



E-Newsletter

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From the Editor's Desk

CHANDRAYAAN -2

The whole nation looked forward for the hundred percent success of Chandrayaan -2 since it was launched on July 22nd 2019 from Satish Dhawan Space Centre located at Sriharikota in Andhra Pradesh. Chandrayaan -2 is a proud and gigantic mission of ISRO knitted with several scientific objectives and technology demonstrations. The mission is aimed at improving the understanding of the moon and explore the moon's south polar region; the region where no country has reached so far. It envisaged the demonstration of soft landing of lander Vikram on moon and operate the rover Pragyan on the lunar surface. ISRO has made untiring and incredible efforts to place the Lander at an appropriate location on the moon's south pole region but received a set back in the early hours of 7th September just few moments prior to its planned landing on lunar surface. Communication with lander was abruptly ended and Vikram appears to have set its presence on the moon by hard landing. It may be recalled that the Chairman ISRO has been cautioning about 15 minutes of terror that the mission may experience in the last stage of Vikram's journey while reaching the destination. It has been proven in the past by other countries that the landing is the hardest thing in the planetary exploration. However, India has approached the final phase almost in its maiden attempt. ISRO scientists successfully tackled various phases in the composite spacecraft mission and they shall be given credit for that they so far achieved. Without losing precious time, ISRO has already started the critical analysis of the events that prevented the soft landing of Vikram on the lunar surface. It has been trying to establish the contact with lander by all possible routes. The ISRO scientists are trying to accomplish this contact possibly within a short period, prior to the moon entering the lunar night. It may be noted that the lander and rover are supposed to be functional only for 14 days starting from the day of their touch down on the moon. India's moon mission dream is not over yet but we hope that ISRO would overcome all the obstacles in its path for establishing the contact with lander and rover before the deadline.



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INAE Youth Conclave 2019

The third INAE Youth Conclave was organized at Indian Institute of Technology (IIT), Delhi on Aug 9-10, 2019. Prof. V Ramgopal Rao, Director IIT, Delhi had kindly hosted the event. Dr. Purnendu Ghosh, Vice President INAE and Chairman INAE Youth Committee along with Prof Shaikh Ziauddin Ahmmad, IIT Delhi and Prof. BK Panigrahi, FNAE IIT Delhi organised the event. The Conclave was organized for engineering students in Graduate, Post Graduate and Doctoral level. The event included interactive sessions of students with INAE Fellows and other Subject Experts and presentations by students based on engineering models or engineering ideas. The engineering model and idea presentations were based on five topics of national importance namely **(a) Health is Wealth (b) Digital Revolution (c) Environment Protection (d) Lab to Market** and **(e) Waste to Wealth**. The Conclave was attended by more than 200 engineering students from all over the country, and about 30 INAE Fellows participated in the deliberations. The Conclave was inaugurated by the Chief Guest, Prof. Anil D Sahasrabudhe, Chairman AICTE and Guest of Honour was Prof K VijayRaghavan, Principal Scientific Adviser to the Government of India.



Dr. Sanak Mishra, President INAE addressing the audience in the Inaugural Session of INAE Youth Conclave 2019



Chief Guest, Prof Anil D Sahasrabudhe, Chairman AICTE delivering Address during INAE Youth Conclave 2019



Guest of Honour, Prof. K VijayRaghavan, Principal Scientific Adviser to Govt. of India, delivering Address in INAE Youth Conclave 2019

The Inaugural Session was followed by individual/team presentations by students on the five chosen theme area. Each participating student/student team was judged by a panel of judges consisting of experts from academia and industry. The Top three from each group were awarded prize money of Rs. 25,000 for the winner, Rs. 15,000 for the first runner-up and Rs. 10,000 for the second runner-up. The presentation session was followed by technical sessions on “Engineering Education: Demand and Supply”, “Technical Innovation in India: Frugal and Conventional”, “Societal Reinvention through Technology” and “Young Entrepreneur: Prospect and Challenges”.



Presentation of engineering ideas by student on Waste to Wealth during INAE Youth Conclave 2019

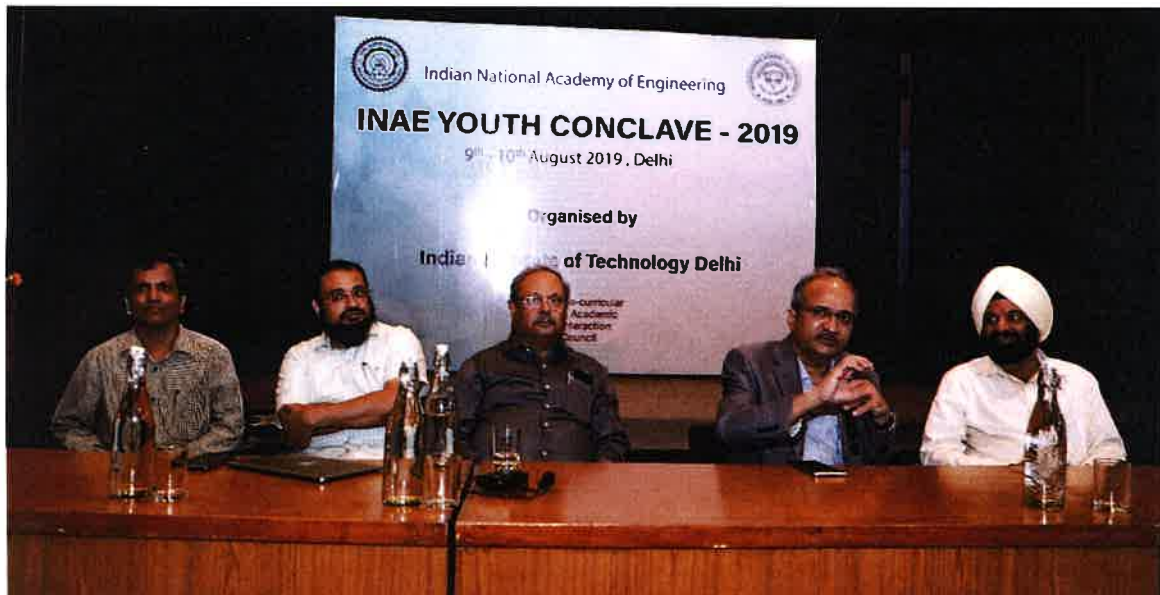


Panel Discussion Sessions by INAE Fellows (left to right): Prof. Amit Agrawal, IIT Bombay, Prof. Anurag Sharma, IIT Delhi and Prof Prem Krishna; Prof. Manoj Tiwari, IIT Kharagpur, Prof. KL Chopra, Dr. Purnendu Ghosh and Prof BK Panigrahi

The conclave concluded with the award ceremony for the awardees. The students who attended the conclave were held interactions with INAE Fellows from Academia, R&D and Industry during the sessions. Dr. Purnendu Ghosh, Vice President, INAE and Chairman INAE Youth Committee congratulated all the awardees. He informed that all the awardees would be inducted as INAE Student Members for a period of 5 years and encouraged their involvement in INAE activities.



Presentation of Awards to Winners in Award Ceremony of INAE Youth Conclave 2019



Prof V Ramgopal Rao, Director, IIT Delhi (Second from right) in the Concluding Session



Group Photograph of Participants and Delegates at INAE Youth Conclave 2019 at IIT Delhi

Engineers Conclave 2019

The **Seventh Engineers Conclave-2019 (EC-2019)** is being held jointly with **Bharat Electronics Limited (BEL)** on **Sep 19-21, 2019** at **BEL, Bangalore**. INAE had taken an initiative of organizing an annual mega event of engineers as “Engineers Conclave” since 2013 jointly with major Engineering Organizations/Strategic Departments/Institutions/Industry on rotation basis. The objective of the Engineers Conclave is to provide a platform for engineers from allied fields to meet, deliberate and recommend right engineering solutions to some of the pertinent issues of national importance. Each conclave has two themes, one specific to the host department and other specific to some social problem where engineering intervention is desired. The two themes for the Engineers Conclave 2019 are “**Defence Technology & Innovation**” and “**Transformation of Rural India Using Digital Technologies**”, which have been chosen keeping in view the current National Priorities and interest. All INAE Fellows and Young Associates have been invited to participate in the Engineers Conclave 2019.

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.

Prof. Benjaram Mahipal Reddy, FNAE, Formerly Chief Scientist and Head, CSIR-IICT, Hyderabad	Manipal Institute of Technology, Manipal	Delivered lectures on "Advanced Catalysts for Energy and Environmental Applications". According to the feedback from the engineering college, the lectures on recent developments in nanoscience and nanotechnology by Prof. Reddy have been very beneficial for both students and teachers.
	August 8, 2019	

<p>Dr. Suvankar Ganguly Principal Scientist, R&D Division, TATA Steel Ltd.</p>	<p>Department of Mechanical Engineering, Jadavpur University July 27, 2019</p>	<p>Delivered lectures on "Experimentation Related to Industrial Rolling Operation". According to the feedback received from the engineering college, the interaction with Dr. Ganguly has led to a number of students undertaking project work in the area of heat transfer in hot rolling mills. A collaborative research programme has also been initiated.</p>
<p>Dr. Jalpesan Krishnan, Former L&T Chair, MS University, Baroda</p>	<p>Dr. Mahalingam College of Engineering and Technology July 25-27,2019</p>	<p>Delivered lectures on "Advanced Welding Technique"," Design of Welding Fixtures" and " Design of Welding Fixtures". As per the feedback received from the faculty coordinator, the scheme is of immense help for students and faculty. Specific technical requirements as required by the institute was also discussed with the DVP.</p>
<p>Dr. Ananta Lal Das, Ex Director, Society for Applied Microwave Electronics Engineering and Research (SAMEER)</p>	<p>National Institute of Technical Teachers Training and Research, Chandigarh July 23-25,2019</p>	<p>Delivered lectures on "Basic Antenna: Theory & Application", "Design of Basic Feeds for Microstrip and Waveguide Antennas", "Methods for antenna Performance Measurements". As per the feedback received from the faculty coordinator, interaction with the DVP and his experience in research has motivated the students to identify research topics.</p>
<p>Dr. Sreekumar Thaliyil Veedu Senior Consultant, Reliance Industries Ltd. (RIL)</p>	<p>DKTE Society's Textile & Engineering Institute, Ichalkaranji July 17-19, 2019</p>	<p>Delivered lectures on "Acrylic Fibre Manufacturing and its Applications","Fibres for Fashion" and " High performance fibre Manufacturing and its Applications". According to the feedback received from the engineering college, the DVP lectures are beneficial for both students and lectures. Aspirant PhD students and present research scholars have also benefitted from the interactions.</p>
<p>Dr. G. Janakiram, General Manager (Technical Services), Eurotex Industries & Exports Ltd, Kolhapur</p>	<p>DKTE Society's Textile &Engineering Institute, Ichalkaranji July 8-10,2019</p>	<p>Delivered lectures on "Process Control in Spinning and Weaving " and " Waste Control and Yarn Realization". According to the feedback from the engineering college, the scheme is very helpful for institute as it helps the students to get exposure to the direct ideas on the actual practices followed in the industry and also the expectation of industries from academia.</p>
<p>Dr. R Nagendra, Senior Director, M/s Stedrnt Technoclinic Pvt. Ltd., Bangalore</p>	<p>Nitte Meenakshi Institute of Technology-NMIT, Bangalore June 13-15, 2019</p>	<p>Delivered lectures on "Alternatives to Natural River Sand -Need of the hour", "Need of Quality Assurance and Quality Control in Construction", "Demonstration of Testing on Materials and Concrete". According to the feedback received from the faculty coordinator, the scheme is beneficial both for students and teachers. The DVP also guided students and helped identifying projects. He has also suggested changes in curriculum.</p>

Important Meetings held during August 2019

- INAE Apex Committee on August 8, 2019 at INAE Office, Gurgaon
- Workshop on "Imagining the Future of INAE" On August 8, 2019 at INAE Office, Gurgaon
- Selection Committee for selection on awardees for Young Engineer and Innovator Entrepreneur Award on August 26, 2019 at INSA, New Delhi
- Selection Committee for selection of awardees for Innovative Students Projects Award on August 27, 2019 at INSA, New Delhi
- Meetings of INAE Forum on Civil Infrastructure held on August 17, 2019 and August 28, 2019 at New Delhi

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 September 2019, click here.

Honours and Awards

1. Prof BV Rao, FNAE Adjunct Faculty, NIAS, Bangalore; National President, IIPE and formerly Professor IIT Madras and former Pro-Chancellor & Advisor VIT University, Vellore has been conferred with Lifetime Achievement Award at the **Indian Technology Congress (ITC)-2019**, held on September 4-5, 2019 at Bangalore. This Award was presented at the Inaugural Ceremony of the Congress on September 4, 2019 with a Citation, for his contributions to Engineering Education and his involvement with many Professional Societies to share his knowledge. Earlier he was involved in many national projects undertaken by many R&D organizations like ISRO, DRDO, BARC, Shipyards, Energy and Electrical Utilities. ITCA identifies each year advanced topics related to Engineering and Technology and Dr Rao delivered a Keynote address on the topic "**Human Digitalization and Future Intelligence**" at the Plenary Session.



Dr. B. V. A. Rao, FNAE being felicitated with Lifetime Achievement Award at the Indian Technology Congress held on 04 September 2019 by Dr. C N Aswathanarayana, Deputy Chief Minister of Karnataka Govt.

Prof BVA Rao was also conferred the **Lifetime Achievement Award** on 31 August 2019 by the **Indian Montessori Centre (IMC)** for his contribution towards the growth of **Montessori System of Education and Training of Teachers** during the last 26 years by way of establishing Training Centres located in various cities like Bengaluru, Chennai, Coimbatore, Hosur, Mangalore, Hyderabad, New Delhi including one in Saigon, Vietnam. Under his Presidentship, **IMC** has

turned out so far 4145 Teachers and 9 Trainers (called Directors). Dr. Rao also runs his own institution **Hymamshu Jyothi Kala Peetha**, (established in 1942) in Bengaluru, known for its Pre-School education both in Nursery and Montessori.



Dr B. V. A. Rao, FNAE, being felicitated by Sri H. N Suresh, Director, Bharatiya Vidya Bhavan, Bengaluru on 31 August 2019 for his 26 years of service towards Montessori system of education on the occasion of 150th Birth Anniversary of Dr. Maria Montessori.

New of Fellows

1.	Dr RK Bhandari, FNAE, Formerly Director, Central Building Research Institute, Roorkee & Programme Director, UN-HABITAT, Nairobi and Formerly Chairman, Centre for Disaster Mitigation and Management, VIT, Vellore delivered the 4th Arvind Verma Memorial Lecture on August 21, 2019 at New Delhi. The topic of the lecture was “The Urgency for Resurgence of the Culture of Geotechnical Engineering Practice in India”.
2.	Prof BS Murty, FNAE Professor, Department of Metallurgical & Materials Engineering, IIT Madras has taken over as Director of IIT Hyderabad from August 26, 2019.
3.	Dr. Debabrata Das, FNAE Visiting Professor, Former Head and Renewable Energy Chair Professor, Department of Biotechnology, Former Professor-in-Charge, P K Sinha Centre for Bioenergy, Indian Institute of Technology, Kharagpur has authored a book entitled "Biochemical Engineering: An Introductory Text Book" published by Jenny Stanford Publishing Pte. Ltd., Singapore. The book provides students the knowledge that will enable them to contribute in various professional fields, including bioprocess development, modelling and simulation and environmental engineering.

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>

International/National Conferences in September 2019

International Conference on Computational Intelligence and Data Science on 6th to 7th September 2019 at Gurugram

<https://conferencealerts.com/show-event?id=212782>

International Conference on Emerging Trends in Science and Engineering ICESE 2019 on 18th to 19th September 2019 at Hyderabad

<https://conferencealerts.com/show-event?id=215180>

3rd International Conference on Technological Advances in Mechanical Engineering on 19th to 20th September 2019 at Chennai

<https://conferencealerts.com/show-event?id=218280>

Recent Advances in Chemical, Environmental, Bioprocess, Textile, Mining, Material & Metallurgical Engineering (CEBTME-2019) on 21st September 2019 at New Delhi

<https://conferencealerts.com/show-event?id=218992>

1. Fiber-Optic Vibration Sensors Could Prevent Train Accidents

Researchers have developed new sensors for measuring acceleration and vibration on trains. The technology could be integrated with artificial intelligence to prevent railway accidents and catastrophic train derailments. The fiber accelerometers could be used for real-time monitoring of defects in the railway track or the train to pinpoint problems before an accident occurs. The devices can detect frequencies more than double that of traditional fiber-optic accelerometers, making them suitable for monitoring wheel-rail interactions. The durable sensors include no moving parts and work well in the noisy and high-voltage environments found in railway applications. "In addition to railway monitoring, these new accelerometers can be utilized in other vibration monitoring applications, for example, structural health monitoring for buildings and bridges and vibration measurements of aircraft wings," said a researcher. For more than 15 years, the researchers have been working on condition-monitoring systems that use an all-optical sensing network to continuously monitor critical railway components. These systems can help replace inefficient and costly scheduled railway maintenance routines with predictive maintenance based on actual conditions. Systems developed by the researchers have been installed in Hong Kong and Singapore. "An all-optical sensing network has many advantages as it is immune to electromagnetic interference, has long transmission distance and the sensors don't require electricity," said researchers. "However, there is a need for fiber-optic sensors that are optimized to measure different parameters in railway systems." The fiber-optic accelerometers typically used in condition-monitoring systems are based on fiber Bragg gratings (FBGs) and cannot be used to detect vibrations higher than 500 Hz. Although this is adequate for most railway applications it can't be used to measure the wheel-rail interactions that are an important source of track wear. To overcome this problem, the researchers designed a new fiber-optic accelerometer that uses a special optical fiber known as a polarization-maintaining photonic crystal fiber that is coiled into the shape of a disc only 15 millimeters in diameter. The coiled fiber is glued between a stainless-steel substrate and a cylindrical mass block. When a vibration occurs, the mass block will press on the coiled fiber at a frequency matching that of the vibration. This external force causes the wavelength of light in the fiber to shift in a measurable way." This interferometric configuration uses changes in the light inside the fiber to acquire precise information about the vibrations," said researchers. "Installing these accelerometers on the undercarriage of an in-service train allows them to monitor vibrations that would indicate defects in the track. They can also be used to detect problems in overhead lines used to power trains." After thoroughly testing prototypes of the new accelerometer in the laboratory, the researchers carried out a field test by installing the device on an in-service train. They also installed an FBG-based accelerometer and a piezoelectric accelerometer for comparison. They found that the new fiber accelerometer detected acceleration in a manner similar to the piezoelectric accelerometer. However, piezoelectric sensors require expensive shielded cables to reduce the effects of electromagnetic interference noise. Because the FBG-based accelerometer can't operate well at high frequencies, noise concealed some of the useful vibration information. The new accelerometers perform considerably better than existing accelerometers used for monitoring acceleration in trains. In this work, the researchers used a commercial polarization-maintaining photonic crystal fiber. They have since designed and fabricated a new type of fiber with smaller outer diameters, lower bending losses and higher birefringence, all of which would allow them to build a smaller accelerometer with even higher sensitivity. These new accelerometers could open new sensing and monitoring possibilities by providing data that supports implementation of artificial intelligence in the railways industry.

Source <https://www.sciencedaily.com/releases/2019/07/190717122617.htm>

2. Using Wi-Fi Like Sonar to Measure Speed and Distance of Indoor Movement

Researchers from North Carolina State University have developed a technique for measuring speed and distance in indoor environments, which could be used to improve navigation technologies for robots, drones -- or pedestrians trying to find their way around an airport. The technique uses a novel combination of Wi-Fi signals and accelerometer technology to track devices in near-real time. "We call our approach Wi-Fi-assisted Inertial Odometry (WIO)," says Raghav Venkatnarayan, a Ph.D. student at NC State. "WIO uses Wi-Fi as a velocity sensor to accurately track how far something has moved. Think of it as sonar, but using radio waves, rather than sound waves." Many devices, such as smartphones, incorporate technology called inertial measurement units (IMUs) to calculate how far a device has moved. However, IMUs suffer from large drift errors, meaning that even minor inaccuracies can quickly become exaggerated. In outdoor environments, many devices use GPS to correct their IMUs. But this doesn't work in indoor areas, where GPS signals are unreliable or nonexistent. "We created WIO to work in conjunction with a device's IMU, correcting any errors and improving the accuracy of speed and distance calculations," says Muhammad Shahzad, assistant professor of computer science at NC State. "This improvement in accuracy should also improve the calculations regarding a device's precise location in any indoor environment where there is a Wi-Fi signal." The researchers wanted to test the WIO software but ran into a problem: they could not access the Wi-Fi network interface cards in off-the-shelf devices such as smartphones or drones. To address the problem, the researchers created a prototype device that could be used in conjunction with other devices. The researchers found that using WIO improved a device's speed and distance calculations dramatically. For example, devices using WIO calculated distance with a margin of error ranging from 5.9% to 10.5%. Without WIO, the devices calculated distance with a margin of error from 40% to 49%. "We envision WIO as having applications in everything from indoor navigational tools to fitness tracking to interactive gaming," Venkatnarayan says. "We are currently working with Sony to further improve WIO's accuracy, with an eye toward incorporating the software into off-the-shelf technologies," says Shahzad.

Source <https://www.sciencedaily.com/releases/2019/08/190827145726.htm>

Mechanical Engineering

3. Robotic Cane Shown to Improve Stability in Walking

By adding electronics and computation technology to a simple cane that has been around since ancient times, a team of researchers at Columbia Engineering have transformed it into a 21st century robotic device that can provide light-touch assistance in walking to the aged and others with impaired mobility. A team led by Sunil Agrawal, professor of mechanical engineering and of rehabilitation and regenerative medicine at Columbia Engineering, has demonstrated, for the first time, the benefit of using an autonomous robot that "walks" alongside a person to provide light-touch support, much as one might lightly touch a companion's arm or sleeve to maintain balance while walking. "Often, elderly people benefit from light hand-holding for support," explained Agrawal. "We have developed a robotic cane attached to a mobile robot that automatically tracks a walking person and moves alongside" he continued. "The subjects walk on a mat instrumented with sensors while the mat records step length and walking rhythm, essentially the space and time parameters of walking, so that we can analyze a person's gait and the effects of light touch on it." The light-touch robotic cane, called CANINE, acts as a cane-like mobile assistant. The device improves the individual's proprioception, or self-awareness in space, during walking, which in turn improves stability and balance. "This is a novel approach to providing assistance and feedback for individuals as they navigate their environment," said Joel Stein, Simon Baruch Professor of Physical Medicine and Rehabilitation and chair of the department of rehabilitation and regenerative medicine at Columbia University Irving Medical Center, who co-authored the study with Agrawal. "This strategy has potential applications for a variety of conditions, especially individuals with gait disorders." To test this new device, the team fitted 12 healthy young people with virtual reality glasses that created a visual environment that shakes around the user -- both side-to-side and forward-backward -- to unbalance their walking gait. The subjects each walked 10 laps on the instrumented mat, both with and without the robotic cane, in conditions that tested walking with these visual perturbations. In all virtual environments, having the light-touch support of the robotic cane caused all subjects to narrow their strides. The narrower strides, which represent a decrease in the base of support and a smaller oscillation of the center of mass, indicate an increase in gait stability due to the light-touch contact. "The next phase in our research will be to test this device on elderly individuals and those with balance and gait deficits to study how the robotic cane can improve their gait," said Agrawal, who directs the Robotics and Rehabilitation (ROAR) Laboratory. "In addition, we will conduct new experiments with healthy individuals, where we will perturb their head-neck motion in addition to their vision to simulate vestibular deficits in people." While mobility impairments affect 4% of people aged 18 to 49, this number rises to 35% of those aged 75 to 80 years, diminishing self-sufficiency, independence, and quality of life. By 2050, it is estimated that there will be only five young people for every old person, as compared with seven or eight today. "We will need other avenues of support for an aging population," Agrawal noted. "This is one technology that has the potential to fill the gap in care fairly inexpensively."

Source <https://www.sciencedaily.com/releases/2019/08/190806131449.htm>

Chemical Engineering

4. Ultra-Fast Bomb Detection Method Could Upgrade Airport Security

Researchers from the University of Surrey have revealed a new ultra-fast method to detect materials that could be used to build explosives. The new detection method is able to analyse a wider range of materials than current thermal based detection systems used in today's airports, while reducing false positive reports. A team of researchers from Surrey detail how they have built on their previous ground-breaking work on super-fast fingerprint drug testing, to develop a technique that is able to detect key explosives in just 30 seconds. The new method, which uses swabbing material to collect samples of explosives, is able to detect substances such as nitrotoluenes, trinitrotriazine, hexamethylene triperoxide diamine and nitroglycerine. Detection of peroxide-based explosives is key as high-profile terrorist attacks such as the London bombings in 2007 used devices made from these materials. Surrey's swab spray technique is able to achieve higher sensitivity results than previously published works and was also tested on dirty surfaces such as new and used keyboards. Dr Melanie Bailey, co-author of the paper from the University of Surrey, said: "It's the unfortunate reality that security, especially in our airports, has to stay several steps ahead of those that wish to cause harm and destruction. The current thermal based way of detecting explosive material is becoming outdated and has the propensity of producing false positives. What we demonstrate with our research is an extremely fast, accurate and sensitive detection system that is able to identify a wide range of explosive materials." Dr Catia Costa, co-author of the paper from the University of Surrey, said: "The need for fast screening methods with enhanced selectivity and sensitivity to explosives has reached a new boiling point with the recent terrorist activity. The use of paper spray for applications such as these may help reduce false-negative events whilst also allowing simultaneous detection of other substances such as drugs, as previously reported by our group." Dr Patrick Sears, co-author of the paper from the University of Surrey, said: "The critical advantage of this system is the ability to uniquely identify the explosive being detected, making it much less likely to create false alarms. The selectivity of this system means that it could also be used to identify a range of other threat materials whilst the sensitivity would allow the detection of invisible traces of explosives."

Source <https://www.sciencedaily.com/releases/2019/08/190829101051.htm>

5. Future of LEDs Gets Boost from Verification of Localization States in InGaN Quantum Wells

Light-emitting diodes made of indium gallium nitride provide better luminescence efficiency than many of the other materials used to create blue and green LEDs. But a big challenge of working with InGaN is its known dislocation density defects that make it difficult to understand its emission properties. Researchers in China report an InGaN LED structure with high luminescence efficiency and what is believed to be the first direct observation of transition carriers between different localization states within InGaN. The localization states were confirmed by temperature-dependent photoluminescence and excitation power-dependent photoluminescence. Localization states theory is commonly used to explain the high luminescence efficiency gained via the large number of dislocations within InGaN materials. Localization states are the energy minima states believed to exist within the InGaN quantum well region (discrete energy values), but a direct observation of localization states was elusive until now. "Based primarily on indium content fluctuations, we explored the 'energy minima' that remain within the InGaN quantum well region," said Yangfeng Li, the paper's lead author and a now postdoctoral fellow at the Hong Kong University of Science and Technology. "Such energy minima will capture the charge carriers -- electrons and holes -- and prevent them from being captured by defects (dislocations). This means that the emission efficiency is less affected by the large number of defects." The group's direct observation of localization states is an important discovery for the future of LEDs, because it verifies their existence, which was a long-standing open scientific question. "Segregation of indium may be one of the reasons causing localization states," said Li. "Due to the existence of localization states, the charge carriers will mainly be captured in the localization states rather than by nonradiative recombination defects. This improves the high luminescence efficiency of light-emitting devices." Based on the group's electroluminescence spectra, "the InGaN sample with stronger localization states provides more than a twofold enhancement of the light-output at the same current-injection conditions as samples of weaker localization states," Li said. The researchers' work can serve as a reference about the emission properties of InGaN materials for use in manufacturing LEDs and laser diodes. They plan to continue to explore gallium nitride-related materials and devices "not only to gain a better understanding of their localizations but also the properties of InGaN quantum dots, which are semiconductor particles with potential applications in solar cells and electronics," Li said. "We hope that other researchers will also conduct in-depth theoretical studies of localization states

Source <https://www.sciencedaily.com/releases/2019/09/190904135642.htm>

6. Energy-Efficient Power Electronics: Gallium Oxide Power Transistors with Record Values

Powerful electronic components are indispensable for future communications, for the digital transformation of society and for artificial intelligence applications. On a footprint as small as possible, they should offer low energy consumption and achieve ever higher power densities, thus working more efficiently. This is where conventional devices reach their limits. Scientists all over the world are therefore investigating new materials and components that can meet these requirements. The Ferdinand-Braun-Institut (FBH) has now achieved a breakthrough with transistors based on gallium oxide (beta-Ga₂O₃). The newly developed beta-Ga₂O₃-MOSFETs (metal-oxide-semiconductor field-effect transistor) provide a high breakdown voltage combined with high current conductivity. With a breakdown voltage of 1.8 kilovolts and a record power figure of merit of 155 megawatts per square centimeter, they achieve unique performance figures close to the theoretical material limit of gallium oxide. At the same time, the breakdown field strengths achieved are significantly higher than those of established wide bandgap semiconductors such as silicon carbide or gallium nitride. In order to achieve these improvements, the FBH team tackled the layer structure and gate topology. The basis was provided by substrates from the Leibniz Institute for Crystal Growth with an optimized epitaxial layer structure. As a result, the defect density could be reduced and electrical properties improved. This leads to lower on-state resistances. The gate is the central 'switching point' of field effect transistors, controlled by the gate-source voltage. Its topology has been further optimized, allowing to reduce high field strengths at the gate edge. This, in turn, leads to higher breakdown voltages.

Source <https://www.sciencedaily.com/releases/2019/08/190827095034.htm>

7. Chandrayaan-2 Successfully Separates from Vikram Lander Carrying Pragyan Rover: ISRO



India's first moon lander Vikram successfully separated from its mother spacecraft Chandrayaan-2 on September 2, 2019 (Monday) at 1:15pm, said Indian Space Research Organisation (ISRO). According to ISRO, the Vikram Lander is currently located in an orbit of 119km x 127km. The Chandrayaan-2 Orbiter continues to orbit the Moon in its existing orbit. The Chandrayaan-2 spacecraft comprises three segments -- the Orbiter (weighing 2,379kg, eight payloads), the lander 'Vikram' (1,471kg, four payloads) and rover 'Pragyan' (27kg, two payloads). Vikram also carries Pragyan. The health of the Orbiter and Lander is being monitored from the Mission Operations Complex (MOX) at ISRO Telemetry, Tracking and Command Network (ISTRAC) in Bengaluru with support from Indian Deep Space Network (IDSN) antennas at Bylalu, near Bengaluru. All the systems of Chandrayaan-2 Orbiter and Lander are healthy. The Indian space agency said post Vikram's separation, there will be two de-orbital operations. The manoeuvres will achieve an orbit around the moon of 36km x 110km, ISRO had earlier said. After the moon touchdown by Vikram, the rover -- Pragyan -- will roll down from it to carry out research for which it was designed. Even after the separation of Vikram, the Orbiter will continue to fly around the moon. On July 22, the Rs. 978-crore Chandrayaan-2 was launched into space by India's heavy-lift rocket Geosynchronous Satellite Launch Vehicle-Mark III (GSLV Mk III).

Source <https://gadgets.ndtv.com/science/news/isro-chandrayaan-2-vikram-lander-separation-september-2-2094336>

8. Process Flow for High-Res 3D Printing of Mini Soft Robotic Actuators

Soft robots are a class of robotic systems made of compliant materials and capable of safely adapting to complex environments. They have seen rapid growth recently and come in a variety of designs spanning multiple length scales, from meters to submicrometers. In particular, small soft robots at millimeter scale are of practical interest as they can be designed as a combination of miniature actuators simply driven by pneumatic pressure. They are also well suited for navigation in confined areas and manipulation of small objects. However, scaling down soft pneumatic robots to millimeters results in finer features that are reduced by more than one order of magnitude. The design complexity of such robots demands great delicacy when they are fabricated with traditional processes such as molding and soft lithography. Although emerging 3D printing technologies like digital light processing (DLP) offer high theoretical resolutions, dealing with microscale voids and channels without causing clogging has still been challenging. Indeed, successful examples of 3D printing miniature soft pneumatic robots are rare. Recently, researchers from Singapore and China, namely from the Singapore University of Technology and Design (SUTD), Southern University of Science and Technology (SUSTech) and Zhejiang University (ZJU), proposed a generic process flow for guiding DLP 3D printing of miniature pneumatic actuators for soft robots with overall size of 2-15 mm and feature size of 150-350 μm . In DLP 3D printing, photo-absorbers are commonly added into polymer solutions to enhance the printing resolutions in both lateral and vertical directions. Meanwhile, overly increasing the dose leads to rapid degradation in the material's elasticity which is crucial for soft robots to sustain large deformations. "To achieve a reasonable trade-off, we first selected a photo-absorber with good absorbance at the wavelength of the projected UV light and determined the appropriate material formulation based on mechanical performance tests. Next, we characterized the curing depth and XY fidelity to identify the suitable combination of exposure time and sliced layer thickness," explained co-first author Yuan-Fang Zhang from SUTD. "By following this process flow, we are able to produce an assortment of miniature soft pneumatic robotic actuators with various structures and morphing modes, all smaller than a one Singapore Dollar coin, on a self-built multimaterial 3D printing system. The same methodology should be compatible with commercial stereolithography (SLA) or DLP 3D printers as no hardware modification is required," said corresponding author Professor Qi Ge from SUSTech. To exemplify the potential applications, the researchers also devised a soft debris remover comprising a continuum manipulator and a 3D printed miniature soft pneumatic gripper. It can navigate through a confined space and collect small objects in hard-to-reach positions. The proposed approach paves the way for 3D printing miniature soft robots with complex geometries and sophisticated multimaterial designs. This integration of printed miniature soft pneumatic actuators into a robotic system offers opportunities for potential applications such as jet-engine maintenance and minimally invasive surgery.

Source <https://www.sciencedaily.com/releases/2019/08/190829100944.htm>

Energy Engineering

9. New Rechargeable Aqueous Battery Challenges Lithium-Ion Dominance

A new rechargeable high voltage manganese dioxide zinc battery, exceeding the 2 V barrier in aqueous zinc chemistry, is the latest invention by City College of New York researchers. With a voltage of 2.45-2.8V, the alkaline MnO₂|Zn battery, developed by Dr. Gautam G. Yadav and his group in the CCNY-based CUNY Energy Institute, could break the long dominance of flammable and expensive lithium (Li)-ion batteries in the market. To break the previously daunting 2 V barrier in aqueous zinc chemistry, primary inventor Yadav and his team interfacially engineered two different aqueous electrolytes that deliver the theoretical capacity (308mAh/g) reversibly for many cycles. "The voltage of current commercially available alkaline MnO₂|Zn batteries is around 1.2-1.3V, and this has been considered low compared to Li-ion which has a voltage >3V," said Yadav. Voltage has been Li-ion's greatest asset and as helped fuel its rise in an energy hungry world. "Unfortunately it contains elements that are toxic and geopolitically sensitive with Asian countries having a monopoly on mining and manufacturing them," added Yadav. "

Source <https://www.sciencedaily.com/releases/2019/08/190820154247.htm>

Interdisciplinary Engineering and Special Fields

10. Electronic Glove Offers 'Humanlike' Features for Prosthetic Hand Users

People with hand amputations experience difficult daily life challenges, often leading to lifelong use of a prosthetic hands and services. An electronic glove, or e-glove, developed by Purdue University researchers can be worn over a prosthetic hand to provide humanlike softness, warmth, appearance and sensory perception, such as the ability to sense pressure, temperature and hydration. While a conventional prosthetic hand helps restore mobility, the new e-glove advances the technology by offering the realistic human hand-like features in daily activities and life roles, with the potential to improve their mental health and wellbeing by helping them more naturally integrate into social contexts. The e-glove uses thin, flexible electronic sensors and miniaturized silicon-based circuit chips on the commercially available nitrile glove. The e-glove is connected to a specially designed wristwatch, allowing for real-time display of sensory data and remote transmission to the user for post-data processing. Chi Hwan Lee, an assistant professor in Purdue's College of Engineering, in collaboration with other researchers at Purdue, the University of Georgia and the University of Texas, worked on the development of the e-glove technology. "We developed a novel concept of the soft-packaged, sensor-instrumented e-glove built on a commercial nitrile glove, allowing it to seamlessly fit on arbitrary hand shapes," Lee said. "The e-glove is configured with a stretchable form of multimodal sensors to collect various information such as pressure, temperature, humidity and electrophysiological biosignals, while simultaneously providing realistic human hand-like softness, appearance and even warmth." Lee and his team hope that the appearance and capabilities of the e-glove will improve the well-being of prosthetic hand users by allowing them to feel more comfortable in social contexts. The glove is available in different skin tone colours, has lifelike fingerprints and artificial fingernails. "The prospective end user could be any prosthetic hand users who have felt uncomfortable wearing current prosthetic hands, especially in many social contexts," Lee said. The fabrication process of the e-glove is cost-effective and manufacturable in high volume, making it an affordable option for users unlike other emerging technologies with mind, voice and muscle control embedded within the prosthetic at a high cost. Additionally, these emerging technologies do not provide the humanlike features that the e-glove provides. The research team is seeking partners to collaborate in clinical trials or experts in the prosthetics field to validate the use of the e-glove and to continue optimizing the design of the glove.

Source <https://www.sciencedaily.com/releases/2019/09/190904081320.htm>

Engineering Innovation in India

Interesting Facts About Chandrayaan-2, India's Moon Mission to The Lunar South Pole

Moon is the closest cosmic body at which space discovery can be attempted and documented. It is also a promising testbed to demonstrate the technologies required for deep-space missions. **Chandrayaan-2** attempts to foster a new age of discovery, increase our understanding of space, stimulate the advancement of technology, promote global alliances, and inspire a future generation of explorers and scientists. Moon provides the best linkage to Earth's early history. It offers an undisturbed historical record of the inner solar system environment. Though there are a few mature models, the origin of the moon still needs further explanations. The lunar south pole is especially interesting because of the lunar surface area here that remains in shadow are much larger than that at the north pole. There is a possibility of the presence of water in permanently shadowed areas around it. In addition, the South Pole region has craters that are cold traps and contain a fossil record of the early solar system.



To trace back the origin and evolution of the Moon, now, it becomes essential to do extensive mapping of the lunar surface to study variations in lunar surface composition. Evidence for water molecules discovered by Chandrayaan-1, requires further studies on the extent of water molecule distribution on the surface, below the surface and in the tenuous lunar exosphere to address the origin of water on Moon. **Chandrayaan-2** is an Indian lunar mission that will boldly go **where no country has ever gone before** the Moon's south polar region. Through this effort, the aim is to improve our understanding of the Moon - **discoveries that will benefit India and humanity as a whole**. These insights and experiences aimed at a paradigm shift in how lunar expeditions are approached for years to come propelling further voyages into the farthest frontiers.

Apart from these things, Chandrayaan-2 is -

- **First space mission** to conduct a soft landing on the Moon's South Polar Region
- **First Indian expedition** to attempt a soft landing on the lunar surface with home-grown technology
- **First Indian mission** to explore the lunar terrain with home-grown technology

Moreover, India will become the fourth country in the world to soft-land on the lunar surface, a feat previously accomplished by only three other countries - the US, Russia, and China

Major challenging aspects of Chandrayaan-2 mission

Some of the technological challenges of this mission are:

- The propulsion system consisting of throttleable engines to ensure landing at low touchdown velocity
- **Mission management** - propellant management at various stages, engine burns, orbit, and trajectory design
- **Lander Development** - Navigation, guidance and control, sensors for navigation and hazard avoidance, communication systems and lander leg mechanism for a soft landing
- **Rover Development** - Roll down (from the lander) mechanism, roving mechanism (on the lunar surface), development and testing of power systems, thermal systems, communication and mobility systems
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14 Interesting Facts About Chandrayaan-2

1. Chandrayaan-2 consists of three components: **the Orbiter, the Lander (Vikram) and the Rover (Pragyaan)**. The Lander of Chandrayaan 2 is named Vikram after **Dr Vikram A Sarabhai**, the Father of the Indian Space Programme.
2. Chandrayaan 2's algorithm is wholly developed by India's scientific community.
3. **Unlike Chandrayaan-1**, Chandrayaan-2 will attempt to soft-land its Vikram module on the lunar surface and deploy a six-wheeled Rover, Pragyaan on the Moon to carry out several scientific experiments.
4. **The mission life of Chandrayaan-2's Orbiter** will be one year whereas the mission life of lander (Vikram) and rover (Pragyan) will be one Lunar day which is equal to fourteen earth days.
5. Apart from studying the Moon's surface, Chandrayaan-2 will also examine the satellite's outer atmosphere.
6. **The Orbiter payloads will conduct** remote-sensing observations from a 100 km orbit while the Lander and Rover payloads will perform in-situ measurements near the landing site.
7. Chandrayaan-2 will attempt to soft-land the lander -Vikram and rover- Pragyan in a high plain between two craters, **Manzinus C and Simpelius N, at latitude of about 70° south**.
8. Chandrayaan-2 has several science payloads to expand the lunar scientific knowledge through a detailed study of **topography, seismography, mineral identification and distribution, surface chemical composition, thermo-physical characteristics of topsoil and composition of the tenuous lunar atmosphere**.
9. Chandrayaan 2's Dual Frequency Synthetic Aperture Radar (DFSAR) will measure the **quantitative estimation of water-ice in the polar regions**.
10. Its Dual Frequency Radio Science (DFRS) experiment will study the temporal evolution of electron density in the Lunar ionosphere.
11. Chandrayaan 2 Large Area Soft X-ray Spectrometer or CLASS will measure the Moon's X-ray Fluorescence (XRF) spectra to examine the presence of major elements such as **Magnesium, Aluminium, Silicon, Calcium, Titanium, Iron, Sodium**, and its XRF technique will detect these elements by measuring the characteristic X-rays they emit **when excited by the Sun's rays**.
12. Chandrayaan 2's Solar X-ray Monitor (XSM) will observe the X-rays emitted by **the Sun and its corona**, measure the intensity of solar radiation in these rays, and support CLASS.
13. Chandrayaan-2 will **study water molecule distribution** using infrared spectroscopy, synthetic aperture radiometry & polarimetry as well as mass spectroscopy techniques.
14. The Chandrayaan-2 mission is a **precursor to the ambitious Gaganyaan project**, which aims to place **three Indians in space by 2022**.

Source <https://www.indiatoday.in/education-today/gk-current-affairs/story/14-unknown-facts-chandrayaan-2-india-s-moon-mission-to-lunar-south-pole-1574222-2019-07-27>