

Gulzar Group of Institutes, Ludhiana

Department of Mechanical Engineering

**MECHTECH**

Monthly Bulletin

*Covering latest researches and publications in*

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Sharpening Minds. Brightening Tomorrow.

**GULZAR GROUP OF INSTITUTES**

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## ➤ **Researches and Publications in Mechanical Engineering:-**

### **1. Theoretical analysis of reinforcement layers in bonded flexible marine hose under internal pressure**

Fudan University researchers, Dr. Young Zhou, Professor Menglan Duan and Dr. Jianmin Ma in collaboration with Dr. Guomin Sun at the Offshore Oil Engineering Company investigated the analysis of reinforced layers in bonded flexible marine hoses under internal pressure. They aimed at developing a theoretical solution to clarify the mechanical behaviours of the reinforcement layers and further presenting a mathematical approach for multi-layer composites of synthetic fibres in structures. Eventually, the feasibility and accuracy of the method were verified by comparing the results to those available in the literature. Their work is published in the research journal, *Engineering Structures*.

Reference: <https://advanceseng.com/reinforcement-layers-bonded-flexible-marine-hose-internal-pressure/>

### **2. Limiting Stokes' wave of extreme height in arbitrary depth**

Professor Shijun Liao and Mr. Xiaoxu Zhong have successfully developed a homotopy analysis method to solve the limiting Stokes wave in arbitrary water depth thereby overcoming the greatest challenges experienced by the initially used approaches. The study is hoped to advance the solution of various problems in fluid mechanics as well as other fields by enabling the creation of new approaches. Their work is published in the research journal, *Journal of Fluid Mechanics*.

Reference: <https://advanceseng.com/limiting-stokes-wave-extreme-height-arbitrary-depth/>

### **3. Calibration of blade tip-timing sensor for shrouded blades**

Zdenek Kubín at the University of West Bohemia in Pilsen in collaboration with Dr. T. Mísek, J. Hlous, T. Dadaková and Dr. J. Kellner at Doosan Škoda Power and Dr. T. Bachorec at SVS FEM investigated the use of eddy current and optical sensors in blade tip timing measurements and calibration in steam power stations. They performed measurements in various conditions and presented the detailed calibration procedure. Eventually, the obtained results were compared to the theoretical ones to validate the feasibility of the model. They purposed to improve the operation efficiency of the steam turbines, reduce damages and improve their lifespan for large power output generation. Their work is published in the journal, *Mechanical Systems and Signal Processing*.

Reference: <https://advanceseng.com/calibration-blade-tip-timing-sensor-shrouded-blades/>

#### **4. High-frequency dynamic response of thin plate with uncertain parameter based on average wavelet finite element method :-**

Xi'an Jiaotong University scientists from the School of Mechanical Engineering: Dr. Jia Geng, Dr. Xingwu Zhang and Professor Xuefeng Chen developed an average wavelet finite element method for efficient dynamic analysis in the high-frequency domain. This is attributed to the fact that it overcomes the effects of uncertain parameters and low computational efficiency. Therefore, it will enable engineers in different fields to pre-design and optimize equipment in the high-frequency domain at low costs thus enhancing their functionality. Their work is published in the journal, *Mechanical Systems and Signal Processing*.

Reference: <https://advanceseng.com/high-frequency-dynamic-response-thin-plate-uncertain-parameter-average-wavelet-finite-element-method/>

#### **5. Crop recognition under weedy conditions based on 3D imaging for robotic weed control**

Iowa State University scientists, Dr. Ji Li and Professor Lie Tang from the Agricultural and Bio-system Engineering developed a novel system that would overcome the canopy occlusion and illumination variation problems encountered in modernized weed control systems. Specifically, they hoped to apply a 3D imaging sensor and develop corresponding machine vision algorithms to discriminate crop plants from weeds under challenging field conditions where weed infestation was severer than normal. Their work is currently published in the research journal, *Journal of Field Robotics*.

Reference: <https://advanceseng.com/crop-recognition-under-weedy-conditions-3d-imaging-robotic-weed-control/>

#### **6. Unusual redox behaviour of the magnetite hematite core-shell structures processed by the laser floating zone method**

The study by University of Aveiro scientists presented the successful growth of magnetite core and hematite shell structure fibres using the floating zone technique. In general, the highly oriented shell microstructure was formed during the growth under an atmosphere with lower oxygen content. Altogether, the results of the magnetic studies were in good agreement with structural and microstructural results. Their work is currently published in the research journal, *Dalton Transactions*.

Reference: <https://advanceseng.com/unusual-redox-magnetite-hematite-core-shell-structures-laser-floating-zone/>

## **7. Indian Railways leads world by example! PM Modi flags off 1st ever diesel to electric conversion locomotive**

Indian Railways has created history by converting a diesel locomotive into electric locomotive for the first time in the world. This all new converted energy-efficient electric locomotive had been flagged off by PM Narendra Modi in Varanasi .The entire project is an Indian R&D innovation for the entire world, says Indian Railways. As India looks to reduce its carbon footprint, this ‘Make in India’ initiative by Indian Railways is a welcome step.

Piyush Goyal-led Indian Railways now plans to convert all diesel locomotives into electric locomotives during mid life rehabilitation. According to the national transporter, the ‘Make in India’ project is a step towards saving traction energy cost. It is being said that with conversion of diesel locomotives into electric locomotives, the fuel bill of Indian Railways will reduce significantly.

Reference: <https://www.financialexpress.com/infrastructure/railways/indian-railways-leads-world-by-example-pm-modi-flags-off-1st-ever-diesel-to-electric-conversion-locomotive/1491851/>

## **8. Active vibration control of a flexible rod moving in water**

Mechanical Engineering investigated simultaneous control of the bridge and a trolley of a refueling machine and its potential use in eliminating the unnecessary vibration during the transportation of the fuel rod. Their research work is currently Dr. Umer Hameed Shah and Dr. Keum-Shik Hong at Pusan National University from School of published in the research journal, *Automatica*.

Reference: <https://advanceseng.com/active-vibration-control-flexible-rod-moving-water/>

## **9. Direct Detection of Akhiezer Damping in a Silicon MEMS Resonator**

Silicon Microelectromechanical Systems (MEMS) resonators have broad commercial applications for timing and inertial sensing. However, the performance of MEMS resonators is constrained by dissipation mechanisms, some of which are easily detected and well-understood, but some of which have never been directly observed. The work, published by Janna Rodriguez et al. present measurements of the quality factor,  $Q$ , for a family of single crystal silicon Lamé-mode resonators as a function of temperature, from 80–300 K. By comparing these  $Q$  measurements on resonators with variations in design, dimensions, and anchors, they have been able to show that gas damping, thermoelastic dissipation, and anchor dampings are not significant dissipation mechanisms for these resonators.

Reference: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6381092/>

## **10. Real time observation of binder jetting printing process using high-speed X-ray imaging**

A high-speed synchrotron X-ray imaging technique was used to investigate the binder jetting additive manufacturing (AM) process. A commercial binder jetting printer with droplet-on-demand ink-jet print-head was used to print single lines on powder beds. The printing process was recorded in real time using high-speed X-ray imaging. The ink-jet droplets showed distinct elongated shape with spherical head, long tail, and three to five trailing satellite droplets. Significant drift was observed between the impact points of main droplet and satellite droplets. The impact of the droplet on the powder bed caused movement and ejection of the powder particles. The depth of disturbance in the powder bed from movement and ejection was defined as interaction depth, which is found to be dependent on the size, shape, and material of the powder particles. For smaller powder particles (diameter less than 10  $\mu\text{m}$ ), three consecutive binder droplets were observed to coalesce to form large agglomerates. The observations reported here will facilitate the understanding of underlying physics that govern the binder jetting processes, which will then help in improving the quality of parts manufactured using this AM process.

Reference: <https://www.nature.com/articles/s41598-019-38862-7>

## **11. Bone-inspired enhanced fracture toughness of de novo fiber reinforced composites**

Amplification in toughness and balance with stiffness and strength are fundamental characteristics of biological structural composites, and a long sought-after objective for engineering design. Nature achieves these properties through a combination of multiscale key features. Yet, emulating all these features into synthetic *de novo* materials is rather challenging. An integrated approach, combining numerical simulations, ad hoc manufacturing techniques, and testing, yields a novel composite with enhanced fracture toughness and balance with stiffness and strength, offering an optimal lightweight material solution with better performance than conventional materials such as metals and alloys. The results also show how the new design significantly boosts the fracture toughness compared to a classic laminated composite, made of the same building blocks, also offering an optimal trade-off with stiffness and strength. The predominant mechanism, responsible for the enhancement of fracture toughness in the new material, is the continuous deviation of the crack from a straight path, promoting large energy dissipation and preventing a catastrophic failure. The new insights resulting from this study can guide the design of *de novo* fiber-reinforced composites toward better mechanical performance to reach the level of synergy of their natural counterparts.

Reference: <https://www.nature.com/articles/s41598-019-39030-7>

## ➤ **Updates from the Automobile Sector :-**

### **1. New business model launched for countrywide CNG stations**

Petrotech 2019 – the 13th international oil and natural gas conference and exhibition – was held at the India Expo Mart at Noida during the past week. On the sidelines of this event, Dharmendra Pradhan, minister of Petroleum and Natural Gas & Skill Development and Entrepreneurship, has launched the Dealer Owned Dealer Operated (DODO) model for setting up CNG stations. He released the general guidelines for the schemes, under which the entire earmarked dealer plot shall be developed exclusively to help set up CNG stations and allied commercial activities at the discretion of CGD (City Gas Distribution) activities.

Reference: <https://www.autocarindia.com/car-news/new-business-model-launched-for-countrywide-cng-stations-411547>

### **2. Kia Motors' first India dealership opens in Noida**

Kia Motors will make its India entry with the launch of the Hyundai Creta-rivaling Kia SP2i SUV in the coming months. Ahead of its official market entry in a few months' time, Kia Motors has inaugurated its first dealership in India. Called Allied Motors, the first Kia Motors dealership in India is a multi-story facility located in Noida, Uttar Pradesh. The company has the Kia Rio hatchback and the Kia Stinger sedan on display at its first outlet in the country.

Reference: <https://www.autocarindia.com/car-news/kia-motors-first-india-dealership-opens-in-noida-411546>

### **3. Maharashtra Traffic Police start digitising the challan system**

Traffic police in the state of Maharashtra have started the process of digitising the 'challan' system. A 'challan' refers to the receipt for fines recovered via traffic rule violations. Authorities have kick-started the 'One State One e-challan' initiative in the state. The first phase of this initiative is being rolled out in commissionerates of Mumbai, Nagpur, Navi Mumbai, Thane, Pune and Pimpri-Chinchwad. Following this, other parts of Maharashtra will be covered in the next phase of the initiative, said the traffic police in a press note. Under the scheme, motorists who have been fined can pay off their dues at [mahatraficechallan.gov.in](http://mahatraficechallan.gov.in), the note said. The department has also discontinued the existing 'MTP' mobile phone application and is introducing two new applications in its place.

Reference: <https://www.autocarindia.com/car-news/maharashtra-traffic-police-start-digitising-the-challan-system-411537>

#### **4. Volvo keen to assemble electric XC40 in India**

Late last year, Volvo announced its plans to bring in a host of electrified and electric vehicles to India. Beginning 2019, the range would include four plug-in hybrids, all of which would be assembled at its plant in India. The Swedish company is now looking at adding its first and yet to be officially revealed all-electric car to that list – the electric version of the XC40. The managing director, Volvo Auto India, said that with the announcement of the reduction in import duties from 15-30 percent to 10-15 percent for electric vehicle components, assembling an electric car in India presents a very interesting case.

Reference : <https://www.autocarindia.com/car-news/volvo-keen-to-assemble-electric-xc40-in-india-411526>

#### **5. Pininfarina Battista electric hypercar secrets revealed**

Less than a year after the launch of brand Automobili Pininfarina at Rome’s stunning Palazzo Barberini, the company will spark to life its ultra-exclusive electric hypercar, the Battista, at the 2019 Geneva motor show on March 4. Automobili Pininfarina has been drip-feeding us teasers soon after the first prototype was shown at a private viewing in Pebble Beach. And from what we’ve seen so far, the Battista – true to the ethos of the legendary design house whose badge it now proudly wears on its nose – has a purity of design that is simple and elegant. There are no spoilers, diffusers or any aero appendages, and the unique split tail revealed as a teaser has already become the Battista’s signature.

Reference: <https://www.autocarindia.com/car-news/pininfarina-battista-electric-hypercar-secrets-revealed-411679>

### **➤ Researches and developments in General Engineering**

#### **1. Scientists Measure Exact Edge Between Superconducting and Magnetic States**

Scientists at the U.S. Department of Energy’s Ames Laboratory have developed a method to accurately measure the “exact edge” or onset at which a magnetic field enters a superconducting material. The knowledge of this threshold called the lower critical field plays a crucial role in untangling the difficulties that have prevented the broader use of superconductivity in new technologies.

Reference: <https://phys.org/news/2019-02-scientists-exact-edge-superconducting-magnetic.html>

## **2. New Measurement Technique for Topological Quantum Systems**

Researchers at University Hamburg have demonstrated a new scheme for measuring the topological index of a system. The index describes the topological nature of materials and influences certain properties such as the conductivity. The scientists report their findings, which may lead to important applications in metrology and possible prospects for quantum computers, in the journal Nature Physics.

Reference: <https://www.scienceandtechnologyresearchnews.com/new-measurement-technique-for-topological-quantum-systems/>

## **3. A Transformer to Drive the Transition from AC to DC**

Researchers have developed a compact and efficient medium-frequency transformer. Their device is poised to enhance the flexibility and efficiency of tomorrow's smart grids and DC power distribution networks. Scientists now came up with a way of optimally designing and producing medium-frequency transformers (MFT)- rated for 100kW and operated at 10kHz- to enable technologies for SSTs. After careful testing, scientists found that the MFT serves as the basis for technical tutorials, some of which have already been given to various specialists from the academic and industrial worlds.

Reference: <https://www.techexplorist.com/transformer-drive-transition-ac-dc/20953/>

## **4. Fast, Flexible Ionic Transistors for Bioelectronic Devices**

A team led by Dion Khodagholy, assistant professor of electrical engineering at Columbia Engineering, and Jennifer N. Gelinias, Columbia University Medical Center, Department of Neurology, and the Institute for Genomic Medicine, has developed the first biocompatible ion-driven transistor that is fast enough to enable real-time signal sensing and stimulation of brain signals.

Reference: <https://www.scienceandtechnologyresearchnews.com/fast-flexible-ionic-transistors-for-bioelectronic-devices/>

## **5. Robot mimics desert ants to find its way home without GPS**

A six-legged robot can find its way home without the help of GPS, thanks to tactics borrowed from desert ants. The robot, called AntBot, uses light from the sky to judge the direction it is going. To assess the distance travelled, it uses a combination of counting its steps and observing the apparent motion of objects it passes. All three of these techniques are used by desert ants.

Reference: <https://www.newscientist.com/article/2193880-robot-mimics-desert-ants-to-find-its-way-home-without-gps/>

Have a great day!