INDIAN NATIONAL ACADEMY OF ENGINEERING
(INAE)
&
INDIAN INSTITUTE OF TECHNOLOGY, HYDERABAD
PRESENT

15th NATIONAL FRONTIERS OF ENGINEERING (NatFoE) SYMPOSIUM

JULY 09-10, 2021

भारतीय प्रौद्योगिकी संस्थान हैदराबाद
Indian Institute of Technology Hyderabad

www.iith.ac.in/natfoe2021

15th National Frontiers of Engineering (NatFoE) Symposium

July 09-10, 2021

Abstract Booklet

Contents

Message by Prof. Indranil Manna

President, INAE

भारतीय राष्ट्रीय अभियांत्रिकी अकादमी
Indian National Academy of Engineering

Unit No.604-609, SPAZE, I Tech Park, 6th Floor, Tower A, Sector 49, Sohna Road,
Gurgaon – 122 018, **India** Phone: (+91) 124 4239480, Fax: (+91) 124 4239481
Email: president@inae.in, inaehq@inae.in, Website: www.inae.in

प्रोफ़ेसर इंद्रनील मान्ना / PROFESSOR INDRANIL MANNA

FNAE, FTWAS, FNA, FNASc, FASc, MAPAM, FIE(I), FIIM, FEMSI, FAScT, PRS, DSc (hc), PhD
JC Bose Fellow

अध्यक्ष / President

Vice-Chancellor
Birla Institute of Technology (BIT), Mesra
Ranchi, Jharkhand 835215, India
Tel: +91 651 2275402; Fax: +91 651 2275401
Email: imanna@metal.iitkgp.ac.in, vc@bitmesra.ac.in
im_kgp@yahoo.co.in

MESSAGE

President, INAE

It is heartening to note that the Fifteenth National Frontiers of Engineering Symposium (NatFoE) is being held at Indian Institute of Technology Hyderabad on July 9-10, 2021. 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 single 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 technical issues, gaps and challenges for providing solutions to problems faced in the chosen areas, so as to advance the state-of-the-art technologies in the country in these niche sectors.

This year, in line with the Government of India's initiative to celebrate 75th Year of Independence (*Azadi ka Amrit Mahotsav*), INAE has resolved to dedicate a special session to this theme.

I am delighted that the Fifteenth NatFoE Symposium will focus on four specific themes of (i) Artificial Intelligence & Machine Learning, (ii) Advanced Materials & Manufacturing Technology, (iii) Infrastructure & Unconventional energy and (iv) Rural entrepreneurship. Not only these themes are globally important, both academia and industry in India are deeply involved in these directions and poised to make a big stride soon. The twenty-four speakers invited to participate in this two-day event represent a good blend of experts from Industry, R&D and Academia, who are emerging leaders in the respective domains by their own right.

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

On behalf of INAE, I sincerely thank Professor BS Murty, Director, IIT Hyderabad and his team for their untiring efforts in ensuring the timely conduct of the event. The organizers have made praiseworthy efforts in meticulously putting together a thoughtful program despite the tremendous impediments imposed by the pandemic in the country and planned for the first such symposium being held online. I wish the Fifteenth National Frontiers of Engineering Symposium all the success and the delegates a fruitful participation.

Jai hind!

Indranil Manna

Date: June 22, 2021

Message by Prof. Sivaji Chakravorti

Vice-President, INAE

भारतीय राष्ट्रीय अभियांत्रिकी अकादमी
Indian National Academy of Engineering
604–609, छठी मंजिल, टॉवर ए, स्पेज़ आई–टैक पार्क, सैक्टर 49, सोहना रोड, गुड़गाँव–122018 (भारत)
Unit No. 604-609, 6th Floor, Tower A, SPAZE I-Tech Park, Sector 49, Sohna Road, Gurgaon-122018 (INDIA)
दूरभाष/Ph: (91)-0124–4239480, फैक्स/Fax: (91)-0124–4239481, ई–मेल/Email: inaehq@inae.in, वैबसाइट/Website : www.inae.in

प्रोफैसर शिवाजी चक्रवती/Prof. Sivaji Chakravorti
FNAE, FNASc, FAST, FIETE, FIE
Vice-President (Fellowship, Awards and Corporate Communication)

Professor, Electrical Engineering Department
Jadavpur University, Kolkata 700032, West Bengal
Mob: 9830092189; Tele: 033-24146948
Email: s_chakrav@yahoo.com,
schakravorti.electrical@jadavpuruniversity.in

Message

It is my privilege to welcome all speakers/participants to the "National Frontiers of Engineering (NATFoE) Symposium" and the national design competition event "Innovations in Manufacturing Practices (IMP)" to be held on 9-10 July 2021. On behalf of INAE and on my personal behalf, I would like to congratulate Indian Institute of Technology Hyderabad for the superb drive in organizing these programs online, despite the difficult situation prevailing in the country.

NATFoE and IMP are testament of the commitment of INAE in reaching out to society in general and for celebration of knowledge in particular. It is difficult to start a good initiative, but it is even more difficult to maintain its standard over the years. In this aspect, NATFoE and IMP have excelled in not only maintaining the standard but also to raise the bar further up year after year. This year NATFoE, which is hosted by IIT Hyderabad, with four focused themes has evoked lots of interest in each and every one of the speakers/participants and will surely invigorate the skills and talents to work for a better tomorrow. A notable feature of this year's NATFoE is the special session on "Azadi ka Amrit Mahotsav" to commemorate India's 75th Year of Independence.

Around fifty speakers and participants from different institutes/industries of the country will be participating in this symposium. NATFoE will provide an appropriate platform for all these outstanding early career engineers to get introduced to each other, and through this interaction facilitate collaboration in engineering, the transfer of new techniques and approaches across fields, and establishment of contacts among the next generation of engineering leaders. There will be special lectures by eminent engineers, which will stoke the fire in the brilliant young minds.

IMP is a national level design competition involving UG and PG students as well as start-ups. The competition has evoked enthusiastic response from the target participants across the country. The final presentations are going to be the best from amongst the innovative projects carried out nation-wide.

In the end, I put on record my appreciation of the enormous efforts of the organising team of IIT Hyderabad lead by Prof. B.S.Murty along with the four theme coordinators and the IMP coordinator in overcoming all the prevailing obstacles.

With very best wishes for the grand success of NATFoE and IMP 2021.

Sivaji Chakravorti **Date: 14 June 2021**

Message by Prof. B.S. Murty

Director, IITH

भारतीय प्रौद्योगिकी संस्थान हैदराबाद
Indian Institute of Technology Hyderabad

भारतीय प्रौद्योगिकी संस्थान हैदराबाद
Indian Institute of Technology Hyderabad

Prof. B.S. Murty | प्रोफ. बी. एस. मूर्ति | FNAE, FNA, FASc, FNASc, FTWAS, FAPAM, FASM, FEMSI, FIIM, FAPAS

Director | निदेशक

Message for NatFoE-2021

Dear friends,

Welcome to NatFoE-2021 and welcome to IIT Hyderabad. All of you are familiar with National Frontiers of Engineering Symposium (NatFoE), which is an annual flagship event of Indian National Academy of Engineering (INAE). NatFoE is 15 years old now as it started in 2006, organized by IIT Delhi. 2nd to 7th NatFoE were organized in 2007 by IIT Delhi, in 2008 by IIT Madras, in 2009 by IGCAER Kalpakkam, in 2010 by Siksha O Anusandhan University, Bhubaneswar, in 2011 by IIT Hyderabad and in 2012 by IIT Guwahati. After year's break, NatFoE continued to be organized with the 8th (2014) by IIT Gandhinagar, 9th (2015) by IIT Jodhpur, 10th (2016) by IIT Kanpur, 11th (2017) by IIT Bombay, 12th (2018) by IIT Guwahati, 13th (2019) by IIT Bhubaneswar. The 14th NatFoE (2020), which was supposed to be organized by Bennett University could not be held due to Covid-109 Pandemic.

We, at IIT Hyderabad are delighted to host the 15th NatFoE, in an online manner due to the pandemic, during July 9-10, 2021. We are extremely happy that after IIT Delhi and IIT Guwahati, we are the third institute to hold NatFoE twice. The four themes chosen for this NatFoE, namely, Artificial Intelligence & Machine Learning, Advances in Materials & Manufacturing Technology, Infrastructure & Unconventional Energy and Rural Entrepreneurship are all contemporary areas have been attracting the attention of research not only within the country but globally. Both the speakers and the participants are some of the best in the country in these fields, and have been carefully chosen for the symposium.

A highlight of this year's NatFoE is a special session "Azadi Ka Amrit Mahotsav", to celebrate the innovations in the field of science and technology, as a part of Diamond Jubilee celebrations of Indian Independence. Another event of INAE, Innovations in Manufacturing Processes, is also being organized together with NatFoE-2021, which identifies innovative ideas from BTech, MTech students and startups in the field of manufacturing. Two special evening talks will be delivered by Dr. Tessy Thomas, Director General (Aeronautical Systems) DRDO and Dr. Debashish Bhattacharjee, Vice President New Materials Business, Tata Steel, to inspire the participants with their eminence.

IIT Hyderabad, with its moto, Inventing and Innovating in Technology for Humanity (IITH), has been constantly engaged in technology development in various fields. I am confident that NatFoE-2021 will be a platform, wherein various innovations in the four themes will be unveiled and the strategies for their commercialization will be discussed, paving way for the country to become a leader in technology innovations in these fields, which is a mission of INAE.

Wishing you all fruitful time at NatFoE-2021,

B.S. Murty

कंडी, सांगारेड्डी - ५०२ २८५, तेलंगाणा, भारत फोन: (०४०) २३०१ ६००१ फेक्स: (०४०) २३०१ ६०००
Kandi, Sangareddy - 502 285, Telangana, INDIA PHONE : (040) 2301 6001 FAX : (040) 2301 6000
director@iith.ac.in, bsm@iith.ac.in
www.iith.ac.in

Date: June 22, 2021

Organizing Team

Program Schedule

Day 1 (July 9, 2021; Friday)	
08.30 - 09.00	Registration/Technical set up
09.00 - 09.25	Inaugural Session
09.30 - 11.30	Session-1 (Theme: Artificial Intelligence & Machine Learning)
11.30 - 12.00	Break
12.00 - 13.00	IMP Session
13.00 - 14.30	Break
14.30 - 16.30	Session-2 (Theme: Advances in Materials & Manufacturing Technology)
16.30 - 17.00	Break
17.00 - 17.15	IITH Virtual Tour
17.15 - 18.00	Pre-dinner talk (Speaker: Dr. Tessy Thomas, DRDO)
18.00 - 18.30	Break
18.30 - 19.30	Cultural program (Indian Qawwali by Ahmed Brothers)
Day 2 (July 10, 2021; Saturday)	
09.00 - 11.00	Session-3 (Theme: Infrastructure & Unconventional Energy)
11.00 - 11.30	Break
11.30 - 13.00	Special Session on Azadi Ka Amrit Mahotsava
	(Chair: Prof. Indranil Manna, President, INAE)
13.00 - 14.30	Break
14.30 - 16.30	Session-4 (Theme: Rural Entrepreneurship)
16.30 - 17.00	Break
17.00 - 17.45	IMP Session Grand Finale
17.45 - 18.30	Pre-dinner Talk (Speaker: Dr. Debashish Bhattacharjee, Tata Steel)
18.30 - 19.30	Summary, Roadmap and Concluding Remarks
	(Chair: Prof. Sivaji Chakravorti, Vice President, INAE)

Inaugural Session	
July 9, 2021 (Friday) (9:00-9:25)	
09.00 - 09.05	Welcome Remarks (Prof. B. S. Murty, Director, IIT Hyderabad)
09.05 - 09:10	About NatFoE Symposium: Prof. Sivaji Chakravorti, Vice President, INAE
09:10 - 09:20	Presidential Remarks (Prof. Indranil Manna, President, INAE)
09:20 - 09:22	Releasing Symposium Abstract Booklet
09:22 - 09:25	Vote of Thanks (Dr. Chandra Shekhar Sharma, Coordinator, NatFoE 2021)

Session-1 (Theme: Artificial Intelligence & Machine Learning)	
July 9, 2021 (Friday) (9:30-11:30)	
09.30 - 09.45	Dr. Vineeth N Balasubramanian
09.45 - 10:00	Dr. Piyush Rai
10:00 - 10:15	Dr. Preethi Jyothi
10:15 - 10:30	Dr. Sunny Manchanda
10:30 - 10:45	Dr. Amit Acharyya
10:45 - 11:30	Discussion
Session-2 (Theme: Advances in Materials & Manufacturing Technology)	
July 9, 2021 (Friday) (14:30-16:30)	
14.30 - 14.45	Dr. Suhash Ranjan Dey
14.45 - 15:00	Dr. Neena S John
15:00 - 15:15	Dr. Senthilkumaran Kumaraguru
15:15 - 15:30	Dr. Vikranth Racherla
15:30 - 15:45	Dr. Suryakumar S
15:45 - 16:30	Discussion
Session-3 (Theme: Infrastructure & Unconventional Energy)	
July 10, 2021 (Saturday) (9:30-11:30)	
09.30 - 09.45	Dr. Mahendrakumar Madhavan
09.45 - 10:00	Dr. Arjun Sil
10:00 - 10:15	Dr. Syed Khaja Karimullah Hussaini
10:15 - 10:30	Dr. Ramendra Sundar Dey
10:30 - 10:45	Dr. Chandra Shekhar Sharma
10:45 - 11:30	Discussion
Session-4 (Theme: Rural Entrepreneurship)	
July 10, 2021 (Saturday) (14:30-16:30)	
14.30 - 14.45	Dr. Prasad S. Onkar
14.45 - 15:00	Dr. Rajib Deb
15:00 - 15:15	Dr. Shailandra Tiwari
15:15 - 15:30	Dr. Sriparna Chatterjee
15:30 - 15:45	Dr. Mudrika Khandelwal
15:45 - 16:30	Discussion

Special Session on Azadi Ka Amrit Mahotsava	
July 10, 2021 (Saturday) (11:30-13:00)	
11.30 - 11.45	Dr. Suhani Mohan
11.45 - 12:00	Dr. Pooja Devi
12:00 - 12:15	Dr. Mitesh M. Khapra
12:15 - 12:30	Dr. Tapas Kumar Maji
12:30 - 13:00	Discussion

Keynote Addresses

Advances in Aerospace Materials and Manufacturing Technologies

Dr. Tessy Thomas

Dr. Tessy Thomas obtained her B. Tech in Electrical Engineering from Calicut University, ME in Guided Missiles from Institute of Armament Technology (now Defence Institute of Advanced Technology), Pune and PhD in Missile Guidance from Jawaharlal Nehru Technological University (JNTU), Hyderabad. She obtained MBA in Operations Management from Indira Gandhi National Open University (IGNOU), New Delhi.

Dr. Tessy Thomas Joined IAT, Pune as a faculty member in Guided Missiles in the year 1986. She joined DRDL, Hyderabad in 1988. She was associated with Agni Programme right from its developmental flights. She has designed the guidance scheme for long range missile systems which is used in all Agni missiles, for which she was conferred with Agni self-reliance award in the year 2001. She led a major project AGNI-4 as Project Director, for a state-of-art system with many new technologies for the first time and successfully flight tested and proven. She was also Project Director (Mission) for the long-range AGNI-5 system, which was successfully flight tested and proven. As Director, Advanced Systems Laboratory, DRDO, she held multi-dimensional roles and responsibilities and lead the development of strategic missile system from 2014 to 2018.

Dr. Tessy Thomas is the recipient of many prestigious awards including Lal Bahadur Shastri National Award for Excellence in Public Administration Academics and Management-2012; DRDO Agni Award for Excellence in Self-Reliance – 2001; DRDO Award for Path breaking Research/Outstanding Technology Development-2007; DRDO Scientist of the Year Award-2008; DRDO Performance Excellence Award for Agni-4 in 2011; DRDO Performance Excellence Award for Agni-5 in 2012; Suman Sharma Award by The Institution of Engineers (India), National Design and Research Forum for Engineering Design in 2009; Madam Marie Curie Mahila Vijnana Puraskar-2012; Dr. Y. Nayudamma Memorial Award for the Year 2014 for Outstanding Contributions in the field Missile Technology, “Bharat Ratna Sir Mokshagundam Visvesvaraya Award-2016” towards outstanding contributions in the field of Engineering towards design, development and realization of indigenous missile systems by The Institution of Engineers (India), Telangana State Centre, Hyderabad, “Distinguished Woman Scientist Award” in 2016 for her contributions in the field of Missile Technology by Andhra Pradesh Science Congress, Andhra Pradesh Academy of Sciences.

Evolution of high strength automotive steels and their future

Dr. Debashish Bhattacharjee

Dr Debashish Bhattacharjee completed B.E. in Metallurgical Engineering from Jadavpur University in 1986, M. Tech in Metallurgy from IIT Kanpur in 1989 and PhD in Materials Science & Metallurgy from University of Cambridge, UK in 1993.

He joined Tata Steel in the R&D function in 1996 and headed the function as Chief Research & Development and Scientific Services between 2002 and 2009. In 2009, he was seconded to Tata Steel Europe as Group Director Research, Development & Technology for Tata Steel Group. Dr Bhattacharjee is an expert in development of materials and associated technologies. He has more than 50 international peer reviewed journal publications and 20 patents.

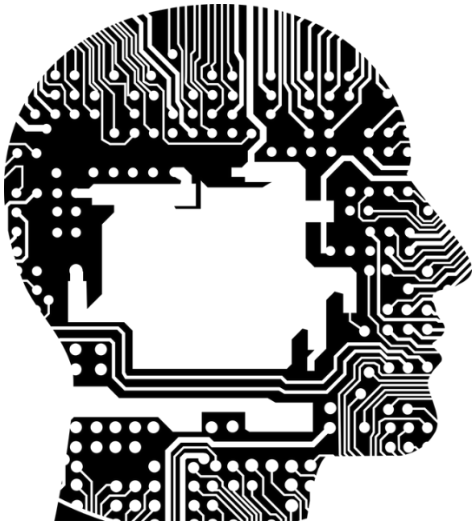
Dr Bhattacharjee is a Fellow of the Indian National Academy of Engineering and of the Indian Institute of Metals. He is Visiting Professor at the Imperial College London, at the University of Warwick, UK, and at the University of Science and Technology, Beijing, China.

Currently he is Vice President Technology & New Materials Business, Tata Steel based in Kolkata.

Dr Bhattacharjee's hobbies include playing cricket and acting in plays.

Abstract:

Over the last few decades, emphasis on weight reduction to improve fuel economy and enhanced crash safety performance have been the primary focus of the major auto manufacturers. This has triggered the evolution of high strength steels starting from first generation to second and finally to third generation advanced high strength steels. Unique microstructural features are produced with novel alloying additions and different processing combinations. Sustained developments aiming at specific applications will necessitate careful microstructure control which will optimize the different strengthening mechanisms. It is true that more than half of the steels present today did not in existence a decade ago. Therefore, this can safely be envisaged that a significant number of next generation high strength steels will be developed with the help of breakthrough technologies and innovations through industry-academia collaboration. We also see the future to be more multi-material to give combination of properties to components not possible through monolithic materials.



Artificial Intelligence
&
Machine Learning

Speakers

Towards Explainable and Robust AI Practice

Vineeth N Balasubramanian[1]
[1] Department of Computer Science and Engineering/ Artificial Intelligence,
Indian Institute of Technology Hyderabad, Kandi, Sangareddy-502285, Telangana, India
vineethnb@cse.iith.ac.in

The last decade has seen rapid strides in Artificial Intelligence (AI) moving from being a fantasy to a reality that is a part of each one of our lives, embedded in various technologies. A catalyst of this rapid uptake has been the enormous success of deep learning methods for addressing problems in various domains including computer vision, natural language processing, and speech understanding. However, as AI makes its way into risk-sensitive and safety-critical applications such as healthcare, aerospace, and finance, it is essential for AI models to not only make predictions but also be able to explain their predictions and be robust to adversarial inputs. This talk will introduce the audience to this increasingly important area of explainable and robust AI, as well as describe some of our recent research in this domain including the role of causality in explainable AI, as well as the connection between explainability and adversarial robustness.

Vineeth N Balasubramanian is an Associate Professor in the Department of Computer Science and Engineering at the Indian Institute of Technology, Hyderabad (IIT-H), India, and currently serves as the Head of the Department of Artificial Intelligence at IIT-H. His research interests include deep learning, machine learning, and computer vision. His research has resulted in over 100 peer-reviewed publications at various international venues, including top-tier venues such as ICML, CVPR, NeurIPS, ICCV, KDD, ICDM, and IEEE TPAMI. His PhD dissertation at Arizona State University on the Conformal Predictions framework was nominated for the Outstanding PhD Dissertation at the Department of Computer Science. He serves as a Senior PC/Area Chair for conferences such as CVPR, ICCV, AAAI, IJCAI, and is an Associate Editor for the Pattern Recognition journal with recent awards as Outstanding Reviewer at ICLR 2021, CVPR 2019, ECCV 2020, etc. He is also a recipient of the Teaching Excellence Award at IIT-H (2017) and a Google Research Scholar Award - earlier known as Google Research Faculty award (2020). His research is funded by various organizations including DST, MeiTY, DRDO, Microsoft Research, Google Research, Adobe, Intel, KLA and Honeywell. He currently serves as the Secretary of the AAAI India Chapter. For more details, please see https://iith.ac.in/~vineethnb/.

Learning Continually Without Forgetting Past Knowledge

Piyush Rai
Department of Computer Science and Engineering,
Indian Institute of Technology, Kanpur, and Google Research India
piyush@cse.iitk.ac.in piyushrai@google.com

Deep Learning methods have been immensely successful in obtaining excellent predictive performance in a variety of domains, such as computer vision and natural language processing. However, unlike humans, who can retain their past knowledge when learning to solve new tasks, deep learning methods tend to forget how to solve previously learned tasks when learning a new task. This typically happens because, for standard deep learning models, the model parameters (the network weights) get overwritten when optimizing the model performance for the new task. In this talk, I will discuss some ways (including some of our recent work) to mitigate this problem, which enables continual/lifelong learning in deep learning models.

Piyush Rai is currently a visiting faculty researcher at Google Research India and an associate professor (currently on leave) in Computer Science and Engineering department at IIT Kanpur. In the past, he has been a research faculty in Electrical and Computer Engineering at Duke University, a post-doc in Statistics and Computer Science at UT Austin, and a Ph.D. student in Computer Science at University of Utah. He is broadly interested in area of machine learning and artificial intelligence, especially focusing on probabilistic modeling and approximate inference. He is also a recipient of various awards, some of which include IBM Faculty Award, Google India Faculty Award, Visvesvaraya Young Faculty Fellowship, and best student paper award at ECML, and regularly serves in senior program committees of top machine learning and AI conferences.

New Frontiers for Automatic Speech Recognition

Preethi Jyothi[1]
[1] Department of Computer Science and Engineering,
Indian Institute of Technology, Bombay
pjyothi@cse.iitb.ac.in

Voice-driven technologies, powered by automatic speech recognition (ASR) engines, have seen widespread use in recent years. With internet users growing rapidly in India, it is an important challenge to make voice-based technologies cater to these new users. However, most of the languages spoken by these new users in India have little to no labeled speech data, which is a huge deterrent in building voice-driven technologies. The linguistic diversity among Indian users contributes to large variations in accents, which adversely affects ASR performance even on resource-rich languages like English. Technology users in multilingual communities like India also make frequent use of code-switching when interacting with machines, involving the use of multiple languages within the span of a sentence or a conversation, that further complicates voice-driven interactions. In this talk, we will describe some of our recent work that aims to address some of these challenges that are critical to tackle for the widespread adoption of speech technologies in India.

Preethi Jyothi is an Assistant Professor in the Department of Computer Science and Engineering at IIT Bombay. Her research interests are broadly in machine learning applied to speech and language, specifically in low-resource settings and for Indian languages. She was a Beckman Postdoctoral Fellow at the University of Illinois at Urbana-Champaign from 2013 to 2016. She received her Ph.D. in computer science from The Ohio State University. Her Ph.D. thesis dealt with statistical learning methods for pronunciation models. Her work on this topic received a Best Student Paper Award at Interspeech, 2012. She was awarded a Google Faculty Research Award in 2017 for her proposal on accented speech recognition. She serves on the ISCA SIGML board and is a member of the Editorial Board of Computer Speech and Language, one of the prominent journals in speech and language processing.

Continual Learning Machines

Sunny Manchanda,
Defence Research & Development Organisation, Young Scientist Laboratory – Artificial Intelligence
sunny@dysl-ai.drdo.in

It has been a human endeavor to build AI with the capability to learn new skills over time akin to learning in intelligent beings. This in deep learning AI research community, generally referred to as Continual learning, has seen a lot of interest and excitement in the recent past. While the AI community is taking rapid strides on reaching and at times surpassing human level intelligence on a narrow task, the need for continual learning is more apparent than ever. This talk will try to cover some ground on the recent progress in the techniques and algorithms for continual learning in deep networks and motivate why such a paradigm is fundamental to build next generation of intelligent machines.

Shri Sunny Manchanda, is a computer scientist who graduated from IIT Delhi specializing in Artificial Intelligence. In academia he along with Prof. Aaditeshwar Seth were driven towards finding answers to India ‘s Development Story using AI technologies like Satellite Data Analysis to contribute towards data driven policy making. He has also been working in the domain of complex airborne systems for the past decade on the AEW&C Netra Team. As a computer scientist he was initially chosen to work in the Aerospace domain of Indian Defence Research and was awarded the coveted Vice Chancellor Commendation Certificate for top position in Aeronautics stream at the prestigious Indian Defence Training School at Pune. Shri Sunny Manchanda is one of the youngest Directors of DRDO and was picked by the Principal Scientific Advisor to the Prime Minister and the DRDO top brass to head the new DRDO Young Scientist Laboratory for Artificial Intelligence (DYSL-AI). He is currently driven to establish DYSL-AI as a global research laboratory with focus on Vision, Speech and Language Technology.

AI For Next Generation Healthcare Systems Design

Amit Acharyya[1]
[1] Department of Electrical Engineering/Artificial Intelligence,
Indian Institute of Technology Hyderabad, Kandi, Sangareddy-502285, Telangana, India
amit_acharyya@ee.iith.ac.in

Next generation healthcare will be significantly benefited by the emergence of the AI. Subsequently the corresponding systems design would also observe a paradigm shift in its architectural implementation. This talk would touch upon the fields of the healthcare that would find immediate applications of the AI including cardiovascular health monitoring, artificial limbs and prosthesis, paralysis, activity recognition and autism. In all these cases with appropriate case studies it will be demonstrated that how AI will play a major role in resolving such burning healthcare issues. It also necessitates the respective systems design in a resource constrained scenario where the algorithm needs to run on a computational platform in real time with scarcity of power and area. In last five years there have been an uprisen the field of such AI specific systems design which will also be discussed as part of this talk.

Amit Acharyya received his Ph.D. degree in 2011 from the School of Electronics and Computer Science in the University of Southampton, UK. Currently he is working as an Associate Professor in the Indian Institute of Technology (IIT), Hyderabad, India. His research interests are in the area of Machine learning hardware design, VLSI architecture design for resource-constrained Signal processing applications and AI and Low Power Design Techniques. He has authored more than 81 international peer reviewed conferences, 69 international refereed journals including Royal Society, Nature Publishing, IEEE and contributed towards 8 book chapters. He is also handling several projects of Government of India including Science and Engineering board (SERB), Department of Science and Technology (DST), Ministry of Electronics and Information Technology (MEITY) and Defence Research and Development Organization (DRDO) apart from working in the private Industry sponsored projects. Dr. Acharyya's research has been awarded and acknowledged by several national and international bodies viz. Institution of Engineers India - Young Engineer award, Visvesvaraya young Faculty Award by the Ministry of Electronics and Information Technology, Digital Trail Blazer Award by the India Today, AMD Best project award, Microsoft Award, National Research and Development Corporation (NRDC)'s budding scientist award, GE Healthcare research award, Intel PhD Fellowship Award, Global Challenge Research Funds with University of Liverpool (UK), research grants from TSMC (USA), Xilinx (USA), RedPine Signals' (USA), Suzuki (Japan), young Investigator Award by the European Heart Rhythm Society. and TSMC's research grant. Dr. Acharyya is also serving as an Associate Editor of IEEE Transactions on Nanotechnology. He is also serving IEEE Computer Science Society's Integrity committee as the Vice Chairman. More details can be found at: https://www.iith.ac.in/~amit_acharyya/.

Participants

Dr. Abhijnan Chakraborty
Department of Computer Science and Engineering,
Indian Institute of Technology, Delhi

Abhijnan Chakraborty is an Assistant Professor at Indian Institute of Technology Delhi. His research interests fall under the broad theme of Computing and Society, covering the research areas of Social Computing, Information Retrieval and Fairness in Machine Learning. Before IIT Delhi, he spent 2.5 years at the Max Planck Institute for Software Systems (MPI-SWS), Germany as postdoc. He obtained his PhD from IIT Kharagpur, where he was awarded Google India PhD Fellowship and Prime Minister's Fellowship for Doctoral Research. He has also worked at Microsoft Research for 2 years. He has authored several papers in top-tier conferences including WWW, KDD, AAAI, AAMAS, CSCW and ICWSM. He has won the best paper award at ASONAM'16 and best poster award at ECIR'19. More details about him can be found at https://www.cse.iitd.ac.in/~abhijnan/.

Dr. Debangshu Dey
Department of Electrical Engineering, Jadavpur University

Dr. Debangshu Dey received his B.E.E, M.E.E. and Ph.D. degrees from Jadavpur University in 2003, 2005 and 2009, respectively. Presently he is working as an Assistant Professor in the Electrical Engineering Department, Jadavpur University, Kolkata, India. Dr. Dey has published more than 50 International Journal papers including 22 papers in IEEE Transactions and co-authored one book from Springer-Verlag London and also edited 2 volumes published by IEEE with 4 patents granted to him including 1 US Patent. He is the recipient of IEI Young Engineer Award in 2014, TARE research associateship from SERB, GoI in 2018, VisvesaryaYoung Faculty Research Fellowship in 2019, Outstanding Chapter Engineer Award by IEEE PES, Kolkata and two best paper awards. He was the visiting researcher in various institutes like University of Applied Sciences, Augsburg, Germany and ISI, Kolkata. His areas of interest are applications of signal and image processing tools in electrical and bio-medical systems, condition monitoring of electrical equipment, non-invasive testing related to condition assessment.

Dr. Mansi Sharma
Department of Electrical Engineering,
Indian Institute of Technology, Madras

Mansi Sharma received Ph.D. in Electrical Engineering, in 2017, from the Indian Institute of Technology Delhi. She received M.Sc. Degree in Mathematics, in 2008, and M.Tech. Degree in Computer Applications, in 2010, from Department of Mathematics, IIT Delhi. She has been awarded the prestigious INSPIRE Faculty Award in 2017 by the Indian National Science Academy. Since May 2018, she has been working as an INSPIRE Faculty in the Dept. of Electrical Engineering, Indian Institute of Technology Madras, India. Her research interests include Computer Vision, Computational Imaging, 3D Displays, Deep Learning, Virtual Reality, Augmented Reality, Haptic Technology, Visuo-haptic Mixed Reality in Medicine, Machine Learning Assisted Haptic-enabled Neurorehabilitation, Tensor Processing for 3D Media, Algebraic Perspective on Machine Learning, and Applied Mathematics.

Dr. Mridula Verma
Institute for Development and Research in Banking Technology (IDRBT), Hyderabad

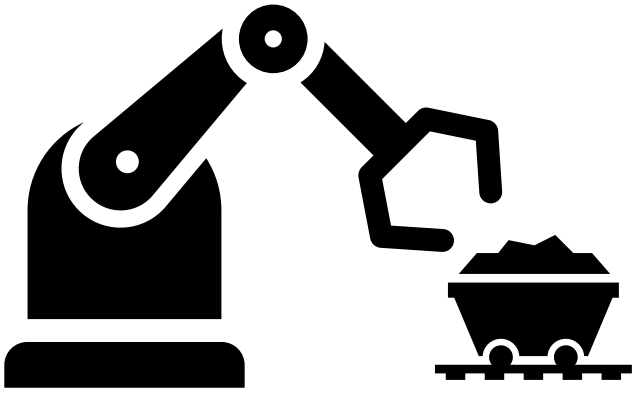
Mridula Verma (Ph. D., 2018 - Indian Institute of Technology (Banaras Hindu University)) is working as an Assistant Professor at Institute for Development and Research in Banking Technology (Established by Reserve Bank of India), Hyderabad. Her research interests include Video Analytics, Multilingual Natural Language Processing, Machine Learning Optimization Algorithms and Applications, Data Science and Convex Optimization. She has more than seven years of research and teaching experience, with the contribution of 20+ research articles in reputed journals and conferences, such as Neurocomputing, Pattern Recognition Letters, Knowledge and Information Systems, International Joint Conference on Neural Networks (IJCNN), IEEE International Conference on Systems, Man, and Cybernetics (IEEE SMC), IEEE Sensors Journal etc. She is the reviewer of many International Journals and Conferences like IEEE Transaction on Knowledge and Data Engineering, IEEE Access, IEEE Sensors Journal, ACM Multimedia, etc.

Dr. Subrahmanyam Gorthi
Department of Electrical Engineering, Indian Institute of Technology, Tirupati

Dr. Subrahmanyam Gorthi is working as an Assistant Professor in the Department of Electrical Engineering, Indian Institute of Technology (IIT) - Tirupati since August 2016. Before Joining IIT-Tirupati, he worked as a Chief Engineer in the Health and Medical Equipment (HME) division of Samsung R&D Institute in Bangalore (SRI-B), India, for more than a year. He worked as a Postdoctoral Research Fellow at Harvard Medical School and Boston Children's Hospital for one and half years. He did his Ph.D. in Medical Image Processing at the Swiss Federal Institute of Technology (EPFL), Switzerland. He did his Masters (MSc (Engg.)) in Computational Science at the Indian Institute of Science (IISc), Bangalore, India. His current research areas include computer vision, medical imaging, image processing, and signal processing. More details about his teaching and research can be found at: https://subrahmanyamgorthi.weebly.com.

Dr. Yamuna Prasad
Computer Science and Engineering, Indian Institute of Technology, Jammu

Yamuna Prasad received the Ph.D. Degree in computer science and Engineering from Indian Institute of Technology Delhi, India. He was a Postdoctoral Fellow of Thompson Rivers University, BC, Canada from 2017 to 2018, and a visiting scholar with University of Cincinnati, OH, USA, in 2018. He is currently assistant professor in the department of computer science and Engineering, Indian Institute of Technology Jammu, India. He has authored over dozens of articles in peer-reviewed journals and conferences in the area AI, ML and Bioinformatics. He has also delivered talks and webinars in the area of AI/ML in various national and international venues. He has served as a reviewer of many international journals and conferences. His research interests include intersection of artificial intelligence, optimization, soft computing, machine learning and deep learning.



Advances in Materials and Manufacturing Technology

Speakers

Electrochemical Process for Design and Development of New Age Materials

Suhash Ranjan Dey[1], Chokkakula L.P. Pavithra[1], Reddy Kunda Siri Kiran Janardhana[1]
[1] Department of Materials Science and Metallurgical Engineering,
Indian Institute of Technology Hyderabad, Kandi, Sangareddy-502285, Telangana, India
suhash@msme.iith.ac.in

Advancement in Materials happens through bringing out new compositions of alloys, compounds, and combination of different elements/reinforcements as composites under structural and functional materials domains. Further enhancement of materials properties can be imparted through tailoring its internal structuring and changing its dimensions (from 3D to 0D). Usually, modern day materials are developed through several new age technologies. However, there are age-old time-tested useful materials processing techniques which still retain its practices due to its comprehensive knowhow, easy processing, versatility and from lab-to-industry scalability. Electrochemical process is one such traditional age-old technique in materials development which is tried from earlier days for single element depositions to modern day complex alloys/compounds/composites makings, in all dimensions. Today, electrochemical technique has showed its worth from fabrication to characterization, processing, and recycling for varied present-day applications starting from energy, healthcare to environment sectors.

In the presentation, the author shall delve on two aspects of materials advancement using electrochemical deposition: design and development. One can design new range of compositions through fast combinatorial material science and develop it further by controlling the functionality through changing their dimensionality. The authors used electrodeposition to generate Ni-Cu materials library of varied compositions and applied mathematical modelling and electrode kinetics to predict the obtained alloy compositions. In addition, this approach has led to the advanced materials development, where the authors have electrodeposited a new FeCoNiCuZn multi-principal element alloy thin films in single step in aqueous medium and further scaled down its dimension into nanowires to enhance its functionality.

Dr. Suhash R. Dey received his B.Sc. in Chemistry (Hons.) in 1998 from University of Delhi, India. He obtained his M.Sc. in Chemistry in 2000 and M.Tech. in Materials and Metallurgical Engineering in 2002 from Indian Institute of Technology Kanpur, India, and his Ph.D. in Materials Science in 2006 from Université Paul Verlaine–Metz, France. He pursued his research career as Post-Doctoral fellow in Risø National Laboratory, Denmark; as Alexander von Humboldt Research Fellow in Technical University Dresden, Germany and as Research Scientist in Ruhr-University Bochum, Germany. In 2010, he returned to India to join the department of Materials Science and Metallurgical Engineering in IIT Hyderabad. Currently, he is working in the same institute as Professor and Head of Department. With time, Suhash has received several scientific fellowships and awards. His current research focuses on combinatorial alloy design of emerging materials with varied morphologies for energy conversion, sensors, and biomedical applications.

Metal Oxide Nanomaterials with Spiky Morphology for Multifunctional Applications

Neena S John, Ramya Prabhu B., K. Bramhaiah
[1]Centre for Nano and Soft Matter Sciences, Shivanapura, Bengaluru-562162, India
jsneena@cens.res.in

Metal oxide nanomaterials with diverse morphology are of great interest as they exhibit unique characteristics that can be exploited for various applications such as photocatalysis, photodegradation of pollutants, molecular sensing, antibacterial coatings, energy storage etc. The spikes are often micrometer long with nanometer sharp tips and multitude of them together contribute to enhanced surface area and defect concentration promoting light harvesting and charge transfer with adsorbed molecules and other nanoparticles. We have synthesized various metal oxides such as molybdenum oxide, niobium oxide and mixed metal oxides with spiky morphology via hydrothermal synthesis amenable to scale up. Sea urchin MoO_3 is employed as a surface enhanced Raman (SERS) substrate for rhodamine 6G dye molecules and the SERS activity observed is quite high with an enhancement factor (EF) of the order 10^5 and a detection limit of 100 nM when compared to other morphologies. The observed EF is quite high for a metal oxide substrate and is attributed to the enhanced charge transfer between analyte molecules and the substrate promoted by the oxygen vacancies along with surface defects and hydroxyl groups on MoO_3 spikes providing more active sites for the adsorption of probe molecules. The above substrates allow chemical modification on the spiky tips for sensing of other analytes as well. In another study of mixed metal oxides, the composition was designed to exhibit antimicrobial property. The composition of metal oxides along with the spikes exert physical and chemical effects on the microbes, thereby deactivating them. The system is effective against both gram positive and gram-negative bacteria and bacteriophage virus and can be applied as antimicrobial coatings. The mixed metal oxides are photoactive, and they are efficient in degrading organic matter and hence, are recyclable.

Dr. Neena S John works as Scientist-E at Centre for Nano and Soft Matter Sciences, Bengaluru. Her research field includes inorganic nanomaterials, diverse morphology for unique properties and applications in molecular sensing, hybrids with carbon nanomaterials for multifunctional materials, non-noble metal-based materials for renewable energy particularly, electrochemical energy and scanning probe microscopy-based investigations of materials. The materials are synthesized in our laboratory to suit the desired applications to obtain better performance. She has published 40 journal articles and filed 2 patents.

Towards Faster Qualification of Powder Bed Fusion Process Through Multiscale Linked Surrogate Models

Senthilkumaran Kumaraguru, Hemnath Anandan Kumar
Centre for Smart Manufacturing,
Indian Institute of Information Technology, Design and Manufacturing, Kancheepuram, Chennai, India
skumaran@iiitdm.ac.in

Industries require faster qualification of parts in the metal Additive Manufacturing (AM) processes and use of experimental trial and error methods are limited by high cost and time. While numerical models for the powder bed fusion process are a less expensive alternative, they are time-consuming compared to experimental methods. Employing surrogate models can aid in overcoming such issues by serving as a virtual replica of the physical process [1]. The metal AM process involves many complex physics at various scales, and difficulties have been reported in linking high fidelity process models at various scales by previous researchers [2]. There are separate models for melt pool predictions, microstructures, residual stress, distortion, and powder spreading. But all these happen at different scales, and different surrogates need to be developed using Machine Learning (ML) techniques and linked appropriately to serve as a complete PBF model. To develop an accurate ML model, large data sets must be generated through a combination of simulations and experimental methods from various sources. Along with a large quantity of data, the data quality also must be taken care of to predict accurately by properly encountering the uncertainty in data-generating models. The critical challenges while developing the surrogate model include insufficient data sets, selection bias, missing data, imbalanced data, outliers, which must be considered as it determines the accuracy of the model. These ML mechanisms, when combined with disparate models for linking, can result in computationally efficient models. Reduced computational time with improved prediction accuracy and reduced complexity of the model is crucial for developing such a multiscale linked surrogate model.

References:

[1] M. Vohra, P. Nath, S. Mahadevan, Y.T. Tina Lee, Fast surrogate modeling using dimensionality reduction in model inputs and field output: Application to additive manufacturing, Reliab. Eng. Syst. Saf. (2020).
[2] J.G. Michopoulos, A.P. Iliopoulos, J.C. Steuben, A.J. Birnbaum, S.G. Lambrakos, On the multiphysics modeling challenges for metal additive manufacturing processes, Addit. Manuf. (2018).

Dr. K. Senthilkumaran is currently Assistant Professor in Indian Institute of Information Technology Design and Manufacturing (IIITDM) Kancheepuram, Chennai. He is also the divisional leader for smart manufacturing division at IIITDM Kancheepuram. He obtained his doctorate in Additive manufacturing in Mechanical Engineering department of IIT Delhi. He previously worked as a guest researcher in Systems Integration Division of National Institute of Standards and Technology, USA. His research interests are in additive and sustainable manufacturing. He is Associate editor of ASTM journal on Smart and Sustainable Manufacturing. He is a member of ASME, SME, SAE and IEEE. He is also a member of IFIP WG5.7 developing smart manufacturing technologies. He has been nominated for prestigious in-residence program for inspired teachers at Rashtrapati Bhavan during 2016. As part of outreach activities, he is also the coordinator for Teaching Learning Centre at IIITDM Kancheepuram funded by MHRD, India which develops extremely affordable digital fabrication technologies for colleges, polytechnics, and schools for STEM.

Solid State Sintering Using Friction Processing

Vikranth Racherla
Department of Mechanical Engineering, Indian Institute of Technology Kharagpur, Kharagpur, India
vikranth.racherla@mech.iitkgp.ac.in

Friction processing was used to fabricate solid sintered metal parts, open-cell copper foam parts and sandwich structures. Sintering and dissolution, with NaCl spacers, was used to obtain the copper foam. Pressure and temperature needed for sintering were obtained by plunging a rotating tool into a top sheet in the setup. Setups and tool paths were chosen to obtain the desired shape and size of sintered parts. The presented method, which is done in an open atmosphere, is an attractive alternative to conventional sintering methods, particularly for fabricating solid sintered metal parts with large specific surface area and high strength to weight ratio.

Dr. Vikranth Racherla is a Professor from Mechanical Engineering at IIT Kharagpur. He got his PhD from University of Pennsylvania in 2007. He worked as a postdoctoral fellow in Ecole Polytechnique before joining IIT Kharagpur as an Assistant Professor in 2009. He is currently working in areas of friction stir processing, friction stir additive manufacturing, numerical modeling, and railway engineering.

Studies on Additive Manufacturing of Large Metallic Components

Suryakumar S
Department of Mechanical Engineering,
Indian Institute of Technology Hyderabad, Kandi, Sangareddy-502285, Telangana, India
ssurya@mae.iith.ac.in

With the growth of metallic Additive Manufacturing (AM), processes capable of producing large components (more than 1m in size) with high deposition rates have been of particular interest. On this front, arc based deposition processes stands out among the metallic AM processes with their high deposition rates, high material and power efficiency, lower investment costs, simpler setup and less demanding environment requirements. The essential weld-deposition AM system consists of a wire-based weld unit and a multi-axis motion system. This version of AM, usually referred as WAAM (Wire-Arc Additive Manufacturing), yields high deposition rates and large parts can be produced in significantly lesser time. WAAM produced parts are larger in size and surface. This may in typical AM challenges including residual stress and distortion, non-uniform properties in build direction, stair stepping effect, and poor surface finish. The bottom or intermediate layers of the component undergo a greater number of thermal cycles compared to top ones leading to softening. The hardness is considerably high for top few layers resulting in non-uniformity in mechanical properties. The current work presents the various studies on addressing these issues, including (a) geometrical modelling of the weld-deposition geometry for accurate surface geometry (b) FEM of the process to understand the effect of weld-deposition pattern on residual stress evolution (c) creation of Functionally Gradient Objects using twin-wire welding, leveraging the anisotropy of the process.

Keywords:
Weld-Deposition, Wire-Arc Additive Manufacturing, WAAM, distortion control, anisotropy.

Dr. Suryakumar is a Professor in the Department of Mechanical and Aerospace Engineering at IIT Hyderabad. He has done his BTech & MTech (Dual Degree) from IIT Madras and PhD from IIT Bombay, soon after which he joined IIT Hyderabad as faculty in 2010. His current research interests include Additive Manufacturing of Metallic Objects, particularly large sized; Design for Additive Manufacturing; Circular Manufacturing and Industry 4.0. Beyond the current focus on Additive Manufacturing, he shares a broad passion for manufacturing/ fabrication domain and is currently the Faculty-in-charge for Incubation, Innovation and Startups at IIT Hyderabad. He is the recipient of Excellence in Teaching award by the Institute for the year 2013 and Excellent in Research award for the year 2020.

Participants

Dr. Chandra Sekhar Tiwary
Department of Metallurgical and Materials Engineering,
Indian Institute of Technology, Kharagpur

Chandra Sekhar Tiwary did his B.tech in Metallurgical and materials engineering from National institute of Technology, Durgapur in 2008. After receiving his Ph.D from Indian Institute of Science Bangalore India in 2014, he worked at Rice University, Houston, USA till 2017. His group works on development of new alloys, 3D printing, 2D materials and its applications in energy and electronics, catalysis. He has published more than 250 papers and 10 patents with citation more than 6500 (h index more than 40). He has received young metallurgist from ministry of steel. He is awarded young scientist award from Indian national science academy and NASI. He received INSMANAM young researcher award and excellent microscipict award and others.

Dr. Degala Venkata Kiran
Department of Mechanical Engineering,
Indian Institute of Technology, Tirupati

D.V. Kiran received Master of Technology and Ph.D. degrees specializing in Welding Engineering from Indian Institute of Technology Roorkee (IIT-R) and Indian Institute of Technology Bombay (IIT-B) in 2007 and 2012, respectively. He worked as a Post Doctoral Fellow in the Department of Mechanical Engineering at Korea Advanced Institute of Science and Technology (KAIST), South Korea, from 2012 to 2015. He joined in the Mechanical and Industrial Engineering Department (MIED), IIT-R, as a Ramanujan Assistant Professor, in 2016 and continued till 2017. In 2017 he joined in the Department of Mechanical Engineering, IIT Tirupati as an Assistant Professor. D.V. Kiran is a recipient of the prestigious BK21 fellowship in 2012 and the Ramanujan fellowship in 2015. He is awarded with best PhD thesis award in the year 2012. He has published 35 research papers in peer reviewed journals and conferences. His current research interests include welding science and technology, numerical modeling of fusion welding processes, additive manufacturing, and smart manufacturing.

Dr. I.A. Palani
Department of Mechanical Engineering,
Indian Institute of Technology, Indore

Dr. I. A. Palani is working as Associate Professor in the Department of Mechanical Engineering IIT Indore. After completing his Doctorate from IIT Madras, He worked as a post doctoral research scientist in GISEE, Kyushu University, Japan. He has developed Mechatronics and Instrumentation Lab at IIT Indore. His area of expertise includes laser assisted surface processing, micro-machining, Smart materials and shape memory alloys. He has published more than 100 international journal publications and he has filed 6 Indian Patents. He has executed project from different funding agencies such as DST, SERB, DAAD, JSPS, DRDO, RSF, worth 8 crores. He has closely worked with industries such as Volvo Eischer, John Deere, WABCO as technical consultant. He is a life member in Indian Laser Association and Institute of Smart materials and structures.

Priyanka Nadig
Senior Technical Lead, Cyient Ltd.

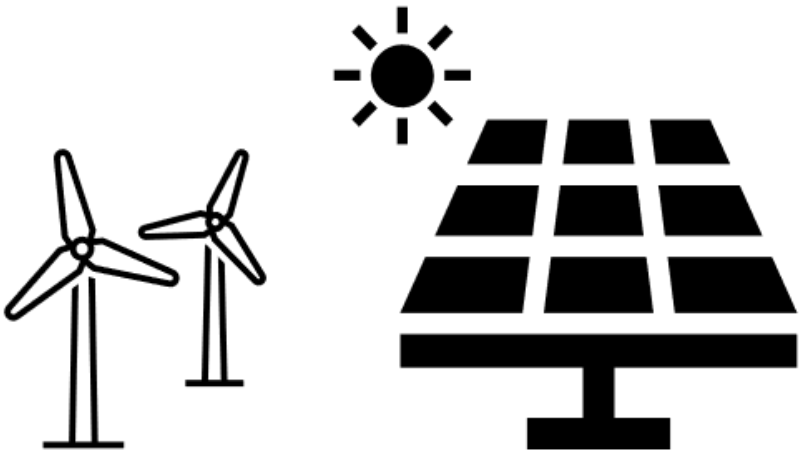
Priyanka Nadig, a Materials Engineering graduate from the University of Sheffield, UK is a manufacturing professional with over 11 years of experience. As an additive manufacturing professional her primary focus has been to establish process-material-property relationships and constantly explore ways to reduce part manufacturing cost, weight, lead time and enhance performance. Currently at Cyient Ltd., as a Senior Technical Lead, she supports the Metal Additive Manufacturing facility at Florida, USA to establish machine-material-process relationship and benchmark alloys for commercial applications. Other focus areas include conducting workshops to prepare engineers from part screening to part printing. Priyanka looks forward to advance her skills and engage in projects with academia and industry to address challenges in the conventional manufacturing processes with additive manufacturing.

Mr. Raghavendra Adla
Founder, CEO, Paninian

Mr.Raghavendra Adla is an Entrepreneur, Researcher and Founder of Deep Tech Startup Paninian working towards transforming Aerospace and Healthcare by applying Artificial Intelligence in novel ways to Augment Engineering and Humanity. Raghavendra has a Masters Degree from University of Manchester, UK where he's earned a distinction for his thesis in applying Swarm Intelligence for Agent Based Simulations. He was a Ross Fellow at Purdue University, West Lafayette in Interdisciplinary Engineering and Imaging working on Parallelizing Machine Learning Algorithms. He's certified by MIT in Complex Systems Architecture and consulted various Fortune 100 companies like Apple, Airbus, UL and Walmartlabs as Enterprise Architect/Data Scientist prior to founding Paninian. He's currently leading a highly multi-disciplinary team of 25 Engineers and PhD researchers at Paninian is applying novel AI and Computational Techniques in areas of Advance Materials, Design and Manufacturing creating Intelligent Cyber-Physical Capabilities to deliver world class products to our Customers in Aerospace.

Dr. Tapasi Sen
Energy and Environment Unit (EEU),
Institute of Nano Science and Technology, Mohali

Tapasi Sen completed her Bachelor's and Master's degrees in Chemistry from Visva-Bharati University in 2004 and 2006, respectively. She received her Ph.D. (2011) from Jadavpur University, India under the guidance of Prof. Amitava Patra. She visited Weizmann Institute of Science, Israel in 2011 as a visiting Scientist. After completing postdoctoral research in Technische Universität Braunschweig, Braunschweig, Germany (2012–2013), she continued her postdoctoral research in Ben-Gurion University of the Negev, Beer-Sheva, Israel. She joined Institute of Nano Science and Technology (INST), Mohali as Scientist C in 2014. Presently she is working as Scientist D (Assistant Professor) at INST. She is an Editorial board member of Nano Research & Applications journal and has authored over 30 publications in peer-reviewed journals. Her research interests include fabrication of plasmonic nanostructures based on DNA origami for biomolecular assays and single molecule sensing applications, and design of nanoantennas for efficient light harvesting systems.



Infrastructure & Unconventional Energy

Speakers

Cold-Formed Steel for Sustainable Construction

Mahendrakumar Madhavan
Department of Civil Engineering,
Indian Institute of Technology Hyderabad, Kandi, Sangareddy-502285, Telangana, India
mkm@ce.iith.ac.in

India has 68.8% of its population residing in rural areas, as per the 2011 census. However, the urbanization rate of India is around 31.8% as per the 2011 census, which is expected to rise to 40% by 2030, leading to a massive demand for housing in semi-urban and urban areas in the near future. The government housing schemes like Pradhan Mantri Awas Yojana (Urban) and Pradhan Mantri Awas Yojana (Garmin) under the Ministry of Housing and Urban Affairs, which are initiated in 2015, have already been working towards building 2 crore affordable houses for the poor, which is chalked out to accomplish by 2022 in 3 phases and thereby reaching the goal of "Housing for all." Generally, concrete is preferred as a building material in most mass housing projects due to its advantages in terms of economy, workmanship, etc. But the use of concrete can lead to numerous long-term ill-effects to the environment like global warming because of the use of cement, which releases CO2 into the environment, and exploitation of natural resources for sand, aggregates, and water, which is a significant concern these days. So, the prime concern of the current society to protect the environment has made it inevitable for Researchers and Structural Engineers to search for readily recyclable and sustainable building material. Steel is a genuine alternative to concrete with a high strength to weight ratio and is considered as an environment-friendly building material that can be recycled many times without losing parent material strength, thereby promoting a circular economy. Currently, hot-rolled steel is primarily used in construction as an alternative to concrete which is purely a factory-made product resulting in a considerable quantity of carbon footprint due to molding and other rolling, milling processes. Alternatively, Cold-Formed Steel (CFS) sections, manufactured by a sequence of pressing or bending operations, can also be used. Initially, the use of these sections is restricted to non-load bearing members. But, with the advent of sophisticated research studies, the CFS is used as a primary load carrying members, which has its unique features and advantages over HRS such as high strength-to-weight ratio, nestablility, and reduction in erection costs, acquisition and transportation costs, ease in construction and recyclability. Currently, the design of CFS members worldwide is carried out based on codes like AISI S100-16/ S2-20, EN 1993-1-3, AS/ NZS 4600:2018, which are periodically updated. However, these codes are not comprehensive and acknowledging this problem, tremendous research has been carried out at IIT Hyderabad over the wide range of CFS viz., Built-up columns, Built-up beams, Sheathed wall panels, Composite flooring systems, Beam-column connections, Beam-beam connections, and many more with the target of making the IS 801: 1975, the Indian standard for CFS design to stand in the row of other international codes. This sophisticated research makes the codes comprehensive and renders the designer's task relatively simple, thereby promoting the use of CFS in mass housing projects which makes the structure sustainable and affordable for all.

Dr. Mahendrakumar Madhavan is an Associate Professor in the Department of Civil Engineering, IIT Hyderabad, India. He obtained his Ph.D. from the University of Alabama at Birmingham, USA, and a master's degree from The NUS, Singapore. Before joining IIT Hyderabad, Dr. Madhavan worked as a Structural Engineer at Alabama Power Company, Birmingham, and is a Registered Professional Engineer (PE) in Alabama, USA. Dr. Madhavan's principal research interests lie in the physical testing of structural members and systems, numerical modeling through the use of commercially available finite element packages, and the development of new design methods for steel-intensive structures. He has published more than 40 peer-reviewed internationally reputed journals. He holds membership in the "American Society of Civil Engineers (ASCE), Structural Engineering Institute (SEI), Technical Administrative Committee on Metals" and in "ASCE SEI Cold-Formed Steel Members Committee." In addition, he is an Editorial board member of the Journal of Structures and is the youngest faculty from India to become an Associate Editor for ASCE Journal of Structural Engineering.

Quantification and Spatial Mapping of Atmospheric Corrosion Hazards in Indian Context

Arjun Sil, Vanapalli Naveen Kumar
National Institute of Technology, Silchar, Assam, India
arjun@civil.nits.ac.in

The natural disintegration of metals into their original mineral forms (oxides, sulphides, and hydroxides) due to environmental exposure is referred to as atmospheric corrosion. Steel's endurance becomes considered as an engineering material positions that acts as a potential contributor to the global economy, and the annual economic impact of corrosion deterioration becomes not less than a natural disaster. The advanced global empirical model developed with innate corrosion dynamics to predict Indian atmospheric corrosion of steel in accordance with the existing environmental conditions. Steel atmospheric corrosion studies conducted using the last four decades available dataset, however, initially for the states of Andhra Pradesh and Telangana and subsequently for the entire country performed. The found spatial-temporal trends in atmospheric corrosion for the entire country assessed and interpreted. The country's atmospheric corrosion maps generated using the ISO pollutant classification system. The whole country spatially delineated into five corrosive zones based on atmospheric corrosion, and a spatial maping of the whole country's atmospheric corrosion zones proposed to help Govt, planners and industries for better planning in a cost-effective manner.

ARJUN SIL B.Tech (NERIST), M.Tech (NIT Silchar) & PhD (IISc, Bangalore), India is currently working as Assistant Professor,Gr-1 in the Department of Civil Engineering, NIT Silchar, India. His research domains essentially interdisciplinary such as Earthquake Engineering including Structural, Geotechnical, Seismology, Space hazards, Corrosion & chloride hazards modeling, blast load & damage modeling, Covid-19 transmission modelling and image based supervised fracture modeling. He has published research articles so far in highly reputed journals (45 nos) and conferences (10 nos), and one granted patent. He has guided so far 31 MTech scholars,01 PhD scholar (defended). He is a reviewer of various notable journals [https://sites.google.com/view/dr-arjun-sil/home]. He has received several awards such as, Outstanding Structural Engineer of the Year Award-2020, Confer by the Governing Council of "Indian Association of Structural Engineers (IAStructE), New Delhi, India for the overall contribution of Civil Engineering, Appointed as "Research Advisor" of NANYANG ACADEMY OF SCIENCES (SINGAPORE), IGS-Sardar Resham Singh Memorial Award-2015, Confer by Indian Geotechnical Society, PhD thesis is nominated as best thesis for “MEDAL” in IISc, Bangalore from Civil Engineering Department 2014-2015, NATIONAL SCHOLARSHIP EXAM,1994 (4th position in State SCERT Exam) in Schooling Level.

Stabilisation of Ballasted Rail Tracks to carry High-Speed Trains

Syed Khaja Karimullah Hussaini[1], Kumari Sweta[2]
[1] Indian Institute of Technology Patna, [2] National Institute of Technology Patna
hussaini@iitp.ac.in

Ballast forms an essential component of a conventional rail track foundation and is responsible for distributing the applied wheel load to the sub-grade soil at an acceptable level while maintaining the track alignment. However, owing to its unbound granular nature ballast undergoes differential track settlement and track misalignment upon repeated passage of trains, thereby affecting the track stability. In the recent past, the railway engineers across the world have resorted to the use of geosynthetics to stabilize the railway tracks. In this research, experimental investigations were carried out by using large-scale direct shear apparatus to explore the shear behaviour of ballast and ballast-sub ballast interfaces with and without geogrids. Model track tests were conducted using large-scale process simulation test (PST) apparatus to simulate the realistic behaviour of railway track under operating conditions. The effect of geogrid on the deformation and degradation behaviour of ballast under high loading frequencies was investigated.

The tests conducted on ballast-geogrid interfaces using large-scale direct shear apparatus revealed that the shear strength was highly influenced by the applied normal stress and shearing rates. The friction angle of ballast (□) was found to decrease from 66.5° to 58° and dilation angle (ψ) from 25.3° to 8.1° with the increase in applied normal stresses σn and shearing rates Sr. The breakage of ballast, evaluated in terms of Marsal's breakage (Bg), increases from 5.1 to 13.2 % with the increase in σn and Sr. The large-scale direct shear test on ballast-sub ballast interface revealed that the friction angle of unreinforced ballast-sub ballast interface was found to decrease from 63.2° to 47.9° and dilation angle (ψ) from 14.6° to 5.2° as the values of σn and Sr increased from 20 to 100 kPa and 2.5 to 10.0 mm/min, respectively. Further, the breakage of ballast (Bg) was found to increase from 2.8 to 6.7 %. However, geogrid inclusions enhanced the shear strength of the ballast-sub ballast interface and also reduced the extent of Bg. The results from the model track test reveal that the deformation and degradation behaviour of ballast is influenced by f. The use of geogrids is shown to reduce the extent of deformations in ballast (both lateral and vertical) and its degradation (Bg: ballast breakage). The assessment of the lateral strain profiles along the ballast depth indicates that the effect of geogrid exists only up to a certain distance called geogrid influence zone (GIZ). The GIZ is also established to be dependent on the type of geogrid used and the loading frequency (f).

Dr. Hussaini is an Assistant Professor in the Department of Civil and Environmental Engineering at Indian Institute of Technology Patna. His research interest includes stabilsation of rail track foundation using geosynthetics and polymers. He has established Railway Engineering Laboratory at IIT Patna to realistically simulate the behavior of rail track foundation under track operating conditions in the laboratory. His research is published in some of the leading Geotechnical and Railway Engineering Journals. He has successfully guided one PhD student, and is currently supervising 4 PhD students at IIT Patna. Prior to joining IIT Patna, he has obtained his Doctor of Philosophy from University of Wollongong, Australia. He had obtained his Master of Technology in Structural Engineering from IIT Madras. Dr. Hussaini was a recipient of DAAD fellowship and has attended Karlsruhe University, Germany during his master's Programme to carry out his research.

Improvisation in Carbonaceous Materials and their Implication in Metal-air Battery and Third Generation Ammonia Synthesis

Ramendra Sundar Dey
Institute of Nano Science and Technology (INST), Sector-81, Mohali-140306, Punjab, India.
rsdey@inst.ac.in

The rapid extinction of non-renewable sources of energy has enormously encouraged researchers to bring out some sustainable alternatives for a green energy-driven electrified future. In this respect, the use of Fuel cells and Zinc-air batteries have gained much attention and several catalysts are developed over the decades to upsurge the sluggish kinetics of oxygen reduction (ORR) process, an integral part of the above mentioned technologies. As the scientific community was gradually inclining toward H_2 energy powered future, several issues regarding storage and maintenance of H_2 as a fuel surfaced. Thus, as a more convenient option, "the friend to the farmer" ammonia (NH_3) synthesis is eventually prioritized as the new transportation fuel and carrier gas for H_2. In the realm of these issues, our group is focused on the development of various carbonaceous catalysts doped with transition metal single/ dual atoms to boost the ORR kinetics and to obtain an appreciable yield of ammonia during the nitrogen electro-reduction (NRR). We develop facile synthetic routes and make use of bio-wastes to construct our catalysts, in order to circumvent the difficulties with respect to scaling-up, synthesis conditions, costly starting materials and tedious purification steps. After the development of different transition metal (first row) doped carbonaceous catalysts, we realized that Fe, Mn, Co and Cu could serve as better active sites for both NRR and ORR processes. We have also explored the mechanistic chemistry and the electronic interactions occurring between the adsorbed O_2 and N_2 molecules and our active species, which was not elaborated in the previous reports. Thus, our research findings could address some of the challenges in the field of ORR and NRR and open up several avenues for further exploration in terms of catalyst development.

Acknowledgements:
The authors acknowledge INST, Mohali for instrumental support and funding agencies DST SERB CRG (CRG/2020/005683), DST INSPIRE (DST/INSPIRE/04/2015/000337) and DST SERB EMR (EMR/2016/000040) for financial assistance.

References:

[1] Biswas, A.; Sarkar, S.; Das, M.; Kamboj, N.; Dey, R. S. A No-Sweat Strategy for Graphene-Macrocycle Co-Assembled Electrocatalyst toward Oxygen Reduction and Ambient Ammonia Synthesis. Inorg. Chem. 2020, 59 (22), 16385–16397.
[2] Sarkar, S.; Biswas, A.; Purkait, T.; Das, M.; Kamboj, N.; Dey, R. S. Unravelling the Role of Fe–Mn Binary Active Sites Electrocatalyst for Efficient Oxygen Reduction Reaction and Rechargeable Zn-Air Batteries. Inorg. Chem. 2020, 59 (7), 5194–5205.
[3] Sarkar, S.; Biswas, A.; Kamboj, N.; Dey, R. S. Unveiling the Potential of an Fe Bis(terpyridine) Complex for Precise Development of an Fe-N-C Electrocatalyst to Promote the Oxygen Reduction Reaction. Inorg. Chem. 2020, 59 (18), 13453–13464.

Dr. Ramendra Sundar Dey is a Scientist at Institute of Nano Science and Technology, Mohali, India. Prior, he was a Hans Christian Ørsted postdoc fellow at Technical University of Denmark (DTU), Denmark. He received Ph.D. in Chemistry at 2013 from Indian Institute of Technology (IIT) Kharagpur, India. He is involved in research in the field of electrochemistry of nanomaterials including engineering of nanomaterials for advanced energy storage technology and non-novel metal nanomaterials for electrocatalysis and hybrid energy technology. Dr. Dey has published more than 35 research articles (including Energy & Environmental science, Journal of Materials chemistry A, Nanoscale, Scientific Reports, Chem. Comm. etc), several books and chapters and filed patent. He has been honored with a number of prestigious National and International recognitions, like, ***INSPIRE Faculty Award*** at 2015, ***Journal of Materials Chemistry A Emerging Investigator*** under the theme highlighting 2019's rising stars of materials by RSC. Recently he has been awarded as "***Associate of Indian Academic of Science***", Bengaluru for the period 2020 to 2023 and member of ***Indian National Young Academy of Sciences (INYAS***) for 2021-2026.

Metal-CO_2 Battery: An Indigenous Technology for India's Mars Mission and An Attempt to Fix CO_2 Emissions on Earth

Chandra Shekhar Sharma, Anil D. Pathak
Department of Chemical Engineering,
Indian Institute of Technology Hyderabad, Kandi, Sangareddy-502285, Telangana, India
cssharma@che.iith.ac.in

Mars Orbiter Mission was India's first interplanetary mission and ISRO became the fourth space agency in the World to successfully reach Mars through its mission, Mangalyaan in 2013. Notably, India is first nation in the world to do so in its first attempt. India's space mission including Mars mission is an example of excellence, accuracy, and innovation. Next Mars mission is planned for 2024. Among many challenges, an appropriate energy storage system especially suitable for the extreme environment has always been a grand challenge for all space agencies. Since Mars atmosphere primarily consists of CO_2, Metal (M)-CO_2 battery technology may be a viable option to explore the feasibility of this technology in the Mars mission particularly with respect to surface landers and rovers by utilizing the CO_2 gas (~95.3%) abundantly available in its atmosphere. This may further reduce the payload mass and launch cost in planetary missions. Further, the batteries developed from the proposed work will be applied in energy conversion and storage systems as it offers high energy density than the currently used lithium-ion batteries and provide a striking option to fix CO_2 emissions & environmental protection. We shall present the proof of concept of Metal-CO_2 battery as demonstrated recently in our lab with latest results.

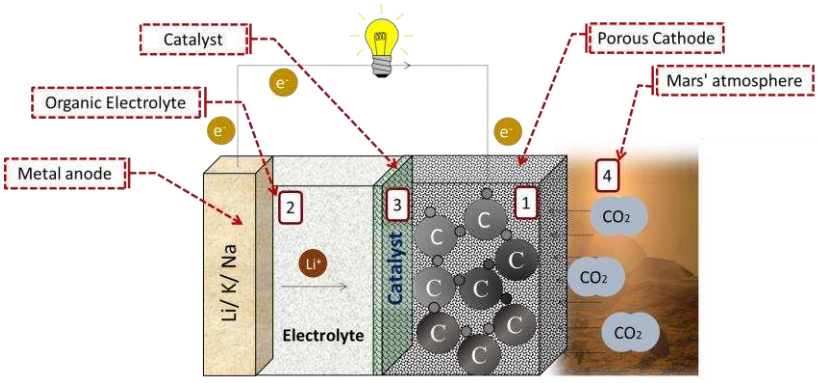


Figure: A schematic of Metal-CO2 battery

Reference:

[1] Anil D. Pathak, C. S. Sharma, Materials Letters, **2021**, *283*, 128868. (Featured Letter)

Chandra Shekhar Sharma is an Associate Professor in the Department of Chemical Engineering at the Indian Institute of Technology, Hyderabad. His research interests include nanostructured polymer & carbon materials including electrospun nanofibers for energy, environmental, healthcare and sensor applications; Nature-inspired functional surfaces & Waste Management. He has published 108 international peer-reviewed journal publications and filed 14 national and international patents so far out of which 2 international patents are granted. He has supervised 9 PhD students so far and is currently guiding 10. He serves as a PAC member of various SERB and DST committees including Technology Development Program and Waste Management Technologies. He is a recipient of several prestigious awards and recognitions at National & International level including the recent honor of prestigious DST Swarna Jayanti Fellowship in Engineering Sciences. He currently serves as the Chairperson of Indian National Young Academy of Sciences (INYAS). For more details, please visit his website: https://iith.ac.in/~cssharma/.

Participants

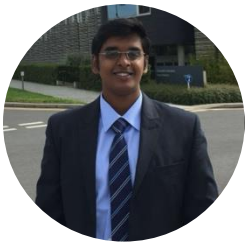
Dr. Abhishek Rajput
Department of Civil Engineering, Indian Institute of Technology, Indore

I am working as Assistant Professor in Deptt. of Civil Engineering from Dec 2018 and Head of Training and Placement Cell from Jun 2019 at IIT Indore. I have done my B.E in Civil Engineering from Govt. Engineering College Jabalpur in 2009 and M.tech and Ph.D. from IIT Rookee in 2011 and 2017 respectively. Before joining to IIT Indore I completed Postdoctoral from Korean Ships and Offshore Research Institute, Republic of Korea In 2017-18. My research area is focused on the behaviour of construction materials under low, medium and high rate of loadings. Recently I have been called as Panelist in Vashwik Bhartiya Vaigyanik Submit under the horizontal "Impact and Crashworthiness" organiged by PMO on 2nd Oct 2020.

Dr. Ananya Gangadharan
GODI INDIA Pvt Ltd

Dr. Ananya Gangadharan, Director of Energy Technology at GODI INDIA Pvt Ltd, a company focused on next generation lithium-ion cells and supercapacitor development. She obtained her PhD from Indian Institute of technology Madras. Later, she carried out her research as a post-doctoral fellow in Indian Institute of technology Hyderabad and Ben-Gurion University of Negev, Israel. Dr Ananya Gangadharan carried out research in material chemistry and electrochemistry focusing on the development of electrochemical energy storage devices for EV's and ESS application. Being passionate about taking technology to real world application she opted to lead the R&D team at GODI for silicon enriched carbon composite and cobalt free cathode material. Lead DRDO and IMPRINT projects related to lithium-ion battery and lithium sulfur battery, filed two patents, and published papers on journal of material chemistry, journal of power source, Electrochimica Acta and so on.

Dr. T. Jothi Saravanan
School of Infrastructure, Indian Institute of Technology Bhubaneswar



Dr. T. Jothi Saravanan is an Assistant Professor at the School of Infrastructure, Indian Institute of Technology Bhubaneswar, Odisha. Previously, he worked as JSPS Postdoctoral Fellow at the Institute of Advanced Sciences, Yokohama National University, Japan. He completed his under graduation in Civil Engineering from College of Engineering Guindy, Anna University, Chennai, in 2012 and obtained his postgraduate degree in Engineering of Structures from the CSIR-Structural Engineering Research Centre, Chennai, under Academy of Scientific & Innovative Research in 2014. Later, he obtained doctoral degree in Civil Engineering from The University of Tokyo, Japan in 2018 with Thesis Adjudged Excellent at Department level. His field of interest include Structural Health Monitoring; Computer Vision based Monitoring; Machine learning; Smart Materials and Structures; Wave Propagation Mechanics; Non-destructive Evaluation; Structural Dynamics and Railway track monitoring. He has authored more than 8 book chapters, 26 journal papers, 31 conference papers and 2 technical reports.

Dr. Mukesh Kumar
Department of Physics, Indian Institute of Technology Ropar, Punjab

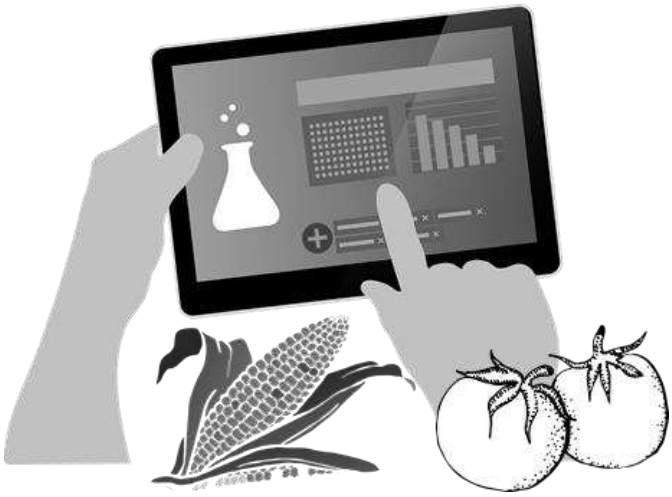
Dr. Mukesh Kumar, associate professor of physics at IIT Ropar, received his doctorate in physics from IIT Delhi and worked in the United States as a postdoctoral fellow at the National Renewable Energy Laboratory in Colorado and at South Dakota State University, focusing on nanoscale charge transport of organic solar cells and flexible thin films for next-generation optoelectronic devices. Dr. Kumar has published two book chapters and over 50 research articles in peer reviewed journals. Dr. Kumar has received many national and international awards like, Young Scientist Research Award from DAE, India; Bhaskara Advanced Solar Energy Fellowship from Indo-US Science and Technology Forum; Faculty Research and Innovation Award, IIT Ropar and prestigious Fulbright-Nehru Academic and Professional Excellence Fellowship from United State India Education Foundation. Dr. Kumar is a member of Indian National Young Academy of Science and National Academy of Sciences, India.

Dr. Raheena M
Department of Civil Engineering, Indian Institute of Technology, Ropar

I am working as Assistant Professor in the department of Civil Engineering, IIT Ropar, India from Jan 2019. I received my dual degree (M. Tech+Ph.D) from department of Civil Engineering, IIT Madras in July 2018 (Batch 2014-2018). Completed my B. Tech in Civil Engineering from NIT Tiruchirapalli in May 2012 (Batch 2008-2012). My areas of research include characterization of soft clays and expansive soils, major focus is on the understanding of physico-chemical properties of the saturated and unsatured state of soils and its influence on the engineering properties. Currently working on a project funded by National Highway Authority of India (NHAI) on sustainable development, in which utilization of different agro-industrial waste materials such as bagasse ash and fly-ash will be used as backfills in highway construction.

Dr. R. Vinu
Department of Chemical Engineering,
Indian Institute of Technology, Madras

Dr. R.Vinu is currently an Associate Professor in Chemical Engineering department at IIT Madras. He serves as the Solid Waste Management area coordinator of the Indo German Center for Sustainability at IIT Madras. At IIT Madras, he leads an active research group that focuses on thermochemical conversion of a variety of feedstocks like biomass, waste plastics, algae, municipal solid wastes and low-quality coals to liquid fuels and chemicals. He has published over 100 research articles, an edited book and 2 patents. He is the recipient of Young Scientist Awards of ICT Mumbai, INSA, NASI and IIChE, Young Engineer Award of Institute of Engineers India, Institute Research and Development Award & Young Faculty Recognition Award from IIT Madras, and Young Associate of the Indian Academy of Sciences-Bangalore. He also serves as the Editor of Advanced Powder Technology and serves in the editorial board of Journal of Analytical and Applied Pyrolysis.



Rural Entrepreneurship

Speakers

Role of Technology and Design in Rural Development

Prasad S. Onkar
[1] Department of Design,
Indian Institute of Technology Hyderabad, Kandi, Sangareddy-502285, Telangana, India
psonkar@des.iith.ac.in

The advancement of technology impacts every human being. But the way it is address the challenges in day-to-day life are more focused on urban problems. In this presentation, a holistic view of rural development is presented in the Indian Context, which emphasizes the role of technology and design interventions. Technology has played an important role in rural development context. From agriculture to sociocultural systems, its influence and presence is well established. Case studies in specific areas like education, construction materials, craft rehabilitation, etc. will be discussed, with reference to the design and technological advancements.

Dr. Prasad Onkar is an Assistant Professor in the Department of Design of IIT Hyderabad. Prior to that he was Assistant Professor at Department of Design at IIT Guwahati. He was also a Visiting Researcher at Virtual Prototyping Lab in the Department of Mechanical Engineering at Politecnico di Milano, Milan, Italy. He completed his PhD in Computer-Aided Conceptual Design from Centre for Product Design and Manufacturing (CPDM), IISc Bangalore. He holds Master of Technology (M. Tech.) degree in Product Design and Manufacturing from Visvesvaraya Technological University, Belgaum, Karnataka, and Bachelor of Engineering (B. E.) degree in Mechanical Engineering from Karnataka University, Dharwad, Karnataka. His research Interests are in Virtual Reality, Haptics, Interaction Design, Product Design, 3D Printing, Affect-Cognition interaction, Design Innovation, etc. He is also the convener of Unnat Bharat Abhiyan (UBA) and member of Rural Development Centre of the Institute.

Entrepreneurship Opportunities in Indian Livestock

Rajib Deb[1], Prasanna Pal[2]
[1] ICAR-National Post-Doctoral Fellow, Animal Genomics Laboratory, Animal Biotechnology Center,
ICAR-National Dairy Research Institute, Karnal-132001, Haryana, India
[2] PhD Research Scholar, Animal Physiology Division,
ICAR-National Dairy Research Institute, Karnal-132001, Haryana, India
drrajibdeb@gmail.com

Livestock sector is one of the important components of the agriculture of Indian economy. India having 303.76 million bovines, 74.26 million sheep, 148.88 million goats and about 9.06 million pigs as per 20th Livestock Census in the country. Milk production during 2018-19 is 187.7 million tonnes showing an annual growth of 6.47% in comparison to 2017-18 (DAHDF Annual Report 2019-20). Currently the total Poultry population in our country is 851.81 million (as per 20th Livestock Census) and egg production is around 103.3 billion numbers during 2018-19. Livestock sector forms a significant livelihood activity for most of the rural farmers, supporting agriculture in terms of critical inputs, contributing towards health as well as nutrition of the household, complementing incomes, contribution towards employment opportunities, and finally being a trustworthy "bank on hooves" in times of requirements. Livestock sectors acts as a complementary ae well as supplementary enterprise. Value of output from livestock sector was about Rs. 10,43,656 crore at current prices during 2017-18 which is about 33.25% of the value of output from agricultural and allied sector (DAHDF Annual Report 2019-20). There are tremendous opportunities for developing livestock sector based rural entrepreneurship in India.

Dr. Rajib Deb, MVSc, Ph. D having 9 years of experience as Scientist (Animal Biotechnology) at Indian Council of Agricultural Research, New Delhi, Govt. of India. He has made outstanding contributions in advanced molecular biology and genomics research of livestock especially dairy cattle, the prime animals in agriculture for the past eight years with a focus on improving the livelihood of dairy cattle farmers. His research reflects a continuum of high quality basic, strategic, and applied research in animal health and productivity. He has published more than 40 research articles in reputed journals, filed 9 Indian Patents, developed several technologies including diagnostic kits. He is recipient of different National and International awards including NASI Associate, INYAS Membership, NAAS Associate, TWAS Fellowship, ICAR Junior & Senior Research Fellowship, NAVS Associateship, Young Scientist Awards etc.

Steering Data Driven Agriculture in India: A Way Towards Lower Cost Better Output

Shailandra Tiwari
Fasal
shailendra.tiwari@wolkus.com

Indian farmers have always relied on instincts and experiences in decision making, however everything around has changed including the climate, the soil, the agro chemicals, the seeds, the fertilizers. Fasal is deeply engaged to make a data driven massive disruption in the way our farmers are making farm level decisions. Through various sensors integrated with AI and IoT and crop science, Fasal looks at predicting answers to questions such as - How much irrigation is required for a particular soil type? When should the crop be irrigated? Is there a chance that a particular disease will attack my crop in the next few days? How much and which spray to use? Is this the right weather condition to take a spray? What are the different activities to be carried out during the different stages of the crop? What type of fertilizers should be used; how much and when? Fasal has helped its numerous farmers reduce cost of cultivation and increased quality and yield, through our AI powered platform for horticulture, delivering farm specific, crop specific, crop-stage specific, actionable advisory. We propagate sustainable agriculture, and our solution impacts the social, economical and environmental facets, hence making a big impact on the UN's Sustainable Development Goals. Fasal is driven by Innovation. And Fasal is on the quest to make precision agriculture accessible to every farmer in the world!

Shailendra is the Founder of Fasal. A graduate from NIFT, he was featured in Forbes Asia 30 under 30 class of 2020. Shailendra has previously worked on sectors like Edtech, HRtech, Fintech big data etc. He also co-published a research paper on User Interest Modeling from Social Media Network Graph.

A Way Towards Sand Based Add-On Filter For Zero Bacteria Drinking Water

Sriparna Chatterjee
Materials Chemistry Department,
CSIR-Institute of Minerals and Materials Technology, Bhubaneswar, Odisha 751013
sriparna251@gmail.com

We have developed an Add-on technology to the existing Terafil filter of CSIR-IMMT to provide zero bacteria drinking water satisfying the WHO standard. The existing Terafil filter of IMMT is proven cost-effective water purification technology for both, household and community level scale. It has been propagated all over the country at household, community scale and in the natural calamity affected areas. It removes iron and other impurities responsible for turbidity, but does not remove the dissolved bacterial/microorganism contamination completely. Hence development of this add-on technology to remove all kind of bacteria/microorganism contamination completely will find wider acceptability and dissemination in all sections of the society. This work is expected to have a big societal impact in the country.

Dr. Sriparna Chatterjee is currently working in CSIR-Institute of Minerals and Materials Technology, Bhubaneswar. Earlier she was a research student at Tata Institute of Fundamental Research, Mumbai. She was a postdoctoral fellow in Institute of Physics, Bhubaneswar. Later, she was in University of Massachusetts, Dartmouth as a visiting scholar. She also visited University of North Texas as a Visiting Researcher. Dr. Chatterjee has visited Germany, Australia and USA for different academic purposes. Her research interests are in the interdisciplinary fields of Materials Chemistry, Physics and Surface Engineering, specifically in Nanostructured materials for Multifunctional coating. She has completed guidance of 01 PhD and approximately 25 UG/PG project students. She is recipient of several awards viz., INSPIRE Faculty Award by DST, Er. Sankarsan Jena Memorial Award-2017 from The Institution of Engineers (India), Ganesh Mishra Memorial Award-2015 from The Institution of Engineers (India), National scholarships by Govt. of West Bengal for holding rank in Secondary and Higher Secondary examinations and several best paper awards in distinguished national and international conferences and seminars. In 2020, she has been selected for prestigious Indian National Young Academy of Science (INYAS) member. She has been elected as National Core Committee member of INYAS in 2021. She has also been elected as Executive Member of Indian Institute of Metals, Bhubaneswar Chapter. Till date, she has published 46 SCI publications, 01 patent, 01 book chapters, more than 35 conference contributions and presented more than 20 scientific deliberations.

Antimicrobials For Preservation of Fresh Produce and Hygiene

Mudrika Khandelwal[1], Shivakalyani Adepu[2]
[1,1] Department of Materials Science and Metallurgical Engineering,
Indian Institute of Technology Hyderabad, Kandi, Sangareddy-502285, Telangana, India
mudrika@msme.iith.ac.in

Antimicrobials have emerged to be more important than before, given the recent pandemic. This talk is about the application of antimicrobials in two very important areas of importance, in particular to the rural sector– female hygiene and food packaging. Fungal infections are very common and go unnoticed till they need serious medical interventions. One of the most common infection in females is vaginal candidiasis, caused by fungus candida. It is discussed how a simple intervention of including an herbal antimicrobial in hygiene products can improve lives. India loses a lot of fresh produce to microbial infections due to lack of storage facilities. Again, it is shown that the involvement of antimicrobial agent in existing packaging can increase the shelf life of fresh produce without much increase in the costs and logistics. This can ultimately ensure nutrition security for the country.

Dr Mudrika Khandelwal is currently an associate professor in the Department of Materials Science and Metallurgical Engineering at IIT Hyderabad. Mudrika has been working to develop scientific solutions for societal problems (many of which are part of the SDGs, declared by the UN and priorities of the Indian Government) including antimicrobial materials for food packaging and controlling infectious diseases, materials for energy storage, and environmental remediation, using sustainable nanofibrous cellulosic materials. Earlier she has done her bachelors and Master of Technology from IIT Bombay and Doctorate at University of Cambridge, UK. Her work has received the Gandhian Young Technological Innovation award in 2016. She is an elected member to Indian National Young Academy of Sciences and member to National Academy of Sciences, India. Recently, she has received the prestigious Young Engineer Award from Indian National Academy of Engineers and the National Academy of Sciences India Platinum Jubilee Young Scientist Award.

Participants

Dhruv Gupta
iTIC Incubator

Dhruv is a researcher turned entrepreneur and now an Innovation Management Consultant. He is a computer scientist by certificate, mathematician by hobby and a design thinker by training. Dhruv did his first startup at age of 18 and had built 3 (three) tech startups by now, with successes and failures. He has a strong hold in technology domain of Machine Intelligence and is well versed in designing user experience, business models and revenue models. He had been part of the journey for many startups as consultant, mentor and investor. With all the learnings and experiences, Dhruv is designing next generation products and helping companies to grow to the next level. In his personal time, he could be found folding paper to add new members to his origami dragon army or gazing into deep dark night sky. He is an F1 fan and tweets with the handle @drvgpt.

Dr. Poonam Kumari
Department of Mechanical Engineering,
Indian Institute of Technology, Guwahati

Poonam Kumari is currently an Associate Professor in the Department of Mechanical Engineering at the Indian Institute of Technology Guwahati. She received her Ph.D. degree from Indian Institute of Technology Delhi in 2012. She did her Post-Doctoral Fellowship at Simon Fraser University, Canada. She works in the area of Continuum Mechanics and Smart Material and Structures. She has developed three-dimensional as well as two-dimensional solutions for composite and piezolaminated plates. Currently, she is working in the field of wearable device and nanofiber reinforced PVDF flexible mats for energy harvesting. She has published 31 International Journal publications and 34 International Conference publications. She has received Young Engineer Award-2017 from Indian National Academy of Engineers. In year 2019, she also received SERB women excellence award. She got DUO-India professor fellowship 2020 award for conducting research at U.K.

Dr. Priya Jadhav
Centre for Technology Alternatives for Rural Areas,
Indian Institute of Technology, Bombay

Prof. Priya Jadhav is an Assistant Professor working in the areas of rural electrification, and energy and water usage in irrigation. Her research attempts to connect social, technical, governmental and policy aspects. She often collaborates with regional engineering colleges in Maharashtra and has been a participant of the Unnat Maharashtra Abhiyan – an initiative to involve engineering institutes in regional problems. The general philosophy of research is to stay focused on regional planning issues and work on strengthening avenues for capacity building at various levels of society. Prof. Jadhav has had a previous career in industry and is a founder of a successful software company Nagarro Inc, and a PhD from MIT, Cambridge, USA, in Organic Semiconductor Solar cells.

Dr. Siddhartha Singha
School of Agro & Rural technology,
Indian Institute of Technology, Guwahati

Dr. Siddhartha Singha is a Food & Bioprocess Engineer by training and working in the area of food and bio processing for the last thirteen years. Currently he is working as Assistant Professor at Centre for Rural Technology at IIT Guwahati. He has work experience in NIFTEM-Ministry of Food Processing Industries, GoI and in Industries like Pepsico Holdings, Bridge2Tech. He is active to bring the culture of innovation in Policy making, Institution building, human resource development and research especially in the area of food & nutritional security. He is part of various Government programs like RuTAG, NetProFan- FSSAI etc. and various stakeholder groups. As an advisor to different NGOs and Industries he contributes to the ecology of agri/bio entrepreneurship for sustainable usage of the natural resources and circular economy.

Dr. Sushmee Badhulika
Department of Electrical Engineering,
Indian Institute of Technology, Hyderabad

Dr. Sushmee Badhulika obtained her master's and Ph. D degree in Electrical Engineering from University of California Riverside, USA. Currently she is an Associate Professor at the Department of Electrical Engineering, Indian Institute of Technology (IIT), Hyderabad, India. Her research interests include Flexible and wearable nano-electronics; Flexible Bioelectronics; Lab-on-a-Chip devices; Micro/Nano Fabrication; Electrochemical sensors and Supercapacitors.

Dr. Swati Ghosh Acharyya
School of Engineering Sciences and Technology,
University of Hyderabad

Dr. Swati Ghosh Acharyya is presently working as an Associate Professor in University of Hyderabad. She works on the development of corrosion resistant surfaces, online monitoring of corrosion fatigue of high strength steels by acoustic emission sensing, and electrochemical sensing of heavy metal ions. Her research group has developed an eco-friendly, high yield, technique for bulk production of graphene from graphite. Graphene based nanocomposites are used to fabricate corrosion resistant, abrasion resistant, hydrophobic, high temperature resistant coatings and electrochemical sensors. She has an experience of working as a scientific officer at Materials Science Division, Bhabha Atomic Research Center for six years and is a young associate of INAE. She has received SERB Women in excellence Award by DST-SERB-2020, Young engineer award by INAE, for Materials Engineering, 2018, Corrosion awareness award by National association of Corrosion Engineers (NACE) 2007 and G. S. Tendulkar Award, 2006, by The Indian Institute of Metals.


AZADI KA
AMRIT MAHOTSAV
Commemorating 75 Years of Independence
#AmritMahotsav

Speakers

Rural Entrepreneurship Model for Improving Menstrual Hygiene

Suhani Mohan[1], Manglika Tripathi[2]
Saral Design Solutions Private Limited
suhani@saraldesigns.in

88% of menstruating women in India use home-grown alternatives like old fabric, rags, sand, ash, wood shavings, newspapers, dried leaves, hay, and plastic. There is a 70% increase in incidence of reproductive tract infections owing to poor menstrual hygiene.[1]

Saral Designs has developed the world's first fully automatic machine for small-medium scale production of sanitary pads, called "SWACHH" (2 design patents). SWACHH along with a unique "Business in a Box" model is enabling community driven production of high-quality products at half the price of multinational brands. This is a menstruator-led, community-based program that takes a three-pronged approach to 1) Eradicate the stigma surrounding menstruation, 2) Provide livelihood opportunities to low-income women, 3) Ensure access to affordable sanitary napkins in low-income communities. Along with the business, Saral is enabling rural entrepreneurs to build a last-mile women-driven distribution network (called "Sanginis") and co-create awareness content for communities with a gender lens.

Since 2017, Saral has sold more than 40 Swachh machines which have produced 11 million sanitary pads and 3.7 million 3ply face masks. After completion of a 2-year project funded by Grand Challenges Canada piloting Business in a Box model in 6 semi-urban and rural geographies of India, Saral has carried out an estimating effects study to analyze the impact of their program. 61.36% girls have shown improved knowledge on MHM through our school programs and 24% girls and women have shown improved knowledge on MHM through community awareness programs.

Suhani is the co-founder and CEO of Saral Designs, a start-up providing access to quality affordable menstrual hygiene products to low-income women in India using decentralized machine technology developed in-house. Suhani is an Acumen India Fellow, Young Alumni Achiever by IIT Bombay, recognized as 2018's top 25 trailblazing Indian women by Forbes and winner of the National Entrepreneurship Award 2016 by Ministry of Skill Development and Entrepreneurship. An ex-investment banker, Suhani holds a bachelor's degree in Metallurgical Engineering and Materials Science from IIT Bombay.

Green Synthesized Hybrid Nanostructured Materials for Green Hydrogen Generation

Pooja Devi
CSIR-Central Scientific Instruments Organisation, Sector 30 C, Chandigarh, 160030, India
poojaiitr@csio.res.in

The emerging deficit in demand and supply of energy, and escalating global air pollution makes it necessary to develop alternative solutions to mitigate these issues. Amongst varied sources of renewable energy, hydrogen has found a key place due to its high combustion energy, low ignition, fast flame propagation speed, wide operational range, and clean combustion by-products. Though there are several approaches for its production from coal, natural gas, biomass, etc., but the green hydrogen produced from water is projected as a sustainable solution for meeting future requirements. However, in present scenario its high production cost and low efficiency, limit its techno commercial viability, which can be addressed by developing efficient materials, processes, and low-cost infrastructure utilizing solar driven electrolysis or photoelectrochemical water splitting. Our group has explored green route obtained carbon and plasmonic materials including carbon dots, Au, Ag, and Cu as an efficient photosensitizer for wide band gap materials for photo electrochemical water splitting in this direction. The present talk will discuss the properties of these green route obtained materials and their utilization in green hydrogen generation on interfacing with oxide, nitrides, and silicon based photoanodes and photocathodes.

Keywords:
Nanomaterial, Green Hydrogen, Plasmonic, Photo electrochemical Water Splitting.

References:

[1] Thakur, A., Kumar, P., Bagchi, S., Sinha, R. K., & Devi, P. (2019). Green synthesized plasmonic nanostructure decorated TiO2 nanofibers for photoelectrochemical hydrogen production. Solar Energy, 193, 715-723.
[2] Thakur, A., Devi, P., Saini, S., Jain, R., Sinha, R. K., & Kumar, P. (2018). Citrus limetta organic waste recycled carbon nanolights: photoelectro catalytic, sensing, and biomedical applications. ACS Sustainable Chemistry & Engineering, 7(1), 502-512.
[3] Roy, K., Ghosh, D., Sarkar, K., Devi, P., & Kumar, P. (2020). Chlorophyll (a)/Carbon Quantum Dot Bio-Nanocomposite Activated Nano-Structured Silicon as an Efficient Photocathode for Photoelectrochemical Water Splitting. ACS Applied Materials & Interfaces, 12(33), 37218-37226.
[4] Ghosh, D., Roy, K., Sarkar, K., Devi, P., & Kumar, P. (2020). Surface Plasmon-Enhanced Carbon Dot-Embellished Multifaceted Si (111) Nanoheterostructure for Photoelectrochemical Water Splitting. ACS Applied Materials & Interfaces, 12(25), 28792-28800.

Dr. Pooja is working as a Principal Scientist at CSIR-CSIO, Chandigarh. She has done her Ph.D. in Material Science from AcSIR and M. Tech. in Nanotechnology from IIT Roorkee. Her research interest includes catalyst design for clean energy solution specifically Hydrogen energy, water and air pollutants degradation. Her group has also developed sensor materials and devices for water pollutants monitoring. She has published 72 high impact publications, edited 07 books, 14 book chapters, and delivered 55 invited/oral talks. She is recipient of SERB Women Excellence Award (2020), INAE Young Engineer Award (2021), Young Associateship of Indian Academy of Science (2019-22); Young Scientist Award (2019) from Indian Science Congress Association, Young Scientist Award (2019) from International Society for Energy, Environment and Sustainability, Indo-US WARI fellowship (2017), and Canadian Commonwealth Fellowship (2010). She is also core committee member of Indian Young National Academy of Science, and New Delhi, and active towards science outreach activities.

Samanantar: The Largest Publicly Available Parallel Corpora Collection for 11 Indic Languages

Mitesh M. Khapra
Department of Computer Science and Engineering, Indian Institute of Technology, Madras
miteshk@cse.iitm.ac.in

We present Samanantar, the largest publicly available parallel corpora collection for Indic languages. The collection contains a total of 46.9 million sentence pairs between English and 11 Indic languages (from two language families). In particular, we compile 12.4 million sentence pairs from existing, publicly available parallel corpora, and we are additionally mine 34.6 million sentence pairs from the web, resulting in a 2.8X increase in publicly available sentence pairs. We mine the parallel sentences from the web by combining many corpora, tools, and methods. In particular, we use (a) web-crawled monolingual corpora, (b) document OCR for extracting sentences from scanned documents (c) multilingual representation models for aligning sentences, and (d) approximate nearest neighbor search for searching in a large collection of sentences. Human evaluation of samples from the newly mined corpora validates the high quality of the parallel sentences across 11 language pairs. Further, we extracted 82.7 million sentence pairs between all 55 Indic language pairs from the English-centric parallel corpus using English as the pivot language. We trained multilingual NMT models spanning all these languages on Samanantar and compared with other baselines and previously reported results on publicly available benchmarks. Our models outperform existing models on these benchmarks, establishing the utility of Samanantar. Our data and models will be available publicly and we hope they will help advance research in Indic NMT and multilingual NLP for Indic languages.

Mitesh M. Khapra is an Associate Professor in the Department of Computer Science and Engineering at IIT Madras and is affiliated with the Robert Bosch Centre for Data Science and AI. He is also a co-founder One Fourth Labs, a startup whose mission is to design and deliver affordable hands-on courses on AI and related topics. He is also a co-founder of AI4Bharat, a voluntary community with an aim to provide AI-based solutions to India-specific problems. His research interests span the areas of Deep Learning, Multimodal Multilingual Processing, Natural Language Generation, Dialog systems, Question Answering and Indic Language Processing. He has publications in several top conferences and journals including TACL, ACL, NeurIPS, TALLIP, EMNLP, EACL, AAAI, etc. He has also served as Area Chair or Senior PC member in top conferences such as ICLR and AAAI. Prior to IIT Madras, he was a Researcher at IBM Research India for four and a half years, where he worked on several interesting problems in the areas of Statistical Machine Translation, Cross Language Learning, Multimodal Learning, Argument Mining and Deep Learning. Prior to IBM, he completed his PhD and M. Tech from IIT Bombay in Jan 2012 and July 2008 respectively. His PhD thesis dealt with the important problem of reusing resources for multilingual computation. During his PhD he was a recipient of the IBM PhD Fellowship (2011) and the Microsoft Rising Star Award (2011). He is also a recipient of the Google Faculty Research Award (2018), the IITM Young Faculty Recognition Award (2019) and the Prof. B. Yegnanarayana Award for Excellence in Research and Teaching (2020).

Metal-organic 'Soft' Hybrids for Photocatalytic CO_2 Reduction and H_2 Production

Tapas Kumar Maji
Molecular Materials Laboratory, Chemistry and Physics of Materials Unit,
School of Advanced Materials (SAMat),
Jawaharlal Nehru Centre for Advanced Scientific Research, Jakkur, Bangalore-560064
tmaji@jncasr.ac.in

Nanoscale processable soft organic-inorganic hybrid materials find several applications in biological and material sciences.[1] In general such materials are built by the self-assembly of low molecular weight gelators (LWMG) based linker and metal ions.[1]The inclusion of metal ions into low molecular weight gelator systems has proven to be advantageous in combining the functionality of traditional coordination chemistry with the wide array of exciting applications.[2] Here novel and interesting optical, electronic, magnetic and catalytic properties can be introduced based on synergistic interactions of metal ions and LWMG. [3-7]Additionally, stimuli responsive behaviour is just another reason that such soft material will reside at the forefront of chemical technology. These soft hybrids can also be exploited in energy and environmental applications, like photo or electro-catalytic water splitting, CO_2 reduction, water purification, or separation and delivery of small molecules.[7-9] In my talk, I will focus on rational design and synthesis of several LWMG and their self-assembly with metal ions towards novel functional hybrid materials.

1. Sutar, P.; Maji, T. K. *Chem. Commun.,* **2016**, *52*, 8055
2. Sutar, P.; Surech, V. M.; Jayaramulu, K.; Hazra, A.; Maji, T. K. *Nature Commun.* **2018**, *9*, 3587
3. Roy, S.; Samanta, D.; Kumar, P.; Maji, T. K.; *Chem. Commun.* **2018**, *54*, 275
4. Sutar, P.; Maji, T. K. *Inorg. Chem*. **2017**, *56*, 9417
5. Sutar, P.; Maji, T. K. Maji, *Chem. Commun*. **2016**, *52*, 13136
6. Suresh, V. M.; De, A.; Maji, T. K. C*hem. Commun.* **2015**, *51*, 14678
7. Sutar, P.; Suresh, V. M.; Maji, T. K. *Chem. Commun.* **2015**, *51*, 9876
8. Verma, P.; Singh A.; Rahimi, F.A.; Maji, T. K. *J. Mater. Chem. A*., 2021 https://doi.org/10.1039/D1TA02425F
9. Verma, P.; Singh A.; Maji, T. K. *Chem. Sci*., 2021, 12, 2674

Tapas K Maji obtained his PhD in 2002 from Indian Association for the Cultivation of Science (IACS), Kolkata. After a postdoctoral stint at Kyoto University, he joined Jadavpur University. Then he moved to Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), Bangalore. Currently, he is a professor in the Chemistry and Physics of Materials Unit at JNCASR. His current research interest focuses on the design and synthesis of bulk and nanoscale metal–organic frameworks (MOFs) and organic porous polymers for energy-storage and generation, carbon capture and sequestration. He also works on different photo-physical aspects of MOFs and coordination polymer gels.

List of All Participants

S. No.	Name	Email id	Affiliation
1	Piyush Rai	piyush@cse.iitk.ac.in	IIT Kanpur
2	Preethi Jyothi	pjyothi@cse.iitb.ac.in	IIT Bombay
3	Vineeth N Balasubramanian	vineethnb@cse.iith.ac.in	IIT Hyderabad
4	Amit Acharyya	amit_acharyya@ee.iith.ac.in	IIT Hyderabad
5	Sunny Manchanda	sunny@dysl-ai.drdo.in	DRDO DYSL AI Bengaluru
6	Mitesh Khapra	miteshk@cse.iitm.ac.in	IIT Madras
7	Mridula Verma	vmridula@idrbt.ac.in	IDRBT Hyderabad
8	Abhijnan Chakraborty	abhijnan@iitd.ac.in	IIT Delhi
9	Sai Subrahmanyam Gorthi	s.gorthi@iittp.ac.in	IIT Tirupati
10	Debangshu Dey	debangshudey80@gmail.com	Jadavpur University Kolkata
11	Yamuna Prasad	yamuna.prasad@iitjammu.ac.in	IIT Jammu
12	Mansi Sharma	mansisharma@iitm.ac.in	IIT Madras
13	Suhash Ranjan Dey	suhash@msme.iith.ac.in	IIT Hyderabad
14	Tapas Kumar Maji	tmaji@jncasr.ac.in	JNCASR Bengaluru
15	Neena S. John	jsneena@cens.res.in	CeNS Bengaluru
16	Suryakumar S.	ssurya@mae.iith.ac.in	IIT Hyderabad
17	Vikranth Racherla	vikranth.racherla@mech.iitkgp.ac.in	IIT Kharagpur
18	Senthilkumaran K	skumaran@iiitdm.ac.in	IIITDM Kancheepuram
19	Tapasi Sen	tapasi@inst.ac.in	INST Mohali
20	Chandra Sekhar Tiwary	chandra.tiwary@metal.iitkgp.ac.in	IIT Kharagpur
21	Raghu Adla	radla@paninian.com	Paninian Inc
22	D. Venkata Kiran	dvkiran@iittp.ac.in	IIT Tirupati
23	Priyanka Nadig	Priyanka.Nadig@cyient.com	CYIENT
24	I. A. Palani	palaniia@iiti.ac.in	IIT Indore
25	Mahendra K. Madhavan	mkm@ce.iith.ac.in	IIT Hyderabad
26	Syed K. K. Hussaini	hussaini@iitp.ac.in	IIT Patna

27	Arjun Sil	arjun@civil.nits.ac.in	NIT Silchar
28	Chandra Shekhar Sharma	cssharma@che.iith.ac.in	IIT Hyderabad
29	Pooja Devi	poojaiitr1987@gmail.com	CSIR-CSIO Chandigarh
30	Ramendra S. Dey	rsdey@inst.ac.in	INST Mohali
31	Abhishek Rajput	abhishekrajput@iiti.ac.in	IIT Indore
32	Raheena M	raheena@iitrpr.ac.in	IIT Ropar
33	Jothi Saravanan	tjs@iitbbs.ac.in	IIT Bhubaneshwar
34	R. Vinu	vinu@iitm.ac.in	IIT Madras
35	Mukesh Kumar	mkumar@iitrpr.ac.in	IIT Ropar
36	Ananya G.	ananyagangadharan@gmail.com	GODI Energy
37	Shailendra Tiwari	shailendra.tiwari@wolkus.com	Fasal agritech
38	Suhani Mohan	suhani@saraldesigns.in	Saral Deisgn
39	Omkar Prasad	psonkar@des.iith.ac.in	IIT Hyderabad
40	Rajib deb	drrajibdeb@gmail.com	ICAR-NRCP Guwahati
41	Sriparna Chatterjee	sriparna251@gmail.com	CSIR-IMMT Bhubaneswar
42	Mudrika Khandelwal	Mudrika@msme.iith.ac.in	IIT Hyderabad
43	Poonam Kumari	kpmech@iitg.ac.in	IIT Guwahati
44	Swati Ghosh Acharyya	sgase@uohyd.ernet.in	HCU Hyderabad
45	Sushmee Badhulika	sbadh@ee.iith.ac.in	IIT Hyderabad
46	Dhruv Gupta	dhruv@aisea.co	AISEA
47	Priya Jadhav	jadhav_priya@iitb.ac.in	IIT Bombay
48	Siddhartha Singha	siddharthafp@iitg.ac.in	IIT Guwahati

List of Student Participants

S. No.	Name	Email id	Affiliation
1	Pritam Kishore Chakraborty	ms18resch11002@iith.ac.in	IIT Hyderabad
2	Sahil Rohila	ms15resch11006@iith.ac.in	IIT Hyderabad
3	Vishwanath N	me17resch11001@iith.ac.in	IIT Hyderabad
4	Nikesh Thammishetti	ce16resch11005@iith.ac.in	IIT Hyderabad
5	Kaushal Kumar Maurya	cs18resch11003@iith.ac.in	IIT Hyderabad
6	Omkar Sangabathula	ch18resch01007@iith.ac.in	IIT Hyderabad
7	Aakanksha Ruhela	ch18resch01006@iith.ac.in	IIT Hyderabad


INAE & IIT Hyderabad
present
IMP
Innovation in Manufacturing Processes
July 9-10, 2021
Highlights of IMP
National Level Project Competition open to all Engineering students and practitioners (undergraduate, postgraduates (not PhD students) and startups)
Eligible Branches of Students: Aeronautical, Biomedical, Chemical, Civil, Computer/Information, Design, Electrical, Electronics, Industrial, Instrumentation, Material Science, Mechanical, Power, Production and other allied branched.
Eligible Startups: Entrepreneurs-in-Residence (EiR) and Startups with less than two years and incubated at any of the Technology Business Incubators (TBI).
Entries of this competition should be submitted before XX, Month 2021 through the online form given below. The entries should be submitted in the form of five minutes video of their model and a write up of maximum 250 words.
18 entries would be shortlisted for the final round (six each from UG, PG and Startups).
These selected entries would be given an opportunity to showcase their innovation through walk through demo portal active along with the NATFOE conference.
A group cannot have more than three members.
A project of students' as a course work may also be sent as an entry, if it is eligible otherwise not.
From the eighteen shortlisted entries, a national committee comprising of experts from INAE and IITH will select seven prizes or less as given here.
PRIZES
U.G
1st INR 40,000
2nd INR 20,000
P.G
1st INR 40,000
2nd INR 20,000
Start up
1st INR 40,000
2nd INR 20,000
Deadline: 31st May, 2021
Application Link: www.iith.ac.in/natfoe2021

NATFOE 2021 PRESENTS

SUFI QAWWALI
BY
AHMED BROTHERS

July 9, 2021
18:30-19:30
Venue: Auditorium, Block A, IIT Hyderabad
***Live streaming on Youtube**

About the Souvenirs

We could not have the opportunity to host you "in person", however, we have tried to bring to you the local culture, in form of souvenirs. The first is the beautiful Bidri memo box with 6 coasters. Bidri craft is made with a blackened alloy of zinc and copper inlaid with thin sheets of pure silver, making this a very unique craft which comes to life through many tedious processes of moulding, polishing and quoting. This box is inspired by this craft and the same has been recreated with using paper and foiling techniques. Use this to take notes and enjoy your beverage while you enjoy the NatFoE.

The Korai Grass bags are handwoven and handcrafted. These colourful yet eco-friendly bags are made using (Eco-friendly) natural dry korai grass and is a prevalent art in rural parts.

We are also sending a special mug which shows magic when pour a hot tea in it.

Hope you will remember the NatFoE 2021 through this little effort.

Indian Institute of Technology, Hyderabad
IITH Main Road, Near NH-65, Sangareddy, Kandi, Telangana 502285.
Email: natfoe2021@iith.ac.in