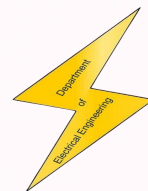


Department of Electrical Engineering

Indian Institute of Technology (Indian School of Mines) Dhanbad



VIBHAV



Vol.I, No.4

December, 2024

Monthly Newsletter

MESSAGE FROM HoD's DESK

By PROF. SUKANTA DAS



Dear All,

Hope you are doing well!

With a great pleasure, I hereby introduce the fourth edition of the Monthly Newsletter of the Department of Electrical Engineering: "VIBHAV".

This edition of the Newsletter primarily focuses to report the achievements of the department for the month of December-2024. Apart from the contributions of teaching fraternity, the students' contributions in technical report writing are the other key highlights in this version.

I invite you to go through this edition of our Monthly Newsletter. I also request our students to engage themselves actively for the betterment of the Monthly Newsletter. All of you are requested to forward your constructive comments at ee@iitism.ac.in. The Editorial Team is committed to publish much improved versions in the forthcoming editions of "VIBHAV".

Wish you all a very Happy New Year!

Thank you all.

Best regards.

ABOUT THE DEPARTMENT

The Electrical Engineering department was established in the year 2005. The four-year B.Tech. program in Electrical Engineering was started in the academic session 2006-07. Though, the Department of Electrical Engineering is one of the latest of the existing departments of the Institute, the Electrical Engineering Section existed as a part of earlier Mining Machinery Engineering department from 1975. Apart from different B.Tech. programs, the department at present also offers M.Tech programs in Power System Engineering and Power Electronics & Electrical Drives. Through the Ph.D. and Post-Doctoral Programs majority of the research activities are being carried out in the department.

INDIVIDUAL ACHIEVEMENT

Prof. Sukanta Halder has bagged a DST funded project named "Sustainable Learning Environments Design of an Off-Grid Distributed Energy System Integrating an Intelligent Water Management Pump in the Eruvapalem Village School Premises" with the total sanctioned amount of Rs. 85,96,356/- as the lead PI.

Hearty Congratulations to him for his achievement!



Prof. Sukanta Halder

PUBLICATIONS

Journals

- Rajendra Kumar Sharma, **Bhukya Krishna Naick**, "A novel quasi oppositional artificial rabbits optimization algorithm for optimal distributed generation allocation in radial distribution systems under different load models," *Computers and Electrical Engineering*, vol. 122, 109965, 2024 (to be published in March 2025).
- V.K.Raushan, S.Ganguly, **A.Baral**, S.Chakravorti, "A Model with Time-Varying Parameters for Condition Assessment of Transformer Oil," *IEEE Instrumentation & Measurements Magazine*, In Press, Paper ID. IMM-D-24-00117, 2024.
- Sandeep Tripathy, Ashish Shrivastava, and **Kartick C. Jana**, "An Efficient Energy Management System for a Micro-grid System Considering the Volatility

- of Hybrid Renewable Energy,” *International Journal of Hydrogen Energy*, 2024 (Accepted).
- M. Kumar, **T. Maity**, and M.K. Kirar, “Energy savings by optimizing the speed of the primary ventilation fans in Indian underground coal mines based on VOD and TOU tariffs,” *Energy Efficiency*, vol. 17, no. 105, 2024.
 - **Sethupathy S.**, D. S. Balsara, D. Bhoirya and H. Kumar, “Techniques, Tricks and Algorithms for Efficient GPU-Based Processing of Higher Order Hyperbolic PDEs,” *Communications on Applied Mathematics and Computation*, Springer Nature, vol. 6, pp. 2336–2384, 2024.
 - Aniket Vatsa and **Ananda Shankar Hati**, “Enhanced Visual Identification of Dimensionally Expanded FDS for Transformers Insulation Aging State Assessment,” *IEEE Transactions on Industry Applications*, 2024 (Early Access).

Conferences

- Alok Ranjan, and **Devara Vijaya Bhaskar**, “Resilient PMSM Motor Control: Advanced Fault-Tolerant Strategies for Open-Phase Faults,” *IEEE International Conference on Power Electronics Drives and Energy Systems (PEDES)*, NIT Karnataka, 2024. (Presented)
- Alok Ranjan, and **Devara Vijaya Bhaskar**, “Optimized Voltage Harmonic Injection Strategies to Mitigate Speed Fluctuations in PMSM EV Drives,” *IEEE International Conference on Power Electronics Drives and Energy Systems (PEDES)*, NIT Karnataka, 2024. (Presented)
- Alok Ranjan, and **Devara Vijaya Bhaskar**, “A Comprehensive Approach with Optimizing Current Harmonic Regulation in IPMSM Drive,” *IEEE International Conference on Power Electronics Drives and Energy Systems (PEDES)*, NIT Karnataka, 2024. (Presented)
- Alok Ranjan, and **Devara Vijaya Bhaskar**, “Optimized Model Predictive Current Control for Enhanced Light Commercial Vehicle Performance,” *IEEE International Conference on Power Electronics Drives and Energy Systems (PEDES)*, NIT Karnataka, 2024. (Presented)
- Amitesh Prakash, Alok Ranjan, **Vijaya Bhaskar Devara**, and Utkal Ranjan Muduli, “Torque Enhancement of BLDC Motor Considering Iron Loss: Modeling and Compensation Approach,” *IEEE International Conference on Power Electronics Drives and Energy Systems (PEDES)*, NIT Karnataka, 2024. (Presented)
- Amitesh Prakash, **Vijaya Bhaskar Devara**, Alok Ranjan Prashant Kumar, and Utkal Ranjan Muduli, “Advanced Control and Modeling for Enhanced BLDC Motor Efficiency and Performance,” *IEEE International Conference on Power Electronics Drives and Energy Systems (PEDES)*, NIT Karnataka, 2024. (Presented)
- Prakirty Kumari and **Dushyant Sharma**, “Performance and Stability Comparison of Grid Forming Inverters with Droop and VSG Controls for Autonomous Microgrids,” *IEEE Power India International Conference (PIICON)*, MNIT Jaipur, 2024.
- Pankaj Sarkar, Arnab Ghosh, **Nitai Pal**, Sudipta Chakraborty and Faizan A Khan, “Gravity Battery: A Scalable Solution for Renewable Energy Storage in Mining Applications,” *International Conference on Mine Ventilation and Environment for Green Mining (MVEGM)*, Puri, Odisha, 2024.
- Promit Kumar Saha, **Nitai Pal**, Faizan A. Khan and Aftab Alam, “EV Battery Charging System and Impact of Uncoordinated Charging on Distribution Network,” *International Conference on Energy Systems, Drives and Automations (ESDA)*, Kolkata, 2024.
- Dilip Kumar, Rammanohar Lohia, Yogesh Kumar Chauhan, Ajay Shekhar Pandey, and **Nitai Pal**, “A Novel Hybrid MPPT Approach for Tip Speed Ratio and Pitch angle control in Wind Energy Conversion System using Sea Lion – Puma Algorithm,” *International Conference on Energy Systems, Drives and Automations (ESDA)*, Kolkata, 2024.
- Swati Lipsa, Ranjan Kumar Dash, Subhra Debdas, Korhan Cengiz, Pankaj Kumar and **Nitai Pal**, “An accurate and explainable approach towards cardiac disease detection using bidirectional long short-term memory,” *International Conference on Energy Systems, Drives and Automations (ESDA)*, Kolkata, 2024.
- Arka Dutta, Bheemaiah Chikondra, Pradipta Kumar Pal and **Kartick Chandra Jana**, “A Data Driven Energy Efficient Control of Induction Motor Drive with Vector Control,” *IEEE International Conference on Power Electronics, Drives and Energy Systems (PEDES)*, NIT Suratkal, 2024.
- A Shekhar, **S. Mandal**, “Design and Development of Cryptophane-A clad Micro Optical Ring Resonator based Methane Sensor for Underground Coal Mine Applications,” *Mine Ventilation and Environment for Green Mining (MVEGM)*, IIT (ISM) Dhanbad, 2024. (Presented)
- Md Asif Hussain, and **Ananda Shankar Hati**, “Model-Free Predictive Current Control of a Matrix Convert-fed Induction Motor,” *IEEE Power & Energy Society Singapore Chapter 2nd Power Electronics and Power System Conference*, Singapore, 2024.
- Md. Asif Hussain, **Ananda Shankar Hati**, and Vinod Khadkikar, “Model Reference Adaptive System Based on Ultra-Local Model for Induction Motor Drives,” *IEEE International Conference on Power Electronics, Drives and Energy Systems (PEDES)*, NIT Suratkal, 2024.
- Vinayak Ajinath Mastud, **Ashok Kumar**, and Sanjay Kumar Sena, “Step-by-Step Reliability Analysis of Wireless Battery Charger for Electric Vehicles using the Markov Process,” *International Conference on Sustainable Energy Technologies and Computational Intelligence (SETCOM)*, Gandhinagar, 2024. (Accepted)
- B. Mudi, **S. Halder**, S. Tolani, Sk Bittu, N. Das, and U.S. Kumar, “Adaptive Control Framework for Enhanced Current Regulation in Bidirectional Battery Charger,” *IEEE International Conference on Power, Energy, Environment and Intelligent Control (PEEIC)*, GLBITM, 2024.
- B. Mudi, **S. Halder**, S. Tolani, Gaurav, Sk Bittu, and N. Das, “A High-gain Non-isolated DC-DC Converter for Electric Vehicle Battery Charger,” *International*

Conference on Emerging Technologies and Applications in Electrical Engineering (ICETAAE), NIT Raipur, 2024. (Presented)

- Anagha Rajendran K P, **Soumyabrata Barik**, and Sudarshan Swain, “Fuzzy PSO Algorithm for Optimal DG Integration in a Practical Indian Distribution Network Using Logic OR-Based Forward Backward Load Flow”, *IEEE International Conference on Smart and Sustainable Developments in Electrical Engineering (SSDEE)*, IIT (ISM) Dhanbad, 2024. (Accepted)

PATENTS

Patent no. 202431100461, Dated 27th Dec. 2024, “Photovoltaic Based Single DC Input Hybrid Output Converter,” C. Verma, S. K. Sena and **A. Kumar** to Indian Patent Office on 27th December 2024.

AWARDS RECEIVED

- The best paper award is received for “Resilient PMSM Motor Control: Advanced Fault-Tolerant Strategies for Open-Phase Faults” in *PEDES* Conference at NIT Karnataka, 2024.
- The second best paper award is received for the paper titled “A Novel Hybrid MPPT Approach for Tip Speed Ratio and Pitch angle control in Wind Energy Conversion System using Sea Lion– Puma Algorithm” in the *International Conference on Energy Systems, Drives and Automations (ESDA2024)* organized by Applied Computer Technology, Kolkata.
- The second best paper award is received for the paper titled “An accurate and explainable approach towards cardiac disease detection using bidirectional long short-term memory” in the *International Conference on Energy Systems, Drives and Automations (ESDA2024)* organized by Applied Computer Technology, Kolkata.
- The best paper award is received for the paper titled “A Data-Driven Energy Efficient Control of Induction Motor Drive

with Vector Control” presented in the *IEEE International Conference on Power Electronics, Drives and Energy Systems (PEDES2024)*, at NIT Suratkal, Karnataka.

OUTREACH ACTIVITIES

- **Prof. Nitai Pal** delivered expert lecture as Keynote Speaker for FDP on IPR and the *International Conference on Energy Systems, Drives and Automations (ESDA2024)* organized by Applied Computer Technology, Kolkata.
- **Prof. Nitai Pal** acted as a session chair in the *International Conference on Energy Systems, Drives and Automations (ESDA2024)* organized by Applied Computer Technology, Kolkata.
- **Prof. Nitai Pal** delivered expert lecture in the EDP Course on “Refresher Training Program for CIL Executives,” organized by the Department of Management Studies & Industrial Engineering, IIT (ISM) Dhanbad
- **Prof. Nitai Pal** evaluated a Ph.D. Thesis of NIT Patna as an External Examiner.
- **Prof. Sukanta Halder** served as National Advisory Committee member of the conference *International Conference on Emerging Technologies and Applications in Electrical Engineering (ICTAAE 2024) Conference*, NIT Raipur, India.
- **Prof. Sukanta Halder** chaired a technical session in *International Conference on Emerging Technologies and Applications in Electrical Engineering (ICTAAE 2024) Conference*, NIT Raipur, India.
- **Prof. Sukanta Halder** served as Technical Program Committee member in *International Conference on Power, Energy, Environment and Intelligent Control (PEEIC-2024)*, Greater Noida, India.
- **Prof. Soumyabrata Barik** served as Technical Session Chair in *International Conference on Emerging Technologies and Applications in Electrical Engineering (ICETAAE-2024)*, NIT Raipur, India.

INTERNATIONAL VISITS

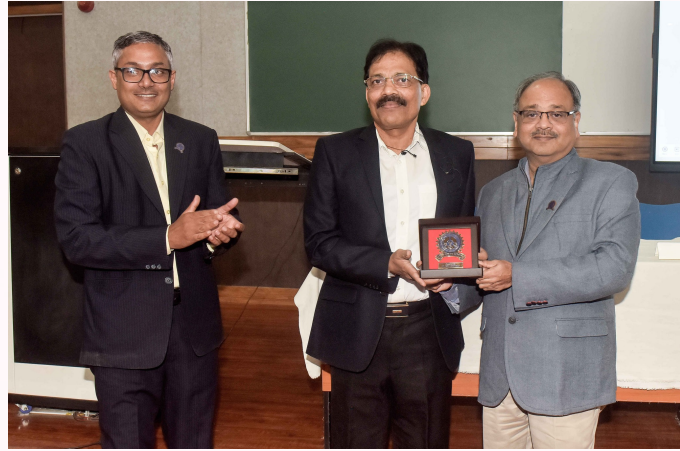
Prof. Tanmoy Maity attended *International Conference on Energy and Power (ICEP2024)* in Bali, Indonesia during 4th December, 2024 to 6th December, 2024 for presenting a research Paper on “Power recovery from waste air of mine ventilation fans using wind turbines”.

EXPERT LECTURES IN THE DEPARTMENT

Prof. Sukanta Halder delivered an expert lecture on “Evolving Intelligent e - Propulsion System for Next - Generation e-Mobility” on 16th December 2024 organized by The Institution of Engineers (India) Dhanbad Local Centre Jointly With Department of Electrical Engineering, IIT (ISM), Dhanbad.
Venue: Departmental Seminar Hall (1st Floor, NAC)



Prof. Arijit Baral organized an Expert Lecture on the theme “Emerging Roles of Hydrogen in Power and Transport Sectors” on 24th December 2024. The lecture, technically co-sponsored by DEIS Chapter of IEEE Kolkata Section, provided an excellent and unique opportunity to interact with the expert to develop research ideas related to the potential of Hydrogen in transport and power sectors. The lecture was delivered by Prof. K.V. Vidyanandan, Professor of Practice, NIT Calicut
Venue: NAC Auditorium (1st Floor, NAC)



Glimpses from the Expert Lecture by Prof. K.V. Vidyandanan, Professor of Practice, NIT Calicut in EE Department.

UPCOMING EVENTS

First *IEEE International Conference on Smart and Sustainable Developments in Electrical Engineering (SSDEE)* from 28th Feb. to 2nd Mar. 2025.

🔗Link to Access: <https://people.iitism.ac.in/ssdee-2025/>

Five-day Executive Development Program entitled “Preventive Maintenance and Electrical Safety in Mines” to be organized by the Department of Electrical Engineering, IIT (ISM), Dhanbad from 20th Jan. to 24nd Jan. 2025.

Coordinators: **Prof. Nitai Pal** and **Prof. Pradip K. Sadhu**

🔗Link to Access: <https://www.iitism.ac.in/announcement>

STUDENTS' CORNER

Understanding the Rise of Intelligent Fault Diagnosis (IFD) **Ashika Singh – (23JE0167)**

Intelligent Fault Diagnosis (IFD) has made a huge impact on managing machines and systems, especially as we search for more accurate, automated ways to interpret all the data our equipment generates. Many studies note a surge in IFD-related research “since the 2010s,” which makes sense given our increasing reliance on technology and the sheer volume of operational data we produce.

In the past, spotting potential problems in engines, HVAC systems, or even complex factory lines often meant sending people to perform manual checks or relying on rigid, rule-based programs. Neither approach was ideal. Some operations run with hundreds of chillers, motors, pumps, or air-handling units (AHUs), and the traditional methods often couldn't keep up with shifting operational condi-

tions or huge data streams. As sensors become more common, it's not sustainable (or cost-effective) for humans to sift through every alert or reading.

One big stumbling block in older systems was relying on “artificial feature extraction”, which meant experts had to painstakingly encode what to look for—like a certain vibration peak or temperature spike—to diagnose a fault.

That's slow and can miss unfamiliar issues. In contrast, machine learning systems "begin to release the contribution of human labor," essentially letting the algorithms adapt and learn from new data on their own. Picture a campus with countless chillers and fans: if just one pump strainer clogs, you might get higher energy use, hot offices, or worse, a total shutdown. Modern IFD aims to catch these red flags immediately—sometimes before the folks in the building ever notice.

If your facility could instantly flag small motor or pump glitches, how much unplanned downtime (and money) would you save each year?

Beyond convenience, reliable IFD solutions could completely reshape how we maintain and upgrade industrial systems. Some researchers talk about blending deep learning, transfer learning, and domain adaptation so that knowledge from one environment can be leveraged in another. It's like borrowing insights from a wind farm's turbines and applying them to a factory-related system. The potential payoff is enormous: fewer failures, shorter diagnostic times, and a smooth path to commissioning brand-new systems without starting from zero.

From Traditional Models to End-to-End Learning

The earliest wave of fault diagnosis tools—like expert systems, artificial neural networks (ANNs), or support vector machines (SVMs)—did provide some automation but still demanded humans to pick out features (think vibration frequencies or wavelet transforms). It was a decent start but didn't scale well to enormous datasets or complex fault signatures.

Enter deep learning, which is now widely hailed for "end-to-end diagnosis procedures that directly bridge the raw monitoring data to the fault states." In plain terms, models like stacked autoencoders (AEs) and convolutional neural networks (CNNs) can take raw time-series sensor data—from fan speeds and pressure differentials to coil temperatures—and learn the telltale patterns that lead to a breakdown, all without someone having to set detailed thresholds.

In fact, "the advent of deep learning theories has reformed IFD in further re-

leasing the artificial assistance." This not only empowers operators who lack deep expertise to interpret sophisticated results via dashboards and automated alerts, but it also means we can seamlessly combine diverse data sources—vibrations, temperatures, currents—into a single model. CNN-based systems have proven especially good at tackling varied data, making them robust in spotting weird behavior that older methods might overlook.

How would you feel about letting an AI decide on a critical fix for a massive piece of equipment rather than waiting for a human specialist's opinion?

That said, deep learning can be pretty hungry for labeled data, and real-world machinery doesn't always break frequently enough to provide those labels. This is where cutting-edge research steps in, using methods like domain adaptation and transfer learning to share insights from a "source domain" with ample labeled data over to a "target domain" that might have very little.

The Power of Transfer Learning and Domain Adaptation

Transfer learning essentially "attempts to use the diagnosis knowledge from one or multiple tasks to other related ones," which is especially relevant in setups where you might have limited examples of faults. Think about a state-of-the-art data center with new cooling towers and not many historical breakdowns on record. Instead of waiting for something to fail, a transfer learning model can draw on data from a similar, older facility with a well-documented track record, jump-starting your fault detection.

One particularly exciting angle is the rise of "GAN-based approaches," where generative adversarial networks create "fake but similar" labeled data that imitates potential failures. Other research focuses on aligning the "maximum mean discrepancy (MMD)" so that the target system's features match up with labeled data from the source system, making the model more resilient to shifts in load or environment.

Some folks have even developed "instance-based approaches" like TrAdaboost, which recalibrates how much weight the model gives to source or target

data. If the target site only has a few labeled failures, you lean more heavily on those samples, ensuring the model tunes itself to local conditions. Together, all these tools make it easier for advanced IFD to be adapted quickly, whether you are expanding an existing plant or standing up a completely new facility.

If a seasoned factory can "teach" a brand-new facility to spot faults, do you see operators trusting an AI-based knowledge transfer right away?

These developments could transform not just energy infrastructure but also industries like automotive, aerospace, and general manufacturing. Thanks to IoT sensors, we can pump massive, real-time data into cloud platforms that run near-instant analytics. That means fewer outages, safer operations, and lower costs—a new chapter for machine health management.

A Future Vision for Automated Maintenance and Human Collaboration

Looking ahead, "online IFD" is definitely the next big thing. Instead of offline, historical analysis, we're moving toward live streams of data, aided by ideas like "incremental learning" and "lifelong learning," which let models refine themselves continually. Of course, "negative transfer" is still an issue: if two systems are just too different, borrowing knowledge might backfire. But new work in "transitive transfer learning" tries to fix that, choosing only relevant portions of the knowledge or adjusting them carefully so the overall model still benefits.

In tandem with this, "explainable AI" is becoming more important because neural networks can feel like a total "black box." One promising strategy is to bring in "rigorous machine learning theories," such as SVM or hidden Markov models, on top of deep learning's raw power. Others are exploring wavelet-based visuals or "feature inversion" that literally shows you which parts of a signal triggered a particular fault prediction. A bit of transparency goes a long way toward building confidence in these models.

Down the road, it's entirely plausible that AI-based fault diagnosis will be woven into everything, from HVAC units to electric vehicle chargers. That means

fewer emergency repairs, lower energy consumption, and minimized environmental impact. We've already seen "recent breakthroughs in adversarial learning (GAN) and domain adaptation" that let systems handle differences between machines or conditions, so, eventually, something like a gear failure in one plant could instantly inform a sister facility halfway around the world.

Is a future with virtually no surprise downtime a pipe dream, or is machine learning about to make it a reality?

In closing, the rapid shift from manual checks to sophisticated IFD really shows how far we've come in "bridging the relationship between collected data and the health states of machines." By embracing deep learning, transfer learning, and the sheer volume of data we now gather

worldwide, we're on the cusp of remarkably stable and efficient operations. As organizations feed more high-quality data into these models, our approach to maintenance and reliability will never be the same. Tomorrow's machines and systems will likely operate with fewer disruptions and better performance—an exciting prospect for anyone who's ever dealt with unexpected breakdowns or costly repairs.

The Best Paper of the Department award by IIT(ISM) Dhanbad is received by **Mr. Anand Kumar**, a Ph.D. scholar under the guidance of **Prof. Somnath Pan**, for the paper titled "Design of fractional order PID controller for load frequency control system with communication delay," *ISA Transactions*, Vol. 129, pp. 138-149, 2022.

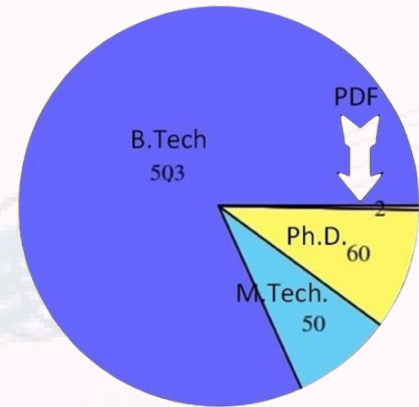
Hearty Congratulations to both of them!

Dr. Sourav Basak and **Dr. Parimal**, are awarded with the Ph.D. degree in Electrical Engineering in the month of Dec. 2024.

Hearty Congratulations to both of them!

Mr. Alok Ranjan, a full-time Research scholar, received a "Ned Mohan Memorial Student Travel Award" in *IEEE International Conference on Power Electronics Drives and Energy Systems (PEDES 2024)*, NIT Karnataka, Surathkal, India.

Hearty Congratulations to both of them!



Student Strength

EDITORIAL TEAM

Editor-in-Chief	: Prof. Sukanta Das
Associate Editors	: Prof. Soumyabrata Barik & Prof. Shyam A. B.
Student Editor	: Upasana Tharu
☎	: +91-326-2235287, 5443, 5024
✉	: ee@iitism.ac.in
📅	: +91-326-2296563