WELCOME TO OPEN DAY 2020!

EXHIBITS | DEMOS | EXPERIMENTS

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GROUND FLOOR | FIRST FLOOR | SECOND FLOOR | HIGH VOLTAGE LAB
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<td>EE Dept. Entrance Foyer</td>
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<td>Power Systems</td>
<td>An overview of Power Generation, Transmission and Distribution</td>
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| B      | B108     | High Power Lab          | 1. Levitation with linear motion  
2. Levitated rotating disc  
3. B-H curve demonstration  
4. Demonstration of switched reluctance motor principle |
| C      | C117     | Power electronics lab1  | Exhibition of different power electronic converters                                         |
|        | C119     | Protection and Monitoring (PAM) Lab | Behavior of Domestic loads during Normal load conditions and Series arc faults.               |
|        | C122     | Electronic & microprocessor lab | Exhibition of Power electronic components and power electronics lab course experiments       |
|        | C124     | Power Systems           | Electrical Substation Operation in the Lab                                                 |
**Demonstration of B-H Curve**

**B-H curve:-**
- Property of core materials used in electrical machines.
- Shows the variation of its magnetic permeability
- Area enclosed = Energy lost (in J) for 1 pu volume of core in 1 cycle

**Schematic of setup:-**

**Experimental setup**

**Variation of B-H curve with frequency**
SWITCHED RELUCTANCE MACHINE (SRM)

Operating Principle

- Unaligned
  - Zero torque on rotor

- Partially aligned
  - Torque on rotor

- Aligned
  - Zero torque on rotor

Excitation Principle

- Excitation started just after unaligned position, and withdrawn just before aligned position
- Excitation pattern AA’ - CC’ - BB’ - AA’ for clockwise movement

SRM Applications

- Home appliances
- Automotive
- Spindles
- Turbo-charger
- Turbines
- Compressor
- Blower
MAGLEV

ROTATE AND LIFT
LENZ’S LAW
LC RESONANCE

@ HIGH POWER LAB!
BE PREPARED TO GET LEVITATED!!
@ HIGH POWER LAB

CONSTRUCTION

LEVITATION

LINEAR MOTION

WORKING
- Rotating magnetic field turned to linear magnetic field
- Eddy current levitation

APPLICATIONS
- Transportation (Low & medium speed trains)
- Conveyor systems
- Sliding doors
- Accelerators and Launchers

PEG, EE, IISc, Bangalore
**Power Electronic Converter Topologies**

**Introduction**
- Power converter is a basic module in power electronics-based energy conversion applications.
- Based on the frequency form on the input and output sides, converters are categorized as: dc-ac (inverter), dc-dc (converter), ac-dc (rectifier).

**Double Pulse Test**
- Characterization of device from different manufacturers, at elevated temperatures.

**Experimental Results**
- 1st pulse: setup required load current
- 2nd pulse: characterize the device

**General Purpose Inverter Stack**
- (a) GPIS power board
- (b) Gate driver
- (c) Sensor cards
- (d) Protection card
- (e) DSP controller

**Power Electronics Group**
Room No: C122

Power Electronics Lab

Electronic Packages
Learn about SMT (Surface Mount), THT (Through Hole) Technology and many more.

PE Switches
BJT
MOSFET
IGBT

Op-Amps

Resistance
THT
SMT

Boost Converter

Linear Power Supply

PE Lab
- Lab Exercises and Procedures
- Inductor Design and Principles
- Heat Sink Mounting
- DC-DC Converter Open & Closed Loop Operation.
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| A    | A208     | MILE Lab | 1. Demo: Natural sounding Text-to-speech in English and its extension to sound like our beloved PM Modi in Hindi  
2. Demo on "Automatic Speech Recognition for Tamil, Kannada, Hindi and English" |
| B    | B 218    | Spectrum lab | 1. Glaucoma diagnostics on the smartphone -  
2. Time and pitch scaling of speech -  
3. Spectrum Works -- An assortment of various Image Processing demos |
|      | B220     | Power Electronics Group | Tesla coil demonstration |
|      | B222     | Control & Network Systems | "Coordinated and networked robotics" |
| C    | C234     | DSP LAB | 1. Bidirectional Visitor Counter with automatic room light control.  
2. Image Denoising in FPGA  
3. Breathing and Heart rate monitoring system  
4. Automatic Ambulance Detection in Trafficlights |
|      | C237     | Power Systems | Power Grid Sensors: Power Quality and Phasor Measurements |
Wing B
CONTROL & NETWORK SYSTEMS GROUP
ON-DEMAND DYNAMIC MULTI-MODAL TRANSPORTATION

Multi-Modal Last mile connectivity for you
- Homes to offices to the city, an all integrated real-time transportation network optimization and decision making.
- Environment friendly and lower system travel cost and time.
- Last-mile connectivity based feeding schemes.

CONTROL & NETWORK SYSTEMS GROUP
WIRELESS SENSOR AND ROBOTIC NETWORKS

Challenges:
- unreliable sensor nodes
- Limited energy, computation, communication resources
- Privacy and Security
- Frequent network changes

How do we control and gather information on the network scale?
FOR AUTONOMOUS VEHICLES EQUIPPED WITH V2X COMMUNICATION, EFFICIENTLY MANAGE THE INTERSECTION WITHOUT SIGNAL LIGHTS

CONTROL & NETWORK SYSTEMS GROUP
MODELLING AND CONTROL OF SWARMS

• Swarms appear frequently in Nature and in Engineering Applications
• Flocking of birds and swarming nature of insects
• Water in a system of connected tanks seek the same level
• We use this nature to make a swarm of agents converge to a distribution

Applications:
• Shaping the distribution of the fleet of a ride sharing service e.g. Uber, Ola etc.
• Coordinating large groups of self-interested humans

For more details visit: http://auto.ee.iisc.ac.in/index.html
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| B          | B 309    | MILE Lab 2                 | 1. Controlling music using your muscles  
2. "Visual Illusions" Biofeedback, Is your heart in sync with your breathing??            |
| C-324      |          | LISA (Lab for Imaging Sciences and Algorithms): | 1. Video stylization  
2. Finding human pose in a video                                                             |
| C Wing Foyer |         | LEAP Lab                   | 1. Human language learning/speaker change detection  
2. EEG Analysis  
3. Representation Learning and Speech Recognition  
4. Speaker/language recognition  
5. Diarization  
6. Speech Enhancement |
| C326 and C315 |        | SPIRE LAB                  | 1) How fast can you sketch a Vowel?  
2) Speak and know your ALS score  
3) How good is your pronunciation?  
4) See how you say !!  
5) Speak to know your facial muscle activation's  
6) Can you fool the computer by mimicking celebrity voice?  
7) Pitch Follower  
8) Turn & twist your speech  
9) who is who? |
ARE YOU ATTENTIVE WHILE WATCHING?

LET'S CHECKOUT @ MILE LAB 2 ROOM: B309

Time to grab some chocolates!!!
Image Analysis and Computer Vision Lab (EE 314)

Generate your own art in different styles.

See the magic.

Let AI do your Homework.

Be the Picasso of your generation.

Indian Institute of Science

Wing C
**Spire : Room No - 315**

**Mimic your favourite celebrity**

![Diagram showing the process of mimicking a celebrity's speech features and generating an i-vector to calculate the score.]

**How fast can you sketch the Vowel ??**

![Diagram showing the process of analyzing speech, vocal tract response, and global excitation to determine the speed of sketching a vowel.]

**See How You Say !!**

![Diagram illustrating feature extraction and articulatory inversion to visualize speech.]

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**Speak To Know Your Facial Muscle Activations**

**Introduction:**
This system allows users to express emotions as input and demonstrates which facial muscles are being activated for that emotion.

**Method:**
This system uses a 6-LED (6 Light Emitting Diode) sensor module developed by us to detect the facial movements. The LED readings are recorded simultaneously to build the training set for the model. Facial EMG signals measure the potential difference when a muscle contracts during speech production. Medtronic micro-detectors (MPDC) feature an embedded 4-channel EMG amplifier and the EMG signals are processed and filtered. Each channel represents the specific muscle location. They are fed into the model as the training set, with the MPDC array as input and the EMG array as output.

**Environment Setup:**
As shown in the figure, 3 channels of EMG were recorded using Ag/AgCl surface electrodes with a circular recording area having a diameter of 1 cm.

The electrodes were positioned to capture the activity of 3 articulator regions: the buccal transducer (channel 1, 3, the aperture region), the phonator channel (channel 2, 4), the depressor muscle (channel 3), the anterior body of the glottis (channel 1), and the tongue (channel 2).

**Conclusion:**
Given the speech input, it is now possible to see which muscles are getting activated.

Additionally, the muscle activity is normalized, thus, it is relatively easier to calibrate data and has a wide appeal for practical usage as well.

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**Venue: Room no 325**

**Pitch Follower**

**Pitch Estimation**

![Diagram showing the process of pitch estimation and tracking.]

**Catch your pitch if you can??**

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**Open Day' 20**
How good is your Pronunciation?

How would you sound like?

INPUT SOUND

OUTPUT SOUND

z[n] = x[N - n]
Z(n) = x(n) + x[n - n_1] + Mx[n - n_2]
y(n) = sin[2π - f_0 - 1], Z(n) = x(n)y(n)
Z(n)_1 = x(n)^2
Z(n)_2 = x(n)^2
Z(n) = x(N - n)

OPEN DAY 2020
Venue: C326

Speak & know your ALS score

GOAL: Predict ALS

How??
Learning and Extraction of Acoustic Patterns (LEAP) Lab

Image + Audio = Fast Learning?

Decoding Auditory Brain

Why do we need two ears?

Your voice is your password

Who spoke when?

Speaker 1  Speaker 2  Speaker 3  Speaker 4

C328, II Floor, EE.
IISc Open Day 29-02-2020
ELECTRICAL ENGG. Dept.
HV Lab

Venue:
High Voltage Engineering building
(Take underpass beside Prakruthi restaurant to reach location)

Demos @Ground floor:

1. Local air breakdown along surface (Litchenberg figures)

![Image A]

2. Principle of ion thrusters and arc inception/quenching

![Image B]
3. Simulating naturally occurring lightning

4. Damages due to lightning currents
Introduction To Electromagnetic Launch

- The conventional chemical-propellant based launchers have reached their physical limits and hence it is difficult to raise the launch velocity any further.
- Electromagnetic launch technology uses Electromagnetic energy to drive an object at high or hyper velocity (above 2 km/s).
- Different types of EM launchers have been developed and coilgun is one such launcher which is being demonstrated here.

Induction Coilgun

Principle of Electromagnetic Induction:

- The induced emf in a closed loop equals the negative of the time rate of change of magnetic flux linkage with the loop.
  \[ E = -\frac{d\Psi}{dt} \]
  where \( E \) = induced emf and \( \Psi \) = magnetic flux linkage with the loop.
- Alternatively, the direction of any magnetic induction effect is such as to oppose the cause of the effect.

(a) Motion of magnet causes increasing downward flux through loop.
   \[ \vec{B}_{\text{induced}} \]
   The induced magnetic field is upward to oppose the flux change. To produce this induced field, the induced current must be counterclockwise as seen from above the loop.

(b) Motion of magnet causes decreasing upward flux through loop.
   \[ \vec{B}_{\text{induced}} \]
   The induced magnetic field is downward to oppose the flux change. To produce this induced field, the induced current must be clockwise as seen from above the loop.

Possible Applications

- Missile Launching
- Artillery Guns
- Naval Guns
- Anti-tank Guns
Electromagnetic Manufacturing

Pulsed Power Laboratory, Indian Institute of Science Bangalore

INTRODUCTION TO ELECTROMAGNETIC MANUFACTURING

- Electromagnetic Manufacturing uses an intense transient magnetic field generated by a pulsed power source to apply a transient force on the work piece.
- Contraction of the workpiece takes place without any direct mechanical contact.
- It uses a coil to apply the required electromagnetic force during the discharge of a capacitor bank.
- Used for shaping and joining of similar or dissimilar materials based onprocess of forming, heating, forging, stamping etc.

WORKING PRINCIPLE

- These techniques are based on transient force to achieve the required goal.
- A high voltage charged capacitor bank discharges through a transformer/induction coil placed in the proximity of the work piece.
- Interaction of induced current in the work piece with the magnetic field produces the coil leads to strong repulsive force by opposing magnetic fields.
- Workpiece deformation occurs via electromagnetic repulsion and the required objective is then achieved.

APPLICATIONS

- Electromagnetic flat sheet metal forming
- Tubular expansion or compression of similar and dissimilar metals such as aluminum, copper, steel or aluminum alloy.
- No heat treatment required.
- Applications in manufacturing of aerospace and automotive components.
- High energy processing of powdery metals.

ADVANTAGES OVER CONVENTIONAL PROCESSES

- Improved formability (the amount of stretch available without tearing)
- Welding can be greatly suppressed.
- Forming can be combined with painting and assembling with dissimilar components including glass, plastic, ceramics, and other metals.
- Close tolerances are possible as thin sheet can be formed and the setting stress is reduced.
- Lightweight dies are sufficient which can reduce tool costs.
- Lubricants are reduced or are unnecessary, so forming can be used in severe conditions.
- Mechanical contact with the workpiece is not required, so accurate surface finishing and design can be achieved.
- The electromagnetic pulse can be controlled to high degree of accuracy and hence the forming is highly reproducible.
- The operation of the equipment is simple which consists of charging and discharging of capacitors.
- The process does not leave tool marks.
- The parts made are stronger than the parent material unlike in all the other processes.
- Hardening takes place due to high strain rate forming, which is favourable.
- During the process of forming, the material is impact loaded into plastic region, resulting into permanent deformation.
- It is a green process (no smoke).

DISADVANTAGES

- Non-conductive materials cannot be formed directly, but can be formed using a conductive die plate.
- The high voltages and currents involved require careful safety considerations.