

## Report of activities of IEEE IAS Kolkata Chapter for 2015

The IEEE Industry Applications (IAS) Chapter Kolkata organized **eight** technical lecture programmes in **2015**. They also hosted the delegates from the IEEE-IAS Head-Quarters in Kolkata. Details of the above activities are presented the following paragraphs.

- 1. The first Technical Lecture Meeting** was organized on 21<sup>st</sup> January, 2015, at the Department of Electrical Engineering at the Indian Institute of Engineering Science and Technology, Shibpur on the topic “Three Switch Cell Soft-switching Resonant Buck Converter for Point-of-load Application”. The talk was delivered by Mr. Anindya Ray, Engineer, Power Grid Corporation of India Ltd., Kolkata, India and past Masters student of IIT Kharagpur with specialization of Power Electronics and Machine Drives. The talk discussed the limitations of conventional PWM converters for high frequency point-of load (POL) application. Conventional PWM converters are less efficient for large conversion ratio, as compared to resonant converters, which utilize some soft-switching technique. The talk presented a resonant buck converter with only three switches and providing good efficiency for a large voltage step-down ratio at 1MHz switching frequency. Unlike conventional resonant topologies, no transformer was used in this case as minimum possible footprint was the target. Also a sampled-data model of the converter was derived instead of conventional state-space model as power is transferred at switching frequency. Detailed steady-state analysis of the converter along with simulation and experimental results are illustrated in this presentation. The speaker also gave a short discussion on the electronic PCB, which he had himself designed for the converter. The talk was attended by 36 participants, including five IEEE members.



Mr. Anindya Roy delivering his talk at the Electrical Engineering Department of IEST Shibpur



Mr. Anindya Roy receiving the certificate of appreciation from Prof. M. Sengupta, Chairman – IEEE-IAS Kolkata Chapter

- 2. The Second Technical Lecture Meeting** was organized on 6<sup>th</sup> February, 2015, at the Department of Electrical Engineering at the Indian Institute of Engineering Science and

Technology, Shibpur, on the topic “HVDC Design Considerations – A Utility Perspective.” The talk was delivered by Dr. Tapan K. Manna, Senior Electrical Engineer, working for M/s Burns and McDonnell in Kansas City, Missouri, USA. This topic describes key design considerations for a new LCC-HVDC and VSC-HVDC terminals. Major design factors and challenges with two different converter technologies will be discussed in this presentation. The presentation discussed regarding the basic design considerations, typical design studies, LCC-HVDC and VSC-HVDC Technologies, Converter Transformers, Harmonic Generations, Solar Storms and GIC, DC Blocking Schemes, Multi-terminal HVDC Systems, Application of DC Hybrid Circuit Breakers, Design of Ground Electrodes and Other Design Challenges. The talk was attended by 35 participants, including five IEEE members.



Dr. Tapan K. Manna delivering his talk at the Electrical Engineering Department of IEST Shibpur



Dr. Tapan K. Manna receiving the certificate of appreciation from Prof. M. Sengupta, Chairman – IEEE-IAS Kolkata Chapter

- 3. The Third Technical Lecture Meeting** was organized on 18<sup>th</sup> March, 2015 at the Department of Electrical Engineering at the Indian Institute of Engineering Science and Technology, Shibpur, on the topic “DC Voltage Balancing in three-level inverter.” The talk was delivered by Dr. Sibaprasad Chakrabarti, Chief Technology Officer – CSIR and CEO – Hertz Power Control. The talk presents the problem of neutral voltage balancing in inverters – starting from a single phase two-level inverter and then moving on to the case of three-level inverters. NPC (neutral-

point-clamped) three-level inverters suffer from fluctuations in neutral point voltage with uncontrolled neutral point current produced by PWM (pulse width modulation). This further produces unbalance in the three phase output voltages and is a well-known problem across the industries. This presentation described why the neutral voltage fluctuation problem arises when PWM is exercised. A step by step approach was presented to demonstrate how PWM technique needs to be modified to regain control over the neutral point current producing DC voltage unbalance. All these claims were backed up by the simulation results in MATLAB/SIMULINK platform. The talk was attended by 29 participants, including seven IEEE members.



Dr. Sibaprasad Chakrabarti receiving the certificate of appreciation from Prof. M. Sengupta, Chairman - IEEE-IAS Kolkata Chapter

- 4. The Fourth Technical Lecture Meeting** was organized on 11<sup>th</sup> June, 2015 at the Department of Electrical Engineering at Jadavpur University, on the topic “Roles and achievements of the Power Electronics group of the National Center for Photovoltaic Research and Education, IIT Bombay.” The talk was presented by Prof. Kishore Chatterjee, Professor, Department of Electrical Engineering, Indian Institute of Technology, Bombay. NCPRE has four subgroups working on 1) Silicon based PV cells, 2) New materials based PV cells, 3) Characterization and simulation of solar cells and 4) Power evacuation from solar PV systems through power electronic based interface. The talk presented a general overview of the achievements of Power Electronics group of the NCPRE. This was followed by a detailed discussion on one of the deliverables of the project entitled, the development of a reduced stage standalone PV system suitable for rural house hold applications. The talk was attended by seventeen participants, including six IEEE Members.
- 5. The Fifth Technical Lecture Meeting** was organized on 8<sup>th</sup> July, 2015 at the Department of Electrical Engineering at Indian Institute of Engineering Science and Technology, Shibpur, on the topic “Development of Earth-Abundant and Low-cost KesteriteCZTSSeThin Film Heterojunction Solar Cells.” The talk was presented by Dr. Sandip Das, Assistant Professor, Department of Electrical Engineering, Kennesaw State University, Georgia, USA. This presentation discussed on the fabrication and characterization of CZTSSe thin film solar cellsconcentrating on the major performance limiting factors.  $\text{Cu}_2\text{ZnSn}(\text{S}_x\text{Se}_{1-x})_4$ thin-films were grown on Mo-coated SLG substrates by a two-step vacuum-based technique in which physical vapour deposited stacked precursor layer (ZnS/Cu/Sn) was annealed under mixed

(S+Se) vapour. The hetero-junction was formed by deposition of n-CdS window layer on top of the p-CZTSSe absorber film via low-cost chemical bath deposition technique. Structural, compositional, and morphological properties of the CZTSSe films were investigated by Raman spectroscopy, scanning electron microscopy (SEM), energy dispersive X-ray spectroscopy (EDX), X-ray photoelectron spectroscopy (XPS), and atomic force microscopy (AFM). PV performance of the cells was evaluated under simulated AM1.5G solar radiation. The talk was attended by twenty three participants, including nine IEEE Members.



Dr. Sandip Das receiving the receiving the certificate of appreciation from Prof. M. Sengupta, Chairman – IEEE-IAS Kolkata Chapter

- 6. The Sixth Technical Lecture Meeting** was organized on 20<sup>th</sup> August, 2015 at the Department of Electrical Engineering at Indian Institute of Engineering Science and Technology, Shibpur, on the topic “Industrial Automation and Trends.” The talk was presented by Mr. Abhijit Maitra, Chief Manager of Automation division of Primetals Technologies India. This presentation discussed the role and trends of modern automation in industry. In industry power is used to produce goods or deliver service. Leaving out manual energy, other forms of energy have the best controllability through automation techniques applied by modern day controllers called Programmable Logic Controllers (PLC) or Distributed control System (DCS). Industrial automation while covers a large domain of its applicability, it is however extensively used in various motion control applications with Electrical motors. Automation has also found its application in the controlled delivery and management of electrical power to the consumer. The control system in earlier days achieved through relay-contactor logics are replaced today through PLC/DCS, which are also capable of handling regulatory controls through PID loops. The complexity of electrical circuitry is now transformed into more manageable software of these controllers. With advancement of technology, these controllers have become powerhouses in terms of deliverables other than just controlling functions. They are used for monitoring, data acquisition and further advanced usage like resource and production planning, maintenance regime, forecasting and diagnostics, recommendations by analytical modelling techniques etc. The modern trends in Industrial automation is taking leverage of the progress in wireless technology, big data, cloud computing, IoT, enterprise automation, robotics and remote monitoring technologies. This talk gave the audience the approach of modern-day automation

via PLC and DCS and talked about the various aspects of this domain. The talk was attended by sixty-two participants, including eleven IEEE Members.



Mr. Abhijit Maitra receiving the receiving the certificate of appreciation from Prof. M. Sengupta, Chairman – IEEE-IAS Kolkata Chapter



Audience during the technical lecture by Mr. Abhijit Maitra at the EE Dept. Seminar Hall, IEST Shibpur (Date: 20.08.2015)

**The Seventh Technical Lecture Meeting** was organized on 24<sup>th</sup> September, 2015 at the Department of Electrical Engineering at Indian Institute of Engineering Science and Technology, Shibpur, on the topic “Power Electronics and Drives in Automobile Engineering.” The talk was presented by Mr. Saikat Subhra Ghosh, Commonwealth Research Scholar at The University of Cambridge, UK. With the rising concern about global pollution and depleting storage of fossil fuel, electric and hybrid electric vehicles are no more science fiction – they are not only reality but also necessity for a sustainable future. Further, in vehicle technologies and automation features of modern car – such as cruise control, electronic suspension etc. are coming into most of the cars. In this scenario, a paradigm shift of global automobile industry is anticipated between 2020 -2025. Given this context, power electronics and electric drives are finding more and more application in automobile engineering. Besides power train for electric and hybrid electric vehicles there are several applications of static converters and medium power actuators also. In this talk different



Mr. Saikat Subhra Ghosh receiving the receiving the certificate of appreciation from Prof. K. Mukherjee, Exe-com Member – IEEE-IAS Kolkata Chapter

application scopes for power electronic converters and electric drives for automobile engineering were discussed, with a special emphasis on electric and hybrid electric drives. The talk was attended by twenty-nine participants, including five IEEE Members.

**7. The Eighth Technical Lecture Meeting: IEEE Distinguished Lecture Program – 2015:** This meeting was organized on 16<sup>th</sup> November, 2015, at the Department of Electrical Engineering at Indian Institute of Engineering Science and Technology, Shibpur, on the topic “Overview of Electrical Diagnostics Techniques for Medium/High Voltage Industrial Induction Machines.” The talk was presented by Dr. Sang Bin Lee, Professor of Electrical Engg., Korea University, Seoul, Korea. Induction machines are undoubtedly the most dominant and important type of electrical apparatus used in industrial facilities in the power generation, petroleum & chemical, metals, pulp & paper, cement, and mining industries, etc. Continued operation of induction machines is critical for maintaining the productivity, efficiency, and reliability of the industrial facility. The objective of this lecture was to present an overview of electrical diagnostic techniques used in the field for off-line testing and on-line condition monitoring of medium~high voltage induction machines. The subjects covered in this lecture included, 1) Overview of motor testing and diagnostics, 2) High resistance connections, 3) Rotor cage testing, 4) Airgap eccentricity / bearing testing, 5) Stator magnetic wedge testing, 6) Stator core testing, 7) Stator winding insulation testing. A description of the fault, root causes and consequences of failure are given for each type of fault component, and the advantages and disadvantages of commercially available on-line and off--line technologies were presented. The typical causes of false positive and negative fault indications encountered in the field, produced by commercial motor inspection methods such as steady state on-line spectrum analysis and off-line standstill testing are also given. The target audience was practicing engineers and researchers in the area of reliability, diagnostics, and prognostics for electrical machines in industrial environments. This course also served as an introduction/overview of electric



Prof. Sang Bin Lee receiving the receiving the certificate of appreciation from Prof. M. Sengupta, Chairman – IEEE-IAS Kolkata Chapter



Prof. Sang Bin Lee receiving the receiving the plaque for distinguished lecture from Prof. K. Mukherjee, Member – Exe-com – IEEE-IAS Kolkata Chapter

machine diagnostics for attendees with undergraduate level knowledge of electric machines. The meeting was attended by forty-four participants, including eight IEEE members.

**8. Visit by Delegates from IEEE-IAS Head-Quarters:** Mr. David B. Durocher (President – IEEE-IAS) and Dr-Ing. Peter Magyar (Head- Chapter and Membership Development Committee), visited the IEEE-IAS Kolkata Chapter during 10<sup>th</sup> and 11<sup>th</sup> April, 2015. The visitors met the various executive-committee members of the IEEE-IAS Kolkata Chapter at IEST Shibpur, where they also gave a presentation to the students about the various



Dr.-Ing. Peter Magyar (left) and Mr. David B. Durocher (right) during the dinner, in honor of the local chapter office-bearers (11.04.15)

activities of the IAS. The Kolkata-chapter-chairperson, Prof. M. Sengupta, delivered a brief talk regarding the domain, activities and recent achievements of the local chapter. The visitors were also given a brief presentation regarding the activities of the Electrical Engineering Society, a student-body under the Electrical Engineering Department of IEST Shibpur. The guests were also introduced to the other members of the Kolkata Chapter over lunch. They also visited the various laboratories of the Electrical Engineering Department at IEST Shibpur.



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