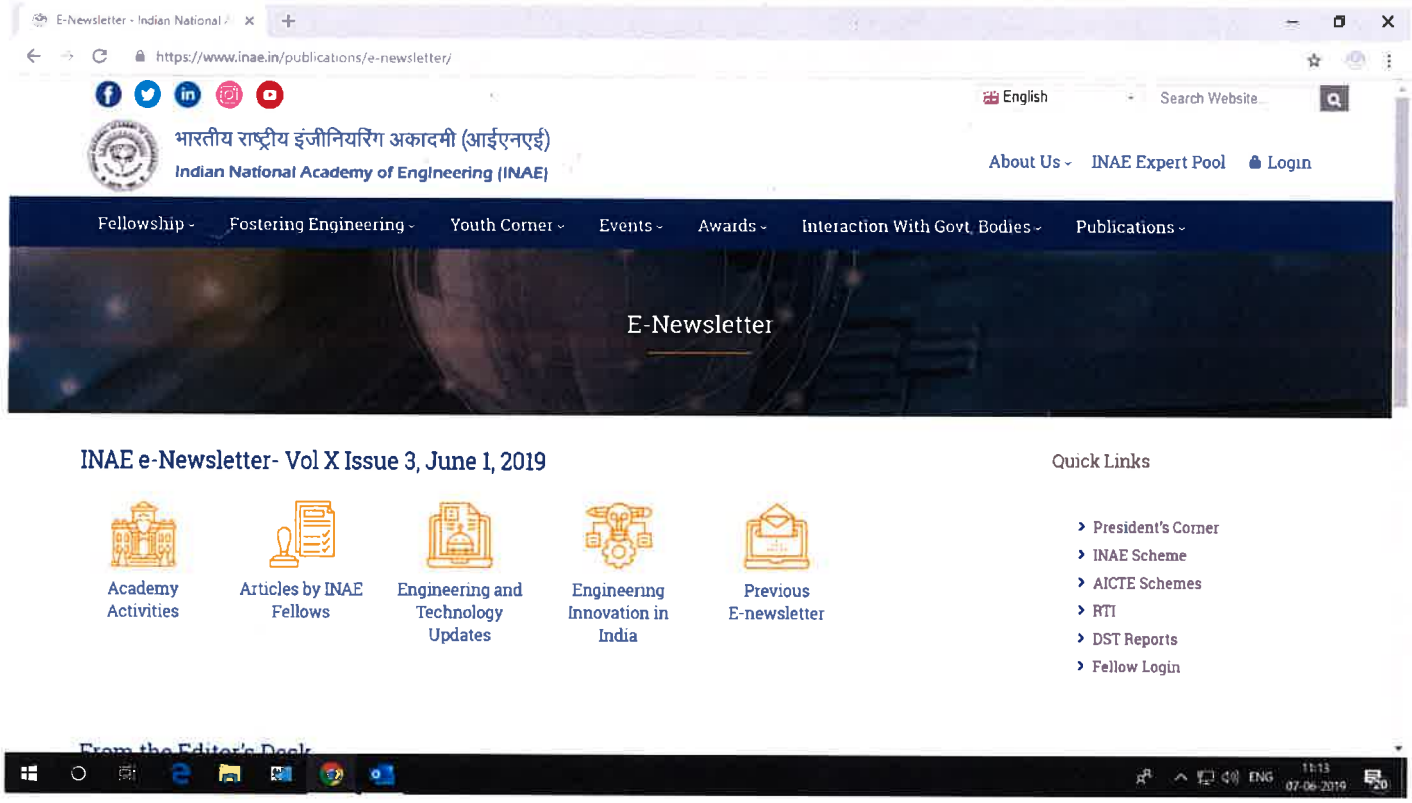
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From the Editor's Desk

Artificial Intelligence in Manufacturing Sector

In recent years the research activities in Artificial Intelligence (AI) technologies have increased by several folds. There is no discipline of engineering to-day where the AI has not penetrated. AI is generally described as an artificial creation of human-like intelligence that can learn, reason, plan, perceive, or process natural language. The availability of super computers, and usage of various databases in electronic form and the optimisation of data is bringing perceptible and significant changes in the fields such as e-commerce, transportation, health care, traffic control, banking, power distribution, sensors development, speech recognition etc. Engineering and manufacturing of products is a different story. Materials are often seen as enablers of engineering as well as the bottleneck for performance. As products get engineered to the performance limit of the materials they are based on, one expects an increasing demand for novel materials and faster cycle times for development of new products.

There are two key aspects in which AI holds promise for engineering today. Discovery of new materials with designer properties is now possible using a combination of physics based computations and machine learning. By combining electronic structure calculations with artificial neural networks, one is able to identify structures that possess chosen properties such as a particular band gap, elastic modulus etc. Identifying a suitable composition of an alloy with desired properties is not a formidable task given the availability of materials databases. It is now possible to reduce experimentation significantly and shorten the materials development cycle resulting in significant reduction in cost, leading to saving crores of research funds in projects across several engineering domains. AI will deliver the maximum benefit to materials discovery and design if and when multi-scale models can be integrated across multiple length and time scales. This integration includes the entire process from modeling and materials design through processing to manufacturing using advanced materials. The usage of Integrated Computational Materials Engineering (ICME) techniques ensure a link between materials science, product development and manufacturing processes with the promise of reducing the cycle time for development.

The ecosystem of AI has now matured to an extent that materials development can take up the advances made in ICME immediately. Ultimately, the goal is to use AI-based tools to quickly and efficiently design ever more complex systems involving multiple materials or hybrid materials and interfaces. While digitization, automation and networking of manufacturing processes is still underway, there is a possibility that in India AI technologies could place manufacturing and engineering on par with the rest of the world. Every discipline of engineering has a lot to explore how the AI technologies can make a difference to their market space. To usher this change across the board, universities, research laboratories and industries should catch up as they prepare the next generation workforce. AI and machine learning based systems are bringing revolutionary changes in the functioning and performance of various metallurgical industries. In recent years the accumulation of quality data and its analysis has emerged a valuable resource for usage of AI. The accumulated data shall comprise both metadata and data uncertainty to ensure its usability. Quality data would be expected to bring in significant insight of the composition, microstructure, desirable mechanical properties and manufacturing processes and create space for innovation and optimisation.

Very recently, Mishra Dhatu Nigam limited, Hyderabad, which is engaged in the development of high temperature materials for strategic applications in Atomic Energy, Space, Defence and Power Sector, has organised a workshop on Application of AI in Alloy Development and Predictive Process Optimization with the main objective of creating awareness and sensitising their research and production teams about the integration of AI based system in their alloy development and manufacturing process schedules. It is foreseen that MIDHANI will have increased marketing potentials by developing new alloys using AI. The relevant topics discussed in the workshop included: (i) Alloy Development and Process Optimization through Thermodynamic and Kinetic Simulations (Dr. R. Sankarasubramanian, DMRL Hyderabad), (ii) Integrated Computational Materials Engineering and AI (Prof. G. Phanikumar, IIT Madras), (iii) TRANSFORM-An Optimization Methodology for Computationally Expensive Engineering Process Models, (Prof. K. Mitra, IIT Hyderabad), (iv) Artificial Intelligence Based Hierarchial Methods for Multiscale Process-Structure Property Correlations (Dr. A. Alankar, IIT Bombay), (v) Opportunities for Modeling in AI (Prof. A.N. Choudhury, IISc Bangalore), (vi) Simulation and AI driven Materials Engineering with TCS

PREMAP- Alloy Design to Process Scale-Up (Dr. B.P. Gautham , TCS, Pune) and (vii) Smart Steel Plants of the Future (Dr. G. Balachandran, JSW Steels, Salem). Dr. Sanak Mishra FNAE, (President of INAE), Prof. K. Bhanu Sankara Rao FNAE (Editor-in-Chief INAE publications) and Dr. S.K. Jha Director, Production and Marketing, MIDHANI were present during the deliberations and participated in the open discussion. We wish that many industries come forward to take up the AI mission into materials development required for various engineering products. INAE would soon be bringing a special issue of INAE Letters on the applications of AI and ICME. The potential contributors for this issue may kindly contact the Editor-in-Chief, INAE publications.

Prof. K. Bhanu Sankara Rao
Chief Editor, INAE Publications
Pratt & Whitney Chair Professor
School of Engineering Sciences and Technology
University of Hyderabad,
Gachibowli, Hyderabad 500 046

ACADEMY ACTIVITIES

Announcements-Nominations have been invited for the following:

- **INAE Young Entrepreneur Award 2019:** Last Date for receipt of Nominations- **June 30, 2019**
- **Innovative Student Projects Award:** Last Date for receipt of Nominations- **July 7, 2019**
- **Abdul Kalam Technology Innovation National Fellowship:** Last Date for receipt of Nominations for the **first phase of 2019-2020 – August 10, 2019**

Abdul Kalam Technology Innovation National Fellowship

Indian National Academy of Engineering (INAE) and Science and Engineering Research Board (SERB), Department of Science and Technology (DST) had launched the INAE-SERB, DST Abdul Kalam Technology Innovation National Fellowship in the year 2017 to recognize, encourage and support translational research by Indian Nationals working in various capacities of engineering profession, in public funded institutions in the country. The nominee should have a minimum of 5 years' service left in the parent organization. The Fellowship amount is Rs 25,000/- per month in addition to salary being drawn and a Research Grant of Rs.15.00 lakh per annum will also be provided. An Overhead of Rs.1.00 lakh per annum will also be provided to the host institute. A Maximum of 10 Fellowships will be awarded per year. The duration of the Fellowship will be initially for three years, extendable by upto two more years depending on the performance and the Fellowship can be held for a maximum of 5 years. Nominations are accepted for the Fellowship throughout the year. In addition, two calls for nominations are announced in each Financial Year. A soft copy of the nomination is required to be forwarded to INAE through email, followed by one ink signed original hard copy to be sent to INAE Office, Gurgaon through Speed Post/Courier.

The first call for nominations to be considered for the subject Fellowship, during the Financial Year 2019-2020 has been announced. All nominees who had applied in previous Financial Years are eligible to apply again once in response to either the first call or second call for nominations announced for the Financial Year 2019 - 2020. As per guidelines, a nominee may also apply again once in each subsequent Financial Year till he/she has a residual service of five years left in his/her parent organization. **The last date for the receipt of nominations to be considered in response to the first call for nominations for the Financial Year 2019- 2020 is August 10, 2019.**

INAE Foundation Day Celebrations on April 11, 2019

Indian National Academy of Engineering (INAE) was raised on 20th April 1987 having registered by the Registrar of Societies and was formally inaugurated on 11th April 1988 at New Delhi by the then Prime Minister, Mr. Rajiv Gandhi at a colourful Foundation Function in New Delhi. In order to commemorate this momentous occasion, INAE had decided to celebrate the FOUNDATION DAY of INAE on 11th April every year. Besides the INAE Office at Gurgaon, a number of Local Chapters had celebrated the Foundation Day which were covered in the e-newsletter of May 2019. Besides the Local Chapters already covered, INAE Kharagpur Chapter also celebrated the Foundation Day and a brief report is given below.

- **INAE Foundation Day Celebrations by INAE Kharagpur Chapter**

To commemorate the momentous occasion of the Foundation of the INAE on 11th April, 1987, a meeting of all existing INAE Fellows at Kharagpur (primarily located at IIT Kharagpur) was organized in the Board Room of IIT Kharagpur on 11th April, 2019 at 5 pm. The meeting was convened by Prof Indranil Manna, Vice-President, INAE and was presided over by Prof PP Chakrabarti, FNAE, Director, IIT Kharagpur and was attended by 18 INAE Fellows and Young Associates The meeting was essentially a brainstorming session and informal get-together to discuss several issues related to INAE and role of INAE in the national and state level wherein engineers and engineering could play a significant role. The Director emphasised the need to develop a better cohesion between school children and premier engineering institutions like IITs so that the former could clearly understand the career prospects, expectations and obligations of the engineering professionals and also, the engineering education system in IITs and other premier institutions so that the youth could fashion their educational

as well as career objectives accordingly. He also stressed on the need to properly, if not aggressively, advertise the various achievements at both individual level and at the institute level at the IITs so that these achievements get their due attention and recognition from all corners. Some members also suggested that IITs should provide special incentives to carry out industrial projects at both UG and PG levels. The meeting ended by offering Vote of Thanks to the Director and to all the Fellows and Young Associates who attended the meeting.

Group Photo during INAE Foundation Day Celebrations at IIT Kharagpur

Prof PP Chakrabarti, Director, IIT Kharagpur (in the centre) presiding over the celebrations

INAE Local Chapter Activities

- **INAE Mumbai Local Chapter**

INAE Mumbai Local Chapter organized a talk by Prof JM Vasi, FNAE on the topic **"Assessing the Performance of Solar Photovoltaics in India: Need for a Multi-disciplinary Approach"** at IIT Bombay, Mumbai on May 3, 2019. The Program was as follows:

5: PM Tea and Networking of Fellows

5:30 pm:	Welcome by Prof DN Singh, Hon. Secy, INAE Mumbai Chapter
5:35 pm:	Introduction to the Chapter and the speaker by Prof Grover, Hon. Co-Chair, INAE Mumbai Chapter
5:45 -to 6:35 pm:	Talk by Prof Vasi on "**Assessing the Performance of Solar Photovoltaics in India: Need for a Multi-disciplinary Approach" followed by discussions**
6:40 to 7:00 pm:	Brief meeting of Executive Committee members on programs to follow.

Prof AK Suresh, Co-Chair, INAE Mumbai Local Chapter presenting a Bouquet to Prof JM Vasi

Group Photo of Participants at INAE Mumbai Local Chapter Event at IIT Bombay

The event was attended by about 50 INAE Fellows and other experts and was a great success.

Technical Contributions by INAE Fellows

1. **Summary of book authored by Prof R.N. Iyengar, FNAE on "Nārada Śilpaśāstra"**

Prof R.N. Iyengar, FNAE, Distinguished Professor, Centre for Ancient History & Culture, Jain University, Bangalore has recently authored a book on "**Nārada Śilpaśāstra" published by** Jain University Press. A brief summary of the book is given below.

Nārada Śilpaśāstra

[Sanskrit Text on Architectural Civil Engineering]

R.N. Iyengar, (*helped by* K.S.Kannan & S.Y.Wakankar)

Jain University Press, 2018, Rs.300/- (ISBN 978-93-85327-58-2)

India has a rich and ancient tradition of building cities, monuments, towers, dams, bridges, reservoirs, step-wells and other civic infrastructure besides beautiful temples and palaces. Some of the present-day highways are aligned on ancient tracts that were first laid several centuries ago. There are several ancient Sanskrit texts known as either *Vāstuśāstra* or *Śilpaśāstra* that describe some aspects of residential buildings, temples and other structures. The present text, attributed to the authorship of Nārada, the legendary sage and polymath, is a *Vāstuśāstra* text, although traditionally the manuscripts are titled *Nārada Śilpaśāstra*. This text, in terse technical Sanskrit prose describes site selection, planning of villages and cities, construction of roads, dams, lakes, foundation, basement, building typology, importance rating, super structure of private and public buildings including marriage halls, art galleries, theatres and temples. Internal evidences point out that in its present form, this text originated at a time when weekdays were not in vogue, but acquired additional material at a later period and fixed in South India around 6th century CE. Prof. R.N. Iyengar, himself a renowned Civil Engineer, helped by two Sanskrit scholars, has for the first time brought out this unique Sanskrit text on the theory and practice of Architectural Civil Engineering in ancient India with Introduction, translation, notes and figures.

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Excerpts from the Foreword of Prof. Michel Danino *(Member, ICHR)*

"……The efforts… bound to elicit much scholarly interest in India and abroad. This critical edition, based on three manuscripts, comes with a careful editorial apparatus, which includes … Prof. Iyengar's meticulous discussion of the date and provenance of the text, which he attributes to the sixth century CE at the latest and to south India respectively, is in my view conclusive; it also shows the breadth of his scholarship in the technical literature in Sanskrit...it is certain that from the angle of sustainability at least, if not also aesthetics, our "modern" concepts or urbanism and architecture would benefit from an open-minded scrutiny of texts… such as the one Prof. Iyengar and his collaborators have now put in our hands…."

ju.publications@jainuniversity.ac.in

2. **Summary of Technology License Agreement on Biohydrogen Production Process signed by Dr. Debabrata Das, FNAE & his research group at IIT Kharagpur with M/s. Dhampur Sugar Mills Ltd.**

Technology License Agreement on Biohydrogen Production Process

Indian Institute of Technology (IIT) Kharagpur has pioneered the promising Research and Development of biohydrogen production process by applying fermentation technology and actively involved in this research work for a period of last more than twenty years. The commendable contributions towards development of a commercially competitive and environmentally benign bioprocess began with the isolation and characterization of high-yielding hydrogen producing bacterial strain *Enterobacter cloacae* IIT-BT 08, which is known to be the highest producer of hydrogen by fermentation. They successfully demonstrated **10 m^3 Pilot Plant studies** for the commercial exploitation of the process using cane molasses, rice mill wastes, distillery effluent, sewage sludge, etc. sponsored by **MNRE, Government of India .** The aim was to synchronize the bioremediation of wastewater with clean energy generation**. IIT Kharagpur and M/s. Dhampur Sugar Mills. Ltd., Dhampur, UP signed a Technology License Agreement on 3rd May, 2019** on the development of Biohydrogen Production Process in the commercial scale. They have published **6 books** and more than **150 publication** in the peer reviewed journals on the different bioenergy generation processes. International Association of Hydrogen Energy conferred **Akira Mitsui award to Prof. Debabrata Das**, FNAE, Group leader for his contribution in hydrogen research at WHEC 2008 at Brisbane.

10 m^3 Biohydrogen Pilot Plant at IIT Kharagpur

Mr. Vijay Goel, President, M/s. Ms. Dhampur Sugar Mills Ltd., India, Prof. Debabrata Das, Inventor and Prof. Pallab Dasgupta, Dean, SRIC, IIT Kharagpur at the Technology Licence Agreement Ceremony on "Biohydrogen production from the distillery effluent" at IIT Kharagpur.

Academia Industry Interaction

AICTE-INAE Distinguished Visiting Professorship Scheme

Industry-academia interactions have become essential as with the world over technological changes in recent times these can impart relevant knowledge to the students in the engineering institutions, that is sustainable in the changing conditions. While industries could gain by using the Academia's knowledge base to improve the industry's cost, quality and global competitive dimensions; thereby reducing dependence on foreign know-how and expenditure on internal R&D, academicians benefit by seeing their knowledge and expertise being fruitfully utilized practically and also by strengthening of curricula of educational programs being offered at engineering colleges/institutions. INAE together with All India Council for Technical Education (AICTE) launched "AICTE-INAE Distinguished Visiting Professorship Scheme" in 1999. Under this scheme, Industry experts are encouraged to give a few lectures in engineering institutions. This scheme has become popular among industry experts as well as engineering colleges.

Brief details pertaining to recent visits of industry experts under this scheme are given below.

Dr. SK Gupta Project Coordinator (Saline Water), CSSRI	Karnal Institute of Technology and Management, Karnal March 6-8, 2019	Delivered lectures on "Soil properties and Soil Classification Systems", "Improving Hardware and Software for High Productivity in Canal Commands" and " Flow of Water Through Porous Media (Soils)". As per feedback from the

		engineering institute, the scheme is beneficial for the students.
Dr. Sreekumar Thaliyil Veedu Senior Consultant, Reliance Industries Ltd. (RIL)	DKTE Society's Textile & Engineering Institute, Ichalkaranji March 27-30,2019	Delivered lectures on "Developments in Synthetic Fibres", "Developments in High Performance Fibres" and "Developments in Synthetic Fibres". As per the feedback from Faculty Coordinator in the engineering institution, the DVP has helped in syllabus development and review of mini projects. In addition, the interactions with the DVP has benefitted both students and faculty members.
Prof MR Madhav Professor Emeritus and Visiting Professor, IIT Hyderabad and JNTUH	Vallurupalli Nageswara Rao Vignana Jyothi Institute of Engineering and Technology, Hyderabad March 13-15,2019 Gayatri Vidya Parishad College of Engineering, Visakhapatnam April 15-16,2019	Delivered Lectures on "Ground Improvement Through Case Histories", "Fallacies in Estimation of Bearing Capacity of Foundations" and "Geosynthetic Reinforced Slopes". As per the feedback received from the engineering institution, the lectures by DVP have been beneficial for both students and faculty members and the DVP has also helped in identifying student projects. Delivered lectures on "Slope Stabilization Methods" and " Versatile Application of Natural Fibre Geotextiles". According to the feedback given by the engineering college, the lectures and suggestions given by the DVP have been found to be very helpful for students and faculty members.
Dr. D. Antony Louis Piriyakumar Director-Startup, Agape Piriyakumar AI Solutions	Thiagarajar College of Engineering, Madurai April 2-4, 2019	Delivered lectures on "Intellectual Property Rights", "Support Vector Machines -Part II" and "Deep Learning". According to the feedback received from the college, the interaction with the DVP has been very useful and helpful for students. He has also helped the college by reviewing projects and introducing of new topics in syllabus.
Dr Jayanta Kumar Saha Deputy General Manager (Applications), Institute for Steel Development & Growth	Department of Mechanical engineering, Jadavpur University April 3-5, 2019	Delivered lectures on "Steel used for Automotive Industry & Protection Techniques Against Corrosion", "Winds of Change Blowing in the Steel Industry (Industry 4.0 Perspective)" and "Overview of Non-Destructive Testing". According to the feedback received from the engineering college, the lectures of DVP are important for students to help them develop an aptitude to serve industries.
Dr. Lalit Kumar Chairman CEPTAM, DRDO, New Delhi; Director (Retd), MTRDC, DRDO, Bangalore	Siddaganga Institute of Technology, Tumkur April 3-5,2019	Delivered lectures on "Maxwell's Equations and Boundary Conditions-I", " Terahertz Technology and Applications" and " Maxwell's Equations and Boundary Conditions-II". According to the feedback from the Faculty Coordinator, the scheme is very helpful for engineering institutes for both the students and the faculty members, specially for additional inputs to course delivery, project guidance and research monitoring.

Dr. Suvankar Ganguly Principal Scientist, R&D Division, TATA Steel Ltd.	Department of Mechanical Engineering, Jadavpur University April 12-13, 2019	Delivered lectures on "Innovation in Industry: Application in the Run -Out Table (ROT) of a Hot Strip Mill" and "Math Modelling of Phase Transformation During Cooling in ROT: Discussion for Specific Cases". According to the feedback received from the engineering college, the lectures were beneficial for the students. The DVP has also helped students with identifying topics for PhD thesis and PG Projects.
Mr. S. Krishna Kumar Former Senior Vice President (Retired), Lucas TVS Ltd, Chennai	RMK Engineering College, Kavaraipettai, Tamil Nadu April 22-24, 2019	Delivered lectures on "Recent Trends in Electric Vehicle Technology with Specific Case Studies on Innovation and Technology Development in Indian Automotive Industry - Already and In Progress", "Geometrical Dimensioning and Tolerancing (GD&T), 3D - Assembly Process and Analysis - Along with Real Case Studies from the Industry" and "Lean Manufacturing, Just-in Time (JIT) Manufacturing Concepts and Quality Management". According to the feedback from the Engineering College, the scheme helps engineering colleges to take advantage of the rich experience of the DVP, which assist the students to gain clarity in career options and helps faculty in imparting specific knowledge. The DVP also presented real industrial case studies, guided projects and helped in identifying future projects.

Important Meetings held during May 2019

- **Meetings of ten INAE Sectional Committees held from May 1, 2019 to May 14, 2019 at INAE Office, Gurgaon.**
- **Meeting of INAE Forum on Civil Infrastructure held on May 4, 2019 at New Delhi**
- **Meeting of PSA-INAE Consultative Committee held on May 7, 2019 at Office of PSA, New Delhi**
- **Meeting of Steering Committee on Research Schemes/Proposals held on May 20, 2019 at INAE Office, Gurgaon**
- **Meeting of INAE Forum on Technology Foresight and Management held on May 30, 2019 at INAE Office, Gurgaon**

International/National Conferences/Seminars being organized by IITs/other Institutions

To view a list of International/ National Conferences/Seminars being held in the month of June 2019, click here.

Honours and Awards

1.	Prof Bhargab B. Bhattacharya, FNAE Professor of Computer Science & Engineering (Retd.) Indian Statistical Institute, Kolkata & Distinguished Visiting Professor Department of Computer Science & Engineering IIT Kharagpur and his research group at ISI Kolkata has recently received a recognition from the Institution of Engineers-India (IEI) and IEEE. Prof Bhargab B. Bhattacharya was conferred with the IEI-IEEE Joint Award for Engineering Excellence - 2018 for contributions to VLSI and microfluidic biochips and their bio-medical applications. Some of the relevant work was supported by INAE Chair Professorship (2016-2018). Further details may be viewed at the link https://www.ieee.org/about/awards/joint-awards-est.html#india

News of Fellows

1	Prof R.N. Iyengar, FNAE, Distinguished Professor, Centre for Ancient History & Culture, Jain University, Bangalore has recently authored a book on "**Nārada Śilpaśāstra"** published by Jain University Press.
2	Dr. Debabrata Das, FNAE, Visiting Professor, Former Head and Renewable Energy Chair Professor, Department of Biotechnology and Former Professor-in-Charge, P K Sinha Center for Bioenergy, Indian Institute of Technology, Kharagpur and his research group have recently signed a Technology License Agreement on their Biohydrogen Production process with M/s. Dhampur Sugar Mills Ltd.

INAE on Facebook and Twitter

INAE has created a Facebook and Twitter Account to post the news of recent INAE activities in the Social Media. The same can be viewed at the link below.

(a) Facebook -link https://www.facebook.com/pages/Indian-National-Academy-of-Engineering/714509531987607?ref=hl

(b) Twitter handle link https://twitter.com/inaehq1

All INAE Fellows are requested to visit and follow the above to increase the visibility of INAE in Social media.

International/National Conferences in June 2019

3rd International Conference on Intelligent Computing and Communications 2019 on 7th to 8th June 2019 at Bangalore
https://conferencealerts.com/show-event?id=212704

International Conference on Intelligent Manufacturing and Energy Sustainability on 21st to 22nd June 2019 at Hyderabad
https://conferencealerts.com/show-event?id=209513

International Conference on Emerging Trends in Information Technology on 21st to 22nd June 2019 at New Delhi
https://conferencealerts.com/show-event?id=208848

Springer - Second International Conference on Soft Computing and Signal Processing on 21st to 22nd June 2019 at Hyderabad
https://conferencealerts.com/show-event?id=209062

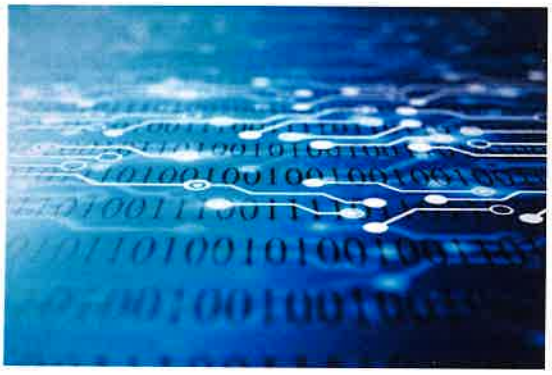
Civil Engineering

1. Building Airports for The Long Run

India has several fine airports and more are on their way to boost the air connectivity between cities and ease congestion in existing airports. Large-scale projects always have long gestation periods. When one considers the idea of designing an airport, it is a herculean task. This is because symbolically the designs need to embody the city's and country's identity by acting as the first and last handshake. Importantly, the key factors of the sensitive nature and security concerns of airports also have to be painstakingly taken in consideration in the designs. Besides aesthetics, it is the functionality of the building that is important and involves proper segregation of visitors, passengers and the baggage system. As passengers are required to stay longer periods in hold areas, queuing immigration and check in areas, it is necessary to provide good visual effect within the building. Minimising heat gain and maximising day light through passive strategies of good planning should be emphasised while designing airport terminal buildings. Security at airports are of utmost importance. This involves ensuring complete safety and smooth flying of passengers, avoiding illegal activities like smuggling to protecting from unfortunate incidents like terrorist attacks and hijacking. Effective lighting plays a huge role in securing outdoor spaces and avoiding inconvenience and regrettable events. It is a fact that airports have evolved in the past decade. Be it attractive bookstores, statement décor pieces or glamourous clothing showrooms, today, airports have all kinds of luxuries. The fact that airports are one of the busiest places and witness the highest level of traffic, it is best to go for products that guarantee durability with an extra edge of magnificence. Airports have turned to Otis' flagship product, the Gen2 elevator for the elevator systems. This range is designed to increase the elevator's efficiency, safety and reliability with key components that include a coated steel belt, as well as the ReGen drive, permanent magnet machine and PULSE monitoring system. Gen2 elevators with ReGen drives are as much as 75% more energy efficient than traditional elevators with conventional drives. This helps achieve substantial energy savings and can help support green building certification. The Gen2 range also has machine-room less (MRL) elevators. These elevators replace large elevator rooms by locating a compact hoisting machine on the top of the elevator shaft. Compared to systems with machine rooms, the compact gearless machine consumes less electricity and saves on other building costs because it does not take up an entire room for parts and equipment. The entire idea in development of airports is not only on the airport's iconic form, but also in the space modulated to conform to the needs of the passengers to make them most comfortable.

Source https://www.constructionweekonline.in/9817-building-airports-for-the-long-run

2. Virtually Energy-Free Superfast Computing Invented by Scientists Using Light Pulses



Digital computing concept.

Superfast data processing using light pulses instead of electricity has been created by scientists. The invention uses magnets to record computer data which consume virtually zero energy, solving the dilemma of how to create faster data processing speeds without the accompanying high energy costs. Today's data centre servers consume between 2 to 5% of global electricity consumption, producing heat which in turn requires more power to cool the servers. The problem is so acute that Microsoft has even submerged hundreds of its data centre services in the ocean in an effort to keep them cool and cut costs. Most data are encoded as binary information (0 or 1 respectively) through the orientation of tiny magnets, called spins, in magnetic hard-drives. The magnetic read/write head is used to set or retrieve information using electrical currents which dissipate huge amounts of energy. Now an international team has solved the problem by replacing electricity with extremely short pulses of light -- the duration of one trillionth of a second -- concentrated by special antennas on top of a magnet. This new method is superfast but so energy efficient that the temperature of the magnet does not increase at all. The team demonstrated this new method by pulsing a magnet with ultrashort light bursts (the duration of a millionth of a millionth of a second) at frequencies in the far infrared, the so-called terahertz spectral range. However, even the strongest existing sources of the terahertz light did not provide strong enough pulses to switch the orientation of a magnet to date. The breakthrough was achieved by utilizing the efficient interaction mechanism of coupling between spins and terahertz electric field, which was discovered by the same team. The scientists then developed and fabricated a very small antenna on top of the magnet to concentrate and thereby enhance the electric field of light. This strongest local electric field was sufficient to navigate the magnetization of the magnet to its new orientation in just one trillionth of a second. The temperature of the magnet did not increase at all as this process requires energy of only one quantum of the terahertz light -- a photon -- per spin. The record-low energy loss makes this approach scalable. Future storage devices would also exploit the excellent spatial definition of antenna structures enabling practical magnetic memories with simultaneously maximal energy efficiency and speed." The lead researcher plans to carry out further research using the new ultrafast laser at Lancaster University together with accelerators at the Cockroft Institute which are able to generate intense pulses of light to allow switching magnets and to determine the practical and fundamental speed and energy limits of magnetic recording.

Source https://www.sciencedaily.com/releases/2019/05/190515131745.htm

3. New Surface Treatment Could Improve Refrigeration Efficiency

Unlike water, liquid refrigerants and other fluids that have a low surface tension tend to spread quickly into a sheet when they come into contact with a surface. But for many industrial processes it would be better if the fluids formed droplets, which could roll or fall off the surface and carry heat away with them. Now, researchers at MIT have made significant progress in promoting droplet formation and shedding in such fluids. This approach could lead to efficiency improvements in many large-scale industrial processes including refrigeration, thus saving energy and reducing greenhouse gas emissions. Over the years, Dr Varanasi and his collaborators have made great progress in improving the efficiency of condensation systems that use water, such as the cooling systems used for fossil-fuel or nuclear power generation. But other kinds of fluids -- such as those used in refrigeration systems, liquification, waste heat recovery, and distillation plants, or materials such as methane in oil and gas liquefaction plants -- often have very low surface tension compared to water, meaning that it is very hard to get them to form droplets on a surface. Instead, they tend to spread out in a sheet, a property known as wetting. But when these sheets of liquid coat a surface, they provide an insulating layer that inhibits heat transfer, and easy heat transfer is crucial to making these processes work efficiently. "If it forms a film, it becomes a barrier to heat transfer," Dr Varanasi says. But that heat transfer is enhanced when the liquid quickly forms droplets, which then coalesce and grow and fall away under the force of gravity. Getting low-surface-tension liquids to form droplets and shed them easily has been a serious challenge. In condensing systems that use water, the overall efficiency of the process can be around 40 percent, but with low-surface-tension fluids, the efficiency can be limited to about 20 percent. Because these processes are so widespread in industry, even a tiny improvement in that efficiency could lead to dramatic savings in fuel, and therefore in greenhouse gas emissions, he says. By promoting droplet formation, he says, it's possible to achieve a four- to eightfold improvement in heat transfer. Because the condensation is just one part of a complex cycle, that translates into an overall efficiency improvement of about 2 percent. That may not sound like much, but in these huge industrial processes even a fraction of a percent improvement is considered a major achievement with great potential impact. "In this field, you're fighting for tenths of a percent," a researcher says. Unlike the surface treatments Varanasi and his team have developed for other kinds of fluids, which rely on a liquid material held in place by a surface texture, in this case they were able to accomplish the fluid-repelling effect using a very thin solid coating -- less than a micron thick (one millionth of a meter). That thinness is important, to ensure that the coating itself doesn't contribute to blocking heat transfer, a researcher explains. The coating, made of a specially formulated polymer, is deposited on the surface using a process called initiated chemical vapor deposition (iCVD), in which the coating material is vaporized and grafts onto the surface to be treated, such as a metal pipe, to form a thin coating. This process was developed at MIT by Gleason and is now widely used. The authors optimized the iCVD process by tuning the grafting of coating molecules onto the surface, in order to minimize the pinning of condensing droplets and facilitate their easy shedding. The process could be carried out on location in industrial-scale equipment, and could be retrofitted into existing installations to provide a boost in efficiency. The process is "materials agnostic," and can be applied on either flat surfaces or tubing made of stainless steel, copper, titanium, or other metals commonly used in evaporative heat-transfer processes that involve these low-surface-tension fluids. "Whatever material you come up with, it tends to be scalable with this process," he adds. The net result is that on these surfaces, condensing fluids such as liquid methane will readily form small droplets that quickly fall off the surface, making room for more to form, and in the process shedding heat from the metal to the droplets that fall away. Without the coating, the fluid would spread out over the whole surface and resist falling away, forming a kind of heat-retaining blanket. But with it, "the heat transfer improves by almost eight times," a researcher says. One area where such coatings could play a useful role, Dr Varanasi says, is in organic Rankine cycle systems, which are widely used for generating power from waste heat in a variety of industrial processes. "These are inherently inefficient systems," he says, "but this could make them more efficient."

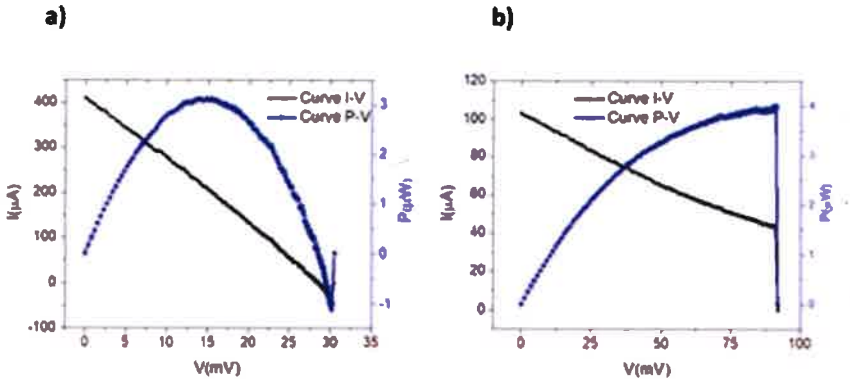
Source https://www.sciencedaily.com/releases/2019/05/190515110339.htm

4. Improving Carbon-Capturing with Metal-Organic Frameworks

Metal-organic frameworks (MOFs) are versatile compounds hosting nano-sized pores in their crystal structure. Because of their nanopores, MOFs are now used in a wide range of applications, including separating petrochemicals, mimicking DNA, and removing heavy metals, fluoride anions, hydrogen, and even gold from water. Gas separation in particular is of great interest to a number of industries, such as biogas production, enriching air in metal working, purifying natural gas, and recovering hydrogen from ammonia plants and oil refineries. "The flexible 'lattice' structure of metal-organic frameworks soaks up gas molecules that are even larger than its pore window making it difficult to carry out efficient membrane-based separation," says Kumar Varoon Agrawal, who holds the GAZNAT Chair for Advanced Separations at EPFL Valais Wallis. Now, scientists from Agrawal's lab have greatly improved the gas separation by making the MOF lattice structure rigid. They did this by using a novel "post-synthetic rapid heat treatment" method, which basically involved baking a popular MOF called ZIF-8 (zeolitic imidazolate framework 8) at 360°C for a few seconds. The method drastically improved ZIF-8's gas-separation performance -- specifically in 'carbon capture', a process that captures carbon dioxide emissions produced from the use of fossil fuels, preventing it from entering the atmosphere. "For the first time, we have achieved commercially attractive dioxide sieving performance a MOF membrane," says Agrawal. The scientists attribute the improvement to a shrinkage of the lattice parameters which makes the chemical bonds of MOF more rigid. The essential chemical composition, bonding environment, and crystallinity of the material was unaffected by the new procedure. "Rapid heat treatment is an easy and versatile technique that can vastly improve the gas-separation performance of the MOF membranes," says Agrawal. "By making the lattice rigid, we can efficiently carry out a number of separations."

Source https://www.sciencedaily.com/releases/2019/05/190516103705.htm

5. Novel Thermoelectric Nanoantenna Design for Use in Solar Energy Harvesting



I-V curves: (a) CDN - Ni-Pt, current in function of voltage (black line) and the electrical potential in 225 function of voltage (blue line). (b) EDN - Ni-Pt, current in function of voltage (black line) and the electrical 226 potential in function of voltage (blue line).

Researchers from a collaboration of three labs in Mexico demonstrate an innovative nanodevice for harvesting solar energy. The work on "Thermoelectric efficiency optimization of nanoantennas for solar energy harvesting," reports that evolutive dipole nanoantennas (EDNs) generate a thermoelectric voltage three times larger than the classic dipole nanoantenna (CDN). Capturing visible and infrared radiation using nanodevices is an essential aspect of collecting solar energy: solar cells and solar panels are common devices that utilize nanoantennas, which link electromagnetic radiation to specific optical fields. The EDN antenna can be useful in many areas where high thermoelectric efficiency is needed from energy harvesting to applications across the aerospace industry. "The work reports on a novel design and demonstration of a nanoantenna for efficient thermoelectric energy harvesting," says Professor Ibrahim Abdulhalim, Ben-Gurion University of the Negev. "They demonstrated thermoelectric voltage three times larger than a classical antenna. This type of antenna can be useful in many fields from harvesting of energy from waste heat, in sensing and solar thermal energy harvesting." The nanoantennas are bimetallic, using nickel and platinum, and were fabricated using e-beam lithography. The nanoantenna design was optimized using simulations to determine the distance between the elements. In comparing their thermoelectric voltage to the classic dipole nanoantenna, the EDNs were 1.3 times more efficient. The characterization was done using a solar simulator analyzing the I-V curves. The results indicate that EDN nanoantenna arrays would be good candidates for the harvesting of waste heat energy.

Source https://www.sciencedaily.com/releases/2019/05/190503100804.htm

6. A New Sensor for Light, Heat and Touch

Inspired by the behaviour of natural skin, researchers at the Laboratory of Organic Electronics, Linkoping University, have developed a sensor that will be suitable for use with electronic skin. It can measure changes in body temperature, and react to both sunlight and warm touch. Robotics, prostheses that react to touch, and health monitoring are three fields in which scientists globally are working to develop electronic skin. They want such skin to be flexible and to possess some form of sensitivity. Researchers at the Laboratory of Organic Electronics at Linköping University have now taken steps towards such a system by combining several physical phenomena and materials. The result is a sensor that, similar to human skin, can sense temperature variation that originates from the touch of a warm object, as well as the heat from solar radiation. "We have been inspired by nature and its methods of sensing heat and radiation," says Mina Shiran Chaharsoughi, doctoral student in the Organic Photonics and Nano-optics group at the Laboratory of Organic Electronics. Together with colleagues she has developed a sensor that combines pyroelectric and thermoelectric effects with a nano-optical phenomenon. A voltage arises in pyroelectric materials when they are heated or cooled. It is the change in temperature that gives a signal, which is rapid and strong, but that decays almost as rapidly. In thermoelectric materials, in contrast, a voltage arises when the material has one cold and one hot side. The signal here arises slowly, and some time must pass before it can be measured. The heat may arise from a warm touch or from the sun; all that is required is that one side is colder than the other. "We wanted to enjoy the best of both worlds, so we combined a pyroelectric polymer with a thermoelectric gel developed in a previous project by Dan Zhao, and other colleagues at the Laboratory of Organic Electronics. The combination gives a rapid and strong signal that lasts as long as the stimulus is present," says Magnus Jonsson, leader of the Organic Photonics and Nano-optics group. Furthermore, it turned out that the two materials interact in a way that reinforces the signal. The new sensor also uses another nano-optical entity known as plasmons. "Plasmons arise when light interacts with nanoparticles of metals such as gold and silver. The incident light causes the electrons in the particles to oscillate in unison, which forms the plasmon. This phenomenon provides the nanostructures with extraordinary optical properties, such as high scattering and high absorption," Magnus Jonsson explains. In previous work, he and his co-workers have shown that a gold electrode that has been perforated with nanoholes absorbs light efficiently with the aid of plasmons. The absorbed light is subsequently converted to heat. With such an electrode, a thin gold film with nanoholes, on the side that faces the sun, the sensor can also convert visible light rapidly to a stable signal. As an added bonus, the sensor is also pressure-sensitive. "A signal arises when we press the sensor with a finger, but not when we subject it to the same pressure with a piece of plastic. It reacts to the heat of the hand," says Magnus Jonsson.

Source https://www.sciencedaily.com/releases/2019/05/190514093408.htm

7. How ISRO Satellites Tracked Fani, Saved Many Lives

As meteorologists observed a trough of low in the southern Indian Ocean, five Indian satellites kept a constant eye on the system as it brewed into cyclone Fani. As it developed into an "extremely severe cyclone", the satellites launched by ISRO sent data every 15 minutes to the ground station, helping track and forecast its movement and save hundreds of lives. According to IMD, data from satellites Insat-3D, Insat-3DR, Scatsat-1, Oceansat-2 and Megha Tropiques was used to study the intensity, location and cloud cover around Fani. There was a cloud cover around the eye of the storm up to 1000km radius, though the rain clouds were only up to a radius of 100 to 200km. The rest were at a height of around 10,000feet. "Satellites play a critical role in forecasting, particularly during cyclones, helping us describe the initial parameters fed into the weather models, closer to the actual atmospheric conditions. This helps us better our forecast," said IMD director general KJ Ramesh. With IMD able to accurately forecast the exact location where the cyclone was to make landfall, officials in Odisha, Andhra Pradesh and West Bengal were able to evacuate more than 11.5 lakh people to safety. One of the main payloads from the satellites used to mark the eye of Fani was the scatterometer onboard Scatsat-1, a polar orbiting miniature satellite, and Oceansat-2, sending data about ocean surface, wind speed and wind direction.

8. From 2D to 1D: Atomically quasi '1D' wires using a carbon nanotube template

Researchers from Tokyo Metropolitan University have used carbon nanotube templates to produce nanowires of transition metal monochalcogenide (TMM), which are only 3 atoms wide in diameter. These are 50 times longer than previous attempts and can be studied in isolation, preserving the properties of atomically quasi "1D" objects. The team saw that single wires twist when perturbed, suggesting that isolated nanowires have unique mechanical properties which might be applied to switching in nanoelectronics. Two-dimensional materials have gone from theoretical curiosity to real-life application in the span of less than two decades; the most well-known example of these, graphene, consists of well-ordered sheets of carbon atoms. Though we are far from leveraging the full potential of graphene, its remarkable electrical and thermal conductivity, optical properties and mechanical resilience have already led to a wide range of industrial applications. Examples include energy storage solutions, biosensing, and even substrates for artificial tissue. Yet, despite the successful transition from 3D to 2D, the barrier separating 2D and 1D has been significantly more challenging to overcome. A class of materials known as transition metal monochalcogenides (TMMs, transition metal + group 16 element) have received particular interest as a potential nanowire in precision nanoelectronics. Theoretical studies have existed for over 30 years, and preliminary experimental studies have also succeeded in making small quantities of nanowire, but these were usually bundled, too short, mixed with bulk material or simply low yield, particularly when precision techniques were involved e.g. lithography. The bundling was particularly problematic; forces known as van der Waals forces would force the wires to aggregate, effectively masking all the unique properties of 1D wires that one might want to access and apply. Now, a team led by Assistant Professor Yusuke Nakanishi from Tokyo Metropolitan University has succeeded in producing bulk quantities of well-isolated single nanowires of TMM. They used tiny, open-ended rolls of single-layered carbon, or carbon nanotubes (CNTs), to template the assembly and reaction of molybdenum and tellurium into wires from a vapor. They succeeded in producing single isolated wires of TMM, which were only 3-atoms thick and fifty times longer than those made using existing methods. These nanometer-sized CNT "test tubes" were also shown to be not chemically bound to the wires, effectively preserving the properties expected from isolated TMM wires. Importantly, they effectively "protected" the wires from each other, allowing for unprecedented access to how these 1D objects behave in isolation. While imaging these objects using transmission electron microscopy (TEM), the team found that these wires exhibited a unique twisting effect when exposed to an electron beam. Such behaviour has never been seen before and is expected to be unique to isolated wires. The transition from a straight to twisted structure may offer a novel switching mechanism when the material is incorporated into microscopic circuits. The team hope the ability to make well-isolated 1D nanowires might significantly expand our understanding of the properties and mechanisms behind the function of 1D materials.

Source https://www.sciencedaily.com/releases/2019/04/190420090531.htm

9. Bio-Inspired Material Targets Oceans' Uranium Stores for Sustainable Nuclear Energy

Scientists have demonstrated a new bio-inspired material for an eco-friendly and cost-effective approach to recovering uranium from seawater. A research team from the Department of Energy's Oak Ridge and Lawrence Berkeley National Laboratories, the University of California, Berkeley, and the University of South Florida developed a material that selectively binds dissolved uranium with a low-cost polymer adsorbent. The results could help push past bottlenecks in the cost and efficiency of extracting uranium resources from oceans for sustainable energy production. "Our approach is a significant leap forward," said coauthor Ilja Popovs of ORNL's Chemical Sciences Division. "Our material is tailor-made for selecting uranium over other metals present in seawater and can easily be recycled for reuse, making it much more practical and efficient than previously developed adsorbents." Popovs took inspiration from the chemistry of iron-hungry microorganisms. Microbes such as bacteria and fungi secret natural compounds known as "siderophores" to siphon essential nutrients like iron from their hosts. "We essentially created an artificial siderophore to improve the way materials select and bind uranium," he said. The team used computational and experimental methods to develop a novel functional group known as "H_2BHT" -- 2,6-bis[hydroxy(methyl)amino]-4-morpholino-1,3,5-triazine -- that preferentially selects uranyl ions, or water-soluble uranium, over competing metal ions from other elements in seawater, such as vanadium. The fundamental discovery is backed by the promising performance of a proof-of-principle H_2BHT polymer adsorbent. Uranyl ions are readily "adsorbed," or bonded to the surface of the material's fibers because of the unique chemistry of H_2BHT. The prototype stands out among other synthetic materials for increasing the storage space for uranium, yielding a highly selective and recyclable material that recovers uranium more efficiently than previous methods. With a practical recovery method, saltwater extraction offers a sustainable alternative to land-mining uranium that could sustain nuclear power production for millennia. Uranium deposits are abundant and replenishable in seawater through the natural erosion of ore-containing rocks and soil. Despite dilute concentrations, approximately 3 milligrams of uranium per ton of seawater, the world's oceans hold massive stores of the element totalling an estimated four billion tons -- a 1000 times greater supply than all land sources combined. "The goal is to develop efficient adsorbent materials at a low cost that can be processed using mild conditions to recover uranium, and also reused for multiple extraction cycles," said a researcher. The team has focused on determining the underlying factors that influence selectivity and increase the volume of recoverable uranium with new materials. Previous studies on amidoxime-based compounds revealed a fundamentally stronger attraction to vanadium over uranium that may be difficult to overcome. The development of H_2BHT offers an alternative approach, using non-amidoxime materials, to better target uranium in mixed-metal water environments. Selectivity has long been a stumbling block on the road to more efficient adsorbent materials. Early advances, driven by trial and error, found amidoxime-based functional groups effectively bind uranium in water but do an even better job of recovering vanadium, although the latter has a comparatively lower concentration in seawater. The highly concentrated acidic solutions used to remove vanadium are an increased expense compared with mild or basic processing solutions and are burdened by caustic waste streams. Moreover, acid processing can damage material fibres, which limits their reuse, making commercial adoption cost-prohibitive. Unlike vanadium-laden materials, the H_2BHT polymer can be processed using mild basic solutions and recycled for extended reuse. The eco-friendly features also bring significant cost advantages to potential real-world applications. The next step, say researchers, is to refine the approach for greater efficiency and commercial-scale opportunities.

Source https://www.sciencedaily.com/releases/2019/05/190516114612.htm

10. Use of Robots and Artificial Intelligence to Understand the Deep Sea

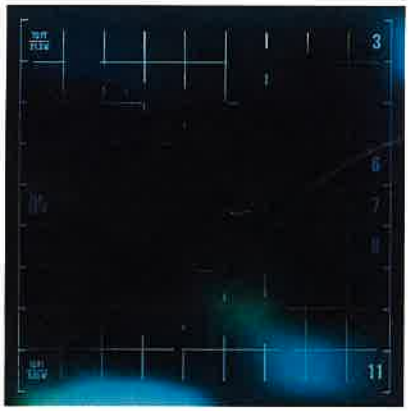
Seabed with marine life.

Artificial intelligence (AI) could help scientists shed new light on the variety of species living on the ocean floor, according to new research led by the University of Plymouth. With increasing threats facing the marine environment, scientists desperately need more information about what inhabits the seabed in order to inform conservation and biodiversity management. Autonomous underwater vehicles (AUV) mounted with the latest cameras are now able to collect vast amounts of data, but a bottleneck is still created by humans having to process it. In a new study marine scientists and robotics experts tested the effectiveness of a computer vision (CV) system in potentially fulfilling that role. They showed on average it is around 80% accurate in identifying various animals in images of the seabed, but can be up to 93% accurate for specific species if enough data is used to train the algorithm. This, scientists say, demonstrates CV could soon be routinely employed to study marine animals and plants and lead to a major increase in data availability for conservation research and biodiversity management. A lead author on the study, said: "Autonomous vehicles are a vital tool for surveying large areas of the seabed deeper than 60m (the depth most divers can reach). But we are currently not able to manually analyse more than a fraction of that data. This research shows AI is a promising tool but our AI classifier would still be wrong one out of five times, if it was used to identify animals in our images. "This makes it an important step forward in dealing with the huge amounts of data being generated from the ocean floor, and shows it can help speed up analysis when used for detecting some species. But we are not at the point of considering it a suitable complete replacement for humans at this stage." One of the UK's national AUVs -- Autosub6000, deployed in May 2016 -- collected more than 150,000 images in a single dive from around 1200m beneath the ocean surface on the north-east side of Rockall Bank, in the North East Atlantic. Around 1,200 of these images were manually analysed, containing 40,000 individuals of 110 different kinds of animals (morphospecies), most of them only seen a handful of times. Researchers then used Google's Tensorflow, an open access library, to teach a pre-trained Convolutional Neural Network (CNN) to identify individuals of various deep-sea morphospecies found in the AUV images. They then assessed how the CNN performed when trained with different numbers of example images of animals, and different of numbers of morphospecies to choose from. The accuracy of manual annotation by humans can range from 50 to 95%, but this method is slow and even specialists are very inconsistent across time and research teams. This automated method reached around 80% accuracy, approaching the performance of humans with a clear speed and consistency advantage. This is particularly true for some morphospecies that the algorithms work very well with. For example, the model correctly identifies one animal (a type of xenophyophore) 93% of the time. While the study does not advocate the replacement of manual annotation, it does demonstrate that marine biologists could be able to implement AI for specific tasks if carefully assessing the reliability of their predictions. This would greatly enhance the capacity of scientists to analyse their data. The researchers say the combination of specialist ecological knowledge with the high-tech AUV's capacity to survey large areas of the seabed, and the fast data processing capacity of AI, could greatly speed up deep-ocean exploration, and with it our wider understanding of marine ecosystems.

Source https://www.sciencedaily.com/releases/2019/05/190510080951.htm

Engineering Innovation in India

This New Composite Material Can Absorb Electromagnetic Radiation



A team of Indian scientists has now developed a new room temperature composite that exhibits high absorption of EMI in the high-frequency range

The rising level of electromagnetic radiation emitted by communication devices and electronic instruments is becoming a cause of concern. An effective shielding material having suitable electrical and magnetic properties can help reduce the problem of Electromagnetic Interference (EMI) as it can reflect or absorb the energy of such radiation. However, absorption type shields are environmentally safe and hence preferred. A team of Indian scientists has now developed a new room temperature composite that exhibits high absorption of EMI in the high-frequency range (8-8 gigahertz). The material has shown 99.99 per cent of EMI shielding. Nickel or silver reflector shields are commonly used but are expensive. In the new material, better shielding performance has been achieved by combining conducting and magnetic materials, which together reduce both electric and magnetic field strength of the radiations by absorbing them. "Although many materials are available to suit the requirement, they lack necessary manufacturing flexibility to mould the shielding into required shapes. Composites offer better machinability. They also have defect centres at the surface interfaces which lead to multiple internal reflections of magnetic fields which contributes to effective EMI shielding," Subodh Ganesanpotti, lead researcher of the study, said. The team used a widely chosen chemical and weather corrosion resistant thermoplastic — Polyvinylidene fluoride (PVDF) as the base material. To the matrix of this polymer, conductivity and magnetism was induced by combining carbon black and Strontium-Yttrium-Cobalt-Oxide (SYCO) fillers, resulting in the new composite. The fabrication was done using the solution mixing and coagulation method. SYCO is a room temperature ferromagnetic material which absorbs magnetic radiation, while carbon black is a readily available highly conductive material. The composites were characterised using attenuated total reflectance FTIR spectroscopy. The EMI shielding effectiveness of a material is described by its ability to attenuate the energy of EM radiation, and the fabricated composite displayed a maximum attenuation of EM by enhanced energy absorption. They found that of the 50.2 dB of absorption, 41.2 dB was due to the composite material. "The composite is cost effective and has versatile application potential," said Ganesanpotti, claiming that, "a 1 to 2.5 mm thick film of this composite can effectively shield EMI in devices like mobile phones and also in radar and military equipment." The results were tested for room temperature requirements. "We are conducting further studies on higher temperature applications. We are also working with different base polymers like silicone rubber to make the composite suitable for implementing in different shapes and moulds to suit various applications," Ganesanpotti added.

Source https://www.downtoearth.org.in/news/science-technology/this-new-composite-material-can-absorb-electromagnetic-radiation-64696