectangular shape of width 10 mm and height 15 mm (ISO: 13314) with an average pore size of 600–1000 μm and structure porosity percentage of 40–70 were obtained. It has been found that the maximum ultimate compressive strength was found to be 119 MPa of PLS with a pore size of 600 μm and an overall relative density (RD) of 57%. Additionally, the structure's failure begins from the micro-porosity formed during the fabrication process due to the improper melting along a plane inclined at 45 degree.

Graphical Abstract:

Ti6Al4V porous lattice structures under compressive loading

21.

Cumulative signaling through NOD-2 and TLR-4 eliminates the Mycobacterium tuberculosis concealed inside the mesenchymal stem cells
M Aqdas, S Singh, M Amir, SK Maurya, S Pahari, JN Agrewala - Frontiers in Cellular and Infection Microbiology, 2021

Abstract: For a long time, tuberculosis (TB) has been inflicting mankind with the highest morbidity and mortality. Although the current treatment is extremely potent, a few bacilli can still hide inside the host mesenchymal stem cells (MSC). The functional capabilities of MSCs are known to be modulated by TLRs, NOD-2, and RIG-1 signaling. Therefore, we hypothesize that modulating the MSC activity through TLR-4 and NOD-2 can be an attractive immunotherapeutic strategy to eliminate the Mtb hiding inside these cells. In our current study, we observed that MSC stimulated through TLR-4 and NOD-2 (N2.T4) i) activated MSC and augmented the secretion of pro-inflammatory cytokines; ii) co-localized Mtb in the lysosomes; iii) induced autophagy; iv) enhanced NF-κB activity via p38 MAPK signaling pathway; and v) significantly reduced the intracellular survival of Mtb in the MSC. Overall, the results suggest that the triggering through N2.T4 can be a future method of immunotherapy to eliminate the Mtb concealed inside the MSC.

22.

Customer-Centered Antecedents of a Value Co-Creation Ecosystem: Integrating Psychological, Social, and Cultural Processes
S Saxena, Amritesh - Emerging Ecosystem-Centric Business Models for Sustainable Value Creation, 2022

Abstract: Considering the call for understanding the broader social and cultural context of value co-creation within emerging multilevel co-creative service systems, this research aims to explore the social and cultural processes along with psychological processes in terms of their influence on resource integration. It primarily adopts the customer perspective of resource integration. First, an integrative structure is developed and then the identified antecedents are positioned under relevant category proposing the multi-perspective VCC antecedent' framework. Further, the extant knowledge about VCC antecedents is used to set the agenda for future research. The study is based on an in-depth review of 85 key articles carefully extracted from a broad set of 1100 papers on VCC within the Scopus database. This review work provides a clear state of the art of VCC antecedents and has a direct implication for managers involved in designing the co-creation strategies for their customers.

23.	[Design and Fabrication of a Bio-inspired Soft Robotic Gripper](#) A Agarwal, A Baranwal, G Stephen Sugun, PK Agnihotri - Machines, Mechanism and Robotics: Part of the Lecture Notes in Mechanical Engineering book series, 2022 **Abstract**: Compliant gripping is a promising way to protect delicate objects from the damage caused by contact pressure. Present work proposes the design of a soft gripper inspired by human fingers. The experimental fabrication of gripper is realized by means of a 3D printed hard skeleton made of acrylonitrile butadiene styrene (ABS) which is actuated by PDMS-based soft dielectric elastomer actuator. Different actuator configurations are explored to demonstrate the design flexibility of the present approach. Experimental results show that both closing and opening mode of gripper actuations are possible by suitably placing the elastomeric layer. Finally, it is shown that lightweight objects can be precisely handled using three-fingered gripper having claw type configuration.
24.	[Dynamics of Thermoacoustic Oscillations in a Multi-Nozzle Combustor](#) Y Nanda, A Saurabh, L Kabiraj, R Villalva Gomez… - AIAA Propulsion and Energy Forum, 2021 **Abstract**: The thermoacoustic instability arising under various operations of the pilot, intermediate and outer fuel stages was investigated. Pressure data was used to construct phase portraits and recurrence plots to understand and inspect the temporal features of the oscillation states during the unstable operations of the different nozzles in the combustor. Non-linear time series methods for phase space reconstruction are employed to characterize thermoacoustic instabilities arising in a high-pressure multi-nozzle combustor with lean direct injection. Spectral proper orthogonal decomposition was applied using time-resolved OH* Chemiluminescence images for the limit cycle oscillations to analyze the spatio-temporal evolution of the instability. Recurrence analysis helped to identify the deterministic behavior occurring in phase spaces. Wigner Ville plots are also used to comprehend the behavior of oscillations in the time-frequency domain. Transitions from the periodic to noise induced states, during various unstable operations of the combustor are discussed in this paper.
25.	[Effect of Nonlinear Conduction on Needle Tip-Plane Breakdown Fields under DC Conditions](#) AJ Thomas, CC Reddy - IEEE Transactions on Dielectrics and Electrical Insulation, 2021 **Abstract**: In this paper, electric field and space charge accumulation have been investigated for needle-plane system (defect) under DC voltage conditions. Prolate spheroidal electrode system, believed to be closer to needle-plane system, has been used for solving the governing differential equations, numerically, for space charge and electric field distributions. Unlike past works in which space charge at needle tip was assumed either qualitatively or quantitatively, in this work, space charge formation is estimated using nonlinearity of material properties alone. A comparison with previous methods based on concentric spherical electrode approximations reveals that the results are different for prolate spheroidal system at different nonlinearities. Interesting results on the role of nonlinear conductivity on the DC electric field and space charge accumulation at needle-tip are presented. Furthermore, needle tip-plane breakdown experiments are conducted and the results suggest a reasonable and realistic estimate of tip-field at breakdown, using the proposed model.
26.	[Effect of Serum Starvation on Rheology of Cell Monolayers](#) A Kiran, C Shekhar, M Sabapathy, M Mishra, L Kumar, N Kumar, V Mehandia - Physics of Fluids, 2021 **Abstract**: The rheological properties of cells and tissues are central to embryonic development and homeostasis in adult tissues and organs and are closely related to their physiological activities. This

work presents our study of rheological experiments on cell monolayer under serum starvation compared to healthy cell monolayer with full serum. Serum starvation is one of the most widely used procedures in cell biology. However, the effect of deprivation of serum concentration on the material properties of cells is still unknown. Therefore, we performed macro-rheology experiments to investigate the effect of serum starvation on a fully confluent Madin–Darby Canine Kidney cell monolayer. The material properties, such as linear and non-linear viscoelastic moduli, of the monolayer, were measured using oscillatory shear experiments under serum-free [0% fetal bovine serum (FBS)] and full serum (10% FBS) conditions. Our results indicate that a serum-starved cell monolayer shows a different rheological behavior than a healthy cell monolayer. The loss and storage moduli decrease for the step-change in oscillatory strain amplitude experiments for a serum-starved cell monolayer and do not recover fully even after small deformation. In comparison, a healthy cell monolayer under full serum condition remains flexible and can fully recover even from a large deformation at higher strain. The effect of adhesion due to fibronectin was also studied in this work, and we found a significant difference in slip behavior for cell monolayer with and without serum.

27.	Elasto-hydrodynamics of non-Newtonian droplet collision with convex substrates SR Mishra, D Samanta, P Dhar - Physics of Fluids, 2021 **Abstract**: In this article, we report the post-collision elasto-hydrodynamics of non-Newtonian elastic or Boger fluid droplets [polyacrylamide (PAAM) solution in water] on convex or cylindrical targets of various diameters. Both hydrophilic and superhydrophobic (SH) surfaces were studied to deduce the role of wettability. Different governing parameters, such as cylinder diameter, Weber number, and fluid elasticity (different polymer concentrations), were systematically varied to understand various hydrodynamic outcomes. In contrast to the Newtonian water droplets on hydrophilic surfaces, PAAM droplets resisted capillary breakup and exhibited formation of long lasting, slender, fluid filaments. In certain cases, these filaments showed the existence of satellite beads during stretching, which are generated through blistering or pearling instability (known as beads-on-a string). In the case of SH surfaces, PAAM droplets rebound at larger cylindrical diameters and higher Weber number compared to water. Thin transient filaments attached to the cylinder surface eventually suppress droplet rebound. Such rebound suppression is essentially a non-Newtonian feature, as water droplets on a cylindrical SH surface always exhibited rebound and fragmentation. Finally, we illustrate phase maps where the different regimes of post-impact elasto-hydrodynamics are correlated as functions of a proposed elastic Weber number (which incorporates the effects of both the Weber and the Weissenberg numbers) and the non-dimensional diameter D*. We show that distinct scaling regimes appear in the elasto-hydrodynamic behavior of the post-impact droplets of elastic fluids.
28.	Energy resolution of Compton electrons in LaCl$_3$: Ce using compact digitizer SS Kaintura, V Ranga, S Panwar, P Sehgal… - Journal of Radioanalytical and Nuclear Chemistry, 2021 **Abstract**: Cerium doped Lanthanum halide scintillators are useful in γ-ray spectroscopy due to their excellent energy resolution and high stopping power. The response of Compton electrons in $1'' \times 1''$ cylindrical LaCl$_3$:Ce scintillator was recorded using a PIXIE-4 digital data acquisition system having no requirement of any external pulse-processing unit and coincidence unit, which makes the whole measurement setup very compact. The intrinsic energy resolution of Compton electrons in LaCl$_3$:Ce was measured employing the Wide Angle Compton Coincidence Technique (WACCT) for energies ranging from 100 keV to 1 MeV by using ^{137}Cs, ^{60}Co and ^{22}Na γ-ray sources. The effect of coincidence energy gating window was also studied. A good agreement

	between the present results obtained using a digital method and the results reported in the literature with the analogue method has been observed.
29.	Enhanced B(E3) strength observed in ^{137}La MSR Laskar, R Palit, E Ideguchi… D Choudhury… - Physical Review C, 2011 **Abstract**: The ^{137}La nucleus was populated by the reaction ^{130}Te(^{11}B, 4n) at 40-MeV beam energy and the lifetime of the 11/2− state at 1004.6keV was measured using a hybrid array of HPGe clover and LaBr3(Ce) detectors by electronic fast-timing technique, providing the value T1/2=263±12ps. The reduced transition probability B(E3)=23.3±2.4W.u. is found to be significantly larger compared to the values observed in lighter odd-A La isotopes. The experimentally determined B(E3) value is compared with theoretical calculations of random-phase approximation which explains the enhanced transition probability to be arising from higher contribution of the $g_{9/2}$ orbital to the proton transition density.
30.	Enhancement of Beam Width and Side Lobe Level Reduction Using PEC Ground Plane in Antenna Array S Bhattacharjee, B Kumbhani - Wireless Personal Communications, 2021 **Abstract**: In this paper, the effect of perfect electric conductor (PEC) as a ground plane on antenna array is investigated. Vertical electric dipole which is of infinitesimal small length is considered as an array element. The effect of mutual coupling is neglected in this work. The effect of PEC as a ground plane is analyzed by considering two cases in this paper. Firstly, the array elements are kept at constant height above PEC and in second case, the array elements are kept with gradually increasing height above the ground plane. Performance of antenna array in presence of PEC for both cases is investigated in terms of main lobe beam width and side lobe level using array factor pattern. Side lobe level and beam width results are compared both in presence of PEC and without PEC i.e. array in free space. It has been observed that there is improvement in the main lobe beam width and reduction in side lobe level when the array is used with PEC as a ground plane with elements kept at gradually increasing height from the ground plane. In addition to this, overall directivity of the array is also found to be increasing exponentially with height on application of ground plane in comparison with that of antenna arrays without ground plane.
31.	Exclusion process on two intersecting lanes with constrained resources: Symmetry breaking and shock dynamics A Jindal and AK Gupta – Physical Review E, 2021 **Abstract**: We present a study of the exclusion process on a peculiar topology of network with two intersecting lanes, competing for the particles in a reservoir with finite capacity. To provide a theoretical ground for our findings, we exploit mean-field approximation along with domain-wall theory. The stationary properties of the system, including phase transitions, density profiles, and position of the domain wall are derived analytically. Under the similar dynamical rules, the particles of both lanes interact only at the intersected site. The symmetry of the system is maintained until the number of particles do not exceed the total number of sites. However, beyond this, the symmetry breaking phenomenon occurs, resulting in the appearance of asymmetric phases and continues to persist even for an infinite number of particles. The complexity of the phase diagram shows a nonmonotonic behavior with an increasing number of particles in the system. A bulk induced shock appears in a symmetric phase, whereas, a boundary induced shock is observed in the symmetric as well as the asymmetric phase. Monitoring the location of localized shock with increasing entry of particles, we explain the possible phase transitions. The theoretical results are

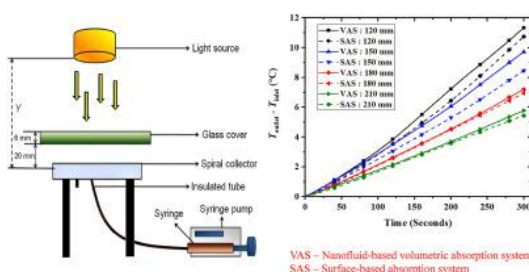|	
	supported by extensive Monte Carlo simulations and explained using simple physical arguments.
32.	Exploiting secrets by leveraging dynamic cache partitioning of last level cache A Agarwal, J Kaur, S Das - Design, Automation & Test in Europe Conference & Exhibition, 2021 **Abstract**: Dynamic cache partitioning for shared Last Level Caches (LLC) is deployed in most modern multicore systems to achieve process isolation and fairness among the applications and avoid security threats. Since LLC has visibility of all cache blocks requested by several applications running on a multicore system, a malicious application can potentially threaten the system that can leverage the dynamic partitioning schemes applied to the LLCs by creating a timing-based covert channel attack. We call it as Cache Partitioned Covert Channel (CPCC) attack. The malicious applications may contain a trojan and a spy and use the underlying shared memory to create the attack. Through this attack, secret pieces of information like encryption keys or any secret information can be transmitted between the intended parties. We have observed that CPCC can target single or multiple cache sets to achieve a higher transmission rate with a maximum error rate of 5% only. The paper also addresses a few defense strategies that can avoid such cache partitioning based covert channel attacks.
33.	Fair Sampling with a Highly Parallel Laser Simulator V Pal, S Mahler, AA Friesem, N Davidson - Conference on Lasers and Electro-Optics, OSA Technical Digest, 2021 **Abstract**: We present efficient fair sampling of ground-state manifold of XY spin Hamiltonian based on dissipatively coupled lasers that includes a massive parallelism. Our simulator could potentially be exploited to address various combinatorial optimization problems.
34.	Foamy slag practice to enhance the energy efficiency of electric arc furnace: An industrial scale validation A Agnihotri, PK Singh, D Singh, M Gupta - Materials Today: Proceedings, 2021 **Abstract**: The aim of the present work is to demonstrate the importance of foamy slag practice during steelmaking in electric arc furnaces (EAF). Steel making practices with foamy slag in the EAF not only reduces the energy consumption but it also protects the refractory materials of furnace linings from the high energy intensity generated by electrodes. It also decreases the noise pollution in conjunction with reduced melting time during the process. Foamy slag practices in electric arc furnace operations persists since long in steel making industries but here authors tried to modify the aforesaid practice at the concern plant in most economical way without impairing the steel quality. In the present study a process-controlled feeding of fine metallurgical coke for optimized foaming has been developed and simultaneous increment in energy efficiency has been noticed by collecting and analyzing the process related data. To carry out the present study more than 140 heats have been taken into consideration, with and without foamy slag generation in electric arc furnace. Considerable reduction in the electrical energy consumption (i.e. from $\sim$510 kwh per tone to $\sim$450 to 460 kwh per tone) has been noticed along with the reduction in total melting time from $\sim$87 min to $\sim$76 min. Present work also confirms that optimized met coke injection in the range of 15–18 kg/tone certainly helps in increasing the foaminess of the slag. FeO content of the slag was also assessed and found in the range of 17–21 wt% having the basicity of 1.8–2.2, which is a good agreement in prospects of yield as well as quality of the steel.

35.	[Heat transfer and friction factor correlations for an impinging air jets solar thermal collector with arc ribs on an absorber plate](#) R Kumar, R Nadda, S Kumar, K Kumar, A Afzal… - Sustainable Energy Technologies and Assessments, 2021 **Abstract**: The thermal enhancement characteristics of a solar thermal collector (STC) roughened with single arc protrusion ribs are investigated. Out of various techniques used for enhancing the performance of STC, jet impingement and artificial roughness (AR) have a dominant role in heat transfer augmentation. The impinging air jets STC is roughened with single arc protrusion ribs of different parametric values. The combined impact of artificial roughness and jet impingement on the thermo-hydraulic performance of STC is experimentally investigated. Reynolds number is varied from 4000 to 18,000 during experimentation. The AR parameters; relative height ratio of the rib is varied from 0.8 to 1.7, relative pitch ratio of the rib is varied from 9 to12, angle of arc protrusion rib from 40° to 80°, streamwise variation to dhy ratio (hydraulic diameter) is from 0.39 to 0.56 and spanwise variation to dhy ratio from 0.82 to 0.99 during experimentation. The parametric values of artificial roughness for the optimum thermo-hydraulic performance of 1.5, are found out to be relative height ratio of rib = 1.1, relative pitch ratio of rib = 10, angle of arc protrusion rib = 60°, streamwise variation to dhy ratio = 0.43 and Span wise variation to dhy ratio = 0.86. Artificial neural network modeling of Nu_{rs} – Nusselt number and ff – friction factor is also performed which accurately predicts these factors easily.
36.	[High-temperature superconductor of sodalite-like clathrate hafnium hexahydride](#) P Tsuppayakorn-Aek, N Phaisangittisakul, R Ahuja… - Scientific Reports, 2021 **Abstract**: Hafnium hydrogen compounds have recently become the vibrant materials for structural prediction at high pressure, from their high potential candidate for high-temperature superconductors. In this work, we predict HfH_6 by exploiting the evolutionary searching. A high-pressure phase adopts a sodalite-like clathrate structure, showing the body-centered cubic structure with a space group of Im3̄m. The first-principles calculations have been used, including the zero-point energy, to investigate the probable structures up to 600 GPa, and find that the Im3̄m structure is thermodynamically and dynamically stable. This remarkable result of the Im3̄m structure shows the van Hove singularity at the Fermi level by determining the density of states. We calculate a superconducting transition temperature (T_c) using Allen-Dynes equation and demonstrated that it exhibits superconductivity under high pressure with relatively high-T_c of 132 K.
37.	[Homogenization of a boundary optimal control problem governed by Stokes equations](#) BC Sardar, A Sufian - Complex Variables and Elliptic Equations, 2021 **Abstract**: This article considers an optimal control problem for the stationary Stokes system in a three-dimensional domain with a highly oscillating boundary. The controls are acting on the state through the Neumann data on the oscillating part of the boundary with appropriate scaling parameters $\epsilon\alpha$ with $\alpha \geq 1$. The periodic unfolding operators are used to characterize the optimal controls. Using the unfolding operators, we analyse the asymptotic behaviour of the optimal control problem under consideration. For $\alpha = 1$, the limit optimal control problem has both boundary and interior controls. For $\alpha > 1$, the limit optimal control problem has only boundary controls.

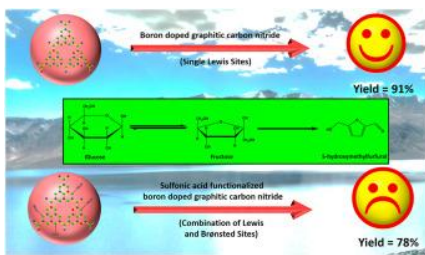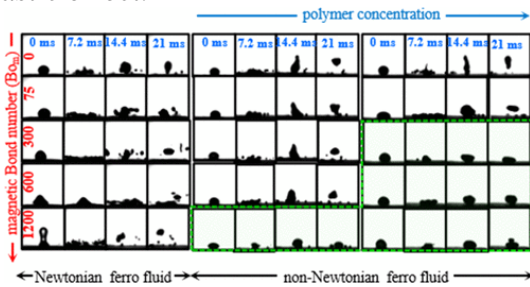| 38. | Hybrid nanoparticles-laden fluid based spiral solar collector: A proof-of-concept experimental study
VV Kulkarni, V Bhalla, K Garg, H Tyagi - Renewable Energy, 2021

Abstract: Over-reliance on limited fossil resources to meet the ever-increasing energy demand has several consequences such as high prices, unpredictable supply, and adverse environmental and ecological impact. It is the need of the current time to explore sustainable renewable energy sources in order to mitigate the environmental consequences and match the increasing demand economically. Out of various sustainable renewable energy sources, solar energy stands out as one of the exemplary candidates. It is a clean energy source with no greenhouse gas (GHG) emissions and is available in abundance at many parts of the world. Prevailing studies corroborate the merit of nanofluids in harnessing solar energy. In this experimental study, thermal analysis of a novel spiral-shaped collector is conducted with both hybrid nanofluid-based volumetric absorption system (VAS) and surface-based absorption system (SAS). In the case of hybrid VAS, homogenous mixture of Al_2O_3 and Co_3O_4 with de-ionized water as base fluid is employed. The experimental results reveal that the maximum temperature rise and thermal efficiency of 9.8 °C and 50%, respectively, is obtained at nanoparticle mass fraction of 100 mg/L Al_2O_3 +100 mg/L Co_3O_4 which is the optimum mass fraction. Whereas, in the case of SAS, volumetric flow rate of 100 mL/h is the optimum volumetric flow rate at which the maximum temperature rise of 8.5 °C is achieved. Further, the effect of variation in volumetric flow rate and the incident flux on the thermal performance of both VAS and SAS is also presented. On comparing the performance of VAS with SAS under a similar condition a temperature rise and thermal efficiency of about 15.3% and 15%, higher is achieved in VAS than SAS (at optimum volumetric flow rate).

Graphical Abstract:

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| 39. | Influence of Lewis and Brønsted Acidic Sites on Graphitic Carbon Nitride Catalyst for Aqueous Phase Conversion of Biomass Derived Monosaccharides to 5-hydroxymethylfurfural
T Chhabra, S Dhingra, CM Nagaraja, V Krishnan - Carbon, 2021

Abstract: Conversion of saccharides to 5-hydroxymethylfurfural is one of the fundamental steps in the synthesis of biodiesel. In this work, we report on the influence of Lewis and Brønsted acidic sites on metal-free graphitic carbon nitride catalysts for the conversion of monosaccharides to 5-hydroxymethylfurfural. We have examined the Lewis acidic sites by doping boron onto graphitic carbon nitride, and under optimal conditions, a maximal 91% yield of 5-hydroxymethylfurfural has been obtained from fructose. Subsequently, the boron doped graphitic carbon nitride was functionalized with Brønsted acidic group to prepare sulfonic acid functionalized boron doped graphitic carbon nitride, which possesses both Lewis and Brønsted acidic sites. However, the use of sulfonic acid functionalized boron doped graphitic carbon nitride as catalyst resulted in a lower yield (78%) of 5-hydroxymethylfurfural from fructose. In addition, time-dependent nuclear magnetic resonance spectroscopic study, temperature-programmed desorption study, and green |

metrics calculations have been performed to substantiate our findings. Overall, this work provides valuable insights on the influence of Lewis and Brønsted acidic sites on graphitic carbon nitride for biomass conversion reactions.

Graphical Abstract:

40.

Infrared Image Correlation for Non-destructive Testing and Evaluation of Materials
V Arora, R Mulaveesala, A Rani, S Kumar, V Kher, P Mishra, J Kaur - Journal of Nondestructive Evaluation, 2021

Abstract: The active thermal non-destructive testing and evaluation technique plays a vital role in health monitoring of various solid materials. Present manuscript demonstrates the applicability of pulse compression favorable Digitized version of linear Frequency Modulated Thermal Wave Imaging (DFMTWI) approach to identify flaws having different geometrical shapes in a Glass Fibre Reinforced Polymer (GFRP) sample. A novel Thermal Image Correlation (TIC) data-processing approach is proposed to obtain the isothermal patterns from the reconstructed pulse compressed data through matched filter scheme to identify sub-surface anomalies. The detection capabilities of the presented approach are compared on various adopted data processing approaches.

41.

Interference-aware Antenna Synthesis for Enhanced Coverage in Intelligent Transportation System
A Sharma, A Prajapati, PT Pinho - IEEE Transactions on Vehicular Technology, 2021

Abstract: In this paper, an antenna synthesis process is investigated for Intelligent Transportation System (ITS) application. The wireless communication between Road Side Units (RSUs) and On Board Units (OBUs) located in the vehicles enables smart mobility. However, to support high speed vehicles and high data rates, a wider coverage area by the RSU antennas projected on the highway is required. This is defined by the radiation patterns of the RSU antennas. On a multi-lane highway, interference from the adjacent lanes is a critical issue which determines the communication reliability in terms of Single-to-Interference plus Noise Ratio (SINR). Hence, in this paper, an interference-aware antenna synthesis process is proposed and a planar array is optimized based on the objective function of obtaining a wide coverage area in terms of SINR distribution for a given modulation scheme. The proposed antenna array enhances the reliable communication area and provides improved SINR distribution across the lane for misaligned vehicles from the center of the lane. The results indicate that the proposed antenna array performs better than the existing designs in terms of communication reliability.

42.

Magneto-Elastic Effect in Non-Newtonian Ferrofluid Droplets Impacting Superhydrophobic Surfaces
GVVS Vara Prasad, P Dhar, D Samanta - Langmuir, 2021

Abstract: In this article, we propose, with the aid of detailed experiments and scaling analysis, the existence of magneto-elastic effects in the impact hydrodynamics of non-Newtonian ferrofluid droplets on superhydrophobic surfaces in the presence of a magnetic field. The effects of magnetic

Bond number (Bo_m), Weber number (We), polymer concentration, and magnetic nanoparticle (Fe_3O_4) concentration in the ferrofluids were investigated. In comparison to Newtonian ferrofluid droplets, addition of polymers caused rebound suppression of the droplets relatively at lower Bom for a fixed magnetic nanoparticle concentration and We. We further observed that for a fixed polymer concentration and We, increasing magnetic nanoparticle concentration also triggers earlier rebound suppression with increasing Bom. In the absence of the magnetic nanoparticles, the non-Newtonian droplets do not show rebound suppression for the range of Bo_m investigated. Likewise, the Newtonian ferrofluids show rebound suppression at large Bo_m. This intriguing interplay of elastic effects of polymer chains and the magnetic nanoparticles, dubbed as the magneto-elastic effect, is noted to lead to the rebound suppression. We establish a scaling relationship to show that the rebound suppression is observed as a manifestation of the onset of magneto-elastic instability only when the proposed magnetic Weissenberg number (Wi_m) exceeds unity. We also put forward a phase map to identify the various regimes of impact ferrohydrodynamics of such droplets and the occurrence of the magneto-elastic effect.

Microstructure and continuous phase transition of a regular Hayward black hole in anti-de Sitter spacetime

AN Kumara, CLA Rizwan, K Hegde, MS Ali, KM Ajith - Progress of Theoretical and Experimental Physics, 2021

Abstract: In this article we study the thermodynamic phase transition of a regular Hayward-AdS black hole, by introducing a new order parameter, which is the potential conjugate to the magnetic charge arising from a non-linearly coupled electromagnetic field. We use Landau continuous phase transition theory to discuss the van der Waals-like critical phenomena of the black hole. The well-known interpretation of the phase transition of an AdS black hole as being a large and small black hole transition is re-interpreted as being a transition between a high-potential phase and a low-potential phase. The microstructure associated with this phase transition is studied using the Ruppeiner geometry. By investigating the behaviour of the Ruppeiner scalar curvature, we find that charged and uncharged (effective) molecules of the black hole have distinct microstructure, which is analogous to that of fermion and boson gas.

Mobility Analysis of Coupled System of Upper Limb Exoskeleton and Human Arm

M Vidyaaranya, S Gupta, E Singla - Advances in Industrial Machines and Mechanisms
Select Proceedings of IPROMM 2020: Part of the Lecture Notes in Mechanical Engineering book series, 2021

Abstract: Misalignment between human and exoskeleton joints is an inevitable challenge that hinders user's safety, comfort, and assistance efficiency. It also results in undesired interaction forces that are applied to the human body limbs, further affecting the safety of the user. In this context of the design of exoskeletons and the study of misalignment effects—through mobility analysis, the overall motion of the coupled model of the exoskeleton and the human limb is proposed to be studied. This paper focuses on the mobility analysis of a coupled system of a 2-DOF
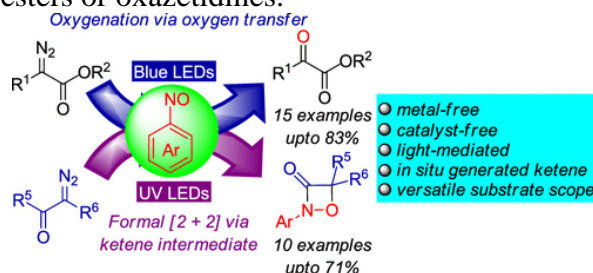
	(degrees-of-freedom) upper-limb exoskeleton for rehabilitation purposes of the human arm. In this work, planar rehabilitation exercises are used as tasks to be followed by the exoskeleton. These possess only planar motion, (i.e., parallel to sagittal plane) consisting of 2-DOF, i.e., flexion–extension movement of both shoulder and elbow joint. Two different configurations (type I and type II) of the upper limb exoskeleton are used to demonstrate the proposed methodology. The type II mechanism consists of redundant DOF that are used to address the problem of misalignment associated with the shoulder joint. The coupled systems of both types are further analyzed and compared in terms of their performance through screw algebra.
45.	Modified Damage Equalization Method for Lifetime Estimation of Dielectrics BS Thind, GN Reddy, AJ Thomas, CC Reddy - IEEE Transactions on Dielectrics and Electrical Insulation, 2021 **Abstract**: This paper presents a modified Damage Equalization Method with statistical features for life estimation of dielectrics. The paper postulates damage as a random variable, which resulted in establishing a relationship between the Weibull scale, shape parameters and the endurance coefficient 'n' of inverse power law. By the modified DEM (m-DEM), for the first time, a range of values of n for each material is proposed, which is useful for design engineers. Until now, the endurance coefficient of inverse power law and strength constant were treated as constants. Here, it is shown that these coefficients do have statistical features or variations. Experiments are conducted on oil impregnated paper and LDPE samples using accelerated step-stresses for life estimation. The results of the estimation of endurance coefficient are compared with existing methods and reasonable conclusions are drawn in favor of the proposed method.
46.	Molecular level investigations on mussel inspired polymer thin films using nonlinear vibrational spectroscopy S Chaudhary, H Kaur, KC Jena - AIP Conference Proceedings, 2021 **Abstract**: The development of surface coatings demands a better understanding of surface/interface chemistry to design high-performance coating materials. We have studied the polymerization processes of mussel-inspired adhesive protein, Dopamine. Molecular level insight on the mechanism of thin film formation during the polymerization processes has been probed using sum frequency generation vibrational spectroscopy. The investigations of the polydopamine thin films with variation in polymerization time of dopamine at air-polymer interface reveal the molecular footprints and polymerization mechanism of dopamine. The polymerization intermediates were dependent on polymerization time, which can be used for immobilization strategies. Additionally, the morphological measurements show the formation of nanoparticles during the polymerization at the surfaces even when the vertical orientation of sample and/ or stirring of solution were followed to prevent macro/nanostructures. The acquired investigations can be applied in designing the deterministic surfaces and interfaces for coating, coupling, and sensing applications.
47.	Motion estimation in hazy videos S Chaudhary, A Dudhane, PW Patil, S Murala… - Pattern Recognition Letters, 2021 **Abstract**: Motion estimation is the basic need for the success of many video analysis algorithms such as moving object detection, human activity recognition, etc. Most of the motion estimation algorithms are prone to weather conditions and thus, they fail to estimate the motion in degraded weather. Severe weather situations like snow, rain, haze, smog, etc., degrades the performance and reliability of video analysis algorithms. In this paper, we have analyzed the effect of the haze on motion estimation in hazy videos. We propose a cascaded architecture i.e. haze removal followed by optical flow for motion estimation in hazy videos. The proposed image de-hazing network is

build upon the Residual and Inception module concepts and named as ResINet. Further, an optical flow is utilized to estimate the motion information. We have carried out the visual analysis to validate the proposed approach for motion estimation in hazy videos. Also, to validate the proposed ResINet for de-hazing, we carried out the quantitative analysis on two benchmark image de-hazing datasets.

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48. [Nondestructive identification of barley seeds variety using near-infrared hyperspectral imaging coupled with convolutional neural network](#)
T Singh, NM Garg, SRS Iyengar - Journal of Food Process Engineering, 2021

Abstract: Nondestructive inspection of varietal purity of seeds plays an important role in crop improvement, agricultural production, and plant breeding. In the present study, a rapid and nondestructive technique, that is, near-infrared hyperspectral imaging (NIR-HSI) was applied to discriminate the barley seeds variety. A large dataset of 35,280 seeds was collected from different locations and years incorporating 35 Indian barley varieties (29 hulled and 6 naked barley varieties). The hyperspectral reflectance images of the ventral side and dorsal side of seeds were acquired in the near-infrared range of 900–1700 nm. Mean spectra were extracted and pretreated by six preprocessing techniques (standard normal variate (SNV), multiplicative scatter correction (MSC), Savitzky–Golay (SG) smoothing, SG first derivative, SG second derivative, and detrending). Subsequently, raw and preprocessed spectral data were fed as input to the convolutional neural network (CNN) including traditional machine learning models (partial least squares discriminant analysis (PLS-DA), K-nearest neighbors (KNN), and support vector machines (SVM)). It was observed that the end-to-end CNN model built on raw spectra overperformed the model using the preprocessing strategies. In addition, the CNN model outperformed the three traditional models with a testing set accuracy of greater than 98%. The results demonstrated that NIR-HSI coupled with end-to-end CNN could be a robust way to quickly, accurately, and nondestructively identify the variety of barley seeds.

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49. [Optimal dispersion on an anonymous ring in the presence of weak Byzantine robots](#)
AR Molla, K Mondal, WK Moses Jr - Theoretical Computer Science, 2021

Abstract: The problem of dispersion of mobile robots on a graph asks that n robots initially placed arbitrarily on the nodes of an n-node anonymous graph, autonomously move to reach a final configuration where each node has at most one robot on it. This problem is of significant interest due to its relationship to other fundamental robot coordination problems, such as exploration, scattering, load balancing, relocation of self-driving electric cars to recharge stations, etc. The robots have unique IDs, typically in the range $[1,\text{poly}(n)]$ and limited memory, whereas the graph is anonymous, i.e., the nodes do not have identifiers. The objective is to simultaneously minimize two performance metrics: (i) time to achieve dispersion and (ii) memory requirement at each robot. This problem has been relatively well-studied when robots are non-faulty.

In this paper, we introduce the notion of Byzantine faults to this problem, i.e., we formalize the problem of dispersion in the presence of up to f Byzantine robots. We then study the problem on a ring while simultaneously optimizing the time complexity of algorithms and the memory requirement per robot. Specifically, we design deterministic algorithms that attempt to match the time lower bound ($\Omega(n)$ rounds) and memory lower bound ($\Omega(\log f n)$ bits per robot).

Our main result is a deterministic algorithm that is both time and memory optimal, i.e., $O(n)$ rounds and $O(\log f n)$ bits of memory required per robot, subject to certain constraints. We subsequently provide results that require less assumptions but are either only time or memory optimal but not

	both. We also provide a primitive, utilized often, that takes robots initially gathered at a node of the ring and disperses them in a time and memory optimal manner without additional assumptions required.
50.	Parameterization of Pilot Point Methodology for Supplementing Sparse Transmissivity Data A Kapoor, D Kashyap - Water, 2021 **Abstract**: Pilot point methodology (PPM) permits estimation of transmissivity at unsampled pilot points by solving the hydraulic head based inverse problem. Especially relevant to areas with sparse transmissivity data, the methodology supplements the limited field data. Presented herein is an approach for estimating parameters of PPM honoring the objectives of refinement of the transmissivity (T) interpolation and the model calibration. The parameters are the locations and number of pilot transmissivity points. The location parameter is estimated by defining a qualifying matrix Q comprising weighted sum of the hydraulic head-sensitivity and the kriging variance fields. Whereas the former component of Q promotes the model calibration, the latter one leads to improved T interpolation by locating pilot points in un-sampled tracts. Further, a three-stage methodology is proposed for an objective determination of the number of pilot points. It is based upon sequential upgradation of the Variogram as the pilot points are added to the data base, ensuring its convergence with the head-based optimal Variogram. The model has been illustrated by applying it to Satluj-Beas interbasin wherein the pumping test data is not only sparse, but also unevenly distributed.
51.	Pebble guided near optimal treasure hunt in anonymous graphs B Gorain, K Mondal, H Nayak, S Pandit - International Colloquium on Structural Information and Communication Complexity, Structural Information and Communication Complexity: Part of the Lecture Notes in Computer Science book series, 2021 **Abstract**: We study the problem of treasure hunt in a graph by a mobile agent. The nodes in the graph are anonymous and the edges at any node v of degree deg(v) are labeled arbitrarily as $0,1,\ldots,\deg(v)-1$. A mobile agent, starting from a node, must find a stationary object, called treasure that is located on an unknown node at a distance D from its initial position. The agent finds the treasure when it reaches the node where the treasure is present. The time of treasure hunt is defined as the number of edges the agent visits before it finds the treasure. The agent does not have any prior knowledge about the graph or the position of the treasure. An Oracle, that knows the graph, the initial position of the agent, and the position of the treasure, places some pebbles on the nodes, at most one per node, of the graph to guide the agent towards the treasure. We target to answer the question: what is the fastest possible treasure hunt algorithm regardless of the number of pebbles are placed? We show an algorithm that uses $O(D\log\Delta)$ pebbles to find the treasure in a graph G in time $O(D\log\Delta+\log^{3}\Delta)$, where Δ is the maximum degree of a node in G and D is the distance from the initial position of the agent to the treasure. We show an almost matching lower bound of $\Omega(D\log\Delta)$ on time of the treasure hunt using any number of pebbles.
52.	Performance Analysis of Self Heated Multilayer Vertical Graphene Nanoribbon Interconnects B Kumari, R Kumar, M Sahoo, R Sharma - IEEE 71st Electronic Components and Technology Conference (ECTC), 2021 **Abstract**: In this paper, we report qualitative comparative signal integrity analysis of self-heated Ferric Chloride ($FeCl_3$) doped Top Contacted Multilayer Vertical Graphene Nanoribbon (TC-

MLVGNR) interconnect and its comparison with copper and $FeCl_3$ doped Top Contacted Multilayer Horizontal Graphene Nanoribbon (TC-MLHGNR) interconnects. A coupled three-line interconnect system is utilized in this study. The dimensions of interconnects are taken as per the IRDS-2018 roadmap for 7nm technology node. In realistic scenario, roughness is present on interconnect surfaces and it plays a major role at lower technology nodes. Roughness is inevitable during the fabrication process. It helps to provide the adhesion between dielectric and interconnect. So to capture the realistic scenario, we are considering rough Multilayer Graphene Nanoribbon (MLGNR) interconnects to compare with conventional rough copper interconnects. When compared to rough copper, smooth copper and TC-MLHGNR interconnects, delay of TC-MLVGNR interconnect is reduced by 59%, 51% and 62%, respectively. Even if we consider self-heating, its performance is better than rough copper, smooth copper and TC-MLHGNR interconnects by 26%, 11% and 54%, respectively. It is worth noting that rough TC-MLHGNRs induce the highest delay especially when self-heating effect is considered. Also, this study proves that TC-MLVGNR interconnects outperform TC-MLHGNR interconnects in terms of thermal efficiency by 15% thus making it a potential interconnect candidate for ultra-scaled technology nodes.

53.	[Persistence of spontaneous symmetry breaking in bidirectional transport system with reservoir crowding](#) B Pal, AK Gupta - Journal of Physics A: Mathematical and Theoretical, 2021 **Abstract**: Motivated by the impact of limited resources on the entry and exit of entities on a pathway in many transport systems, we investigate a system comprising of a bidirectional totally asymmetric simple exclusion process coupled to a reservoir featuring crowding effect. The entry and exit of particles from both ends are regulated depending upon the occupancy of the reservoir. The steady state properties of the system have been theoretically analyzed, and the phase boundaries have been obtained. Our findings display a rich behavior, emphasizing on the non-trivial effects of reservoir crowding giving rise to symmetric as well as asymmetric phases. Further, the system exhibits a novel feature in the form of a back-and-forth transition. Also, it is found that spontaneous symmetry breaking phenomena is induced even for very few particles in the system. All the findings are validated by extensive Monte Carlo simulations. The effect of system size on Monte Carlo simulation results have been examined.
54.	[PerSummRe: Gaze-Based Personalized Summary Recommendation Tool for Wikipedia](#) N Dubey, AA Verma, S Setia, SRS Iyengar - Journal of Cases on Information Technology, 2022 **Abstract**: The size of Wikipedia grows exponentially every year, due to which users face the problem of information overload. We purpose a remedy to this problem by developing a recommendation system for Wikipedia articles. The proposed technique automatically generates a personalized synopsis of the article that a user aims to read next. We develop a tool, called PerSummRe, which learns the reading preferences of a user through a vision-based analysis of his/her past reads. We use an ensemble non-invasive eye gaze tracking technique to analyze user's reading pattern. This tool performs user profiling and generates a recommended personalized summary of yet unread Wikipedia article for a user. Experimental results showcase the efficiency of the recommendation technique.
55.	[Photoinduced Diverse Reactivity of Diazo Compounds with Nitrosoarenes](#) S Roy, G Kumar, I Chatterjee - Organic Letters, 2021 **Abstract**: A diverse reactivity of diazo compounds with nitrosoarene in an oxygen-transfer process and a formal [2 + 2] cycloaddition is reported. Nitosoarene has been exploited as a mild oxygen

source to oxidize an in situ generated carbene intermediate under visible-light irradiation. UV-light-mediated in situ generated ketenes react with nitosoarenes to deliver oxazetidine derivatives. These operationally simple processes exemplify a transition-metal-free and catalyst-free protocol to give structurally diverse α-ketoesters or oxazetidines.

Prediction of Melt-Pool Characteristics in SLM Process for Ti6Al4V Using a Semi-Analytical Model

SK Nandi, R Kumar, A Agrawal - ASME 16th International Manufacturing Science and Engineering Conference, 2021
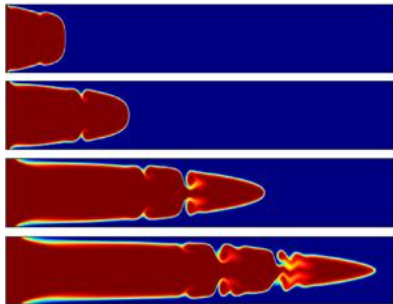
Abstract: Selective Laser Melting (SLM) is a powder-based layer-by-layer manufacturing technique to produce metallic customized shape components. The exceptionally high thermal gradient induces residual stress and distorts the part geometry affecting the yield quality. Computational models are instrumental in optimizing the process controls to fabricate high-quality components, and hence several such methods have been explored to simulate the thermal behavior of the process and the heat transfer in the melt-pool. Most of the practiced techniques are computationally expensive, making it infeasible to perform a parametric study. Based on closed-form exact heat conduction solution and Finite Volume Method (FVM), a pseudo-analytical thermal modeling approach has been employed to estimate the melt-pool characteristics and temperature distribution of the SLM process. A moving volumetric Gaussian heat source laser model and Green's function have been adopted to model the heat input by conduction. The heat loss by conduction and convection has been calculated by implementing Finite Volume discretized equations on a 2-dimensional thin-walled domain with appropriate part boundary conditions. Additionally, the Alternating Direction Implicit iterative technique has been implemented for the fast convergence of the simulation. The model is used to demonstrate the influence of the process parameters and non-linear material phase change for a single-line single layer and multilayer part fabrication. The computed melt-pool dimensions and temperature distribution for varying laser-power, scanning velocity, and layer thickness for Ti6Al4V are validated with the experimental data from the literature with fair agreements.

Probing the Bovine Hemoglobin Adsorption Process and its Influence on Interfacial Water Structure at the Air–Water Interface

S Chaudhary, H Kaur, H Kaur, B Rana, D Tomar, KC Jena - Applied Spectroscopy, 2021

Abstract: The molecular-level insight of protein adsorption and its kinetics at interfaces is crucial because of its multifold role in diverse fundamental biological processes and applications. In the present study, the sum frequency generation (SFG) vibrational spectroscopy has been employed to demonstrate the adsorption process of bovine hemoglobin (BHb) protein molecules at the air–water interface at interfacial isoelectric point of the protein. It has been observed that surface coverage of BHb molecules significantly influences the arrangement of the protein molecules at the interface. The time-dependent SFG studies at two different frequencies in the fingerprint region elucidate the kinetics of protein denaturation process and its influence on the hydrogen-bonding network of

interfacial water molecules at the air–water interface. The initial growth kinetics suggests the synchronized behavior of protein adsorption process with the structural changes in the interfacial water molecules. Interestingly, both the events carry similar characteristic time constants. However, the conformational changes in the protein structure due to the denaturation process stay for a long time, whereas the changes in water structure reconcile quickly. It is revealed that the protein denaturation process is followed by the advent of strongly hydrogen-bonded water molecules at the interface. In addition, we have also carried out the surface tension kinetics measurements to complement the findings of our SFG spectroscopic results.

58.

[Reaction induced interfacial instability of miscible fluids in a channel](#)
SN Maharana, M Mishra - Journal of Fluid Mechanics, 2021

Abstract: When a less viscous miscible fluid displaces a more-viscous one under a pressure-driven channel flow, unstable Kelvin–Helmholtz (K–H)-type billows are formed at the miscible interface. In this paper, we investigate whether such instability can be induced by a simple (A+B→C)-type chemical reaction. Here a miscible solution of one reactant A is displacing another isoviscous reactant B and producing a more-viscous product C at the reactive front. It is found that because of a local increase in viscosity gradient due to the formation of more-viscous product CC, K–H-type billows are formed at the A–C interface. The changes in dynamical properties of such billows are examined by varying the governing parameters such as the mobility ratio Rc, Damköhler number Da, Péclet number Pe and Reynolds number Re. Interestingly, we have found that even at high reaction rates (sufficiently large Da) for Rc=1, the interface remains stable and for larger values of Rc(=3,5) the K–H billows are observed. It is also noticed that a laminar horseshoe-type vortex develops near the wall at the channel inlet where the less-viscous reactant pushes the more-viscous product. We have computed numerically the onset time (tonton) of instability to understand the early-stage developments of the K–H billows. For different values of Da, we have shown the unstable and stable time zones in the (ton–Rc) space. The bipartite (ton–Rc) space also depicts the critical (Da-, Pe- and Re-dependent) Rc value for which instability can be triggered in a finite desirable time. The delay in the onset of instability is observed with increasing Pe. Further it is shown that tonton can be linearly scaled with PePe to have a modified onset time (t∗on), which establishes a proportionate dynamics with respect to Pe in the early stages of the instability. Moreover, a reverse dependency of onset on lower Rc values for higher Reynolds numbers is observed.

59.

[Regional integration and environmental sustainability during the COVID-19 pandemic: Evidence from South Asia](#)
P Jain, B Rakshit, B Raina, S Bardhan - International Social Science Journal

Abstract: South Asia, a sub-region with nearly a third of the world's population living in extreme poverty and hunger, has been affected by the COVID-19 pandemic in an unprecedented way. The pandemic has undermined the progress achieved by the subregion towards attaining sustainable

development goals. This study argues that fostering environmental sustainability in the South Asian region is crucial to "Building Back Better" while taking cognisance of future climate-related risks. With the low level of preparedness, the collapse of global supply chains, and restrictive regional integration, the individual country in the region lacks the fiscal and technical capacity to implement sustainable development goals effectively. Therefore, based on the analytical approach to regional integration, this paper explores the potential role of regional integration in ensuring environmental sustainability in South Asia. Additionally, this study illustrates how the COVID-19 pandemic has affected several environmental aspects at the regional level, such as clean energy, disaster risk reduction, and waste management, and shows how regional cooperation can address these challenges post pandemic. While previous studies mainly focus on regional integration in the European Union, this study targets the crucial importance of regional cooperation in South Asia in achieving environmental sustainability.

60.

Role of density gradients on miscible Rayleigh–Taylor fingers in porous media
S Pramanik, M Mishra - AIP Advances, 2021

Abstract: We investigate the effect of density gradients on miscible Rayleigh–Taylor fingers in homogeneous porous media using two families of concentration-dependent density profiles: (a) monotonic and (b) nonmonotonic. The first family consists of linear, quadratic, and cubic functions of the solute concentration, while the latter is described as a quadratic function of the solute concentration such that the density maximum (minimum) appears in time as diffusion relaxes the concentration gradient. With the help of these simple models, we are able to address one of the most puzzling questions about the fingering instabilities with nonmonotonic density profiles. Using linear stability analysis and nonlinear simulations, we show that density gradients play a pivotal role in controlling instability.

61.

Role of Space-Borne Remote Sensing Technology for Monitoring of Urban and Environmental Hazards
A Tripathi, RK Tiwari - Recent Technologies for Disaster Management and Risk Reduction: Part of the Earth and Environmental Sciences Library book series, 2021

Abstract: The rapid increase in urban population has on one handled to a remarkable increase in demand for dwelling spaces, and on the other hand has led to unprecedented resource competition. With better medical, educational and employment opportunities in urban areas, there is a population exodus from nearby towns and villages towards larger urban centres. This migration trend is more noticeable in developing countries like India, where there is a shift from agriculture to the service sector as a significant employer and GDP contributor. This leads to the growth of cities and metropolis, both in a planned and unplanned manner, leading to a rapid change in Land Use/Land Cover. However, all this is not without cost. A cost which the urban dwellers are paying in terms of environmental and urban hazards like—urban subsidence, land use/land cover change, urban heat island development, urban flooding and increased air and water pollution. Proper monitoring of these hazards is needed for timely response in case of disaster and control and mitigation of any tragic event. This would be highly beneficial in terms of planning for future civic facilities, rescue provisions and emergency services, in addition to taking timely precautionary measures. Physical monitoring of urban hazards and its causes requires lots of expertise and sophisticated equipment, which is both complex and time-consuming. Remote sensing being a non-evasive tool is highly beneficial for urban and environmental hazard monitoring. With a multitude of remote sensors operating in various active–passive and regions of electromagnetic spectra, space-borne remote sensing has proved to be highly beneficial for urban land use/land cover change, urban air quality and pollution monitoring, urban flood modelling and urban heat island mapping, besides many

more other potential hazards and their causes. This chapter focusses on some of the applications of space-borne remote sensing from optical, SAR and thermal sensors. The various applications discussed are a part of real-time research conducted in areas of urban land subsidence monitoring and mapping, urban land use/land cover mapping, urban heat island mapping, Urban flood run-off estimation and urban air pollution monitoring, using various satellite data. The chapter covers different regions and urban centres spread across various regions of India hence shows the geographical diversity of application of remote sensing technology.

62.

[Rose-like Bi_2WO_6 Nanostructure for Visible-Light-Assisted Oxidation of Lignocellulose-Derived 5-Hydroxymethylfurfural and Vanillyl Alcohol](#)
A Kumar, R Srivastava - ACS Applied Nano Materials, 2021

Abstract: Selective production of value-added chemicals using biomass-derived platform chemicals is a sustainable and effective way to fulfil the demands for chemicals around the globe. Photocatalytic biomass conversion is an economical, green, and sustainable process to address the environmental problems caused by the consumption of fossil fuel-derived chemicals and energy sources. In this research work, three Bi-based oxides, Bi_2WO_6, $BiVO_4$, and Bi_2MoO_6, are employed as photocatalysts, and their activities are compared in selective oxidation of two important lignocellulose-derived chemicals, 5-hydroxymethylfurfural (HMF) and vanillyl alcohol (VOL). Among these oxides, the rose-like Bi_2WO_6 nanostructured photocatalyst exhibits the highest catalytic activity and selectively produces 2,5-diformylfuran and vanillin from HMF and VOL. These materials are thoroughly characterized by several techniques (powder X-ray diffraction, X-ray photoelectron spectroscopy, and scanning electron microscopy) to understand the cause of their different physicochemical properties and photocatalytic activities. N2-sorption measurement, DR-UV–visible analysis, pyridine Fourier transform infrared, and photoelectrochemical measurements indicate a large surface area, an appropriate band gap, high surface acidity, and better migration and separation of the photogenerated charge carriers in Bi_2WO_6 than in $BiVO_4$ and Bi_2MoO_6, resulting in higher photocatalytic activity over Bi_2WO_6. The Bi_2WO_6 catalyst exhibits excellent activity under an artificial light source ($\lambda > 420$) and very good activity under the sunlight. The structure-activity relationship is established using catalytic activity data, physicochemical characterization, and scavenging studies. The scavenging studies suggest that the photogenerated holes (h^+), electrons (e^-), and superoxide radicals ($O2^{\bullet-}$) play key roles in achieving high photocatalytic activity. The synthesized photocatalyst exhibits remarkable photostability and recyclability. This research work will motivate researchers and scientists to develop sustainable, cost-effective, and environmentally benign catalytic processes for efficient utilization of sunlight and lignocellulose biomass conversion into energy and value-added chemicals.

63.

[Simultaneous estimation of heat generation and magnetic field in a radial porous fin from surface temperature information](#)
R Das, B Kundu - International Communications in Heat and Mass Transfer, 2021

Abstract: In this paper, for the first time an inverse methodology is demonstrated for

simultaneously predicting the internal heat generation and magnetic field strength in a radial porous fin using the surface temperature response. The operation of the system is considered under an imposed magnetic field and all modes of heat transfer. Initially, validated direct solutions are acquired for calculating the temperature field, and thereafter the unknowns are estimated using an inverse method assisted by the Artificial Bee Colony (ABC) algorithm. Numerical case studies are done to find an appropriate relationship among the given unknowns. The present analysis highlights that while many possible combinations exist satisfying the given thermal profile, however, the magnetic field strength and heat generation always vary linearly for a given distribution of temperature. Even under the influence of random noise, the ABC assisted algorithm is found to accurately reconstruct the available condition and excellently establish the mutual relationship between the parameters with an accuracy within 2%. For the purpose of a required heat transfer from porous fins, the present methodology is concluded to be beneficial in accurately controlling the magnetic field against an unknown condition of internal heat generation.

64.

Structural predictions of superconducting phase in tungsten ditellurides WTe2 from first-principles evolutionary techniques under high pressure

P Tsuppayakorn-aek, A Ektarawong, P Jimlim, N Kanchanavateeab, R Ahuja… - Computational Materials Science, 2021

Abstract: High-pressure phases of WTe_2 are investigated by using first-principles evolutionary algorithm technique. The novel monoclinic (C2/m) and tetragonal (I4/mmm) phases of WTe_2 are found to be thermodynamically stable, as the material is compressed under the applied pressure above 80 GPa. Because of their substantial similarity in terms of enthalpy and several intrinsic properties, the two novel high-pressure phases are likely to coexist in practical samples of WTe_2. By inspecting their electronic band structures, both C2/m and I4/mmm phases are likely type-II Weyl semimetal, and by using the Allen-Dynes equation we find that the two phases also behave conventional Bardeen-Cooper-Schrieffer superconductors. The electron localized solutions and the nature of the chemical bonding in WTe_2 further support the superconducting transition temperature in the proposed C2/m and I4/mmm phases.

Graphical Abstract:

65.

Study of Formability Limit Based on Ductile Damage Criteria of Incremental Sheet Forming of Titanium Grade 2 Sheet

M Pal, V Pandya, A Agrawal - ASME 16th International Manufacturing Science and Engineering Conference, 2021

Abstract: Incremental sheet forming (ISF) process is an alternative and advanced sheet metal forming technique, well-known due to its flexible and die-less method of forming compared to other traditional forming methods. It is a modern concept-based sheet forming technique adaptive to develop both simple and complicated shapes/components successfully. The clamped metal sheet undergoes small incremental deformations via layer by layer line movement of ball point type hemispherical tool with the help of numerically controlled (NC) user pre-defined definite toolpath.

Numerical simulation is an effective method to study the forming process and predict the formability limit in ISF. In this paper, ductile damage failure criteria has been used to investigate the forming limit diagram (FLD) of commercially pure Titanium grade 2 (CP-Ti Gr2) sheet through finite element simulation in ABAQUS® software. Truncated conical shape geometry with three different incremental step depth (Δz) at constant wall angle has been formed. Simulation results of the FLD have been validated and compared with the experimental data from the literature. Finite element analysis (FEA) for predicting the sheet thickness variation along the forming depth and process forming forces also have been carried out. Higher step depth resulted in better formability of the titanium sheet with less sheet thickness reduction. Forming forces (F_z) with smaller step depth showed good results as compared to other two step depths.

66.

Substrate concavity influenced evaporation mechanisms of sessile droplets
A Paul, G Khurana, P Dhar - Physics of Fluids, 2021

Abstract: In this article, we probe the morphing of the evaporation kinetics of sessile droplets on curved hydrophilic and superhydrophobic (SH) surfaces. Concave grooves of different radii have been employed, and optical diagnostics of the droplet profile has been carried out to monitor evolution of the evaporation progress. Our observations reveal curtailed evaporation rates on curved hydrophilic surfaces due to the droplet confinement phenomenon, whereas the rates improve for curved SH surfaces. We study the modulation of triple line transients and contact angle dynamics under the influence of substrate curvature. We show that the effective evaporation rate is determined by the interplay of substrate curvature and a proposed confinement ratio. Furthermore, the internal flow field within the evaporating droplet is studied using particle image velocimetry. Our findings show that minor changes in internal velocity occur due to hydrophilic substrate curvature, whereas for a curved SH surface, the circulation velocity is augmented. A mathematical analysis based on diffusion driven evaporation is proposed to predict the transient variation of evaporation for curved hydrophilic substrates. We explain the enhanced evaporation rate on curved SH on the basis of enhanced circulation velocity and increase in liquid–vapor interfacial shear. The model predictions confirm well to the experimental observations.

67.

Surface finishing requirements on various internal cylindrical components: A review
TS Bedi, AS Rana - Journal of Micromanufacturing, 2021

Abstract: Modern technology requires producing of a sustainable product with a high surface accuracy. In applications where the surface quality is highly considerable in various internal cylindrical components requires technology to manufacture an ultrafine surface finish. There is, in general, a probability of inducing errors into products by the traditional finishing processes (such as grinding/honing), which lead to failure. Preferably with some evidence in the main text. Further, the advanced finishing processes are developed, where the finishing forces can be controlled by varying the power output. Instead of a solid abrasive tool, the smart polishing fluid is used, which gets activated under the magnetic fields. In this manuscript, the material removal under different internal surface finishing processes is elaborated, which helps in improving the surface quality of various industrial components. Also, the surface quality produced on various industrial components after traditional as well as advanced finishing processes are discussed.

68.

Swap-based Load Balancing for Fairness in Radio Access Networks
S Saibharath, S Mishra, C Hota - IEEE Wireless Communications Letters, 2021

Abstract: 5G micro infrastructure comprising micro and picocells would play a pivotal role in densifying the network to provide ample coverage. However, a disproportional association of mobile devices with these small cells would cause hotspots and load imbalance. In such a network,

a few micro or picocells suffer from network congestion. While many others are underutilized, experience lower throughput, and operate below the potential network capacity. To mitigate this drawback, some means of Load Balancing (LB) would be essential in heterogeneous and homogenous networks. To achieve this, we propose an extreme Swap-based Load Balancing (SLB) algorithm between APs, which minimizes the load imbalance at cell edges. The experimental setup uses a dataset contributed by Irish mobile operators. Our results reveal SLB with biasing reduces the load imbalance by a factor of 7.14% compared to the optimal uni-transfer algorithm. Against other state-of-the-art algorithms, it betters by 22.24%. SLB with biasing delivers both lesser load imbalance in APs and signal quality amongst users.

| 69. | Synthesis of Thio-/Selenopyrrolines via SnCl4-Catalyzed (3+ 2)-Cycloadditions of Donor-Acceptor Cyclopropanes with Thio-/Selenocyanates |

PR Singh, P Kalaramna, S Ali, A Goswami - European Journal of Organic Chemistry

Abstract: A straightforward protocol has been developed to access the thio-/selenopyrrolines through the (3+2)-cycloaddition of aryl thio-/selenocyanates with donor-acceptor cyclopropanes (DACs) in the presence of SnCl 4 as a Lewis acid catalyst. Further, good chemoselectivity was observed when DACs were treated with 3-cyano phenyl thiocyanate. These results reveal that thiocyanate is more reactive than nitrile moiety in such (3+2)-cycloaddition reactions.

| 70. | Task Space Reconstruction in Modular Reconfigurable Manipulation System |

AT Reji, A Dogra, SS Jha, E Singla - Advances in Industrial Machines and Mechanisms: Part of the Lecture Notes in Mechanical Engineering book series, 2021

Abstract: Modularity and reconfigurability are efficient and effective solutions to achieve customization in manipulator designs. Customized configurations would be required to accomplish a set of non-repetitive tasks in various fixed environments. These customized manipulator designs are task-based; thus, automatic reconstruction of the task-space is required to create a virtual model for integrating the workspace in design algorithms for task-based customization and design studies. Secondly, it can be integrated with the developed customized robotic systems for demonstrating path planning. To achieve this functionality, we utilize a scene reconstruction framework based on RGB-D cameras for constructing a 3D model of the environment that captures all the necessary geometric and color information. In the first stage of scene reconstruction, various pre-processing activities like point cloud generation and timestamp matching are carried out. In the next stage of local registration, Random Sample Consensus (RANSAC) algorithm and local image features are used for estimating relative transformations between frames. Subsequently, global registration is carried out to find the absolute transformations with respect to a global frame. A scalable and efficient voxel-based representation is used for representing the model. A Robotic Operating System (ROS)-based platform is developed for the complete demonstration of the work in which modular configurations and task-spaces are visualized using Rviz and the path planning of the modular configurations considering the goal positions are done using Moveit! all within the ROS framework. Implementation of the methodology is illustrated through an example of a case study of the utilization of modular manipulators in different work cells.

| 71. | The normal complement problem in group algebras |

H Setia, M Khan - Communications in Algebra, 2021

Abstract: Let Sn be the symmetric group and A_n be the alternating group on n symbols. In this article, we have proved that if F is a finite field of characteristic $p > n$, then there does not exist a normal complement of S_n (n is even) and An (n≥4) in their corresponding unit groups $U(FS_n)$ and $U(FA_n)$. Moreover, if F is a finite field of characteristic 3, then A_4 does not have normal

	complement in the unit group U(FA$_4$).
72.	[Tool Wear Analysis during Ultrasonic Assisted Turning of Nimonic-90 under Dry and Wet Conditions](#) J Airao, CK Nirala, LNL Lacalle, N Khanna - Metals, 2021 **Abstract**: Nickel-based superalloys are widely used in the aerospace, automotive, marine and medical sectors, owing to their high mechanical strength and corrosion resistance. However, they exhibit poor machinability due to low thermal conductivity, high shear modulus, strain hardening, etc. Various modifications have been incorporated into existing machining techniques to address these issues. One such modification is the incorporation of ultrasonic assistance to turning operations. The assisted process is popularly known as ultrasonic assisted turning (UAT), and uses ultrasonic vibration to the processing zone to cut the material. The present article investigates the effect of ultrasonic vibration on coated carbide tool wear for machining Nimonic-90 under dry and wet conditions. UAT and conventional turning (CT) were performed at constant cutting speed, feed rate and depth of cut. The results show that the main wear mechanisms were abrasion, chipping, notch wear and adhesion of the built-up edge in both processes. However, by using a coolant, the formation of the built-up edge was reduced. CT and UAT under dry conditions showed an approximate reduction of 20% in the width of flank wear compared to CT and UAT under wet conditions. UAT showed approximate reductions of 6–20% in cutting force and 13–27% in feed force compared to the CT process. The chips formed during UAT were thinner, smoother and shorter than those formed during CT.
73.	[What Drives Energy Consumption in BRICS Countries? Evidence from ARDL Bounds Testing Approach](#) SR Behera, T Mishra, DP Dash, L Mallick - The Singapore Economic Review, 2021 **Abstract**: Rapid urbanization, openness and growth in human development index are some of the leading determinants of energy consumption in developing countries, particularly in BRICS economies (Brazil, Russia, India, China and South Africa). Thanks to their innate tendency to converge to the growth path of developed nations, BRICS countries are under increasing pressure to limit high energy consumption — triggered by outsourcing from developed nations. This paper attempts to weigh the relative importance of various determinants of energy consumption in BRICS countries between 1980 and 2016, studying in-depth the long-run co-movement pattern of energy consumption with demographic characteristics (depicting demand pressure) and macroeconomic aggregates (depicting cheap production cost). By leveraging on the trade-off between domestic and foreign demand and by employing the autoregressive distributed lag bounds testing approach, we establish differential effects of various predictors: whilst an increase in population growth rate, gross domestic product and capital account openness exert a positive and significant impact on energy consumption in Brazil, China and South Africa, foreign direct investment (FDI) and human development appear to enhance energy consumption in India, China and South Africa. The growth in external demand and the FDI inflows appear to have pushed urbanization, leading to greater energy consumption during the study period. Keeping in mind the sustainability goal, stronger green energy practices and sustainable urbanization patterns are needed to curb excessive energy sources.