

INAE Vision 2020-2025

INAE VISION

To be the premier Engineering Academy of the World providing timely inputs to the national and international policy makers, and to extend appropriate assistance in developing engineered solutions for the challenging problems facing contemporary societies and the humanity as a whole

INAE Mission

To serve professionals in building and institutionalizing engineering and technological excellence in education, research and industry in India and supports advancement of engineering profession globally

Technological Roadmap

We are living in exciting times. We will have to contend with the profound transformation of our society and our industry, because of two revolutions in the making – namely, the digital revolution and the impending transition to fossil fuel free energy globally.

The digital revolution is rapidly transforming the very nature of industrial enterprise today. Many disruptive transformations are maturing rapidly because of the advent of cloud computing and internet of things (IoT) and due to major advances and breakthroughs being made on several fronts such as artificial intelligence (AI) including machine learning (ML) and big data analytics, robotics, autonomy, drones, 3D printing, advance sensors and 5G technologies.

Another revolution in the making is the exciting possibility of fossil fuel-free generation of electricity in the coming decade. The availability of electricity based on renewable sources such as sun, wind and biomass, will cause a major disruption as well as an opportunity for creating a cleaner world, since use of fossil fuels (coal, oil or natural gas) currently, creates deleterious environmental consequences which need urgent attention.

While both these revolutions will cause major disruptions in how we live and work, the transition to the new world in the making is contingent upon the availability of new sources of critical raw materials.

Both digital hardware and generation of electricity from renewables (including the technological challenges associated with energy storage) require a host of new metals and materials for which the new value chains (also the appropriate global supply chains) will have to be established. Innovative processes for extraction of minerals and metals as well as recycling, which are more energy efficient and environment-friendly will have to be developed to produce these critical elements.

To facilitate this global transition, we need to create human resources with high level of domain expertise in different facets of engineering as well as the much needed engineering skill sets needed to deal with the problems of scalability, uncertainty, reliability, complexity, system engineering, ability to deal with variability and yet manufacture products and create solutions of uniform and reproducible quality, capability to design, develop and optimize engineering systems for a given set of inputs and for a desirable set of assured outputs of consistent quality.

Our engineering education has to be appropriately re-engineered so as to equip our future leaders with not only the domain expertise but also the skillsets to innovate continuously and consistently in the face of constant change and dynamic transformations. The human ingenuity and the preparing the well-trained minds, will be critical ingredients in responding to the challenges ahead.

It in this context, INAE has come up with the following areas for our focused attention in the next five years. We believe that these efforts will assist us in facilitating the smooth transition to the new world in the making.

1. Accelerated Discovery, Development and Deployment of Novel Materials, particularly for strategic sectors like Defense, Atomic Energy and Space.

We have an urgent need of materials (metals, alloys as well as composites) development for the following sectors – auto sector (both electric vehicles as well as IC engines based vehicles), aerospace, ultra-supercritical power plants, nuclear power plants, renewable energy sector (novel PV materials, rare earth magnets, battery materials for both large scale energy storage as well as for electric vehicles and other electronic appliances, thermoelectric materials for converting low temperature heat into electricity), novel sensors for healthcare industry, materials for the defense applications and space applications, to name a few.

These materials will have to engineered for India-specific applications. That means one must consider during the process of design & development itself, the kind of natural resources we have and the kind of supply chains we will be able to establish to source the starting raw materials, considering the complex geo-political scenario and vulnerabilities associated with dependence on raw materials from abroad.

The other important consideration is the speed of development. In order to remain globally competitive in this domain, we must leverage the state of the art digital platforms (equipped with advance modeling, simulation, data analytics and knowledge engineering tools) for accelerating the development cycle from conception to deployment in actual applications as well as the entire life cycle (cradle to cradle or cradle to grave in some cases), that is, even for the structural health monitoring of the structures where these materials will be deployed.

Another important consideration is the environmental impact of these materials, that is, we must undertake a life cycle analysis, both with respect to the environmental footprint as well as the energy efficiency (actual consumption as compared to the thermodynamic energy needed to accomplish the particular task), for every developmental effort.

It is now well established that integrated computational materials engineering (ICME) approach can help accelerate the materials development cycle.

INAE will work towards coming up with a national strategy to establish and institutionalize the ICME based approach for all material development efforts. The digital platform, thus created, must be equipped with knowledge engineering capabilities so that it can not only act as a knowledge repository of all past efforts made thus far but also continues to update the knowledge going forward.

2. Strategies for Energy Transition to Fossil Fuels free Renewable Energy Sources

It is inevitable that India, like several other nations of the world, will move away from fossil fuels as a source of energy. While we have made some headway in developing renewable energy sources like solar and wind, the necessary infrastructure to support the energy transition does not exist at the present time.

INAE plans to create an interdisciplinary expert group to study the whole energy transition comprehensively and holistically, keeping in mind the challenges inherent in such a massive transformation.

INAE will focus on the following important sectors which will be disrupted in the immediate future and/or the areas of concern which we require a strategy for, urgently to facilitate the transition

- Large scale energy storage solutions Solutions other than Lithium Ion Batteries which do not seem to be appropriate for a country like India for a variety of reasons including the fact that we do not have the basic raw materials Liquid Metal Flow batteries (for example, Vanadium Flow Batteries) is another attractive option which must be explored.
- Electricity Grid Infrastructure current grid will not be able to cater to intermittent and distributed electricity inputs; the concept of smart grids which is adequately robust to cater to both supply side challenges (renewable energy sources) as well as demand management (dynamic pricing to take care of its peak loads).
- Transportation (electric mobility, both for people as well as for goods).
- Mining, Mineral Processing and Extractive Metallurgy Industry (which currently depends totally on fossil fuels not only as a source of heat but also as a reductant to convert metal oxides to metals).
- Recycling of waste by-products including municipal waste, tailings and smelter slags including steel slag, red mud and spent pot lining, electronic waste and hospital waste.
- Supply chains for raw materials needed for the transition sourcing strategies from other geographies, urban mining, deep sea mining and space mining.
- Finding alternative technology options for the manufacture of steel and cement to reduce the environmental foot-print currently these two materials which will continue to remain the backbone of the Indian economy for the foreseeable future and the consumption is likely to increase by an order of magnitude in the coming decade.
- Waste-water treatment and recycling.
- Water purification technologies including desalination.

3. Excellence in Engineering Education

Several groups including other academies globally, are working on the new curricula for engineering education so that our young emerging leaders are adequately equipped with necessary engineering skill sets to face the challenges in the coming decades.

Various deliberations within India as well as abroad have emphasised the need of providing handson design experience, problem solving skills and exposure to the systems engineering concepts, tools and technologies to the engineering students. The curricula also need to be updated with the advancements in digital technologies.

All engineers must be familiar with the sustainability paradigm and must be able to do life cycle analysis for every engineering product. They must be equipped with knowledge and the experience with various digital platforms and modelling tools such as computational materials engineering (all the way from atomistic scale to macroscopic scale), computational fluid dynamics, structural analysis tools, life cycle analysis modelling tools, engineering scale up, robust design methodologies to take care of uncertainty and complexity, machine learning and data analytics tools and algorithms, multiobjective and multi-variate optimization tools and technologies.

It is important that the professional ethics is part of the engineering course curricula. A multidisciplinary systems perspective to all engineers will certainly broaden their horizons – much needed to face the emerging world scenario. Good communication skills and ability to work in teams, are also prerequisites for engineers to succeed in the real life.

All engineers must possess basic IT skillsets and it is a given since digital technologies are transforming every aspect of our lives.

A multidisciplinary INAE Expert Group will critically examine the current status of engineering education, identify gap areas and strive to fill those gaps with appropriate action plans.

4. World Class Infrastructure

INAE will come up with an action plan in consultation with all stake-holders to upgrade our national infrastructure within next few years. This will include

- Requirements, technology options and the investments needed to create a few smart cities in the country including mobility, healthcare facilities, e-governance, access to affordable housing, utilities (electricity and water), waste collection, processing and recycle, education, communication, maintenance of infrastructural facilities, disaster management infrastructure including extreme events (for example, excessive rain and floods) etc.
- Requirements, technology options and the investments needed to create a rural infrastructure so that they can enjoy access to certain basic amenities where they are located digital connectivity for example can provide them with access to healthcare, online education, information dissemination, financial inclusion, logistics warehousing and agriculture and farm productivity with engineering focus etc.

5. Cyber-physical Systems

Globally innovations are taking place at the interface of digital technologies and domain expertise. For example, manufacturing is being transformed as a consequence of the following – robotics and automation, Internet of Things (IoT), cloud computing, 3D printing, AI, machine learning and data analytics (Digital Twins), structural health monitoring of built structures and engineered products, drones, autonomy, data analytics based predictive asset maintenance systems, blockchain technology to facilitate complete traceability of the products, digital platforms for integrated design, development, deployment and monitoring of materials and products and knowledge engineering platforms for capturing, retaining and context sensitive retrieval of knowledge to solve challenging problems.

Similarly leveraging the advanced digital technologies, the infrastructure available in a given locality or a city can be upgraded for easy accessibility – for example, healthcare facilities, e-governance, utilities (electricity and water)

It is now possible to make most of healthcare facilities available to the citizens at their place of residence (particularly important for senior citizens living alone) through the intervention of digital connectivity, sensors and IoT solutions. Provision of healthcare and affordable Medicare facilities through technological interventions is a key focus area.

INAE will select certain areas for focussed attention during the next five years and develop strategies to create infrastructure to facilitate digital transformation for achieving a set of desirable objectives for example, higher productivity, higher efficiency, better quality of life and better quality of products, reduced cost of services, higher safety of workers, etc.

ACADEMY ACTIVITIES

INAE Announcements

Nominations have been invited for the following:

• Election to Fellowship and Foreign Fellowship 2020: Last Date for receipt of Nominations-April 30, 2020- (provision for online submission of nominations has also been provided through log in facility of INAE Fellows)

Please Note: In view of the unprecedented global crisis due to the pandemic caused by Covid-19 virus and related 21-day locked down (social distancing) period until April 15, 2020 declared by the Government of India to prevent infection outbreak in India, the President INAE is pleased to extend the deadline of submission of nomination to April 30, 2020. Furthermore, it is decided that nomination this year is possible through any of the following means (by April 30, 2020):

- 1. Electronic submission through INAE on-line submission portal (no need to send a signed hard copy subsequently)
- 2. Signed hard copy as per the conventional practice followed until last year (if postal service resumes)
- 3. E mail submission of the entire document including 4-page nomination form (duly signed) and all supporting documents/appendices as a pdf file (to be sent to <u>inaehq@inae.in</u>). In case, the document is not signed (with scanned copy of the signature pages), INAE Office shall confirm the authenticity of the nomination received by checking with the nominator either through email or on phone.
- INAE Young Engineer Award 2020: Last Date for receipt of Nominations- April 30, 2020

Please Note: In view of the unprecedented global crisis due to the pandemic caused by Covid-19 virus and related 21-day locked down (social distancing) period until April 15, 2020 announced by the Government of India to prevent infection outbreak in India, the President INAE is pleased to extend the deadline of submission of nomination to April 30, 2020. Furthermore, it is decided that submission of the entire nomination document as per approved format and all supporting documents/appendices can be submitted by email as a pdf file to INAE (inaehq@inae.in) as a special provision only for this year. In case, the document is not signed (with scanned copy of the signature pages), INAE Office shall confirm the authenticity of the nomination received by checking with the nominator either through email or on phone.

- Abdul Kalam Technology Innovation National Fellowship: Last Date for receipt of Nominations for the year 2020-2021 June 30, 2020
- INAE Young Entrepreneur Award: Last Date for receipt of Nominations- June 30, 2020
- INAE Woman Engineer of the Year Award: Last Date for receipt of Nominations May 15, 2020
- INAE Life Time Contribution Award in Engineering: Last Date for receipt of Nominations - May 15, 2020 - (provision for online submission of nominations has also been provided through log in facility of INAE Fellows)

- Professor Jai Krishna and Professor SN Mitra Memorial Awards: Last Date for receipt of Nominations May 15, 2020 (provision for online submission of nominations has also been provided through log in facility of INAE Fellows)
- INAE Outstanding Teachers Award: Last Date for receipt of Nominations May 15, 2020 - (provision for online submission of nominations has also been provided through log in facility of INAE Fellows)
- Innovative Student Projects Award 2020: Last Date for receipt of Nominations- July 7, 2020

Commitment of INAE to the Efforts of Government of India towards Containment and Eradication of COVID-19 Pandemic

Dr Sanak Mishra, President INAE has written a letter to Dr Pramod Kumar Mishra, Principal Secretary to the Prime Minister conveying utmost admiration in the exemplary manner in which measures have been taken by the Government of India under the inspired leadership of the Hon'ble Prime Minister, towards the containment and eradication of the COVID-19 pandemic. He lauded the Government initiatives encompassing provision of medical services and facilities; promotion of indigenous medical testing facilities; development of cost-effective medical equipment; excellent governance; economic relief measures; repatriating Indian citizens from affected countries; appropriate education of citizens; timely lock-down of the country and ensuring essential supplies and facilities across the country. Dr Sanak Mishra highlighted that INAE commits itself to extend all and any support required by the Government for the furtherance of its initiatives and measures for the containment and eradication of the COVID-19 pandemic and he looked forward to the Academy contributing to the ongoing and novel measures and innovative strategies of the Government of India.

A copy of the letter from Dr Sanak Mishra, President INAE addressed to Dr Pramod Kumar Mishra, Principal Secretary to the Prime Minister can be viewed by clicking here ...

In this regard, Dr Sanak Mishra, President INAE has since initiated a letter to the INAE sFellowship and INAE Young Associates requesting for relevant expertise in the engineering fields from Fellows who can come forward to offer their expertise to mitigate any dimension of the COVID 19 Pandemic from engineering perspective. Once inputs are received, these shall be communicated to Department of Science and Technology by second week of April with the objective of making meaningful contributions to the various measures and initiatives of the Government by providing the pertinent technical inputs to synergize the efforts, with innovative engineering interventions and providing consultancy in concerned fields.

A copy of the letter from Dr Sanak Mishra, President INAE addressed to the INAE Fellowship and INAE Young Associates can be viewed by clicking here ...

Institution of the INAE Woman Engineer of the Year Award

Indian National Academy of Engineering (INAE) has instituted a new award named "INAE Woman Engineer of the Year Award" from this year i.e. 2020 onwards, in order to recognize and promote meritorious contributions of women in engineering profession as part of the initiative on women empowerment. Nominations have recently been invited for the INAE Woman Engineer of the Year Award 2020 during the month of March 2020. The purpose of the award is to recognize and honour deserving women engineers, every year, who have made outstanding contributions to any field of engineering and technology in India and may serve as role models to budding women engineering professionals in the future. The award aims to recognize meritorious and original contributions made by woman engineers in India from academia, research organizations or industry, whose individual efforts have made a significant difference in any branch of engineering and technology, by way of

breakthrough innovation and disruptive change in different fields of engineering and have helped to advance the knowledge and competence to the benefit of the profession and people in India.

The subject award is to be bestowed on an individual only and the nominations for the award should be nominated and seconded only by the Fellows of INAE. Woman engineers between the age of 40 to 60 years, who should be a citizen of India and working in India are eligible for nomination. In case the nominee is an INAE Fellow, she should not be a member of the INAE Governing Council during the year of the award.

INAE will honour three women engineers between the age of 40 to 60 years, every year with this award – one from each of the three categories, (i) Academia, (ii) Industry and (iii) R&D. The award carries a cash award of Rs. 2 lakhs and a citation. The last date for the receipt of nominations for the subject award is May 15, 2020. The guidelines and nomination format for nomination can be downloaded from INAE website www.inae.in

German Chancellor Fellowships by Humboldt Foundation for Tomorrow's leaders

An email has been received from DST forwarding a communication from Mr S. K. Varshney, Adviser & Head, International Bilateral Cooperation, Department of Science & Technology (DST), Government of India informing about nominations for German Chancellor Fellowships for Tomorrow's leaders, a yearly program handled by the Humboldt Foundation. The Alexander von Humboldt Foundation grants up to 50 German Chancellor Fellowships every year to prospective leaders from Brazil, China, India, Russia and the USA – irrespective of their field of work. Recipients use the Fellowship to conduct together with their German host and mentor a socially-relevant project that they have developed themselves. The Chancellor of the Federal Republic of Germany is the patron of this fellowship programme.

The candidate applying for this Fellowship should be:

- The applicant must be a national of Brazil, China, India, Russia or the United States.
- Bachelor's or equivalent academic degree completed less than twelve years before the beginning of the fellowship.
- A confirmation of supervision by the host in Germany.
- A project plan which candidates must draw up on their own and coordinate with their host.
- Initial proven leadership experience

Fellowship benefits for recipients:

- A monthly fellowship of $\notin 2,170, \notin 2,470$ or $\notin 2,770$, depending on your qualifications.
- Individual mentoring during your stay in Germany.
- Additional financial support for items such as family members accompanying you, travel expenses or a German language course.
- A study tour of Germany, an opportunity to meet the German chancellor at the end of your stay and a number of events during which you can make contact with other fellows and representatives of German companies and institutions.
- Extensive alumni sponsorship, particularly to help you sustain contact with collaborative partners in Germany during your entire professional career.

Application deadline: 15 September 2020.

Period of sponsorship: 1 October 2021 – 30 September 2022

Fellows desirous of recommending candidates from their organization may download all relevant information by accessing the links given below.

Further information, a list of all application requirements and a link to the online application form are available at <u>www.humboldt-foundation.de/youngleaders</u>

Advice and contact: If you have any questions regarding the German Chancellor Fellowship Programme or would like individual guidance, please contact us at info@avh.de<mailto:info@avh.de>.

You can find **examples of projects conducted** at <u>https://www.humboldt-foundation.de/web/buka-testimonials-en.html</u>

INAE Local Chapter Activities

- INAE Delhi Local Chapter
- Indian National Academy of Engineering (INAE) Delhi Local Chapter in association with Bharti School of Telecom and Technology Management (IIT Delhi) and IEEE Delhi Local Chapter organized a Lecture by Prof. Arumugam Nallanathan from Queen Mary University, London, UK.

The Indian National Academy of Engineering (INAE) Delhi Local Chapter in association with Bharti School of Telecom and Technology Management (IIT Delhi) and IEEE Delhi Local Chapter organized a lecture on Communication Technologies and Requirements for Industry 4.0 on Feb 3, 2020 at 4.30 P.M. at Bharti School of Telecom and Technology Management, IIT Delhi.

Abstract of the Lecture: The Fourth Industrial Revolution (Industry 4.0) is coming, and this revolution will fundamentally enhance the way the factories manufacture products. The modern manufacturing industry will upgrade to a new era of productivity with the confidence to reinvent their business. To realize this ambitious goal, the industry needs a solution that could support to access real-time information, eliminate downtime, production automation, empower employees with the freedom to work anywhere, anytime, etc. Therefore, the conventional wired lines connecting central controller to robots or actuators will be replaced by wireless communication networks due to its low cost of maintenance and high deployment flexibility, which becomes an evitable trend. However, mission-critical industrial applications require ultra-high reliability and low latency communication (URLLC) that is not supported by our current wireless communication systems and is one of the primary cornerstones of the fifth generation (5G). Thus, there is an urgent need for rethinking the design of communication system. This lecture highlighted the communication requirements and technologies for the revolution towards Industrial 4.0, and the recent advances in information theory for the transmission of short packets, which provide the theoretical principles that govern the practical design of system parameters, followed by proposed framework and methodologies to solve the key issues in the context of URRLC that indispensably needed by Industry 4.0. The talk concluded with directions for future research.

Speaker Profile: Dr Arumugam Nallanathan is Professor of Wireless Communications and Head of the Communication Systems Research (CSR) group in the School of Electronic Engineering and Computer Science at Queen Mary University of London since September 2017. His research interests include Artificial Intelligence for Wireless Systems, 5G and beyond Wireless Networks, Internet of Things (IoT) and Molecular Communications. He published nearly 500 technical papers (including more than 200 top IEEE journal papers) in scientific journals and international conferences.

INAE Delhi Local Chapter organized a lecture by Prof. Sukumar Mishra the topic "Reliable and Secure DC Microgrids" on February 4, 2020 at Bharti School of Telecommunications Technology & Management, IIT Delhi.

INAE Delhi Local Chapter organized a lecture by Prof. Sukumar Mishra, an INAE Chair Professor, in the Department of Electrical Engineering at IIT Delhi on the topic "Reliable and Secure DC Microgrids" on February 4, 2020 at Bharti School of Telecommunications Technology & Management at IIT Delhi Campus, New Delhi. In his talk he first defined what is microgrid, and contrasted with conventional regional and national grids as well as with respect to nanogrid (individual household level) and picogrid (human body level power control, on the order of milliwatts). He then explained the power grid connectivity requirements, and subsequently the aspect of generator based grid connectivity versus currentday solar/wind power based grid connectivity. The issue of lack of any inertia in solar DC grid in grid network stability was addressed. Besides, though there are newer DC-based electrical products coming to the market that can fit with the new DC energy type, the conventional AC-based electrical product manufacturers have concerns on their product lines. Yet, there are efforts on DC microgrid-operated electrical appliances.

Prof. Mishra then discussed some of his efforts on DC-microgrid operated home appliance experiments, including DC-power operated home and EV charging park. To account for the electrical connection/disconnection related surge and instability issue, he introduced the discussion on AI-based intelligent control of microgrid control, where his concept of "derating" of photovoltaic source was presented. The concept of local battery usage instead of "derating" was discussed from cost-efficiency tradeoff perspective. Finally, the tradeoff between microgrid performance optimality and easy/fast controllability in the face of communication link uncertainties through decentralized (instead of fully-centralized) controllability was discussed. The talk was attended by about 20 research students and industry practitioners as well as a few IIT Delhi faculty members. Following the talk, a brief informal discussion was held on the industry-academia collaboration and technology-oriented research.

Indian National Academy of Engineering (INAE) Delhi Local Chapter organized an interaction event with *Telecommunications Standards Development Society, India* on February 14, 2020 at Indian Institute of Technology Delhi

An interaction event was organized by Indian National Academy of Engineering (INAE) Delhi Local Chapter with Telecommunications Standards Development Society, India at Indian Institute of Technology (IIT) Delhi on February 14, 2020. The event was organised with the objective of developing a better understanding on Telecommunications Standards Development Society, India activities on technology standardization to find a synergy towards the Indian academic researchers' technology-oriented research. Telecommunications Standards Development Society, India (TSDSI) officials gave presentations on how the society could assist the academic researchers in the standardization efforts, and explained the other details of TSDSI membership benefits and travel support.

- INAE Pune Local Chapter
- Indian National Academy of Engineering (INAE) Pune Local Chapter organised a Round Table interaction on "Role of Hydrogen in India's Energy Strategy" on 15th February 2020 at Tata Consultancy Services (TCS), Pune

A Round Table Interaction of domain experts on "Role of Hydrogen in India's Energy Strategy" was organized by INAE Pune Local Chapter on February 15, 2020 at Pune. The meeting was attended by Dr Sanak Mishra, President, INAE; Dr PS Goel, Former President, INAE; Dr BN Suresh, Immediate Past - President, INAE and domain experts from INAE Fellowship and other expert invitees from Academia, R&D organizations and Industry. The meeting was organized

with active support from Mr MV Kotwal, Chairman Pune Local Chapter and Dr Pradip, Vice-President, INAE. The invited experts shared insights on the current and future global situation about use of Hydrogen as an energy source; discussed the overall situation in India with respect to technologies, capabilities and affordability for Generation, Storage, Transportation and Usage of Hydrogen and concluded on the approach to be followed by INAE in forwarding recommendations to the Government.

A brief Background note on the pertinent issues related to Role of Hydrogen in India's Energy Strategy which were addressed in the presentations and deliberations during the subject Round table interaction are summarized below:

Energy Strategy – Crucial in India's growth

India's growth & sustainability are rooted in selecting the right strategic path, integrating renewable energy – Solar, Geo-thermal, Tidal, Biomass & Wind, with existing sources involving Hydro, Coal, Oil, Gas & Nuclear. Towards this, India will have to carve out its own strategy while considering the rapid developments taking place globally. This strategy will have to be necessarily transformative, to satisfy aspirations of millions of young Indians and for the country to play its rightful role in a sustainable global community.

The Direction: India's energy security by and large will have to depend on its own resources both renewable as well as non-renewable. This implies that energy sources like solar, wind, biomass will have to be seamlessly integrated with conventional, well-established sources. Simultaneously, the imperatives of reduction in GHGs and the carbon footprint must be factored in. Linkages need to be established also keeping in mind the necessary energy storage requirements. The current electricity transmission & distribution infrastructure will not be able to support the above needs. It is obvious that a clean and well-planned distributed energy system will always remain a vital component of India's energy strategy.

Demand side implications: Keeping in mind the demand side scenario for industrial, residential, commercial, rural & transport sectors, multiple options have been considered by several agencies and working groups. Apart from technological feasibility, the most important questions of financial viability and affordability have also been covered to some extent. As an example, the proposed switch from fossil-fueled vehicles to EVs, while bringing in significant benefits, poses challenges in terms of availability of suitable charging networks and strategically important access to basic raw materials if Lithium-based batteries are the primary mode for energy storage.

The moot question to be answered whether **Hydrogen can play an important role in this energy strategy for India** covers the above issues. In the interaction meeting the speakers shared insights on the current and future global situation about use of Hydrogen as an energy source and discussed the overall situation in India with respect to technologies, capabilities and affordability for Generation, Storage, Transportation & Usage of Hydrogen.

A draft report summarizing the deliberations has been prepared which is under finalization with suggestions from all participants. It is envisaged that subsequently, the recommendations will be summarized in the form of a White Paper containing all the pertinent issues related to Role of Hydrogen in India's Energy Strategy for submission to Prof. K VijayRaghavan, Principal Scientific Advisor (PSA) to the Govt. of India, as suggested.



Ongoing Deliberations during the meeting



Group Photograph of Delegates in the Round Table Interaction

• INAE Bangalore Local Chapter

As informed by Dr AR Upadhya, Hon. Secretary, INAE Bangalore Chapter, the initiative by Dr VK Aatre, Chairman, INAE Bangalore Chapter to engage with the State Govt of Karnataka led to a meeting of a small group of INAE Fellows led by Dr Aatre with the Hon'ble Deputy Chief Minister & Minister for IT, BT and S&T, Higher Education and Skill Development, Shri CN Ashwathnarayana on 14th February 2020. The DCM was briefed about INAE, the rich and diverse Technology &

Engineering expertise and experience available with the FNAES, and how it could be utilised gainfully for finding solutions for some of the problems faced by the state. Subsequently a write up on INAE including a list of technical studies that the Academy has carried out so far , the recommendations of which have been sent to the GoI, was sent to the DCM for favour of information.

Following this, the DCM's Office had asked INAE BC to nominate a Fellow each as a member of the following State Govt Bodies under the Dept of S&T:

- (i) Karnataka Knowledge Commission, chaired by Dr K Kasturirangan.
- (ii) Karnataka State Council for Science and Technology (KSCST), President: Hon'ble Chief Minister, GOK; Vice Presidents: Minister for Finance, Director, IISc and Minister for S&T
- (iii) Executive Committee of KSCST, Chairman: Director, IISc, Co-Chairman: Chief Secretary, GOK

Based on a discussion in the Executive Committee of the Bangalore Chapter, the following INAE Fellows have been nominated by the BC to the above bodies:

- Dr KG Narayanan, Former Director, DRDO- ADE, Bangalore and former Advisor to DG, DRDO

 Member, Karnataka Knowledge Commission
- Dr G Jagadeesh , Professor, Dept. of Aerospace Engineering, IISc
 Member, KSCST
- Dr V Bhujanga Rao, Former DS & Former DG(NS&M), DRDO and presently, ISRO Chair Professor at NIAS, Bangalore □ Member, Executive Committee, KSCST.

Abdul Kalam Technology Innovation National Fellowship – Call for Nominations Announced

Indian National Academy of Engineering (INAE) and Science and Engineering Research Board (SERB), Department of Science and Technology (DST) 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 nominees for the subject Fellowship 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.

The scheme has received a good response and has gained visibility in the engineering community across the country. A maximum of 10 Fellowships are awarded in a year and six Fellowships were conferred in the Financial Year 2017-18, eight in the Financial Year 2018-19 and seven during the Financial Year 2019-20. A total of twenty-one nominees have been selected for conferment of the subject Fellowship since its inception. The next call for nominations for consideration during the Financial Year 2020 -2021 has been announced. The last date for the receipt of nominations is **June 30, 2020**.

Academia Industry Interaction

AICTE-INAE Distinguished Visiting Professorship Scheme

Industry-academia interactions over technological changes have become essential in recent times so that relevant knowledge that would be sustainable in the changing conditions can be imparted to the students in the engineering institutions. 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, academics 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 Santosh N Kaul Former Principal, MIT College of Engineering, MIT Campus, Kothrud Pune,	D Y Patil College of Engineering, Pune Jul 11-13, 2019	Delivered Seminar on "Research Blend in PG Projects in Environmental Engineering and Real-Life Problems", Expert Lecture on "Advanced Techniques in Wastewater Treatment", and Seminar on "Research Projects and Patents".
	Nov 7-9, 2019	Delivered Expert lectures on "Water Pollution and Project Guidance", "Workshop on Research Methodology" and "Projects & Innovations". According to the feedback received from the Engineering College, the students and faculty of Department of Civil Engineering were highly benefitted by the knowledge imparted by the Distinguished Visiting Professor. The UG and PG students also got motivated to initiate their project work on recent trends in water and waste water treatment areas The Faculty started working towards patenting their innovative concepts in industrial waste water treatment. The department got best resource to initiate R&D activities and enhancement of the Environmental Engineering Laboratory.
Dr R Nagendra Senior Director, M/s Stedrant Technoclinic Pvt. Ltd., Bangalore	Nitte Meenakshi Institute of Technology- NMIT, Bangalore Aug 12-13, 2019; Sept 9, 2019; Sept 17-19, 2019; Oct 24-26, 2019	Delivered lectures on "Non-Destructive Testing Methods of Structural Health Monitoring", "Alternatives to being Employable - Expectations of Industry from a Fresh Structural Engineer"; "Forensic Tools for Assessing the Health of Structures" and "Demonstration of NDT Equipments". Delivered lectures on "Do's and Don'ts of Good Construction Practices"; "Presentation on Selection Criteria of Steel (Reinforcing Steel) as a Building Material and "Laboratory Visit to Stedrant Technoclinic Pvt. Ltd."
		As per the feedback received from the engineering institution, students are keen in learning about industry related explanations and responding to the practical aspects of constructions. It was expressed that the DVP Scheme is easily executable when both

		institution and Industry have the inclination to make it successful. Students are showing more and more interest in practical related aspects. Few courses under Smart City concept are proposed for inclusion in the Curriculum.
Prof. S Sreenivasa Murthy, FNAE Formerly Professor, IIT Delhi	BMS College of Engineering, Bengaluru Nov 19-21, 2019 Dec 17-19, 2019	Delivered lectures on "Professional Ethics and Value Education"; "Writing Competitive Research Grant Proposals"; "Projects preparation by UG and PG students", "Preparation of project proposals by faculty members", and "Modernization of laboratory and Lab Manuals".
Dr Chitra Rajagopal, Distinguished Scientist and Director General, System Analysis and Modelling (SAM), DRDO, Delhi	Dept of Chemical Engineering, Alagappa College of technology Campus, Anna University, Chennai Dec 12-13, 2019	Delivered lectures on "How to Prepare a Project Proposal"; "How to Prepare a Research Proposal"; "Integrated Safety Management", "Quantitative Risk Assessment (QRA)" and "HazWaste Management". According to the feedback received from the college, the scheme is beneficial to academia, R&D and industry alike. The interaction with Anna University faculty and students was fruitful. Few collaborative proposals are under discussions. Seminar proposals are also under way.
Prof MR Madhav, FNAE Professor Emeritus and Visiting Professor, IIT Hyderabad and JNTUH	Vallurupalli Nageswara Rao Vignana Jyothi Institute of Engineering and Technology, Hyderabad Jan 9-11, 2020	Delivered lectures on "Ground Improvement by Pre-Fabricated Vertical Drains"; "Stress Paths - Understanding Shear Behaviour of Soil", and "Settlement of Foundations on Sandy Soils". According to the feedback received from the institute, the faculty and students are extremely happy with the Scheme.
Dr D Antony Louis Piriyakumar Director-Startup, Agape Piriyakumar AI Solutions	Thiagarajar College of Engineering, Madurai Jan 23-25, 2020	Delivered lectures on "Computer Vision - Random Sample Consensus (RANSAC)"; "Faculty Interaction"; "Lateral Thinking"; "Mini Project" and "Deep Learning with Python". According to the feedback received from the College, the visiting professor started a lecture series with hands-on-training on Deep Learning with python for Computer vision SIG (Special Interest Group) Students. It is very useful to carry out research work in the area of deep learning. He evaluated the first-year students' thinking level (Cognitive and affective) by handling sessions on Lateral thinking. This will be useful to analyze the students learning rate after one year at the college.

Dr Suvankar Ganguly Principal Scientist, R&D Division, TATA Steel Ltd.	Department of Mechanical Engineering, Jadavpur University Jan 24-25, 2020	Delivered lectures on "Experimental Design of Run-Out Table in a Hot Strip Mill", "Implementation of Mathematical Models in Industrial Practice". As per the feedback received from the University, the present scheme provides a unique platform to students to get exposed to industry relevant projects. Participation of both industry and academia in collaborative projects will help in creating knowledge pool which enable further growth and development.
Dr G Janakiram, General Manager (Technical Services), Eurotex Industries & Exports Ltd, Kolhapur	DKTE Society's Textile & Engineering Institute, Ichalkaranji Feb 17-19, 2020	Delivered lectures on "Review of Cotton Fibre Properties and Testing"; "Review of Yarn Properties and Testing" and "Quality Assurance Activites in Spinning". As per the feedback received from the engineering institute, the students of the textile department were benefitted by the lectures delivered by the visiting professor. The interactions helped some of the UG candidates to get the direction of research and to finalize their project plans on their topic.
Dr SK Gupta, FNAE Former Project Coordinator (Saline Water), Central Soil Salinity Research Institute (CSSRI), Karnal	ICAR-National Dairy Research Institute, Karnal Feb 18-20, 2020	Delivered lectures on "Heat Transfer: Theory of Conduction I"; "Heat Transfer: Theory of Conduction II" and "Thermal Properties of Dairy Products". As per the feedback received from the Institute, the interaction with their students is going on well and the visiting professor is contributing to the on-going teaching programme. The faculty looks forward to his contributions in PG programmes in future.
Dr Ananta Lal Das Ex Director, Society for Applied Microwave Electronics Engineering and Research (SAMEER) (Retired)	National Institute of Technical Teachers Training and Research, Chandigarh Feb 18-20, 2020	Delivered Lectures on "Radar Cross Section (RCS) Fundamentals"; "Radar Cross Section Reduction Techniques" and "Radar Cross Section Measurements". According to the feedback received from the institute, the impact of the scheme is very good. Through lectures, students are exposed to the new areas of research. This helps students to identify areas for thesis problem. These sessions and other inputs also helped faculty in identifying research proposals.
Dr P Chellapandi Former Chairman, Mechanics and Hydraulics Division, IGCAR, Kalpakkam	PSG College of Technology, Coimbatore Feb 24-26, 2020	Delivered lectures on "Fundamentals of Fracture Mechanics"; "Design of Components with Defects" and "Application of Failure Assessment Diagram". As per the feedback received from the College, the scheme has enabled the visit of an eminent personality to offer his valuable guidance. The Scheme is of

		immense benefit to the research scholars and students of PSG College of Technology.
Dr SK Gupta, FNAE	Karnal Institute	Delivered lectures on "Testing Soil's Physico-
	of Technology	Chemical Properties for Water Resources
Former Project Coordinator	and	Projects"; "Canal and Groundwater Irrigation:
(Saline Water), Central Soil	Management,	Retrospect and Prospects" and "Tubewell
Salinity Research Institute	Karnal	Performance for Sustainable Yield". As per the
(CSSRI), Karnal		feedback received from the institute, the institute
	March 4-6, 2020	is leveraging the expertise of Dr Gupta in the
		teaching programme of its Civil Engineering
		students and the students are quite motivated to
		learn from him. They get his support in other
		activities besides the teaching programme and
		wish that this support should continue in the
		future as well.

Important Meetings held during February 2020

- The third meeting of INAE Forum on Civil Infrastructure (Housing) held on February 6, 2020 at New Delhi.
- Meeting of INAE Steering Committee on Research Schemes/Proposals held on February 25, 2020 at INAE Office, Gurgaon.
- Meeting of INAE Forum on Engineering Interventions for Disaster Mitigation held on February 26, 2020 at INAE Office, Gurgaon
- > Thirty-Second Meeting of INAE Forum on Technology Foresight and Management for Addressing National Challenges held on February 27, 2020 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 April 2020, click here....

Honours and Awards

 Prof Bikramjit Basu, FNAE, Professor, Materials Research Centre, Indian Institute of Science, Bangalore has been informed by the International Union of Societies for Biomaterials Science and Engineering (IUSBSE) that his nomination to receive the accolade of Fellow Biomaterials Science and Engineering (FBSE) has been approved. The presentation of the Fellowship which will occur in 2020 at the 12th World Biomaterials Congress to be held in Glasgow, United Kingdom.
 Prof Bikramjit Basu has also been elected as Fellow of the Indian Academy of Sciences, Bangalore

News of Fellows

during 2019 (effective 2020).

1 Prof SN Mukhopadhyay, FNAE Ex-Adjunct Professor, Birla Institute of Technology & Science, Pilani has authored a book on "Fundamentals of Waste and Environmental Engineering" published by TERI Press, New Delhi. 2 Mr Ajay N Deshpande, FNAE, ex CMD/Director (Technical) of EIL, was invited to Manipal University-Jaipur to deliver a talk on the National Science Day by the School of Chemical & Civil Engineering. In his talk titled "Technology / Engineering / Manufacturing Challenges in Hydrocarbon Sector", Mr Deshpande covered the opportunities available for graduating students within the state of Rajasthan due to investments in upstream oil and gas exploration/ production activity, as also in downstream refining and petrochemicals segment. Choice of a career whether in a Technology driven EPC or an Operation company, offers ample challenges for technology innovation, design indigenisation, localised manufacturing and providing value add-services, which he emphasised citing examples in each area. The talk was followed with an engaged discussion on utilizing of these opportunities.

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 <u>https://www.facebook.com/pages/Indian-National-Academy-of-Engineering/714509531987607?ref=hl</u>
- (b) Twitter handle link <u>https://twitter.com/inaehq1</u>

Accomplishments of INAE Staff

- Mr Bhuwan Adhlakha, Manager (Finance and Accounts), INAE has been awarded the Degree of Bachelor of Law Honours (Professional) in May 2019 which was awarded by Maharishi Dayanand University, Rohtak.
- Dr Geetanjali Sawhney, Senior Research Officer, INAE was awarded Silver Medal in the Table Tennis Mixed Doubles category in the 1st Ranking Delhi State Veterans Table Tennis Corporation (VTTC) Tournament held on March 1, 2020 at New Delhi.





भारतीय राष्ट्रीय अभियांत्रिकी अकादमी Indian National Academy of Engineering

604–609, छठी मंजिल, टॉवर ए, स्पेज 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

डॉ. सनक मिश्रा/Dr. Sanak Mishra FNAE, FNASc., FIIM, FIOD, FCSI, FIE, FAIMA, BE & Distinguished Alumnus Award, Indian Institute of Science, Bangalore Vice President of ArcelorMittal, CEO India Projects; MS & PhD and Distinguished Alumnus Award, University of Illinois at Urbana-Champaign (USA) Alexander von Humboldt Fellow (Germany)

Formerly: Managing Director, Rourkela Steel Plant; Director, Steel Authority of India Ltd. (SAIL); Secretary General, Indian Steel Association President, Indian Institute of Metals **AICTE - INAE Distinguished Visiting Professor** Mob.: +91-9810956664, E-mail: mishra.sanak@gmail.com

अध्यक्ष/President

Sub : Commitment of Indian National Academy of Engineering (INAE) to the Efforts of Government of India towards Containment & Eradication of Pandemic COVID-19

Esteemed Dr. PK Mishra,

Greetings from Indian National Academy of Engineering (INAE).

INAE is the only Engineering Academy of the Nation and comprises India's most distinguished engineers, engineerscientists and technologists.

On behalf of INAE and myself, I wish to convey our utmost admiration in the exemplary manner in which measures have been taken by the Government of India under the inspired leadership of the Hon'ble Prime Minister, towards the containment and eradication of the COVID-19 pandemic. It is a matter of pride that the nation has full confidence in the Government initiatives encompassing provision of medical services and facilities; promotion of indigenous medical testing facilities; development of cost-effective medical equipment; excellent governance; economic relief measures; repatriating Indian citizens from affected countries; appropriate education of citizens; timely lock-down of the country and ensuring essential supplies and facilities across the country.

It is my honour to give a brief introduction of INAE and its activities. It was founded in 1987 and is an autonomous institution supported through grant-in-aid(s) by the Department of Science & Technology, Government of India. INAE functions as an apex body and promotes the practice of engineering and technology for their application to solving problems of national importance. It also provides a forum for futuristic planning of India's much needed engineering and technological inputs and brings together specialists from such fields as may be necessary for comprehensive solutions to the needs of the Nation.

As President, of INAE, I humbly submit that INAE commits itself to extend all and any support required by the Government for the furtherance of its initiatives and measures for the containment and eradication of the COVID-19 pandemic. It would indeed be a matter of honour for the Academy to be called upon to contribute to the ongoing and novel measures and innovative strategies being undertaken by the Government of India.

We look forward to your valuable guidance.

With warm regards,

Yours sincerely,

as Thisher

Dr Sanak Mishra

Dr Pramod Kumar Mishra Principal Secretary to the Prime Minister, PMO. South Block New Delhi - 110011



भारतीय राष्ट्रीय अभियांत्रिकी अकादमी Indian National Academy of Engineering

604–609, छठी मंजिल, टॉवर ए, स्पेज 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) दुरभाष/Ph: (91)-0124-4239480, फैक्स/Fax: (91)-0124-4239481, ई-मेल/Email: inaehq@inae.in, वैबसाइट/Website : www.inae.in

डॉ. सनक मिश्रा/Dr. Sanak Mishra FNAE, FNASc., FIIM, FIOD, FCSI, FIE, FAIMA, BE & Distinguished Alumnus Award, Indian Institute of Science, Bangalore Vice President of ArcelorMittal, CEO India Projects; MS & PhD and Distinguished Alumnus Award, University of Illinois at Urbana-Champaign (USA) Alexander von Humboldt Fellow (Germany) अध्यक्ष/President

Formerly: Managing Director, Rourkela Steel Plant; Director, Steel Authority of India Ltd. (SAIL); Secretary General, Indian Steel Association President, Indian Institute of Metals AICTE - INAE Distinguished Visiting Professor Mob.: +91-9810956664, E-mail: mishra.sanak@gmail.com

Subject: Urgent preparation of list of Experts on various aspects of COVID-19 as Engineers/Engineer Scientists/ Technologists for Government agencies like DST

Dear Colleague,

As you are all aware, the world is facing an imminent crisis in the spreading of the COVID-19 pandemic and all affected nations are taking measures to mitigate the effects of this crisis.

It is a matter of pride that the Government of India has taken timely and innovative measures encompassing all sectors towards the containment and eradication of the COVID-19 pandemic so as to minimize the loss to the citizens and the nation, as a result of its fallout.

In this regard, I wish to convey that INAE has been advised to prepare a list of Experts who can deal with the various aspects of COVID-19 as Engineers/Engineer Scientists/ Technologists and plans to send this list to the Government agencies like DST, who would seek their engineering/technical advice and contributions. The Fellows and Young Associates of INAE from Academia, R&D and Industry categories have rich expertise encompassing all disciplines of engineering. It would indeed be befitting if INAE being the only engineering Academy in the country gets associated and makes meaningful contributions to the various measures and initiatives of the Government by providing the pertinent technical inputs to synergize the efforts, with innovative engineering interventions and providing consultancy in concerned fields.

In case any Fellow or Young Associate with substantial expertise, desires to get associated with the above activity, they may send their names, affiliation, full contact address and elaboration of their relevant area of expertise in maximum one page, as soon as possible to INAE for further follow-up actions with Department of Science & Technology.

We request your inputs at the earliest, though not later than April 4, 2020.

With warm and personal regards,

Yours sincerely,

an Thishor

(Dr Sanak Mishra)

DISTRIBUTION: INAE Fellows and Young Associates

National/International Conferences in April 2020

4th IEEE International Conference on Computer, Communication and Signal Processing (ICCCSP 2020) on April 22-23, 2020 at Chennai https://conferencealerts.com/show-event?id=223909

2nd International Conference on Advances in Computing & Information Technology (IACIT- 2020) on April 29-30, 2020 at Bengaluru, Karnataka, https://conferencealerts.com/show-event?id=225401

Engineering and Technology Updates

Civil Engineering

1. Hyderabad Metro Rail Becomes Second Largest Metro Network in India



With the launch of another 11-km stretch in February 2020, Hyderabad Metro Rail has become the second largest metro rail network in the country after Delhi. Telangana Chief Minister Shri K. Chandrashekhar Rao flagged off of the metro train on Green Line stretch from Jubliee Bus Station (JBS) to Mahatma Gandhi Bus Station (MGBS), connecting the twin cities of Hyderabad and Secunderabad. The opening of metro service on this stretch will facilitate movement of commuters between two largest and busiest Road Transport Corporation (RTC) bus stations in Telangana. It passes through several important landmarks like Parade Grounds, Musheerabad, RTC Cross Roads and Sultan Bazar. Hyderabad Metro Rail, the world's largest public-private partnership project, is now the second largest operational metro network in the country covering 69.2 kms, the officials said. The JBS-MGBS stretch is part of Corridor II JBS-Falaknuma (14.78 km). The work on the stretch from MGBS on Musi river to Falaknuma, the famous palace in the old city, is yet to start.id. "L&T is proud to have created a best-in-class, eco-friendly urban mobility system for the people of Hyderabad to global benchmarks to enhance commuter safety and comfort and reduce travel time," said K.V.B. Reddy, MD and CEO, L&T Metro Rail Hyderabad Ltd. He described it an engineering marvel. L& T utilised cutting-edge technologies like Communication Based Train Controls (CBTC), and Regenerative Rolling Stocks for the project. The 11-km 'Corridor II Green Line,' featuring nine stations, connects the twin cities of Secunderabad with Hyderabad at the MGBS on the Musi river. It is expected to reduce travel time to just 16 minutes from one end to the other, as against 45 minutes by road, according to an L&T press release. The world's largest public-private partnership, the Hyderabad Metro Rail is now the second largest operational metro network in the country covering 69.2 kms, the release said. The JBS Parade Ground metro station is one of the tallest in the project with five levels, it said. Spread over three lakh square feet, the MGBS Interchange Metro station is one of the largest in the country with several special features.

Source https://www.livemint.com/industry/infrastructure/hyderabad-metro-rail-becomes-second-largest-metro-network-in-india-see-photos-11581095057705.html

Computer Engineering and Information Technology

2. Computer Scientists' New Tool Fools Hackers into Sharing Keys for Better Cybersecurity

Instead of blocking hackers, a new cybersecurity defense approach developed by University of Texas at Dallas computer scientists actually welcomes them. The method, called DEEP-Dig (DEcEPtion DIGging), ushers intruders into a decoy site so the computer can learn from hackers' tactics. The information is then used to train the computer to recognize and stop future attacks. UT Dallas researchers presented a paper on their work, "Improving Intrusion Detectors by Crook-Sourcing," at the annual Computer Security Applications Conference in December in Puerto Rico. They presented another paper, "Automating Cyberdeception Evaluation with Deep Learning," in January at the Hawaii International Conference of System Sciences. DEEP-Dig advances a rapidly growing cybersecurity field known as deception technology, which involves setting traps for hackers. Researchers hope that the approach can be especially useful for defense organizations. "There are criminals trying to attack our networks all the time, and normally we view that as a negative thing," said Dr. Kevin Hamlen, Eugene McDermott Professor of computer science. "Instead of blocking them, maybe what we could be doing is viewing these attackers as a source of free labour. They're providing us data about what malicious attacks look like. It's a free source of highly prized data." The approach aims to solve a major challenge to using artificial intelligence for cybersecurity: a shortage of data needed to train computers to detect intruders. The lack of data is due to privacy concerns. Better data will mean better ability to detect attacks, said researchers. "We're using the data from hackers to train the machine to identify an attack," said a data scientist at Procter & Gamble Co. "We're using deception to get better data." Hackers typically begin with their simplest tricks and then use increasingly sophisticated tactics, a researcher said. But most cyberdefense programs try to disrupt intruders before anyone can monitor the intruders' techniques. DEEP-Dig will give researchers a window into hackers' methods as they enter a decoy site stocked with disinformation. The decoy site looks legitimate to intruders, said Dr. Latifur Khan, professor of computer science at UT Dallas. "Attackers will feel they're successful," Khan said. As hackers' tactics change, DEEP-Dig could help cybersecurity defense systems keep up with their new tricks.

Source https://www.sciencedaily.com/releases/2020/02/200227072508.htm

Mechanical Engineering



3. Self-Driving Cars Can Mimic Human Drivers

With the help of an improved sight-correcting system, self-driving cars could learn just by observing human operators complete the same task, researchers have found. The team implemented imitation learning, also called learning from demonstration. In this, a human operator drives a vehicle outfitted with three cameras, observing the environment from the front and each side of the car. The data is then processed through a neural network — a computer system based on how the brain's neurons interact to process information — that allows the vehicles to make decisions based on what it learned. The processing system is a convolutional neural network, which is mirrored on the brain's visual cortex. By reducing the visual information, the network can quickly process changes in the environment. This, combined with the knowledge gained from observing the human operator, means the algorithm knows that a sudden obstacle should trigger the vehicle to fully stop to avoid an accident.

Source https://timesofindia.indiatimes.com/home/science/self-driving-cars-can-mimic-human-drivers/articleshow/74544569.cms

Chemical Engineering

4. A Novel Biofuel System for Hydrogen Production from Biomass

A novel technology has been developed for hydrogen production from the process, which involves electron that is produced during the decomposition of biomass such as waste wood. The result produced after biomass decomposition is a high value-added compound, and it is a two-stone technology that improves the efficiency of hydrogen production. A research team led by Professor Jungki Ryu in the School of Energy and Chemical Engineering at UNIST has presented a new biofuel system that uses lignin found in biomass for the production of hydrogen. The system decomposes lignin with a molybdenum (Mo) catalyst to produce high value-added compounds, and the electrons extracted in the process effectively produce hydrogen. An eco-friendly way of producing hydrogen is the electrolysis of water (H₂O). The voltage is applied to the water to produce hydrogen and oxygen at the same time. However, in the currently reported technology, the oxygen generation reaction (OER) is slow and complicated, and hydrogen production efficiency is low. This is because hydrogen gas (H₂) is produced by hydrogen ions (H⁺) as electrons, because these electrons come from the oxygen evolution reaction. Through the study, Professor Ryu and his research team have developed a new biofuel system that uses lignin as an electron donor in a way to reduce the overall inefficiency of the oxygen evolution reaction (OER). This is the principle of using molybdenum-based inexpensive metal catalysts (PMA) to break down lignin at low temperatures, and extract the electrons produced in the process to produce hydrogen. The new device has been designed to move electrons from lignin, along the wire to the electrode where the hydrogen evolution reaction (HER) occurs. With this new system, they can produce hydrogen with less energy (overvoltage) than conventional water electrolysis, as there is no need for oxygen reactions, requiring high energy and precious metal catalysts. Conventional methods require more than 1.5 volts, but the new system was capable of producing hydrogen at a much lower potential (0.95 volts). In addition, vanillin or carbon monoxide (CO), which are produced via lignin breakdown is very useful substance for various industrial processes. "Lignin, the second most naturally abundant biomass, is difficult to decompose. However, using molybdenum-based catalysts (PMA) it was easily degraded at low temperatures," says Research Assistant Professor Yuri Choi, the co-author of the study. "The new biofuel system is a technology that produces hydrogen and valuable chemicals using cheap catalysts and low voltages instead of expensive catalysts such as platinum (Pt)," says Professor Ryu. "Our work is also significant, as it presents a new way to replace oxygen-producing reactions in the electrolysis of water."

Source https://www.sciencedaily.com/releases/2020/03/200310094248.htm

Electrical Engineering

5. A Flexible Brain for AI

Scientists at Osaka University built a new computing device from field-programmable gate arrays (FPGA) that can be customized by the user for maximum efficiency in artificial intelligence applications. Compared with currently used rewireable hardware, the system increases circuit density by a factor of 12. Also, it is expected to reduce energy usage by 80%. This advance may lead to flexible artificial intelligence (AI) solutions that provide enhanced performance while consuming much less electricity. AI is becoming a part of everyday life for almost all consumers. Ridesharing smartphone apps like Uber, Gmail's spam filters, and smart-home devices like Siri and Nest all rely on AI. However, implementing these algorithms often require a large amount of computing power, which means large electricity bills, as well as big carbon footprints. Systems that could -- like the human brain -- be rewired to optimize the computer circuitry for each task would provide greatly enhanced energy efficiency. Normally, we think of hardware, which includes the physical logic gates and transistors of a computer's processor, as fixed by the manufacturer. However, field-programmable gate arrays are specialized logical elements that can be rewired "in the field" by the user for custom logic applications. The research team used non-volatile "via-switches" that remain connected until the user decided to reconfigure them. Using novel nanofabrication methods, they were able to pack twelve times more elements into a grid-like "crossbar" layout. By reducing the distance electronic signals need to be routed, the devices ended up needing 80% less power. "Our system based on fieldprogrammable gate arrays has a very fast design cycle. It can be reprogrammed daily if desired to get the most computing power for each new AI application," first author Masanori Hashimoto says. The use of via-switches also eliminates the need for the programming silicon area that was necessary in previous FPGA devices. "Via-switch FPGA is suitable as a high-performance implementation platform of the latest AI algorithms," says senior author Jaehoon Yu.

Source https://www.sciencedaily.com/releases/2020/03/200309093011.htm

Electronics and Communication Engineering

6. Neural Hardware for Image Recognition in Nanoseconds

Automatic image recognition is widely used today: There are computer programs that can reliably diagnose skin cancer, navigate self-driving cars, or control robots. Up to now, all this has been based on the evaluation of image data as delivered by normal cameras -- and that is time-consuming. Especially when the number of images recorded per second is high, a large volume of data is generated that can hardly be handled. Scientists at TU Wien therefore took a different approach: using a special 2D material, an image sensor was developed that can be trained to recognize certain objects. The chip represents an artificial neural network capable of learning. The data does not have to be read out and processed by a computer, but the chip itself provides information about what it is currently seeing -- within nanoseconds. Neural networks are artificial systems that are similar to our brain: Nerve cells are connected to many other nerve cells. When one cell is active, this can influence the activity of neighbouring nerve cells. Artificial learning on the computer works according to exactly the same principle: A network of neurons is simulated digitally, and the strength with which one node of this network influences the other is changed until the network shows the desired behaviour. "Typically, the image data is first read out pixel by pixel and then processed on the computer," says Thomas Mueller. "We, on the other hand, integrate the neural network with its artificial intelligence directly into the hardware of the image sensor. This makes object recognition many orders of magnitude faster." The chip was developed and manufactured at the TU Vienna. It is based on photodetectors made of tungsten diselenide -- an ultra-thin material consisting of only three atomic layers. The individual photodetectors, the "pixels" of the camera system, are all connected to a small number of output elements that provide the result of object recognition. "In our chip, we can specifically adjust the sensitivity of each individual detector element -- in other words, we can control the way the signal picked up by a particular detector affects the output signal," says Lukas Mennel, first author of the publication. "All we have to do is simply adjust a local electric field directly at the photodetector." This adaptation is done externally, with the help of a computer program. One can, for example, use the sensor to record different letters and change the sensitivities of the individual pixels step by step until a certain letter always leads exactly to a corresponding output signal. This is how the neural network in the chip is configured -- making some connections in the network stronger and others weaker. Once this learning process is complete, the computer is no longer needed. The neural network can now work alone. If a certain letter is presented to the sensor, it generates the trained output signal within 50 nanoseconds -- for example, a numerical code representing the letter that the chip has just recognized.

Source https://www.sciencedaily.com/releases/2020/03/200305132132.htm

Aerospace Engineering

7. Simple, Fuel-Efficient Rocket Engine Could Enable Cheaper, Lighter Spacecraft



It takes a lot of fuel to launch something into space. Sending NASA's Space Shuttle into orbit required more than 3.5 million pounds of fuel, which is about 15 times heavier than a blue whale. But a new type of engine -- called a rotating detonation engine -- promises to make rockets not only more fuelefficient but also more lightweight and less complicated to construct. There's just one problem: Right now this engine is too unpredictable to be used in an actual rocket. Researchers at the University of Washington have developed a mathematical model that describes how these engines work. With this information, engineers can, for the first time, develop tests to improve these engines and make them more stable. "The rotating detonation engine field is still in its infancy. We have tons of data about these engines, but we don't understand what is going on," said lead author James Koch. "I tried to recast our results by looking at pattern formations instead of asking an engineering question -- such as how to get the highest performing engine -- and then boom, it turned out that it works." A conventional rocket engine works by burning propellant and then pushing it out of the back of the engine to create thrust. "A rotating detonation engine takes a different approach to how it combusts propellant," Koch said. "It's made of concentric cylinders. Propellant flows in the gap between the cylinders, and, after ignition, the rapid heat release forms a shock wave, a strong pulse of gas with significantly higher pressure and temperature that is moving faster than the speed of sound. "This combustion process is literally a detonation -- an explosion -- but behind this initial start-up phase, we see a number of stable combustion pulses form that continue to consume available propellant. This produces high pressure and temperature that drives exhaust out the back of the engine at high speeds, which can generate thrust." Conventional engines use a lot of machinery to direct and control the combustion reaction so that it generates the work needed to propel the engine. But in a rotating detonation engine, the shock wave naturally does everything without needing additional help from engine parts. "The combustion-driven shocks naturally compress the flow as they travel around the combustion chamber," Koch said. "The downside of that is that these detonations have a mind of their own. Once you detonate something, it just goes. It's so violent." To try to be able to describe how these engines work, the researchers first developed an experimental rotating detonation engine where they could control different parameters, such as the size of the gap between the cylinders. Then they recorded the combustion processes with a high-speed camera. Each experiment took only 0.5 seconds to complete, but the researchers recorded these experiments at 240,000 frames per second so they could see what was happening in slow motion. From there, the researchers developed a mathematical model to mimic what they saw in the videos. This is the only model in the literature currently capable of describing the diverse and complex dynamics of these rotating detonation engines that are observed in experiments. The model allowed the researchers to determine for the first time whether an engine of this type would be stable or unstable. It also allowed them to assess how well a specific engine was performing.

Source https://www.sciencedaily.com/releases/2020/02/200218143706.htm

Mining, Metallurgical and Materials Engineering

8. Hope for A New Permanent Magnet That's Cheap and Sustainable

Scientists have made a breakthrough in the search for a new, sustainable permanent magnet. Most permanent magnets are made from alloys of rare earth metals -- but the mining and processing of these materials produces toxic by-products, leading to ecological challenges around rare-earth mines and refineries. At the same time, demand for permanent magnets is increasing as they are a common component in renewable energy, consumer electronics and electric-powered vehicles. A team of scientists, led by the University of Leeds, has made a breakthrough in a new advanced material which may eventually replace rare-earth-based permanent magnets. The researchers have developed a hybrid film from a thin layer of cobalt, which is naturally magnetic, covered with molecules of Buckminsterfullerene, a form of carbon. The presence of the carbon dramatically boosted cobalt's magnetic energy product, a measure of the strength of a magnet, by five times at low temperatures. The research team observed the increase in magnetic strength at minus 195 degrees Centigrade, but they hope by chemically manipulating the carbon molecules, they will be able to get the same effect at room temperature. Dr Tim Moorsom, co-principal investigator from the School of Physics and Astronomy at Leeds, said: "This is the first indication I have seen that a rare-earth-free magnet could compare to something like samarium cobalt, a rare-earth-based permanent magnet. "While we have only seen this effect at low temperatures thus far, I am hopeful that a hybrid magnetic material similar to this will one day replace rare earth permanent magnets, helping to mitigate the environmental damage they cause." Although carbon is not magnetic, the way the molecules bond to the cobalt surface causes a magnetic pinning effect, which prevents the magnetism in the cobalt from changing direction, even in strong opposing fields. This surface interaction is the key to the unusually high magnetic energy of the hybrid material. While it may be a long time before hybrid magnets are ready to be used in wind turbines or electric cars, there are other applications which are closer at hand.

Source https://www.sciencedaily.com/releases/2020/03/200303140142.htm

Energy Engineering

9. Ultrathin Organic Solar Cell is Both Efficient and Durable

Scientists from the RIKEN Cluster for Pioneering Research and RIKEN Center for Emergent Matter Science have succeeded, in collaboration with international partners, in creating an ultrathin organic solar cell that is both highly efficient and durable. Using a simple post-annealing process, they created a flexible organic cell that degrades by less than 5 percent over 3,000 hours in atmospheric conditions and that simultaneously has an energy conversion ratio -- a key indicator of solar cell performance -of 13 percent. Organic photovoltaics are considered to be a promising alternative to silicon-based conventional films, being more environmentally friendly and cheap to produce. Ultrathin flexible solar cells are particularly attractive, as they could provide large power per weight and be used in a variety of useful applications such as powering wearable electronics and as sensors and actuators in soft robotics. However, ultrathin organic films tend to be relatively efficient, typically having an energy conversion ratio of around 10 to 12 percent, significantly lower than the ratio in silicon cells, which can be as high as 25 percent, or of rigid organic cells, which can be up to around 17 percent. Ultrathin films also tend to degrade rapidly under the influence of sunlight, heat, and oxygen. Researchers are trying to create ultrathin films that are both energy efficient and durable, but it is often a difficult trade-off. In their research, the group succeeded in showing that an ultrathin cell can be both durable and efficient. The group began with a semiconductor polymer for the donor layer, developed by Toray Industries, Inc., and experimented with a new idea, of using a non-fullerene acceptor, increasing the thermal stability. On top of this, they experimented with a simple postannealing process, where the material was heated to 150 degrees Celsius after an initial annealing at 90 degrees. This step proved to be critical in increasing the durability of device by creating a stable interface between the layers. According to Kenjiro Fukuda, one of the authors of the study, "By combining a new power generation layer with a simple post-annealing treatment, we have achieved both high energy conversion efficiency and long-term storage stability in ultra-thin organic solar cells. Our research shows that ultra-thin organic solar cells can be used to supply high power in a stable way over long periods of time, and can be used even under severe conditions such as high temperature and humidity. I very much hope that this research will contribute to the development of long-term stable power supply devices that can be used in wearable electronics such as sensors attached to clothes."

Source https://www.sciencedaily.com/releases/2020/03/200309152058.htm

Interdisciplinary and Special Engineering Fields and Leadership in Academia, R&D and Industry

10. Robot Uses Artificial Intelligence and Imaging to Draw Blood

Rutgers engineers have created a table-top device that combines a robot, artificial intelligence and near-infrared and ultrasound imaging to draw blood or insert catheters to deliver fluids and drugs. Their most recent research results suggest that autonomous systems like the image-guided robotic device could outperform people on some complex medical tasks. Medical robots could reduce injuries and improve the efficiency and outcomes of procedures, as well as carry out tasks with minimal supervision when resources are limited. This would allow health care professionals to focus more on other critical aspects of medical care and enable emergency medical providers to bring advanced interventions and resuscitation efforts to remote and resource-limited areas. "Using volunteers, models and animals, our team showed that the device can accurately pinpoint blood vessels, improving success rates and procedure times compared with expert health care professionals, especially with difficult to access blood vessels," said senior author Martin L. Yarmush, of the Department of Biomedical Engineering in the School of Engineering at Rutgers University-New Brunswick. Getting access to veins, arteries and other blood vessels is a critical first step in many diagnostic and therapeutic procedures. They include drawing blood, administering fluids and medications, introducing devices such as stents and monitoring health. The timeliness of procedures can be critical but gaining access to blood vessels in many people can be quite challenging. Failures occur in an estimated 20 percent of procedures, and difficulties increase in people with small, twisted, rolling or collapsed blood vessels, which are common in paediatric, elderly, chronically ill and trauma patients, the study says. In these groups, the first-stick accuracy rate is below 50 percent and at least five attempts are often needed, leading to delays in treatment. Bleeding complications can arise when major adjacent arteries, nerves or internal organs are punctured, and the risk of complication rises significantly with multiple attempts. When nearby blood vessels are inaccessible, more invasive approaches such as central venous or arterial access are often required. The robotic device can accurately steer needles and catheters into tiny blood vessels with minimal supervision. It combines artificial intelligence with near-infrared and ultrasound imaging to perform complex visual tasks, including identifying the blood vessels from the surrounding tissue, classifying them and estimating their depth, followed by motion tracking. In other published work, the authors have shown that the device can serve as a platform to merge automated blood-drawing and downstream analysis of blood. Next steps include more research on the device in a broader range of people, including those with normal and difficult blood vessels to access.

Source https://www.sciencedaily.com/releases/2020/03/200304141540.htm



IIIT-H Invention to Enable Personalised AC Temperature at Workplaces

People at workplaces will no longer have to deal with a uniform air-conditioning temperature as researchers at the International Institute of Information Technology, Hyderabad (IIIT-H) have invented a method that will enable co-workers to have personalized temperature as per their comfort. In a bid to provide more user control, Prof Vishal Garg and his student Sam Babu Godithi from the IIIT-H invented the mechanism iSPACE (Intelligent System for Personal Ambient Control and Energy Efficiency), which was recently patented in the US. Funded by the Department of Science and Technology (DST) under the US-India Joint Centre for Building Energy Research and Development (CBERD) project, the mechanism consists of a SmartHub, and a smart power strip that enables networking of all personal environment devices, providing a unified interface to the user, while integrating personal environment with the building level control systems. For example, a person having a workstation facing a window may have higher sunlight versus some sitting away from the window. This means that a uniform air conditioning temperature set for the floor will not provide the same level of comfort to the window-facing occupant (who would need a lower setting) and the occupant sitting further away. The mechanism invented by the IIIT-H researchers will optimize the load of devices such as table lamps, air-conditioner, table fans etc. The mechanism is currently being evaluated for two scenarios. In the first scenario, the building publishes the electricity price without any constraint on the load whereas in the other scenario every individual gets a load limit within which he/she has to operate. The research team at Lawrence Berkeley National Lab and IIIT-H are now exploring how this patented technology can be commercialized.

Source https://timesofindia.indiatimes.com/home/education/news/iiit-h-invention-to-enable-personalised-ac-temperature-at-workplaces/articleshow/74634909.cms