

Yaantrika

Newsletter



Department of Mechanical Engineering

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Vision and Mission of the Institute

Vision

- To be one of the premier Institutes of Engineering and Management education in the country.

Mission

- To provide Engineering and Management education that meets the needs of human resources in the country.
- To develop leadership qualities, team spirit and concern for environment in students.

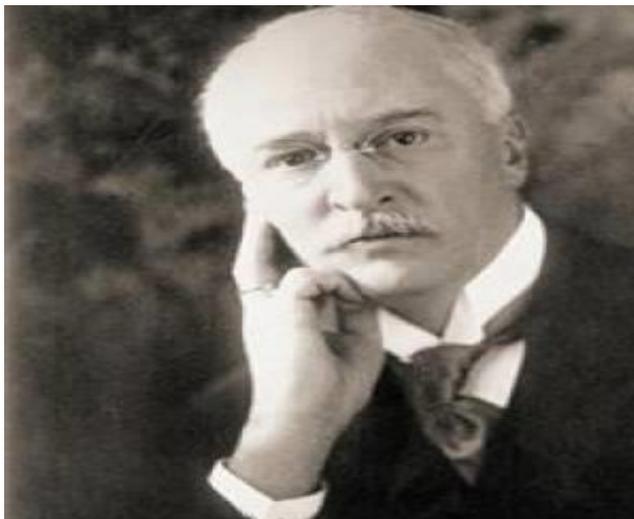
Vision and Mission of the Department

Vision

- To be a premier department for education in Mechanical engineering in the state of Karnataka, that moulds students into professional Engineers.

Mission

- To provide a teaching-learning process that prepares engineers to meet the needs of industry and higher learning.
- Provide environment for self learning to meet the challenges of changing technology and inculcate team spirit and leadership qualities to succeed in professional career.
- To instill professional ethics and concern for environment for the benefit of society.



“Yaantrika” from the Department of Mechanical Engineering, is dedicated to “Rudolf Christian Karl Diesel” a German Inventor and Mechanical Engineer, famous for the invention of the Diesel Engine.

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Recycling Energy from Tube Trains

A world-first trial that uses the latest technology to collect waste energy from Tube train brakes has captured enough power to run a large Underground station, opening the way for significant savings across the network. The trial puts London at the cutting edge technology and clearly demonstrates how energy from trains can be recovered to power Tube stations

London Underground (LU) used the new 'inverter' system at the Cloudesley Road substation on the Victoria line for a five-week trial, and in just one week of operation, the new technology recovered enough power to run a station as large as Holborn for more than two days per week.

The results show that the new green technology could allow LU to tap into a previously inaccessible resource, reducing its overall carbon footprint and saving as much as £6m every year for reinvestment in improving transport. As well as saving energy, the technology has the added benefit of lessening the amount of heat generated by trains braking in tunnels, which in turn would reduce the energy required to operate LU's cooling systems. The results indicated that 1 (MWh) of energy can be captured per day. The results are really exciting and show huge potential for harnessing some of the immense energy in Tube trains. This complements wider work to make other forms of public transport cleaner and greener, including buses, where hybrid and zero-emission technology is introduced. This state-of-the-art regenerative braking system has the potential to transform how stations are powered across the TfL network, unlocking massive power savings and significantly reducing energy bills.

The trial follows a number of other measures put in place by the Mayor and Transport for London to 'green' the Capital's Tube system. In January, it was announced the historic Greenwich Power Station would be revamped to transform it into a low-carbon power generator for the Tube network. Its six new gas engines will replace existing boilers and provide cheaper, cleaner power for the Tube, with waste heat being channelled into a new local heat network that will also benefit residents.

LU is carrying out its largest program of modernization in decades, with major stations, trains, and track and control systems being updated or replaced to meet the needs of the rapidly growing city and provide a 30 percent increase in capacity across the Tube network.

Gautam Kumar, IV sem

Mechanics Meets Chemistry!!!

Mechanics meets chemistry in a new way of manipulating matter and drive chemical reactions along a desired direction. The new technique utilizes mechanical force to alter the course of chemical reactions and yield products not obtainable through conventional conditions. Potential applications include materials that more readily repair themselves, or clearly indicate when and where they have been damaged.

It has been known for decades that breaking high molecular weight polymeric materials often involves the scission of carbon-carbon bonds. This reaction underscores the fact that the macroscopic forces are many orders of magnitude greater than the inter-atomic forces that hold molecules together. Researchers are intrigued by the seductive idea that macroscopic forces can be harnessed and used to perform productive chemistry. By harnessing mechanical energy, we can go into molecules and pull on specific bonds to drive desired reactions. The directionality of the mechanical force makes this approach to control reaction fundamentally different from the usual chemical and physical approaches.

To demonstrate this technique a mechanically active molecule called a mechanophore was placed at the centre of a long polymer chain. The polymer chain was then stretched in opposite directions by a flow field created by the collapse of cavitating bubbles produced by ultrasound, subjecting the mechanophore to a mechanical tug of war. A situation was created where a chemical reaction could go down one of the two pathways. By applying force to the mechanophore, it could be biased as to which of those pathways the reaction chose to follow. One potential application of the technique is as a trigger to divert mechanical energy stored in stressed polymers into chemical reactions leading to new pathways such as self-healing reactions. In the original self-healing concept, microcapsules of a healing agent are ruptured when a crack forms in the material. Capillary action then transports the healing agent to the crack, where it mixes with a chemical catalyst, and polymerization takes place.

With new mechanical triggers, mechanical energy would initiate the polymerization directly. The cross-linking of neighbouring chains would prevent further propagation of a crack and avoid additional damage. It is possible to use mechanical force to steer chemical reactions along pathways that are unattainable by conventional means.

Tejas Sharma, IV sem

Graphene is going to change the world

Since its discovery a decade ago, scientists have hailed graphene as the wonder material that could replace silicon in electronics, increase the efficiency of batteries, the durability and conductivity of touch screens and pave the way for cheap thermal electric energy, among many other things.

It is one atom thick, stronger than steel, harder than diamond and one of the most conductive materials on earth. Scientists are still trying to understand the basic physics of this unique material. Researchers have made a breakthrough in our understanding of graphene's basic properties, observing for the first time electrons in a metal behaving like a fluid.

An electron super highway

In ordinary, three-dimensional metals, electrons hardly interact with each other. But graphene's two-dimensional, honeycomb structure acts like an electron superhighway in which all the particles have to travel in the same lane. The electrons in graphene act like mass less relativistic objects, some with positive charge and some with negative charge. They move at incredible speed $1/300$ of the speed of light and have been predicted to collide with each other ten trillion times a second at room temperature. These intense interactions between charge particles have never been observed in an ordinary metal before.

An ultra-clean sample was created by sandwiching the one-atom thick graphene sheet between tens of layers of an electrically insulating perfect transparent crystal with a similar atomic structure of graphene. If graphene is on top of something that's rough and disordered, it will interfere with movement of electrons. It is really important to create graphene with no interference

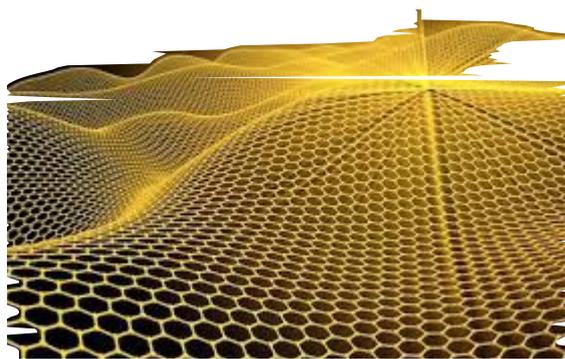
Thermal soup of positive and negatively charged particles was set up on the surface of the graphene, and flow of particles was observed as thermal and electric currents.

A black hole on a chip

How water flows or how a ball curves is described by classical physics. Very small things, like electrons, are described by quantum mechanics while very large and very fast things, like galaxies, are described by relativistic physics. High-energy systems like supernovas and black holes can be described by linking classical theories of hydrodynamics with Einstein's theories of relativity.

When the strongly interacting particles in graphene were driven by an electric field, they behaved not like individual particles but like a fluid that could be described by hydrodynamics. Instead of noticing how a single particle was affected by an electric or thermal force, the conserved energy was seen as it flowed across many particles, like a wave through water.

Physics discovered by studying black holes and string theory, was seen in graphene, this is the first model system of relativistic hydrodynamics in a metal. Moving forward, a small chip of graphene could be used to model the fluid-like behaviour of other high-energy systems.



Molecular Structure of Graphene

Industrial implications

We know that strongly interacting electrons in graphene behave like a liquid. How does that advance the industrial applications of graphene?

Materials conduct heat in two ways: through vibrations in the atomic structure or lattice; and carried by the electrons themselves. There was a need to find a clever way to ignore the heat transfer from the lattice and focus only on how much heat is carried by the electrons. At finite temperature, the electrons move about randomly: the higher the temperature, the noisier the electrons. By measuring the temperature of the electrons, the thermal conductivity of the electrons can be measured precisely.

This work provides a new way to control the rate of heat transduction in graphene's electron system, and will be the key for energy and sensing-related applications.

Converting thermal energy into electric currents and vice versa is notoriously hard with ordinary materials. But in principle, with a clean sample of graphene there may be no limit to how good a device can be done.

Sensor Fusion Technology Has Never Been Faster Or Easier

Multi sensor fusion and integration is a rapidly evolving research area and requires interdisciplinary knowledge in control theory, signal processing, artificial intelligence, probability and statistics, etc. The advantages gained through the use of redundant, complementary, or timelier information in a system can provide more reliable and accurate information.

Multi sensor applications play an essential role in many areas such as advanced driver assistance systems, autonomous driving, multimodal human-machine interfaces, robotics and aerospace. Developing these kinds of applications in the lab or in the vehicle typically requires capturing, synchronizing and processing data in real time from various sensors such as cameras, laser scanners, radars or GNSS receivers and interfacing with communication networks, such as CAN, LIN or Ethernet. During the test and development phase, it is also essential to be able to record, visualize and play back time-correlated data. It provides a modular development and run-time environment for x86- and ARM-based platforms supporting operating systems such as Microsoft Windows® and Linux.

With RTMaps, data is acquired asynchronously and each data sample is captured along with its time stamp at its own genuine pace. This ensures that all data is time correlated. RTMap's unparalleled performance on multi core CPUs enables users to get the most out of their computing architectures and easily set up applications that handle multiple, high-bandwidth data streams, including real-time processing and data fusion. Sensor data can be recorded and played back synchronously for offline development and testing under reproducible conditions. RTMaps provides comprehensive component libraries for automotive sensors, buses and perception algorithms and it supports any type and quantity of sensors and actuators. Algorithms can be developed easily by means of block diagrams or by integrating own code using dedicated software development kits for C++ and Python. It is even possible to process data on multiple distributed platforms while preserving time coherency and synchronization of heterogeneous data streams.

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Functionality

General

Developing, testing, validation and benchmarking of processing algorithms and data fusion algorithms

2-D & 3-D visualization

- Data time-stamping, latency measurement, downstream resynchronization
- Data logging and real-time data playback for offline development and validation
- Graphical programming by means of block diagrams and easy integration of C++, Python and Simulink code
- Optimized, multithread run-time engine and dedicated real-time capabilities
- Data processing and data synchronization on multiple distributed platforms

Supported sensors, communication buses and protocols

- Cameras (GigE Vision, USB 2.0, USB 3.0, FireWire, analog, Camera Link, HDR, from Point Grey, IDS, Basler, AVT, NIT)
- Stereo-vision heads
- Laser scanners (IBEO, Velodyne, SICK, Hokuyo, Quanergy)
- Radars (Delphi, Autocruise, Continental)
- Time-of-flight sensors (LeddarTech)
- CAN, LIN (PEAK, Vector, NI, .dbc files)
- GPS, IMUs (SBG Systems, OxTS, Xsens, VectorNav, IXSEA, Phidgets)
- Communication (TCP & UDP, ASAM XCP over Ethernet, DDS, ASAM XIL API)
- Analog/digital I/O (NI DAQ, Data Translation, Phidgets, Audio)
- Eye trackers (Pertech, faceLAB and biometrics (BIOPAC, Becker Meditec)
- Motion capturing (Kinect, Xtion, Vicon)

Targeted applications

- Advanced driving assistance systems
- Autonomous vehicles
- Mobile robotics
- Data recorders
- Advanced multimodal HMIs

Shreyas R, VIII sem

Electronic Component Testing: A Non-Contact Sport

As electronic circuit boards and components get smaller and more powerful, inherent heat can cause significant damage. Infrared thermography can identify hot spots, allowing for improved thermal management and greater advances in circuit board design.

As chips get smaller and their densities within components grow, heat can become a real problem. Government agencies are spending crores to find new thermal management technologies to help designers make substantial reductions in electronic component size, weight and power consumption and thus eliminate the problem of heat dissipation.

Contact vs. Non-Contact Testing

Designers of VXI boards were experiencing a greater-than-normal flow of returns, with complaints about the boards overheating. The engineers were using simulation modelling to determine where to design in heat sinks and add fans to dissipate heat. Thermo-couples were also mounted to the board during testing and quality phases, hoping to identify potential design issues. Where to mount the thermocouples if hot spots are not known? Mounting hundreds of probes to a board is unrealistic and not really effective. That is the beauty of infrared which has an advantage over thermocouples

Aiming it at a board, the hot spots were instantly apparent and were nowhere near the heat sinks, fans, or thermocouples. After the analysis of the thermal image, the hottest points on the board were easily identified. The engineers realized their fans and heat syncs were not mounted near the hottest components. Knowing more about the device's true thermal properties and heat dissipation can be keys to improving simulation models, improving overall design, and speeding up the rapid prototyping phase of the development cycle.

Accounting for Shrinkage

As devices continue to shrink, the challenges of heat grow. Going from a board that is roughly 9" x 13", down to a device the size of a smart phone with individual components a few hundredths of a micron. Components of that size can't even accommodate a thermocouple to measure heat. The solution is to attach an RTD probe, but even this small probe can skew heat measurements by acting as a heat sink. When they get small enough, a probe can affect the thermo-responsivity of the device. Non contact temperature measurement, such as infrared imaging, is required.

Another use is detecting hot spots for failure analysis. Measuring absolute temperatures isn't as important as finding small hot spots that are causing subtle thermo-differentials. These hot spots can be indicative of failure points or troubles with the device. A technique called "Lock-In Thermography" can improve the sensitivity of the camera by more than 10 times, making it much easier to detect small, subtle hot spots. Infrared inspection can also help with quality assurance by identifying insufficient solder. Today's infrared cameras offer up to 16 times the resolution of cameras used ten years ago for nearly the same cost. As costs continue to come down, thermal infrared cameras will become a standard thermal measurement tool on every test bench.

Challenge to thermal imaging is correcting for surface emissivity. Many electronic boards have components with varying emissivities, some of which are shiny, and therefore, have a low emissivity. This makes them more challenging to measure for absolute temperatures.

Techniques such as high emissivity coatings, image subtraction, and emissivity mapping are examples of ways to compensate. In image subtraction, the infrared inspection system software captures an image before the device is energized, in order to create a thermal baseline. That baseline image is then subtracted from subsequent images after the device is turned on, thereby removing the static reflected temperature values, leaving only the true temperature deltas due to the heating of the device. Image subtraction effectively removes all the apparent thermal hot spots due to erroneous static reflected temperatures from lower emissivity devices and lets you focus on true thermal hot spots generated from the device itself.

The Payoff

With infrared imaging, testing and identifying a problem that once were impossible to find, or at least difficult to locate quickly will be an easy task. For manufacturers, the ROI would be images that pin-point a design flaw, thus reducing test times and time-to-market. Thermal imaging allows engineers to see a complete thermal map of the circuit board, with temperature values for each pixel. There is no concern about mounting thermocouples or RTDs in the wrong place. Thermal images show exactly where the hottest points on a board are. Thermal imaging can be employed in many stages of the research and development process, beyond simple circuit board imaging.

INDUSTRY VISIT

- The department of Mechanical Engg.,BNMIT organized a one day educational visit to **YUKEN INDIA LIMITED(YIL)** in technical & financial collaboration with YUKEN KOGYO COMPANY LIMITED,JAPAN(YKC),leaders in Oil Hydraulic Equipment on 20th April 2016.
- 70 Students of 6th Sem Mechanical Engineering branch along with faculty members visited **Taegutec Jigani Ind.** area,Bangalore on 18th & 24th Feb 2016.



DEPARTMENTAL ACTIVITIES

- A Technical Talk on “Thermal Management of Electronic Equipment” by Dr. K N Seetaramu,Chair Professor,PESU,on 5th March 2016.



- A technical talk on”**Role of Engineers in Global Automation**” by Shri Karthikeyan D,Deputy Manager-Design & Projects,SKF India Ltd.,Bengaluru,was arranged in our institution on Friday,22nd April 2016.

STUDENT’S ACHIEVEMENTS

- Second semester students bagged the first place in the **IPL summer 2016 competition.**



- Sixth semester students bagged the second place in **VTU business plan** presentation held at MSRIT, Bangalore organised by VTU.



- Varun S Deshpandee of 6th Sem Mechanical Engg. Secured third place in **AUTOMATIVE**

QUIZ held at Gate Academy (A Forum of IIT/IISC Graduates) 2016.

- Madhu Channaiah of 8th Sem Mechanical Engineering, has won silver **&gold medal in skit, installation & one act play** annual inter college VTU cultural fest-2016.

- Harish A,Hemant S,Chetan Sriharsha, Abhishekh Bhat of 6th Sem has secured Second Prize in **Paper presentation competition** of Jnanasangama-2016 held on 3rd May at VCET Puttur.

- Prasanna Kumar of 8th Sem Mechanical has won Gold & Silver medal in Folk Orchestra ,skit, one act play in annual intercollege **VTU CULTURAL FEST-2016**
- Pavan Kumar Havinal, Naveen Kumar, Shankar J, Prakash KV of 8th SEM Mechanical Engineering won First best project award for the project **“Design & Fabrication of Stir Casting Furnace”** during the year 2015-16 at BNMIT.
- Shreyash A ,Rajashekhar, Rayyan Anwar, Vijay Sai, Shreyash N of 8th SEM Mechanical Engineering won second best project award for the project **“Development & Fabrication of fused 3D-Printer”** during the year 2015-16 at BNMIT
- Madhu Channaiah of 8th SEM Mechanical Engineering won first best project Presentation award for the project **“Performance Emission & soot Properties from a Diesel, Bio Diesel Ethanol Blend Fuelled Engine”** during the year 2015-16 at BNMIT.
- Ambar Ramprasad Shreyash of 8th SEM Mechanical Engineering won Second best project Presentation award for the project **“Optimization of Aircraft Bulkhead Structure using MSC/Patran & Nastran Software”** during the year 2015-16 at BNMIT

FOOD FOR THOUGHT

At a small company, parking spaces are reserved for the top executives: CEO, president, vice president, secretary, and treasurer with the spaces lined up in that order. The parking lot guard can tell at a glance if the cars are parked correctly by looking at the colour of the cars. The cars are yellow, green, purple, red, and blue, and the executives names are Alice, Bert, Cheryl, David, and Enid.

The car in the first space is red.

- * A blue car is parked between the red car and the green car.
- * The car in the last space is purple.
- * The secretary drives a yellow car.
- * Alice's car is parked next to David's.
- * Enid drives a green car.
- * Bert's car is parked between Cheryl's and Enid's.
- * David's car is parked in the last space.

1. Who is the secretary?

A. Enid B. David C. Cheryl D. Alice

2. Who is the CEO?

A. Alice B. Bert C. Cheryl D. David

3. What colour is the vice president's car?

A. Green B. Yellow C. Blue D. Purple

Answers

1. Option D, Cheryl cannot be the secretary, since she's the CEO, nor can Enid, because she drives a green car, and the secretary drives a yellow car. David's, the purple car, is in the last space. Alice is the secretary, because her car is parked next to David's, which is where the secretary's car is parked.

2. Option C, CEO drives a red car and parks in the first space. Enid drives a green car; Bert's car is not in the first space; David's is not in the first space, but the last. Alice's car is parked next to David's, so Cheryl is the CEO.

3. Option A, vice president's car cannot be red, because that is the CEO's car, which is in the first space. Nor can it be purple, because that is the treasurer's car, which is in the last space, or yellow, because that is the secretary's. The president's car must be blue, because it is parked between a red car (in the first space) and a green car, which must be the vice president's.