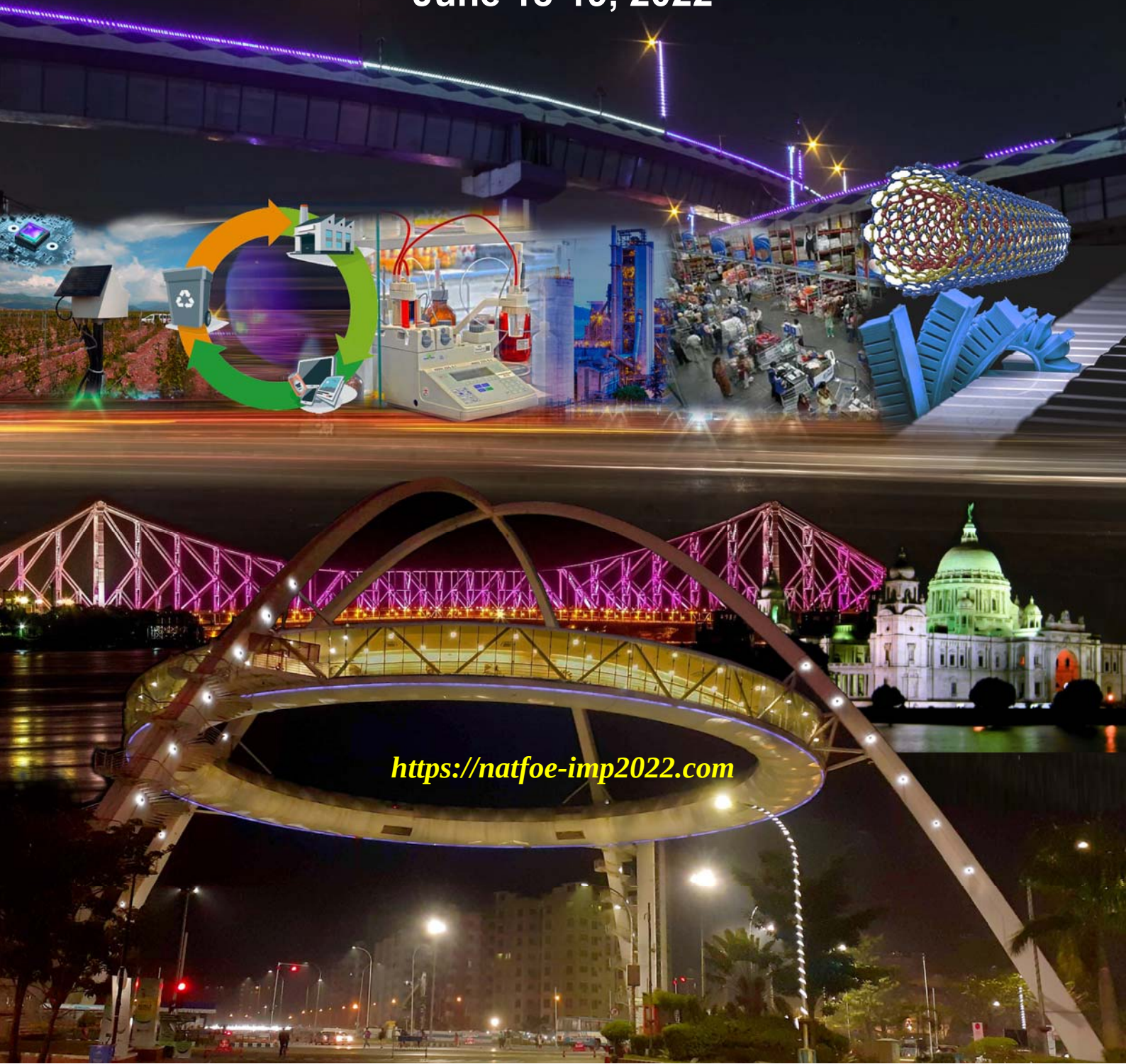
Azadi Ka Amrit Mahotsav

Indian National Academy of Engineering (INAE)
and
Jadavpur University
Present

16th National Frontiers of Engineering (NatFoE) Symposium

June 18-19, 2022



https://natfoe-imp2022.com

16th National Frontiers of Engineering (NatFoE) Symposium

June 18-19, 2022

Abstract Booklet

Venue: Jadavpur University
Salt Lake Campus
LB 8, Sector 3
Kolkata 700106

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MESSAGE

President, INAE

It is heartening to note that the 16th National Frontiers of Engineering Symposium (NatFoE) is being held at Jadavpur University on June 18-19, 2022 in association with IIT Kharagpur. This Symposium was launched by the INAE in 2006 as one of its annual flagship events. It brings together young engineers from industry, academic institutions and R&D Labs on a common platform with a view to deliberate upon emerging trends of research and cutting-edge technologies in selected engineering fields of topical interest. The objective of the Symposium is to highlight relevant technology challenges and identify the gaps and possible strategies to derive realistic solutions.

I am delighted that the 16th NatFoE Symposium will feature four specific themes viz (i) Field-Deployable Miniaturized Sensors, (ii) Waste Valorization and Circular Economy, (iii) Resource Constrained Translational Technologies, and (iv) Nanostructured Surfaces for Functional Materials and Systems and a dedicated special Session to celebrate 75th Year of Independence (*Azadi ka Amrit Mahotsav*). These themes are globally relevant. I am sure that the professionals from academia and industry in India participating in this event will derive significant benefit. I am happy to note that this Symposium will be followed by a one-day National Workshop on Innovation in Manufacturing Practices (IMP 2022) at Jadavpur University, Kolkata on June 20, 2022 to provide a platform for engineering students and start-ups to compete in an All India Contest and showcase innovations in the manufacturing sector.

I am confident that the Symposium will provide an excellent opportunity for sharing of novel ideas and pave the way for collaborative research between brilliant young engineers and researchers from different sectors.

On behalf of INAE, I sincerely thank Professor Amitava Dutta and his team for their untiring efforts in ensuring the timely organisation of the event in physical mode. The organizers have made praiseworthy efforts in meticulously putting together a thoughtful program and ensuring the pleasant stay of all delegates. I wish the 16th National Frontiers of Engineering Symposium all the success and hope that the delegates will have fruitful deliberations and an enjoyable stay at Kolkata.

Jai Hind!

(Indranil Manna)

31st May 2022

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MESSAGE

Vice-president, INAE

I extend warm welcome to all the speakers, participants, Fellows and Young Associates of INAE to the 16th National Frontiers of Engineering (NatFoE) Symposium to be held on 18-19th June 2022 and to the national level competition on Innovations in Manufacturing Practices (IMP) to be held on 20th June 2022. This year these two annual events of INAE are organized by Jadavpur University with active collaboration of IIT Kharagpur in NatFoE.

INAE launched the National Frontiers of Engineering (NatFoE) Symposium in 2006 as its annual flagship event. The aim of this symposium is to bring together about fifty outstanding young engineers and technologists from industry, universities, and research labs to discuss leading-edge research and technical works on four themes chosen every year. The four topics chosen for NatFoE-2022 are very relevant to the present day needs of our country and sixteen outstanding young engineers from all corners of the country will present their works on the four themes. Four eminent speakers will give plenary talks on the chosen themes, which will add great value to the symposium. There is a special session on "Azadi ka Amrit Mahotsav" to celebrate the 75th year of independence of our nation, wherein four innovators will talk about their innovations. More than 20 young participants from various regions of India will not only take active part in the deliberations of the symposium but also make poster presentation on their technical works. A special pre-dinner talk has been arranged on 18th June 2022, which will be given by an outstanding engineering educator.

INAE launched IMP as a platform to enable engineering students at UG and PG levels to take part in a national level competition and showcase their innovative ideas, the scope of which was later extended to include Start-ups of India into this competition. This year large number of entries were received against the call for participation, out of which 18 have been selected by an eminent panel of juries to make final presentation on 20th June 2022.

I take this opportunity to convey my sincere thanks to Jadavpur University to host these two flagship events of INAE and to IIT Kharagpur for collaborating to make NatFoE-2022 a success. I also express my thanks to S.N.Bose National Centre for Basic Sciences, Kolkata, for providing logistic support in organizing these events. My wholehearted thanks to the Coordinator of NatFoE-2022 along with the four theme conveners and the IMP-2022 convener for their immense efforts to put together impressive and imaginative programs.

I look forward to two days of illuminating talks and thought-provoking discussions during the NatFoE-2022 and a day long stimulating presentations by students and start-ups during IMP-2022.

With very best wishes for NatFoE and IMP 2022.

Jai Hind!

(Sivaji Chakravorti)

31st May 2022

যাদবপুর বিশ্ববিদ্যালয়

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OFFICE OF THE VICE-CHANCELLOR : AUROBINDO BHAVAN ANNEXE

MESSAGE

I congratulate the concerned colleagues of my University for taking the responsibility of organizing the 2022 National Frontiers of Engineering Symposium. I also record my personal and the University's gratitude to the Indian National Academy of Engineering (INAE) for reposing faith on Jadavpur University for hosting its annual flagship program that provides an opportunity of bringing together the country's distinguished engineers and technologists across disciplines. I am sure this national event would leave its mark on the teaching-learning process in engineering and technological sciences.

It is indeed a matter of pride that compared to the countries which won independence at the same time we did, our country has contributed significantly to the development and enrichment of the global knowledge on science and technology. India has not only enriched the world's received wisdom on technology and engineering sciences, but has also enormously contributed to the diversification of the existing and received expertise in this realm. I hope the national symposium will not only fruitfully deliberate on this aspect of India's attainments, but will also discuss ways the nation can move forward to use science and technology in making India a better place to live in. This dimension acquires a particular significance for the Symposium's session on "*Azadi ka Amrit Mahotsav*", and I am particularly happy that this session is being orgnanized. In this context, it is pertinent to address such questions as: to what extent the tremendous developments of India's science and technology have been able to improve the livelihood of the common people; have we been able to realize in practice the maxim of laboratory to land and land to the laboratory; to what extent our knowledge of science and technology is contributing towards the creation of a balance between economic growth and maintenance of environmental balance. I hope these issues will find a space during the deliberations of the Symposium.

I take this opportunity of welcoming the participants and INAE dignitaries to our University campus. I wish the Symposium every success.

Suranjan Das.

Suranjan Das.

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Organizing Team

Adviser: Prof. Sivaji Chakravorti, *FNAE*, Jadavpur University

Coordinator: Prof. Amitava Datta, *FNAE*, Jadavpur University

Theme Conveners: Prof. Ranjan Ganguly, Jadavpur University

Prof. Achintya Mukhopadhyay, Jadavpur University

Prof. Rajib Bandyopadhyay, Jadavpur University

Prof. Samit K. Ray, *FNAE*, IIT Kharagpur

Organizing Team: Prof. Apurba Kumar Santra (Convener), Jadavpur University

Dr. Sourav Sarkar, Jadavpur University

Dr. Aranyak Chakravarty, Jadavpur University

Dr. Mithun Das, Jadavpur University

Editor: Prof. Biswendu Chatterjee, Jadavpur University

Program

Day 1:	18th June, 2022	
9:30 AM	**Registration**	
10:00 AM – 11:00 AM	**Inaugural Session**	
	Welcome Address	Prof. Sivaji Chakravorti *Vice-president*, INAE
	Presidential Address	Prof. Indranil Manna *President*, INAE
	Address by the Chief Guest	Prof. Ashutosh Sharma *Institute Chair Professor*, IIT Kanpur & *Former Secretary*, Department of Science and Technology
	Vote of Thanks	Prof. Amitava Datta *Symposium Coordinator*
11:00 AM – 11:30 AM	**Tea Break**	
11:30 AM – 1:30 PM	**Session 1:** **Field-deployable Miniaturized Sensors (Theme: 1)**	
	Session Convener: Prof. Ranjan Ganguly, Jadavpur University	
	Plenary Speaker: Dr. Dhananjaya Dendukuri, Achira Lab, Bengaluru Title: *Rapid Advances in Point-of-care Testing Through Microfluidic Technologies, in a Post COVID World*	
	Invited Speakers: 1. Dr. Pallab S. Mahapatra, IIT Madras Title: *3D Paper-based Milk Adulteration Detection Device* 2. Dr. Pranab K. Mandal, IIT Guwahati Title: *Low-cost POC Devices for Detection of Vitamin D-deficiency in Blood* 3. Dr. Shrutidhara Sarma, IIT Jodhpur Title: *High-performance Miniaturized Physical Sensors Based on Nano-composite Materials and Nanostructures* 4. Dr. Dibyendu Das, IISER Kolkata Title: *Short Peptide-based Nanostructures as Micro-swimmers for Potential Biosensor Applications*	
1:30 PM – 2:30 PM	**Lunch**	
2:30 PM – 3:30 PM	**Poster Session** for the young participants	
3:30 PM – 5:30 PM	**Session 2:** **Waste Valorization and Circular Economy (Theme: 2)**	
	Session Convener: Prof. Achintya Mukhopadhyay, Jadavpur University	
	Plenary Speaker: Prof. M.R. Ravi, IIT Delhi Title: *Biomass Gasification – Science, Technology and Applications*	
	Invited Speakers: 1. Dr. Ravikrishna Vinu, IIT Madras Title: *Hydrothermal Liquefaction of Diverse Feedstocks for Sustainable Solid Waste Management and Energy Production in the Indian Context* 2. Dr. Jayakrishna Kandasamy, Vellore Institute of Technology Title: *Waste Valorization in a Circular Symbiotic Network* 3. Dr. Papita Das, Jadavpur University Title: *Circular Economy on Utilization of Waste Biomass in Pollution Control and Energy Generation* 4. Dr. Amit Arora, IIT Bombay Title: *Green Biorefineries Towards Circular Economy: In Search of Healthy Alternative*	
5:30 PM – 5:45 PM	**Tea Break**	
7:00 PM	**Symposium Special Lecture:** (*Venue*: Nicco Park Auditorium) Prof. P.P. Chakrabarti, *Former Director*, IIT Kharagpur	
8:00 PM	**Symposium Dinner** (*Venue*: Nicco Park)	

Program

Day 2:	19th June, 2022
9:30 AM – 11:15 AM	***Azadi Ka Amrit Mahotsav***
	Invited Speakers:
	1. Prof. Samir K. Pal, S.N. Bose Centre for Basic Science, Kolkata Title: *Probing Crucial Interfacial Dynamics of Nanohybrids for Emerging Biomedical Functionalities* 2. Prof. Avinash K. Agarwal, IIT Kanpur Title: *Future Prospects of Internal Combustion Engines in a Green and Environmental Friendly and Methanol Economy* 3. Dr. Mahati Chittem, IIT Hyderabad Title: *Understanding Difficulties in Performing Medical Procedures in the Hospital Setting: A Qualitative Study* 4. Mr. Rashid K., Genrobotic Innovations Title: *Empowering Society Through Technology*
11:15 AM – 11:30 AM	**Tea Break**
11:30 AM – 1:30 PM	**Session 3**: **Resource-constrained Translational Technology (Theme: 3)**
	Session Convener: Prof. Rajib Bandyopadhyay, Jadavpur University
	Plenary Speaker: Dr. Arpan Pal, TCS Research Title: *Device Edge Computing – Towards Frugal Intelligent Systems*
	Invited Speakers:
	1. Dr. S. Kumaravel, NIT Calicut Title: *Opportunities and Constraints in the Translation of Academic Research into a Product Development* 2. Dr. Debangshu Dey, Jadavpur University Title: *Synergism of Signal Processing and Machine Learning Tools for Condition Monitoring Applications of Electrical Equipment* 3. Dr. Sri Krishna Kumar, IIT Kharagpur Title: *Industrial IOT Integrated with Simulation to Support Real-time Decision Making for Manufacturing Efficiency* 4. Dr. Chirasree Roy Chaudhuri, IIEST Shibpur Title: *Electrical Biosensors Operating in Complex Biological Fluids for Resource Limited Environment*
1:30 PM – 2:30 PM	**Lunch**
2:30 PM – 4:30 PM	**Session 4**: **Nanostructured Surfaces for Functional Materials and Systems (Theme: 4)**
	Session Convener: Prof. Samit Kumar Ray, IIT Kharagpur
	Plenary Speaker: Prof. Suman Chakraborty, IIT Kharagpur Title: *Liquid Infused Slippery Surfaces: From Fabrication to Functionalities*
	Invited Speakers:
	1. Dr. Ritesh Kumar, CSIO-CSIR, Chandigarh Title: *Understanding Olfactory Spaces: A Journey from Molecule to Machine Learning and Instrumentation* 2. Dr. Sayan Bayan, Rajiv Gandhi University, Arunachal Pradesh Title: *Functionalized Graphitic Carbon Nitride (g-C_3N_4) Nanosheets for Flexible and Wearable Triboelectric Nanogenerators (TENG)* 3. Dr. Gururaj Telasang, ARCI Hyderabad Title: *Multifunctional Surfaces Using Femtosecond Laser Surface Texturing and Coatings*
4:30 PM – 4:45 PM	**Tea Break**
4:45 PM – 5:30 PM	**Valedictory Session**

Plenary Lectures

Rapid Advances in Point-of-Care Testing Through Microfluidic Technologies, in a Post COVID World

Dhananjaya Dendukuri

Achira Labs, Bangaluru

Abstract:

In the post COVID world, microfluidic technologies are poised to revolutionise point-of-care medical diagnostic testing. They provide multiple benefits such as sample and reagent volume reduction, multi-parameter analysis, automated and rapid workflow and low footprint. In India, small pathology labs, doctor's offices and home testing could benefit from these technologies through instant results for infectious disease testing as well as reduce errors due to degradation or mis-labeling of samples. Further, point-of-care instruments allow for testing in doctor's office and in many remote settings which are not covered by the current centralized model, thus improving the overall health of our communities. Achira Labs has pioneered the development of an immunoassay platform using the many advantages of microfluidics. The first test panels developed include thyroid and fertility panels and have been validated against gold-standard commercial technologies. The talk will cover advances in microfluidics and point-of-care testing using Achira's technology as a case-study.

Brief Bio-sketch:

Dr. Dhananjaya Dendukuri is the Chief Executive Officer & Co-Founder of Achira Labs, a pioneering point-of-care technology company based out of Bangaluru. Dhananjaya returned to India with his passion for engineering and belief that technology development for underserved markets must be done locally. Starting from his early career experience as a lab scientist and R&D manager (with over 30 publications and 7 issued patents), he now has more than a decade of experience with the fund-raising, commercial, operational and regulatory aspects of building and taking diagnostic technologies to market. He has received the National Technology Award for new technologies (biotechnology) in 2016 and MIT Technology Review's prestigious TR35 awards in India for the work that was being done at Achira. Dhananjaya serves on the jury of the Infosys Prize and the X-prize for diagnostics. He received his Ph.D in Chemical Engineering from MIT and MASc in Chemical Engineering from the University of Toronto and a B.Tech in Chemical Engineering from the Indian Institute of Technology, Madras.

Biomass Gasification – Science, Technology and Applications

M. R. Ravi

Department of Mechanical Engineering, Indian Institute of Technology Delhi

Abstract:

Conversion of biomass into clean energy is often achieved by first converting it into a clean gaseous fuel and subsequently using it for applications that need a clean fuel, such as internal combustion engines. Biomass gasification is the thermochemical route to such conversion, and has been demonstrated to be a reliable and scalable technology for applications of small to medium sizes – a few kW to a couple of MW. The talk will dwell on the basic science of gasification, and discuss the translation of the science to working technology. In fact, this is another example where technology preceded science – just as in the case of many energy conversion technologies. The talk would throw light on technologies that exist commercially today for biomass gasification for various applications. Fixed bed gasification has been established as a robust technology, and downdraft gasification has been demonstrated to be reliable to generate engine-worthy clean producer gas, as early as during the times of World War II – and perfected in the past 3-4 decades. The talk would discuss design features of downdraft gasifiers, and some work on simulating such gasifiers done by the author's group would be presented. The talk would end with the outlook for such technologies to benefit climate concerns such as crop residue-burning in northern India and energy security for village industries.

Brief Bio-sketch:

Prof. M. R. Ravi is a Professor in the Department of Mechanical Engineering at IIT Delhi, where he has been a faculty member since 1996. He obtained his Bachelors in Applied Science from University of Madras and Master of Engineering and PhD from Indian Institute of Science, Bangalore. Prior to joining IIT Delhi, Prof Ravi held research positions at TU Delft and Chercheur Associé, Laboratoire FAST, CNRS, Orsay, France and was a faculty member at IIT Bombay. His research areas include heat transfer, computational fluid dynamics, combustion, biomass energy, rural energy systems. He is currently involved in a number of projects which include Combustion characteristics of gaseous fuel mixtures, measurement of burning velocity of such mixtures, to investigate the effect of composition and equivalence ratio on burning velocity and stability regimes of flame. Computational simulation of open flames of such mixtures to study the effects of stretch field and preferential diffusion effects on the stability regimes; development and investigation of biomass gasification and combustion systems, with specific interest in small scale (≤20 kW) systems for thermal and electrical applications, and powdery biomass based systems; energy audit of rural industrial systems such as pottery kilns, soap stoves, smithy kilns etc. with an objective of fuel savings in such systems by applying basic principles of heat transfer and combustion and development of energy-efficient alternatives for such systems.

Device Edge Computing – Towards Frugal Intelligent Systems

Arpan Pal

Distinguished Chief Scientist, TCS Research

Abstract:

In this talk I will introduce Device Edge Computing as one of the means for creating frugal Intelligent Systems leading towards AI-driven IoT (AIOT). I will cover some application and case studies in different business domains like manufacturing, healthcare, wellness, oil and gas, space-tech etc. I will also introduce some tools and techniques like signal processing driven AI, network architecture search, auto-pruning etc. to convert large-AI models suitable for cloud to tiny-AI models suitable for frugal, resource constrained edge devices. Finally I will conclude with introduction to some futuristic technologies in this space, like neuromorphic computing, metamaterials and nano-sensing systems.

Brief Bio-sketch:

Dr. Arpan Pal has more than 30 years of experience in the area of Intelligent Sensing, Signal Processing & AI, Edge Computing and Affective Computing. Currently, as Distinguished Chief Scientist and Research Area Head, Embedded Devices and Intelligent Systems, TCS Research, he is working in the areas of Connected Health, Smart Manufacturing, Smart Retail and Remote Sensing.
He is on the editorial board of notable journals like ACM TECS, Springer SNCS and is on the TPC of notable conferences like ICASSP and EUSIPCO. He has filed 180+ patents (out of which 95+ granted in different geographies) and has published 160+ papers and book chapters in reputed conferences and journals.
He has also written two complete books on IoT and Digital twins in Manufacturing. He is on the governing/review/advisory board of some of the Indian Government organizations like CSIR, MeitY, Educational Institutions like IIT, IIIT and Technology Incubation centres like TIH.
Prior to joining TCS, Arpan worked for DRDO, India as Missile Seeker Scientist and in Rebeca Technologies as Head of Real-time Systems. He is a B.Tech and M. Tech from IIT, Kharagpur, India and PhD. from Aalborg University, Denmark.

Liquid Infused Slippery Surfaces: From Fabrication to Functionalities

Suman Chakraborty

Department of Mechanical Engineering, Indian Institute of Technology Kharagpur

Abstract:

Obtaining no-maintenance, self-healing and long-lasting surface finish is a panache for surface engineering, not only because of aesthetics, but also to meet the desirable functionalities of the concerned products. Liquid infused slippery surfaces (LISS) have shown great promises in this regard. However, retaining the desired stability of the infused slippery layer at extreme conditions when other engineering alternatives would invariably fail remains to be one of the underlying challenges and opportunities at the same time.

The aim of this talk is to delve with some fundamental scientific and technological issues concerning the stabilization dynamics of liquid infused slippery interfaces*. It is shown that a solid surface that otherwise dewets spontaneously can be stabilized to form a LISS film by harnessing rose-petal mimicking microstructures.* LISS on a copper plate with silicone oil as the lubricating liquid is shown to repel low surface tension liquids even at high temperature. For drops impinging on LISS, it is found that the lubricating layer viscosity orchestrates an under-damped oscillation during the later transients. Finally, a liquid infused slippery interface on cellulose filter paper is shown to be highly durable, offering self-propelling features of soft moieties having emerging applications in energy harvesting and medical diagnostics.

Brief Bio-sketch:

Prof. Suman Chakraborty is a Professor at IIT Kharagpur and Sir J. C. Bose National Fellow. His current areas of research include microfluidics, nanofluidics, micro-nano scale transport. He has been awarded the Bhatnagar Prize and elected as a Fellow of the American Physical Society, Fellow of the Royal Society of Chemistry, Fellow of ASME, Fellow of all the Indian National Academies of Science and Engineering, recipient of the G.D. Birla Award for Scientific Research, National Academy of Sciences India – Reliance Industries Platinum Jubilee Award for Application Oriented Research, IIT Roorkee Research Award, Rajib Goyal Prize for Young Scientists, Indo-US Research Fellowship, Scopus Young Scientist Award, and Young Scientist/Young Engineer Awards from various National Academies of Science and Engineering. He has also been a Humboldt Fellow. He has a large volume of impactful publications as well as patents/licensed technologies and a unique expertise in technology development for the under-served.

Theme:

Field-deployable Miniaturized Sensors

Keynote Lectures

3D Paper-based Milk Adulteration Detection Device

Pallab Sinha Mahapatra
Department of Mechanical Engineering, Indian Institute of Technology Madras

Abstract:

Due to the high demand and limited supply, milk adulteration is widespread in developing countries. In this study, a low-cost, simple-to-use device is developed using the colorimetric approach to detect food adulterants instantly. The developed 3D paper-based microfluidic device can simultaneously detect several contaminants by utilizing a tiny volume of the liquid food sample (say milk).

The developed device has been successfully tested to detect common adulterants in liquid food in a single test (as defined by the Food Safety and Standard Authority of India, FSSAI). Seven adulterants are detected in milk samples simultaneously with high specificity evaluation and detailed color interference analysis. This proposed device outperforms the other alternatives in terms of cost, sample volume, detection time, energy usage, weight, and other factors. In any resource-constrained scenario, this cheap, portable, and user-friendly 3D microfluidic device can be used to analyze liquid foods before consumption.

Brief Bio-sketch:

Dr. Pallab Sinha Mahapatra is an Assistant Professor in the Department of Mechanical Engineering, IIT Madras. He received his Ph.D. and B.E. from the Department of Mechanical Engineering, Jadavpur University, in 2014 and 2007, respectively. He also had postdoctoral research experiences from the University of Illinois at Chicago (UIC). His primary research encompasses interfacial flows, wettability engineering, collective dynamics, and energy systems. He is a recipient of the ISEES Young Scientist Award, SERB Early Carrier Research Award (ECRA), Institute Research and Development Award (IRDA), etc. Dr. Pallab has more than 50 international journal publications and five invention disclosures.

Low-cost POC Devices for Detection of Vitamin D-deficiency in Blood

Pranab K. Mondal

Department of Mechanical Engineering, Indian Institute of Technology Guwahati

Abstract:

Increase in chronic diseases made researchers realize that not only Vitamin-D deficiency affects the bone health but it also aggravates cancer and cardiovascular diseases. Ongoing regulations suggest that 25-hydroxyvitamin D values <12 ng/mL (30 nM) are associated with an increased risk of rickets/osteomalacia, whereas in the healthy general population, 25-hydroxyvitamin D concentrations between 20 and 50 ng/mL (50 to 125 nM) appear to be safe and sufficient for skeletal health. Lateral flow assay plays an important role in analytical sciences due to some exceptional capabilities like sensitivity, specificity, low cost, compact size and user-friendly operation. The proposed prototype, as demonstrated below, is based on the principle of competitive immunoassay in which labelled antibodies after binding with analyte (here Vitamin D3) flows laterally towards the test line for competitive binding with the immobilized vitamin D3. Quantification is done based on the colorimetric signal difference between the test line and the control line. One of the clear benefits of this immunoassay is the 'sample-in-answer-out' system, in which the input is whole/minimally blood and the output is a qualitative or quantitative diagnosis of biomarkers of disease or bio-analyte of interest.

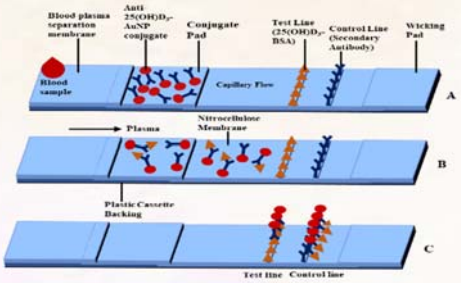


Fig.1.Competitive Immunoassay on Lateral flow chip.

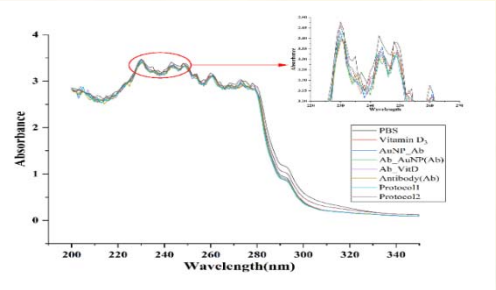


Fig.2. UV-Vis spectra of the immunoassay protocol followed on

Brief Bio-sketch:

Dr. Pranab K. Mondal completed his PhD in 2015 from IIT Kharagpur and presently working as an Associate Professor in Mechanical Engineering Department at IIT Guwahati, India. His research interests are Eletrokinetics, Multiphase Microscale Transport, Magnetofluidics, and development of Lateral Flow Assays. Dr. Mondal has published more than 100 papers in different Journals of international repute and conferences. Dr. Mondal completed a few sponsored research projects, and has been involved with several ongoing projects related to the development of small-scale devices towards attaining several augmented fluidic functionalities. The research work from his group towards the 'development of lab-on-a-chip device for splitting droplet using magnetic field' has led to patent. Dr. Mondal has received a few academic awards.

High-performance Miniaturized Physical Sensors Based on Nanocomposite Materials and Nanostructures

Shrutidhara Sarma

Department of Mechanical Engineering, Indian Institute of Technology Jodhpur

Abstract:

Polymer-based composites have exhibited great potential in the field of miniaturized flexible physical sensors. However, developing flexible sensors having high sensitivity to stimuli, fast response time, low power consumption and multi-directional sensing simultaneously still remains a challenge. Compatible fillers, when used in appropriate concentration can bring significant changes in sensor's performance. Nonetheless, polymer-filler compatibility, uniform dispersion of fillers within the polymer matrix, and their alignment are certain factors that determines the sensor's performance. Similarly, by changing the structural hierarchy of the sensing material the sensor response can be tuned. At FERN lab, we design and fabricate high performance and mechanically robust physical sensors based on novel nanocomposites with applications in wearable sensors for health monitoring, energy-saving devices, and smart structures. We investigate novel nanocomposite materials, strive to understand their structure-property relationships, optimize sensing properties using micro/nano-structures, and design and fabricate sensors having superior sensitivity, wider sensing range and smaller response times etc. Besides, we also seek for compatible fabrication techniques that can bring down the cost of production and offers opportunities for mass production. Our current projects focus on developing flexible temperature and strain sensors from highly conductive nanocomposite fibres by wisely embedding both metallic and carbonaceous nanofillers in polymer matrix to exploit their combined advantages without sacrificing their individual ones. Our research is interdisciplinary, combining advanced research fields from material science to manufacturing and applied engineering and taking a multidimensional approach we aim to deliver solutions to develop high performance flexible sensors.

Brief Bio-sketch:

Dr. Shrutidhara Sarma is an Assistant Professor at IIT Jodhpur in the Department of Mechanical Engineering. Prior to joining IITJ, she was a post-doctorate fellow in South Korea and a Marie Curie Summer School fellow at Cardiff University, UK. She holds a PhD in Thin film sensors from IIT Guwahati and Aristotle University of Thessaloniki, Greece as an Erasmus Mundus fellow. She was awarded the Gold Medal during her B. Tech by Tezpur University in 2012 and the summer research fellowship by Indian Academy of Sciences in 2010. Her research interests are highly interdisciplinary and her works in the field of thin films, layered nanocomposite materials and sensors have been published in several reputed international journals and conferences. Besides academics, she is also an excellent performer of music. She holds a gold medal in national level tabla competition and is a certified graded artist of All India Radio, Guwahati. She had previously represented India in Japan through the Jenesys 2.0 program.

Short Peptide-based Nanostructures as Microswimmers for Potential Biosensor Applications

Dibyendu Das

Department of Chemical Sciences, Indian Institute of Science Education and Research Kolkata

Abstract:

The nanomotor chassis constructed from biological precursors and powered by biocatalytic transformations can access intelligent properties [1-3]. In this context, we developed cross-β amyloid based nanomotors (amylobots) from short amyloidogenic peptide sequences [1-3]. Importantly, motile soft nano constructs were exploited to feature navigational ability through a synergistic action of two orthogonal bio-engines (enzymes), emulating the advanced traits of bacterial motility. The design principle demonstrated the enhanced diffusivity of urease with increasing fuel concentration (urea) and chemotactic motility of cytochrome C towards the chemical cue (substrate). Further, the dual catalytic engines allowed the amylobots to be utilized for enhanced catalysis in organic solvent, a critical advantage for technological applications of the biocatalysts. In addition, utilizing a complex divergent cascade, we further exploited the catalytic potential of cross-β amyloid nanotubes to develop motile fluorescent microswimmers. The short peptide-based paracrystalline nanostructures featured cascade-driven microscopic motility. Moreover, fluorescent microswimmers exploited the orthogonal properties through a divergent cascade network, thus foreshadowing the complexities of extant biology and with the possibility of sensing analytes in complex mixtures.

Reference:

1. Baishakhi et al *J. Am. Chem. Soc.* 2020, *142*, 4098-4103.
2. Nidhi et al *Angew. Chem. Int. Ed.* 2015, *54*, 6492-6495.
3. Chatterjee et al *Angew. Chem. Int. Ed.* 2021, *60*, 202-207.

Brief Bio-sketch:

Dr. Dibyendu Das is an Associate Professor in the Department of Chemical Sciences at IISER Kolkata. Dr. Das received his PhD in Supramolecular Chemistry at Indian Association for the Cultivation of Science and postdoctoral training at Emory University, USA. From Jan 2017, his lab at IISER Kolkata is actively working in the field of systems chemistry, driven self-assembly and creating living matter-like objects. He has received several awards, including the Swarnajayanti Fellowship in Chemical Science 2020, DST, Govt. of India, Indian Peptide Society-Young Scientist Award (IPS-YSA) for Excellence in Peptide Research 2021, CRSI Young Scientist Award 2021 and Associate of the Indian Academy of Sciences 2019. He is also highly recognized through several distinctions like being featured in "75 under-50 scientists shaping today's India" compendium released by Ministry of Science &Technology, membership at the advisory boards of ACS Chemical Reviews, RSC-Materials Horizons, Wiley-Asian JOC 2020-21. His article was featured in the virtual issue of JACS Early Career Investigators as an outstanding work in 2020.

Theme:

Waste Valorization and Circular Economy

Keynote Lectures

Hydrothermal Liquefaction of Diverse Feedstocks for Sustainable Solid Waste Management and Energy Production in the Indian Context

R. VINU

Department of Chemical Engineering, Indian Institute of Technology Madras

Abstract:

Hydrothermal liquefaction (HTL) is a promising thermochemical conversion technique to process wet feedstocks. The products of HTL include organic bio-crude, biochar, and non-condensable gases. Compared to other waste-to-energy conversion processes like combustion, gasification and pyrolysis, HTL is a promising route as it does not involve drying of the feedstock for moisture removal, which is usually a costly operation. Although HTL is a reasonably established process in the laboratory in litre-scale to process few milligrams to grams of biomass, it is yet to be employed on a commercial scale to process huge quantities of diverse feedstocks.

HTL is an important process in the Indian context for municipal solid waste (MSW) management. Indian MSW is unique as it is a heterogeneous, unsegregated mixture of bio-organic and bio-inorganic wastes. In this presentation, I will describe our journey in developing HTL technology to convert a variety of feedstocks including biomass residues, micro/macro algae and MSW to fuels and energy. Through a series of well-designed experiments, we have determined the optimum process conditions to maximize the product yields and their quality. I will also discuss our approach to scale-up this process to clean the existing landfills, and the go-to-market strategy.

Brief Bio-sketch:

Dr. R. Vinu is currently an Associate Professor in Chemical Engineering Department at IIT Madras, Chennai. He also serves as the Solid Waste Management area co-ordinator of the Indo German Center for Sustainability (IGCS) at IIT Madras. He obtained Ph.D. in Chemical Engineering from Indian Institute of Science, Bangalore, in 2010. Prior to joining IIT Madras in 2012, he was a postdoctoral researcher in the Department of Chemical and Biological Engineering at Northwestern University, USA.

At IIT Madras, he leads an active research group that focuses on thermochemical conversion of a variety of feedstocks such as biomass, waste plastics, algae, municipal solid wastes and low-quality coals to liquid fuels and chemicals. He has demonstrated the use of low-power microwave-assisted pyrolysis technique for the production of liquid bio-oil, nanoporous biochar and carbon nanotubes from renewable and non-renewable feedstocks.

He has published over 120 scholarly research articles in various international journals and book chapters. He is the recipient of Young Engineer and Young Scientist Awards of prestigious academies and institutes like IEI, ICT Mumbai, INSA, NASI, IIChE, IAS Bangalore and IIT Madras. He also serves as the Editor of Advanced Powder Technology, and in the editorial board of Journal of Analytical and Applied Pyrolysis.

Waste Valorization in a Circular Symbiotic Network

Jayakrishna Kandasamy
School of Mechanical Engineering, Vellore Institute of Technology University, Vellore

Abstract:

With the rapid growth of global industrialization and urbanization, the consumption of critical resources and materials, such as energy, minerals, and water, is increasing at a rapid rate, adding more pressure on material resources. In addition, the massive consumption of materials and low production efficiency have resulted in wastage of resources and stern environmental impacts, affecting the sustainability of the planet. In the process of sustainability transformation, it is necessary to improve the resource efficiency through circular strategies and waste valorization. This lecture will focus on sharing the knowledge gained form our research conducted in a in a circular symbiotic network (CSN). The technological pathways and roadmap for achieving the sustainability development goals through circular strategies will also be discussed.

Brief Bio-sketch:

Dr. Jayakrishna is an Associate Professor in the School of Mechanical Engineering at the Vellore Institute of Technology University, India. Dr. Jayakrishna's research is focused on the design and management of manufacturing systems and supply chains to enhance efficiency, productivity and sustainability performance. His more recent research is in the area of developing tools and techniques to enable value creation through sustainable manufacturing, including methods to facilitate more sustainable product design for closed-loop material flow in industrial symbiotic setup, and developing composites for orthopaedic bone plate and high temperature composites.
He has mentored 2 doctoral students, 2 post graduate and 31 undergraduate students which have so far led to 70 journal publications in leading SCI/SCOPUS Indexed journals, 29 book chapters, and 96 refereed conference proceedings, 7 books in CRC/Springer Series with total citation of 1569, h-index of 17 and i10-index of 28. Jayakrishna has received numerous awards in recognition for the quality of the work that has been produced. He has been awarded Global Engineering Education Award from Industrial Engineering and Operations Management (IEOM) Society International, U.S.A. in 2021, Institution of Engineers (India)-Young Engineer Award in 2019 and Distinguished Researcher Award in the field of Sustainable Systems Engineering in 2019 by International Institute of Organized Research, Best Faculty Researcher Award for the year(s) 2016 to 2021 consecutively. He is the coordinator of Circular Economy Club, VIT University. He is also the Academic Editor – Mathematical Problems in Engineering, Wiley-Hindawi Publications and Editorial Board Member – Journal of Operational Research for Engineering Management Studies (JOREMS), Area Editor – Operations Management Research, Associate Editor – Circular Economy, Frontiers in Sustainability, Review Editor – Sustainable Manufacturing, Frontiers in Manufacturing Technology, and Book Series Editor -Industrial Engineering, Systems, and Management, CRC Press. He has nearly 9 years of teaching experience in addition to about 1.5 years of industrial and 3 year of research experience.

Circular Economy on Utilization of Waste Biomass in Pollution Control and Energy Generation

Papita Das

Department of Chemical Engineering and School of Advanced Studies in Industrial Pollution Control Engineering, Jadavpur University, Kolkata

Abstract:

Agricultural biomass, specifically lignocellulosic biomass has the potential of contributing a lot to the global economy. Compared to fossil fuels biomass provides sustainable, greener and cleaner energy options. Lignocellulosic biomass has the potential to be used for the development of various value-added products. Lignocellulosic biomass can be broken down into sugars for their conversion into biofuels and bio products like alcohols, organic acids and hydrocarbons by the use of microorganisms, enzymes and catalysts. Lignocellulosic biomasses itself have their own unique properties. They are themselves natural polymers. Thus, various polymers and its composites could be synthesized from them. The cellulose, when obtained from any lignocellulosic material, can be converted into nano-cellulose. Moreover, from cellulose and hemicellulose phenol, furfural, succinic acid, levulinic acid can be obtained. Thus, these biomass utilization processes can be planned together, and diverse products and applications can be obtained from lignocellulosic biomasses, forming a circular economy when applied industrially, These waste materials may also be used for reducing pollutants present in wastewater.

Brief Bio-sketch:

Prof. Papita Das has expertise in highly topical domains of environmental chemical engineering. The research done in her laboratory addresses known and emerging environmental concerns that continue to plague us, with an emphasis on clay-based liner materials, nano-particles, bio-polymeric film for the clean-up of contaminated soil, water and other environmental compartments. Over the years, her research team has made notable contributions on several key areas related to "Environmental Sustainability", which have been recognized with awards in recent years, for example, World Ranking amongst the top 2% Scientist in the year 2020 and 2021, published by Stanford University in the field of Chemical Engineering, which is based on career-long impact. The list represents the top 2% the most–cited scientists in various discipline (where Dr. Das ranks 614 among 55697 researchers in 2021, 534 among 66189 researchers in the field of Chemical Engineering based on career long impact in 2020 and 217 for single year 2020). She has also received the 8th National Award for Technology Innovation by Department of Chemicals and Petrochemicals, Govt. of India in 2018, Woman Scientist – 2012 by The Biotech Research Society of India in 2013 and the Malaviya Memorial Award (Young Faculty Category) by The Biotech Research Society of India on 2016. Further, her research has produced over 170 International Journal publications, 40+ Book Chapters, 12 Books, 2 Book Editors and 100+ Conference which have been well received by the global scientific community through citations (h index 41, citations 7702). She has served as editor of Current Indian Science - Chemical Engineering Division, editorial board member of Bioresources & Bioprocessing and editor of the books titled "Recent Trends in Waste Water Treatment and Water Resource Management", "Advances in oil-water separation: A complete guide for physical, chemical, and Biological processes " associate editor of Frontiers in Chemical Engineering (Environmental Chemical Engineer), 2021, Frontiers in Nanotechnology (Environmental Nanotechnology), 2021, Chemical Science & Engineering Research 2021. She is also an ex-editorial board member of International Journal "HELIYON" and member of various committees of Pollution Control Board, West Bengal.

Green Biorefineries Towards Circular Economy: In Search of Healthy Alternatives

Amit Arora

Centre for Technology Alternatives for Rural Areas (CTARA), Indian Institute of Technology Bombay

Abstract:

The processing waste generated from industries globally account for an average of 1.5 billion tonnes. India is the one of the largest producers of fruits and vegetables in the world with an annual production of around 250 million tonnes. The quantity of horticultural processing waste (HPW) coming from agro processing industries is quite significant. Fruits such as banana, mango, citrus, pomegranate, pineapple, etc. on processing generate waste which is as large as 30-50% of the fruit. The by-products from these industries have high moisture content and are thus prone to microbial spoilage. Most of the processing waste ends up going to dumping yards. The growing need for 'natural products' and the presence of useful bioactive compounds in HPW, defines a converging scope for value addition of the waste. The HPW may serve as an alternative source for recovery of bioactive compounds (Pectin, peptides, carbohydrates, proteins, lipids, and polyphenols) which are highly valuable ingredients for food and pharma applications.

In our lab, my research group is focusing on developing processes to extract high value products in close association with the principles governing the concept of Green Chemistry, which are mainly aimed to reduce wastes and to promote a more efficient use of energy and resources. The growing need for 'natural products' and the presence of useful bioactive compounds in fruit processing waste defines a converging scope for value addition of the waste and generate high value products. Also, converting a renewable non-fossil carbon to multiple value added products in an integrated biorefinery model would assure a continual energy and material supply. Over the longer term, opportunities for “bolting-on” such technology to existing biorefineries, or constructing new greenfield developments, would provide important revenue diversification.

Brief Bio-sketch:

Dr. Amit Arora is Professor at Centre for Technology Alternatives for Rural Areas (CTARA) at IIT Bombay. Before joining IIT Bombay in Jan 2013, Amit worked as an Assistant Professor at University of Wisconsin for 2.5 years. He has obtained his Ph.D degree in Agricultural and Biological Engineering from University of Illinois, Urbana-Champaign, USA and Masters from Indian Institute of Technology Kharagpur, India. Dr. Arora has also worked as a Postdoctoral research associate at University of Illinois-Urbana-Champaign and Wisconsin Institute for Sustainable Technologies, USA. His research activities include Integrated biorefinery to produce biofuels and biochemicals from food processing waste, functional foods and nutraceuticals, technology development for perishables storage, and child and maternal health and nutrition

Theme:

Resource-constrained Translational Technology

Keynote Lectures

Opportunities and Constraints in the Translation of Academic Research into a Product Development

Kumaravel S.

Department of Electrical Engineering, National Institute of Technology Calicut, Kerala

Abstract:

Efforts are taken by researchers throughout the world to develop different technologies for the better lifestyle of the mankind. Most of the research problems addressed by the researches are narrowed research topic and depth to the concepts of Engineering and Technology. As an outcome of the PhD, most of the strategic solutions proposed by the researchers are novel in the state of art. However in the present research scenario, most of the academic researchers transpire the publications of research articles in the SCI journals or in the conferences. A product-level development or a patent is materialized as an outcome of very few PhDs.

A wide gap exists between the researchers and the power industries to translate the novel concepts or solutions proposed by the researchers as the part of their research in to a product. The major constraints which deviate the academic researchers from the product-level development are: the present promotion policies of the academic institutions, criteria considered to award a PhD degree, limited exposures to formulate the industrial level research problems, lack of collaboration between industry and academic institutes, lack of understanding between an academician and an industrialist, insufficient background of knowledge that are required to develop a product as whole, etc.

Brief Bio-sketch:

Dr. Kumaravel S. has been with the Electrical Engineering Department, NIT Calicut Since December 2008. He has acquired B.E. (EEE) from Anjalai Ammal Mahalingam Engineering College, Thiruvarur, M.Tech (Power Systems) from NIT Thiruchirappalli and Ph.D from NIT Calicut. He has also completed Post-Doctoral Fellowship from University College Dublin, Ireland.

His major areas of research include DC-DC converters, stability enhancement of microgrid, etc. As on April 2022, he has published 33 SCI Journal papers including 12 papers in IEEE Transactions and 7 papers in reputed conferences.

He has supervised 6 PhDs and 48 M.Tech scholars. He has completed 2 sponsored projects and has 2 ongoing projects from CSIR and NAMPET-III.

He has been cited in the list of top 2% researchers by Stanford University. He has received awards such as Young Research Fellow from the Ministry of IT, Govt. of India, Young Scientist Award 2017 from KSCSTE, Govt. of Kerala, etc.

Synergism of Signal Processing and Machine Learning Tools for Condition Monitoring Applications of Electrical Equipment

Debangshu Dey

Department of Electrical Engineering, Jadavpur University, Kolkata

Abstract:

The growth in economy and developmental index in India has increased the per capita energy requirement in the country. The government has also taken up firm programmes to extend grid power to the entire population. On the other hand, a large section of the power infrastructure in developed as well as developing countries has become old. Significant numbers of equipment, particularly transformers, are nearing the end of their designed life or have already exceeded it. To extend the life of existing infrastructure, most of the power utilities now-a-days give effort towards condition-based predictive testing and maintenance.

Costs can be reduced, first of all, by a transition from time-based maintenance (TBM) to condition based maintenance (CBM), as well as reliability can be increased if the actual conditions of the expensive high voltage components within the electric power transmission systems are accurately known. Proper asset management strategy is required which requires advanced methods and systems to obtain reliable condition monitoring data of such critical equipment in the power infrastructure.

In India, there exists a lack of indigenous research in this domain, which is evident from number of research publications and possession of intellectual property rights. Most of the equipment and diagnosis packages are based on any single methodology and are foreign proprietary, which are used in our country as a black box. But considering the present scenario of our country's power infrastructure, this is high time to develop indigenous tools for such CBM of various electrical equipment. The present topic will throw some light on the conducted research and developed systems to address this issue by synergizing data acquisition, advanced signal processing and machine learning tools. It has practical importance in Indian power scenario and also has large societal impact considering the economic benefits and the present-day need for resource-constrained translational technologies.

Brief Bio-sketch:

Dr. Debangshu Dey is currently working as an Associate Professor in the Electrical Engineering Department, Jadavpur University, Kolkata, India. He has published more than 100 research papers in International journals and conferences in the fields of his research, including 25 papers in IEEE Transactions, co-authored 2 books from Springer-Verlag London and Elsevier and also edited 2 volumes published by IEEE. He is the Principal Investigator of 3 government-funded projects.

4 patents have been granted to him, of which 1 is a US Patent. He is the recipient of IEI Young Engineer Award in 2014, TARE research associateship from SERB, Govt. of India in 2018, Visvesarya Young Faculty Research Fellowship in 2019, Outstanding Chapter Engineer Award by IEEE PES, Kolkata and two best-paper awards.

Dr. Dey was in-charge of Measurements and Instrumentation Laboratory, Jadavpur University, former Secretary of IEEE Kolkata Section and currently the Vice-chair of IEEE Signal Processing Society, Kolkata and Immediate past chair of IEEE PES Kolkata.

His areas of interest are applications of signal and image conditioning and processing tools in electrical and bio-medical systems, condition monitoring of electrical equipment, non-invasive testing related to condition assessment.

Industrial IOT Integrated with Simulation to Support Real-time Decision Making for Manufacturing Efficiency

Sri Krishna Kumar

Department of Industrial and Systems Engineering, Indian Institute of Technology Kharagpur

Abstract:

In the current era of global competitive market, manufacturers have to improve their manufacturing performance and efficiency continuously in order to sustain their competitive advantage. Industrial manufacturing organizations have been challenged for many years in terms of how to operate more efficiently and the answer lies in adoption of IoT-based application in improving processes, enhancing production efficiency and quality and hence introducing greater flexibility in the system. The IoT is a proven strategy, a developing trend, and an innovative technology. More importantly, the IoT is enabling manufacturers to improve efficiencies, reduce waste and increase profits. IoT applications in manufacturing and smart factory settings are expected to bring in radical advancements and also generate approximately USD 4 Trillion by 2025. Industry 4.0 can result in more flexibility, reduce lead times, adapting to customer demands, new offerings of downstream services and thus increase in productivity.

This talk will focus on one of the industrial applications of IoT in order to achieve manufacturing efficiency. The presentation will contain the following: (1) estimating vendor capacity to supply using simulation and (2) early detection of non-adherence with the supply from the vendor (3) integrating IoT technology with optimization model to track the manufacturing process at vendor's end to facilitate the early warning for timely supply adherence.

Brief Bio-sketch:

Prof. Sri Krishna Kumar is currently working as an Associate Professor in Department of Industrial & Systems Engineering, IIT Kharagpur. He received his PhD from Wolfsan School of Mechanical and Manufacturing Engineering at Loughborough University, UK in the area of virtual enterprise collaboration. His expertise includes Supply Chain Management, Game Theory and Optimization. He is associated with various projects sponsored by Department of Heavy Industry, MHRD and European Union. He has published articles in reputed journals like International Journal of Production Research, Computers in Industry, Computers & Industrial Engineering and Journal of Engineering Manufacture.

Electrical Biosensors Operating in Complex Biological Fluids for Resource Limited Environment

Chirasree Roy Chaudhuri

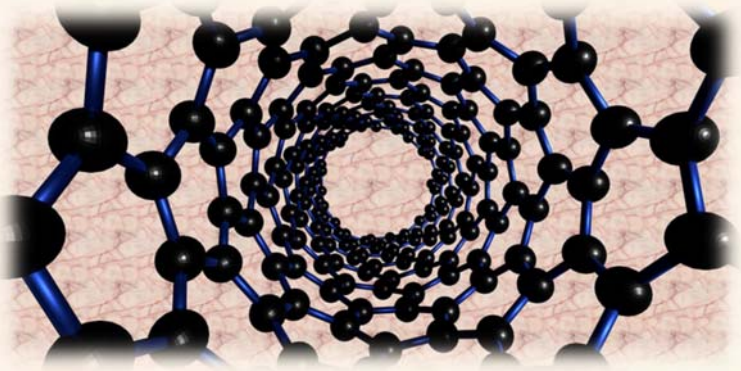
Indian Institute of Engineering Science and Technology, IIEST Shibpur, Howrah

Abstract:

A major opportunity offered by biosensors in the field of diagnostics is enabling technologies that can selectively detect species at ultra-low levels. Such systems are of paramount importance in early detection of cancer and discovery of new biomarkers for treatment of complex diseases, since the existing commercial technologies seldom reach these detection limits. In this aspect, we have developed a suite of affordable technologies for detecting species at ultralow concentrations which can operate in resource-constrained settings. These technologies are based on label-free electrical detection mechanisms which mostly deploy field effect transistor (FET) mode of operation of graphene and zinc oxide nanorods. Conventionally, these sensors demonstrate improved mass transport and are highly sensitive owing to their intrinsic transconductance but their sub-micron feature sizes restrict the fabrication only in specialized clean room settings. Further, the intrinsic device noise and the lack of reliable fabrication deteriorates the signal to noise ratio and hence biomolecule detection and quantification at extremely low levels in physiological fluids become challenging. We have addressed some of these issues by increasing the device dimensions to few hundreds of microns and yet achieve appreciable sensitivity and selectivity by appropriately controlling the device surface roughness and adopting molecular imprinted polymer technology for antibody free biorecognition. These strategies coupled with ring-shaped coplanar gate electrodes surrounding the active sensing regions, localizing the capture of biomolecules on the latter help to overcome the Debye screening effect and enhance the signal to noise ratio.

Brief Bio-sketch:

Dr. Chirasree Roy Chaudhuri is an Associate Professor in the Department of Electronics and Telecommunication Engineering of Indian institute of Engineering Science and Technology Shibpur. She has been engaged in interdisciplinary research in the area of electrical biosensors, chemical sensors and related signal processing with the aim to develop point of care devices. She is a recipient of Young Engineer Award from Indian National Academy of Engineering (INAE), Young Scientist Award from National Academy of Science, India (NASI) and Institute of Smart Materials Structures and Systems and Women Excellence Award from Department of Science and Technology, Government of India. She is a member of Indian National Young Academy of Science (INYAS) and an Associate Editor of the IEEE Sensors journal.



Theme:

Nanostructured Surfaces for Functional Materials and Systems

Keynote Lectures

Understanding Olfactory Spaces: A Journey from Molecule to Machine Learning and Instrumentation

Ritesh Kumar

CSIR-Central Scientific Instrumentation Organization, Chandigarh, India

Abstract:

The presentation will cover my research activities till now and my future plans. My research interests and projects revolve around the following categories.

1. **Electronic Nose and Tongue system development**: I have a keen interest in electronic nose and tongue system development, which can be used for various applications such as quality quantification of food items. I have used electrochemical impedance spectroscopy and pattern recognition to develop electronic tongue systems. I have worked with Indian and foreign companies (TCPL, Food Pairing) in this area to quantify bitterness and recommendation algorithms.
2. **Understanding Chemical space of odorants:** The search for novel and explainable features to predict olfactory perceptual descriptors has been at the forefront of the quantitative structure odor research. I have been able to develop an unsupervised approach to represent "fragrance-likeness" that is based on embedding fragments of molecular SMILES representations and Morgan fingerprints in a high-dimensional vector space.
3. **Odor Source Localization Techniques:** Odor source localization has been studied extensively in biology, e.g. moth mate seeking, lobster foraging, mosquito host tracking. I work on designing better algorithms/techniques using existing hardware and different sensing modalities.

Brief Bio-sketch:

Dr. Ritesh Kumar is a Principal Scientist with CSIR-Central Scientific Instrumentation Organization, Chandigarh, India. He is also a recipient of the Royal Society-Newton Fellow. His research interests and projects revolve around three categories – (i) Understanding Chemical space of odorants using machine learning, (ii) Designing optimization algorithms for Odor Source Localization, and (iii) Electronic Nose and Tongue system development. He has published a significant number of papers in reputed journals like Science, Nature Scientific Reports, PloS One, Nature communications and, IEEE Transaction on Cybernetics. He has worked on various government- and industry-sponsored projects and consulted some exciting startups like Rymo Technologies, FoodPairing NV etc. He has also worked with companies like TATA Consumer Products Ltd. in order to provide scientific consultancies in the area of modeling taste and smell.

Functionalized Graphitic Carbon Nitride (g-C_3N_4) Nanosheets for Flexible and Wearable Triboelectric Nanogenerators (TENG)

Sayan Bayan

Department of Physics, Rajiv Gandhi University, Doimukh, Arunachal Pradesh

Abstract:

Triboelectric Nanogenerators (TENG) have evolved as alternative power sources for supporting today's internet of things (IoT) based gadgets. TENG operates under the combined phenomenon of triboelectrification and electrostatic induction and converts mechanical energy to electrical energy. In this context, functionalized graphitic carbon nitride (g-C_3N_4) nanosheets can be a promising active material for TENG application. Through functionalization of g-C_3N_4 nanosheets, the improvement in triboelectric output can be achieved by modifying the parameters like surface roughness, dielectric constant etc. and may lead to the development of flexible and light weight TENG for generation of power from human biomechanical movements. Additionally, the integration of such nanogenerator with a suitable processor and wireless technology may lead to the self-powered sensors to track human motion from remote location. Consequently, the functionalized g-C_3N_4 nanosheets may form the base of futuristic wearable and flexible power sources that can be compatible for integration to human body at low cost.

Brief Bio-sketch:

Dr. Sayan Bayan is an Assistant Professor at Rajiv Gandhi University in Arunachal Pradesh. He did his Ph.D. in Physics from Tezpur University and worked as post-doctoral fellow at SINP, Kolkata and IIT, Kharagpur. He was the CSIR Senior Research Associate at S.N. Bose National Centre for Basic Sciences, Kolkata. Dr. Bayan has research interests in the areas of low-dimensional materials, optical properties, energy harvesting and bio-medical devices. He has more than 40 publications in international journals and has two Indian patents. He is a member of the project implementation group of a prestigious DST project worth Rs. 10 crores.

Multifunctional Surfaces Using Femtosecond Laser Surface Texturing and Coatings

Gururaj Telasang

International Advanced Research Centre for Powder Metallurgy and New Materials (ARCI), Hyderabad

Abstract:

The presentation concerns surface modification by ultrafast lasers, plasma-based surface modification, and sol-gel-based functional coatings for multifunctional applications. A brief introduction of different available ultrafast lasers and their interaction mechanism with the material surface, a detailed discussion on the surface processing of various materials with the ultrafast laser, especially surface texturing, and structuring will be discussed in detail. Surface texturing aims to develop a periodic surface roughness to modify surface energy, coefficient of friction, bioactivity, and corrosion resistance property. The presentation includes hierarchical micro-nanostructures using femtosecond laser pulses to improve the machinability of tool inserts by reducing diffusion wear; structuring waveguides for photonic devices; creation of microchannels on cyclic olefin polymer films for the microfluidic field; and achieving the wettability-responsive superhydrophobic surface for the polar solvent chemical sensor for biomedical application. Also, it details the plasma surface activation of materials like polycarbonate to improve the adhesion strength of coatings and in-situ generated nano-particle modified sol-gel coatings for transparent scratch resistance coating applications.

Brief Bio-sketch:

Dr. Gururaj Telasang obtained his Ph.D. from Department of Metallurgical and Materials Engineering, IIT, Kharagpur. He specializes in the field of Metal Additive Manufacturing, Powder bed additive manufacturing, Laser Surface Modification and functional sol-gel coatings, Laser surface cladding and Laser assisted repair/refurbishment. He established Joint Technical Demonstration Center for powder bed metal additive manufacturing at ARCI in collaboration with SLM solutions GmbH., Germany, in the year 2016-17. He has been awarded Indo-German DAAD fellowship (2004-2005) and worked at Fraunhofer Institute for Laser Technique (FILT), Aachen, Germany, on laser clad and repair of various critical tools. He has a patent on scratch resistance functional transparent sol-gel coatings for polymers and twelve international publications to his credit. He is a life member of Indian Institute of Metals (IIM), The Aeronautical Society of India, The Indian Institute of Chemical Engineers (IIChE), and SAE INDIA. He is associated with SAE INDIA - Hyderabad division as Vice-chair (2020-22) and also volunteered as Secretary and Treasurer during 2014-2020. He has been honored with award of achievement by SAE ISS for his contributions to organize several technical events for engineering professionals and students.

Azadi Ka Amrit Mahotsav

Special Keynote Lectures

Probing Crucial Interfacial Dynamics of Nanohybrids for Emerging Biomedical Functionalities

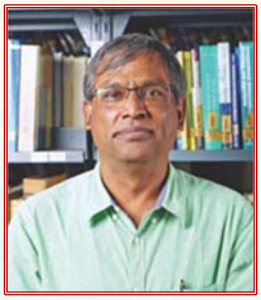
Samir Kumar Pal

Department of Chemical, Biological and Macromolecular Sciences, S. N. Bose National Centre for Basic Sciences, Kolkata

Abstract:

Nanohybrids are composite of two individual counterparts, interacting at the molecular level exhibiting unprecedented properties than the constituents. The modified properties of the hybrid material have often dictated by the interfacial junction between the two moieties. Thus, it is crucial to understand the various critical interactions present at the interfacial position. The commonly used techniques for structural characterization as electron microscopy (SEM, TEM) or x-ray diffraction (XRD) can only be able to visualize the inorganic counterpart whereas the Fourier transformed infra-red spectroscopy (FTIR) and nuclear magnetic resonance (NMR) can distinguish the organic part predominantly. However, there exists necessity to probe the interfacial dynamical properties of the hybrids. There lie the advantages of ultrafast optical spectroscopic methods to envisage the interfacial properties. The junctional charge transfer or energy transfer processes, which are the basis of unusual properties in nanohybrids, can be rationalized using excited state lifetime measurements. Finally, the nanohybrids depict unprecedented biomedical applications in destruction of infectious diseases, liver diseases and cancer. The talk will highlight various hybrid materials, discussing the measurements of their interfacial properties using ultrafast spectroscopy followed by enhanced biological activities.

Brief Bio-sketch:



Prof. Samir Kumar Pal did his PhD in Physics from the Indian Association of Cultivation of Science in 2000. He then worked with Prof. Ahmed H. Zewail at California Institute of Technology till the end of 2003. Currently, Prof. Pal is a Senior Professor at S.N. Bose National Centre for Basic Sciences, India. Prof. Pal is a Fellow of INAE and a Member of the Governing Council of INAE. He has received several other prestigious awards and honours to his credit. He has co-authored over 340 publications and 7 books, given more than 300 invited presentations across the globe, and has more than 12450 citations, h-index of 55 and i10 index of about 206. He is also a co-inventor of more than 40 patents. He is continuously serving as Visiting Professor at several places including CALTECH, USA, TU Brunswig, Germany, University Aarhus, Denmark, Durham University, UK, University Leiden, Netherlands etc.

Selected important Publications: see https://bose.res.in/~skpal/pub.htm

Future Prospects of Internal Combustion Engines in a Green and Environmental Friendly and Methanol Economy

Avinash Kumar Agarwal

Department of Mechanical Engineering, Indian Institute of Technology Kanpur

Abstract:

Energy demand has been rising remarkably due to increasing population and urbanization. Without the transportation by millions of personalized and mass transport vehicles based on IC engines, human civilization would not have reached contemporary living standards. Today, IC engines are facing many challenges related to fuel supply, energy efficiency, and emissions, which require serious research efforts. At this stage of technology development, IC engine based transportation and power generation systems are dependent on conventional fuels such as mineral diesel, gasoline etc., which has resulted in rapid depletion of petroleum reserves. Application of different alternative fuels such as biofuels, alcohols and other synthetic fuels need to be explored for sustainable development of automotive sector. Methanol has emerged as a strong alternate fuel candidate with the highest potential to significantly contribute towards reduction in crude oil dependence and environmental preservation. Methanol can be straightway used as a replacement for gasoline, since it has very high octane number and has been successfully used in many spark ignition (SI) engine applications. However, utilization of methanol in compression ignition (CI) engines is challenging. Various techniques to inject methanol in diesel engines include direct injection of methanol-diesel blends, port fuel injection of methanol and direct injection of pilot diesel, methanol-diesel emulsified fuels, use of methanol with ignition improvers, and use of glow plug concept. Methanol could be produced from several carbonaceous feedstocks such as natural gas, coal, biomass, and CO_2.

In this talk, I will discuss some of the challenges being faced by IC engines in various sectors such as automotive, locomotive, marine, and several technical aspects of using methanol, underlining its potential to be used as a fuel to power Indian economy.

Brief Bio-sketch:

Prof. Avinash Kumar Agarwal has research interests in the areas of IC engines, combustion, fuels, lubricating oil tribology, optical diagnostics, laser ignition, HCCI, particulate and emission control etc. He has a large volume of publications with wide citations and is the top Energy researcher from India in the recently declared Stanford University listing of top 2% researchers globally. Prof. Agarwal is the Editor of 'FUEL', Editor-in-Chief of 'Journal of Energy and Environmental Sustainability', and is in the editorial board of many international journals of repute. He edited "Handbook of Combustion" (5 Volumes; 3168 pages), published by Wiley VCH, Germany, the most updated combustion compilation in the world. He has received several awards and fellowships including Sir J C Bose National Fellowship (2019) by SERB, Clarivate Analytics India Citation Award-2017 in Engineering and Technology, prestigious *Shanti Swarup Bhatnagar* Prize (2016). He is the fellow of various national and international academies of science and engineering including the Indian National Academy of Engineering.

Understanding Difficulties in Performing Medical Procedures in the Hospital Setting: A Qualitative Study

Mahati Chittem

Department of Liberal Arts, Indian Institute of Technology Hyderabad

Abstract:

Background: The standard technique for peripheral intra-venous (IV) access (i.e., vein insertion) often results in many cases of difficult trials and multiple needle penetrations, thereby making the process very painful and risky. Consequently, this project at large, is developing a 3D vein viewer to help reduce these difficulties.

Objectives: The behavioural arm of this project aims to explore and determine the reasons for and experiences of difficulties in performing peripheral IV intra-venous from the perspectives of healthcare providers (i.e., physicians, nurses and technicians).

Methods: Practicing doctors (n=25), practicing nurses (n=25), practicing technicians (n=25) were recruited from various hospitals in Hyderabad. Conventional content analysis was used to analyze the data.

Result: Themes includes: (1) difficulties in performing peripheral vein intrusion: reasons for and experiences of performing the IV insertion, (2) managing difficulties: approaches to handle difficulties and ways by which they can be avoided/reduced, (3) role of communication in handling the procedural difficulties and (4) attitudes towards novel technology for vein viewing/IV insertion devices. The Cohen's Kappa scores were calculated for all themes and there was more than 75% agreement between the coders.

Conclusion: The study findings reveal that healthcare professionals believe that the standard procedure of peripheral vein intrusion was difficult with major issues focused on viewing and accessing veins. A preference for more advanced device that offers better visibility, quick access and makes the process less painful and affordable was strongly suggested.

Brief Bio-sketch:

Dr. Mahati Chittem is an Associate Professor of Health and Medical Psychology at the Department of Liberal Arts in the Indian Institute of Technology Hyderabad, India. Her areas of expertise are in chronic disease management and health behaviours. Within the domain of chronic disease management, she has specialization in psycho-oncology and endocrinology focussed mainly on communication skills (for healthcare providers and patients/caregivers), cultural contexts of care, symptom identification and pathways to care, adherence, and end-of-life issues. Within the domain of health behaviours, she examines the cultural aspects of engaging in dietary, exercise and safe sex behaviours. Along with her research activities, she is a mentor and trains healthcare providers and health organizations to improve their care services. Through her academic and research activities, Dr.Chittem works closely with physicians, engineers, scientists and social scientists. She established and mentored her research group, Health Associated Co-operative and Supportive (HACOS) group, which comprises Master's, MPhil, and PhD scholars.

Further details about her work may be found at her official website:

https://sites.google.com/a/iith.ac.in/dr-mahati-chittem

Empowering Society through Technology

Rashid, K.

Co-Founder & Director at Genrobotic Innovations

Abstract:

Manual scavenging is the world's worst job. One manual scavenger dies every 5 days in India despite the prohibition of manual scavenging by the Hon'ble Supreme Court's MS Act 2013 and over 4 million people are engaged in manual scavenging as their livelihood in India. The manholes could kill a man within a short time during the cleaning process by releasing the poisonous gases which are trapped inside the sewage waste. Apart from the social atrocities, they are also exposed to different health problems by virtue of their occupation.

This problem can be only solved by technology and thus Genrobotics developed Bandicoot – the world's first robotic scavenger capable of identifying the blockages inside the manholes and clearing them at a high speed of operation when compared with manual cleaning. The human comparable innovation works with human-level flexibility inside the manhole, which has the potential to change the lives of millions of manual scavengers. The advanced version Bandicoot V2.0 has poisonous gas sensing, automatic sewer line detection, 4 machine vision, wide-angle IR light sensor cameras, IP 68 machine, smart UI system with self-learning algorithm, and tutorial videos in the local language for the workers to operate the Robot much easier.

Brief Bio-sketch:

Mr. Rashid is a young Indian Entrepreneur and youth innovator, passionate about science, technology, and social entrepreneurship. He did his B.Tech in Computer Science and MBA in International Business. He spent the last 6 years as an entrepreneur along with technological innovations and developed the World's 1st manhole cleaning robot 'Bandicoot' with a vision to eradicate manual scavenging from the world. Rashid co-founded Genrobotic Innovations, after his stint as a software engineer at TCS.

Genrobotics specializes in design and development of Robotic solutions to address most pressing social issues. Bandicoot Robot is one of the turnkey solutions to replace manual scavenging with robotic scavenging with an impact to benefit millions of lives of manual scavengers around the world.

Mr. Rashid enjoys promoting global sustainability and social service by developing innovative technology for the welfare of mankind. His team has received many awards including the ET Social Enterprise Award 2021, Young Change Maker of India Award 2020 from Hon'ble Vice-president of India, National Startup Award 2020 from Government of India for Best Campus Initiated Startup and Infosys Aarohan Social Innovation Award 2019.

Twitter – https://twitter.com/rashidtky

LinkedIn – https://in.linkedin.com/in/rashidtky

Facebook – https://www.facebook.com/rashid.tky

Poster Presentations

List of Posters

Sl. No.	Poster Title	Presenter	Affiliation
1.	Sb_2Se_3 Thin Film Solar Cells: Non-Vacuum Preparation and Performance Evaluation	Arindam Basak	Department of Electronics Engineering, KIIT
2.	Some Glimpses in Powers-of-two Digital Filter Design	Abhijit Chandra	Department of Instrumentation and Electronics Engineering, Jadavpur University
3.	Feature Extraction of Electrochemical Sensor Signals: A System Modelling Approach	Arunangshu Ghosh	Department of Electrical Engineering, NIT Patna
4.	Investigation on Suitability of Nanofluids as Next Generation Insulation in High Voltage Application	Arpan Kumar Pradhan	Department of Electrical Engineering, Jadavpur University
5.	Alertness and EEG: Developments and Directions	Anwesha Sengupta	Department of Electrical Engineering, NIT Rourkela
6.	Investigation of Electrical Insulation and Thermal Performance of Transformer Oil based Nanofluid	Kumari Swati	Department of Electrical Engineering, Jadavpur University
7.	Application of FRAME for Simultaneous LIF and LII Imaging in Sooting Flames Using a Single Camera	Devendra Deshmukh	Department of Mechanical Engineering, IIT Indore
8.	Condition Assessment of Oil-paper Insulation Using Time Domain Dielectric Spectroscopy Data	Deepak Mishra	Department of Electrical Engineering, Indian Maritime University - Kolkata
9.	Biosensors for Diagnostic and Environmental Applications	Kapil Sadani	Department of Instrumentation and Control, Manipal Institute of Technology, Manipal Academy of Higher Education
10.	Optical Sensors for Detection of Small Molecule Environmental Contaminants	Puja Nag	Department of Mechatronics, Manipal Institute of Technology, Manipal Academy of Higher Education
11.	Study of Heat Transfer Enhancement with the Application of Various Nanofluids in a Differentially Heated Cavity	Rabindra Nath Barman	Department of Mechanical Engineering, NIT Durgapur
12.	Relay-aided Approaches for Enhancing Communication Reliability in LoRa-based Wireless Sensor Networks	Siddhartha S. Borkotoky	School of Electrical Sciences, IIT Bhubaneswar

List of Posters

Sl. No.	Poster Title	Presenter	Affiliation
13.	Effect of Temperature on the Dielectric Response of Oil-paper Insulation System	Saurabh Dutta	Department of Electrical Engineering, NIT Patna
14.	Tribological Performance of Electroless Nickel Coatings at Elevated Temperatures	Suman Kalyan Das	Department of Mechanical Engineering, Jadavpur University
15.	Al-induced Electroless Deposition and Characterization of Ni-Sn and Co-Sn Film Anode for Li-ion Battery	Swatilekha Ghosh	School of Advanced Materials, Green Energy and Sensor Systems, IIEST Shibpur
16.	Compact Frequency Selective Surfaces for 5G, Beyond 5G and Super Wide Spectrums	Surajit Kundu	Department of Electronics and Communication Engineering, NIT Sikkim
17.	Improved Cooling System of Li-ion Batteries by Axial Water Flow Through the Core	Sirshendu Mondal	Department of Mechanical Engineering, NIT Durgapur
18.	A Deterministic Model for Bubble Propagation Through Simple and Cascaded Loops of Microchannels in Power-law Fluids	Sandip Sarkar	Department of Mechanical Engineering, Jadavpur University
19.	Rationally Designed Structured Metal Surfaces for Atmospheric Water Harvesting	Soumyadip Sett	Department of Mechanical Engineering, IIT Gandhinagar
20.	Magnetic Moment Reorientation in $ErFe_{0.55}Mn_{0.45}O_3$ and its Potential Applications in Biomedicine	Tirthankar Chakraborty	School of Physics and Material Science, Thapar Institute of Engineering and Technology

Brief Bio-sketch of the Poster Presenters

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Dr. Arindam Basak, *Associate Professor*, Department of Electronics Engineering, KIIT, Bhubaneswar

Dr. Arindam Basak is an Associate Professor in the Electronics Engineering Department of KIIT. He completed his PhD from the Indian Institute of Engineering Science and Technology, Shibpur, ME from Jadavpur University, and B. Tech from University of Kalyani. His research focuses in the areas of Thin Film Solar Photovoltaics, Semiconductor Devices and Nanomaterials. He has authored research papers in reputed international journals and has also served as co-investigator for three projects funded by DST/SERB. He is also heading the school level training and placement activities.

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Dr. Abhijit Chandra, *Assistant Professor*, Department of Instrumentation and Electronics Engineering, Jadavpur University, Kolkata

Abhijit Chandra received his PhD (Engg.) from Jadavpur University in the year 2016. Presently, he is working in the capacity of Assistant Professor at the Department of Instrumentation and Electronics Engineering, Jadavpur University. His research area includes Signal/Image Processing, Wireless Communication, and Wireless Sensor Networks. He has published around 70 research articles in reputed journals and conference proceedings.

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Dr. Arunangshu Ghosh, *Assistant Professor*, Department of Electrical Engineering, NIT Patna

Arunangshu Ghosh (Senior Member, IEEE) received the Ph.D. degree from Jadavpur University, Kolkata, India, in 2015. He is currently an Assistant Professor with the Department of Electrical Engineering, National Institute of Technology Patna, Patna, India. His research interests include the electronic tongue, machine olfaction, system modelling and pattern recognition.

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Brief Bio-sketch of the Poster Presenters

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Dr. Arpan Kumar Pradhan, *Assistant Professor*, Department of Electrical Engineering, Jadavpur University, Kolkata

Arpan Kumar Pradhan (IEEE Senior Member) received his Ph. D degree in Electrical Engineering from Jadavpur University in 2016. In 2017, he received the prestigious POSOCO Power Systems Award (PPSA) for his contribution during Ph.D.
Currently, he is working as Assistant Professor in the Department of Electrical Engineering, Jadavpur University, India. He has worked as Alexander von Humboldt postdoctoral research fellow at University of Stuttgart, Germany from 2020 to 2021. His area of interest is condition monitoring of insulation system in large electrical equipment and overhead porcelain insulator, diagnosis of various Power Quality events.

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Dr. Anwesha Sengupta, *Assistant Professor*, Department of Electrical Engineering, NIT Rourkela

Anwesha Sengupta obtained her Bachelors in Electrical Engineering from Jadavpur University, Kolkata in 2005 and Master of Science (by Research) and Doctoral degrees from Indian Institute of Technology Kharagpur in 2011 and 2018 respectively. She is currently associated with the Department of Electrical Engineering, NIT Rourkela as Assistant Professor since March 2020. Her research interests include signal processing and biomedical signal analysis.

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Dr. Kumari Swati, *SERB- National Post Doctoral Fellow,* Department of Electrical Engineering, Jadavpur University, Kolkata

Kumari Swati received her MS and PhD degrees in Electrical Engineering from Indian Institute of Technology Madras in 2019. She has one-year Post-Doctoral research experience from Khalifa University, Abu Dhabi, U.A.E. She has served as the Project Manager for the Technology Innovation Hub on Data Science, Big Data Analytics and Data Curation at Indian Statistical Institute Kolkata. She has been granted National Post Doctoral Fellowship by SERB, DST and pursuing her research in the Department of Electrical Engineering, Jadavpur University since March 2022. Her area of research includes Diagnostics and Condition Monitoring of Transformer Insulation systems.

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Brief Bio-sketch of the Poster Presenters

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Dr. Devendra Deshmukh, *Associate Professor*, Department of Mechanical Engineering, IIT Indore

Dr. Devendra Deshmukh received the master's degree. in 2002 from the Indian Institute of Science Bangalore, India. He earned Ph.D. in 2012 from Indian Institute of Science Bangalore, India. During his doctoral tenure, he investigated SVO sprays for CI engines. He investigated liquid fraction distribution in dense sprays using planar laser techniques. Later, he joined IIT-Indore, Department of Mechanical Engineering, where he worked on modelling multicomponent evaporating spray, renewable fuels for CI engine and characterizing dense sprays. His current interests include using laser diagnostics for multispecies detection and emissions in biofuel combustion. His other interest includes automotive engines, exhaust emission reduction and waste heat recovery.

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Dr. Deepak Mishra, Assistant Professor, Department of Electrical Engineering, Indian Maritime University - Kolkata

Deepak Mishra (Member IEEE) received his M.Tech and Ph.D. degree in Electrical Engineering from IIT(ISM) Dhanbad in 2015 and 2020 respectively. He received the prestigious POSOCO Power Systems Award (PPSA) 2022. He is presently working as an Assistant Professor in the Department of Electrical Engineering, Indian Maritime University Kolkata. His current field of interest includes condition monitoring of high voltage power equipment.

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Dr. Kapil Sadani, *Assistant Professor*, Department of Instrumentation and Control, Manipal Institute of Technology, Manipal Academy of Higher Education

Kapil Sadani completed his Masters in Technology from The Department of Instrumentation and Electronics, Jadavpur University, Kolkata in 2014 and PhD from Biosensors and Bioinstrumentation Laboratory, Indian Institute of Technology, Bombay in 2020. He has been associated with the Department of Instrumentation and Control, Manipal Institute of Technology, Manipal Academy of Higher Education as Assistant Professor since 2014. His research interests are development of point of care (bio) sensors for environmental and healthcare applications.

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Brief Bio-sketch of the Poster Presenters

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Dr. Puja Nag, *Assistant Professor*, Department of Mechatronics, Manipal Institute of Technology, Manipal Academy of Higher Education

Dr. Pooja Nag completed Masters in Technology from the Department of Instrumentation and Electronics, Jadavpur University, Kolkata in 2014. She worked in Haldia Petrochemicals Private Limited, Kolkata as an Instrumentation Engineer till 2015. Pooja moved to academics as an Assistant Professor in the Department of Mechatronics, Manipal Institute of Technology, Manipal Academy of Higher Education and completed PhD from IIT-Bombay in the Biosensors and Bioinstrumentation lab in 2020. Her research interests include development of point-of-use sensors for detection of environmental contaminants and pharmaceutical residues in water and food.

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Dr. Rabindra Nath Barman, *Assistant Professor*, Department of Mechanical Engineering, NIT Durgapur

Dr. Rabindra Nath Barman is an Assistant Professor in Mechanical Engineering Department, National Institute of Technology Durgapur. He has contributed widely to the scientific community through R& D and product development in manufacturing technology. Dr. Barman is also working in the area of experimental and computational microfluidics/nono-fluidics related to medical diagnostics. He has published more than 40 reputed international journal papers, and successfully completed DST and AICTE funded projects.

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Dr. Siddhartha S. Borkotoky, *Assistant Professor*, School of Electrical Sciences, IIT Bhubaneswar

Siddhartha Borkotoky is an Assistant Professor with the School of Electrical Sciences at IIT Bhubaneswar. He received his PhD in electrical engineering from Clemson University, USA in 2017. He subsequently worked as a postdoctoral researcher with Clemson University and as a senior researcher with Lakeside Labs, Klagenfurt, Austria before joining IIT Bhubaneswar in 2019. His research interests include communication technologies for the Internet of Things, cooperative communications, application-layer coding, and wireless sensor networks.

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Brief Bio-sketch of the Poster Presenters

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Dr. Saurabh Dutta, *Assistant Professor*, Department of Electrical Engineering, NIT Patna

Dr. Saurabh Dutta received his PhD in Electrical Engineering from IIT(ISM) Dhanbad in 2020. Currently, he is working as an Assistant Professor in Electrical Engineering Department at NIT Patna. He has published several papers in high-impact peer-reviewed Journals and national/international conferences. His field of interest includes condition monitoring of high voltage equipment and alternate dielectric liquids. He is a member of IEEE, Dielectrics and Electrical Insulation Society and an Associate Member of the IEI (India).

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Dr. Suman Kalyan Das, *Associate Professor*, Department of Mechanical Engineering, Jadavpur University, Kolkata

Dr. Suman Kalyan Das is currently employed as Associate Professor in Dept. of Mechanical Engg., Jadavpur University. He has completed his PhD from the same University in 2013. His main research interest is related to tribology of materials, material testing and characterization. He has published articles in over 36 international journals, 15 book chapters and participated in about 15 international conferences. Dr. Das has also been employed briefly (about 4 years) as Scientist/Engineer in Vikram Sarabhai Space Center, ISRO where he was involved in the development of separation system for the large booster rocket (S200) of GSLVMk3 launch vehicle.

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Dr. Swatilekha Ghosh, *DST Inspire Faculty*, School of Advanced Materials, Green Energy and Sensor Systems, IIEST Shibpur

Dr. Swatilekha Ghosh is working in the field of electrochemical technologies since 2006. She has experience in electrodeposition (aqueous and ionic liquid electrolyte), electroless deposition and various nanomaterials synthesis processes. These fabrication method offers, alloys, composites, multilayers act as a sustainable coating offering various perspective such as corrosion protection, solar reflector and absorber, super black coating, enhancing the material life by decorative finish, electrode for rechargeable batteries.

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Brief Bio-sketch of the Poster Presenters

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Dr. Surajit Kundu, *Assistant Professor*, Department of Electronics and Communication Engineering, NIT Sikkim

Surajit Kundu (*Ph. D*) is working as Assistant Professor in the Department of ECE, NIT Sikkim. Presently, he is the senior member of IEEE and URSI. He has published 42 papers in SCI journals and conference proceedings of repute. His research interest includes antenna design, frequency selective surfaces, ultra-wideband communication, 5G and beyond wireless technology, ground penetrating radar, satellite communication and navigation. He received "Young Indian Radio Scientist" award from URSI-InRaSS in AP-RASC 2019.

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Dr. Sirshendu Mondal, *Assistant Professor*, Department of Mechanical Engineering, NIT Durgapur

Dr. Sirshendu Mondal is currently serving as an Assistant Professor in the Department of Mechanical Engineering at National Institute of Technology Durgapur, India. He received B.Tech from Kalyani Govt. Engineering College and M.E. and Ph.D. degrees from Jadavpur University, Kolkata, India. He carried out his post-doctoral research at IIT Madras for over 3years. His research interests include analysis of thermofluidic systems, dynamical systems. Dr. Mondal has over 50 research publications, including 22 international journal publications, 5 book chapters, and 1 edited monograph. He is a recipient of Young Scientist Award of the International Society for Energy, Environment, and Sustainability (ISEES).

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Dr. Sandip Sarkar, *Associate Professor*, Department of Mechanical Engineering, Jadavpur University, Kolkata

Dr. Sarkar did a bachelors' degree from IIEST Shibpur, M.Tech. from IIT Kanpur, and obtained his Ph.D. from IISc Bangalore – all in Mechanical Engineering. He has more than 50 peer-reviewed research publications at various international journals of repute and several publications at international conference proceedings. He also authored several book chapters published by various international publication houses. Dr. Sarkar has more than eight years of industrial R&D experience in computational fluid dynamics and heat transfer, and parallel in-house code development. He does research in fluid-structure interaction, microfluidics, nanofluidics, multiphase flows and heat transfer, process modeling of steelmaking, and casting. He has established a new SERB-funded Microfluidic Laboratory at the Department of Mechanical Engineering, JU. He recently got DST NSM research grant for 3D parallel computations on the FSI research project.

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Brief Bio-sketch of the Poster Presenters

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Dr. Soumyadip Sett, *Assistant Professor*, Department of Mechanical Engineering, IIT Gandhinagar

Soumyadip obtained his BE in Power Engineering from Jadavpur University and his Ph.D. in mechanical engineering from the University of Illinois at Chicago. Following his graduate work, he was a postdoctoral fellow at UIUC, advised by Prof. Nenad Miljkovic, before starting as an Assistant Professor in Mechanical Engineering at IIT Gandhinagar in June 2021. His research interest intersects the multidisciplinary fields of thermo-fluids, interfacial phenomena, and renewable energy, with focus on phase change heat transfer.

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Dr. Tirthankar Chakraborty, *Assistant Professor*, Thapar Institute of Engineering and Technology

Dr. Tirthankar Chakraborty completed M.Sc. in IIT Bombay in 2012 and PhD in experimental condensed matter Physics from IISc, Bangalore in 2018. He worked as postdoctoral researcher in Seoul National University, South Korea and at the Max Planck Institute for Chemical Physics of Solids, Germany. Currently he is working as an Assistant Professor at Thapar Institute of Engineering and Technology. Dr. Chakraborty works in the area of multifunctional materials, and their structural, magnetic, dielectric and transport properties.

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