



# Current Trends in Power Electronics & Drives Technology

[Course Code: 171027D10]

## Overview

Power electronics technology is utilized in almost all areas ranging from few watts residential to several megawatt industrial and utility applications. With the development of more efficient and reliable semiconductor switches made up of GaN and SiC materials, need arises to assess the performance and trade-off in the field of power electronics and drives. The key challenges in developing more efficient electrical power converter lie within the technological enhancement in these areas such as challenges imposed by development of electric vehicle, renewable energy source penetration, independent control of two AC Motor Drives and Sensor-less Vector Control of Parallel Connected Multiple Induction Motors fed by a Single Inverter. Japan is playing key role in these areas. Researchers are trying to develop newer topology of converters feeding electrical motors and simultaneously improved control strategies are being developed for enhanced drives performance such as sensorless drive control, artificial intelligence techniques in drives and converters, energy efficient drives technologies etc. These developments are mainly focused on improving system stability, system dynamic behavior, reliability, economics etc. Therefore, it is required to know the state-of-the-art in drives and renewable energy technology. This course covers theoretical details as well as experimental aspects of the above mentioned components. The aim of this course is to study and analyze the design and development procedure for implementing energy efficient drives and renewable energy system. Apart from theory, course aims at conduction of Experimental Hand-on Sessions which will focus on design and real-time control of renewable energy sources and drives.

<b>Dates of Course</b>	<b>11 – 16 Dec, 2017</b>
<b>Course Content</b>	<ul style="list-style-type: none"><li>• Renewable Energy Development Work in Japan</li><li>• Contributions of Japan to Power Electronics and Motor Drive Systems</li><li>• Power Electronics in Smart Grid based Energy Distribution Systems</li><li>• Outlook of EV, HEV, and FCEV</li><li>• High Speed High Power Motor Drives for Industry Applications</li><li>• Independent Control of Two AC Motors Fed by a Four-Leg/Five-Leg Inverter with vector control</li><li>• Sensor-less Vector Control of Parallel Connected Multiple Induction Motors fed by a Single Inverter</li><li>• High efficient converter based on SiC MOSFET and IGBT</li><li>• Advanced magnetic material for inductor and transformer design</li><li>• Multilevel converters for drives and renewable energy source conversion</li></ul> <p><b>Apart from above Lectures, there will be sufficient number of Laboratory Sessions during the Course on Power Electronics Converter Implementation for renewable energy and drives applications.</b></p>
<b>You Should Attend If...</b>	<ul style="list-style-type: none"><li>• You are an Electrical Engineer or research scientist interested in designing power electronics and electrical drive system with current technology.</li><li>• You are an industrial professional working on power electronics and drives system and wish to share, learn</li><li>• you are a student or faculty from academic institution interested in learning how to do research on GPR system or subsystem or want to work with GPR imagery for geological interpretation.</li></ul> <p><b>Number of participants for the course will be limited to Thirty.</b></p>
<b>Course Fees</b>	<p>The participation fees per person for attending the course is as follows:</p> <p><b>Participants from abroad : US \$ 500</b> <b>Industry/ Research Organizations : Rs. 5,000/-</b> <b>Academic Institutions : Students: Rs. 1770/- (For SC/ST students course fee is Rs. 1180/- only)</b> <b>Non-Students: Rs. 2360/-</b></p> <p>The above fees include all instructional materials, free internet facility, tea and snacks. The course fee is inclusive of 18% GST as per institute norms. The participants may avail single bedded shared accommodation and food (breakfast, lunch and dinner) if requested on additional payment and availability basis.</p>

## The Foreign Faculty



**Kouki Matsuse** (*SM'88–F'96*) was born in Tsingtao, China, on August 6, 1943. He received the B.E., M.E., and Ph.D. degrees in Electrical Engineering from Meiji University, Tokyo, Japan, in 1966, 1968, and 1971, respectively. In 1971, he joined the faculty of Meiji University as a Lecturer of Electrical Engineering. Since 1979, he has been a Professor in the Department of Electrical Engineering. He was a chairperson of the Graduate School of Science and Technology, Meiji University (1994-1996,2002). He

served as the Dean of the school of Science and Technology, Meiji University (1996-2002). He served the Executive Trustee, Meiji University(2004-2008), He have been Professor Emeritus, Meiji University from 2014. He works as a Consultant of Meidensha Co., Ltd, full time advisor of Hakujju Institute for Health Science Co., Ltd .and a Lecturer, Graduate School of Engineering, Tokyo Denki University, Japan.

The most significant contribution which he has made is the research on "Sensorless Control of AC Drivers". He has developed and presented the direct field oriented control method of induction motor without speed sensors using adaptive flux observer. He has verified that the proposed method has excellent characteristics for wide speed region. In addition, he developed a new method of identifying simultaneously the motor speed and rotor resistance by signal injections. The new scheme is applied in order to decouple the rotor resistance adaption from the speed estimation. He is a pioneer of the sensorless vector control of AC Motor Drives by signal injection method .The sensorless control system, that he has established, is especially applied for electric vehicle drives and industrial drives. He developed PWM current source GTO inverter system with PWM-controlled thyristor rectifier for induction motor drive. He proposed an analytical method and found out the performance of inverter-fed high-speed induction motor considering cross path resistance between adjacent rotor bars. He investigated and developed high frequency resonant inverter for induction heating and five-level double converters for large capacity induction motor drives. He has done extensive work on industrial drives, especially sensorless control of induction motor. His works have been patented, published, and then practically used in industry. His research work has been applied in several industrial applications.

He has authored more than **270** published in refereed journals and is the holder of **14 patents** including four U.S. patents. He is a coauthor of **10** books and co-editor of Sensorless Control of AC Motor Drives (IEEE Press, 1996). Dr. Matsuse was a member of the Executive Board of the IEEE Industry Applications Society (IAS) during 1998–2001. He served as the Chairperson of the Tokyo Chapter of the IEEE IAS (1999–2000). He was a member of the 2004 IEEE Medal for Engineering Excellence Committee and the IEEE Fellows Committee in 2005–2007. He was the President of the Institute of Electrical Engineers of Japan (IEEJ) in 2009–2010. He served as the Chairperson of the Management Committee of the IEEJ 1995 International Power Electronics Conference (IPEC-Yokohama 1995) and the Organizing Committee of IPECTokyo 2000. He served as the Chairperson of the Japanese National Committee of International Electrotechnical Commission/Technical Committee 22 (Power Electronic Systems and Equipment) (1996–2005). He was the recipient of the IEEJ Outstanding Paper Award in 1992, the IEEE IAS Outstanding Achievement Award in 2000, the IEEJ Outstanding Achievement Award in 2003, and the IEEJ Book of the Year Award in 2008.

## The Host Faculty



**H. M. Suryawanshi** (*M'06–SM'12*) received the B. E. degree in Electrical Engineering from Walchand College of Engineering, Sangli, India, in 1988 and M. E. degree in Electrical Engineering from Indian Institute of Science, Bangalore, in 1994. He has been awarded Ph. D. degree by Nagpur University, Nagpur (India) in 1999. He is currently working as Professor in the Department of Electrical Engineering, Visvesvaraya National Institute of Technology, Nagpur, (India). He was the Dean (Research and Consultancy) during 2013-2016. He is an Associate Editor of IEEE

Transaction on Industrial Electronics, USA. He has received Fellow of Indian National Academy of Engineering (FNAE) in 2012 for his outstanding research. He has received of the Bimal Bose Award in 2009 and Biman Behari Sen memorial award in 2017 from IETE for his leadership in Power Electronics in India and for distinguished contribution,

## Visvesvaraya National Institute of Technology, Nagpur, Maharastra, India

### Patron

**Dr. N. S. Chaudhary**  
Director, VNIT, Nagpur

### Local Coordinator

**Dr. K. M. Bhurchandi**  
Professor & HOD  
Electronics & Communication  
Engineering Department

### Course Co-ordinators

**Prof. H. M. Suryawanshi**  
Professor, EED

**Dr. Pradyumn Chaturvedi**  
Assistant Professor, EED

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Outstanding Achievements Award from Energy Society of India and Pondicherry Engineering College, Govt. of Pondicherry. He is senior member of IEEE (USA), fellow of Institution of Engineer (I) India, Fellow of IETE (I), India. He has published more than **180** papers in International refereed Journal/Conferences like IEEE (USA) and IET (UK). Out of which, he has published **85** papers in International refereed Journal like IEEE, IET, EPE etc. He has reviewed more than 300 papers for International Refereed Journal like IEEE and IET. He has Completed **14** R & D Projects Sponsored by MHRD, DST, NaMPET. Under his supervision **11** Ph.D. have completed and **06** On-going. He has published **15** patents. His research interests include the field of Power Electronics, emphasising developmental work in the area of resonant converters, power factor correction, active power filters, FACTS Devices, Multilevel converters, High Frequency Electronic Ballast and electric drives.



**Pradyumn Chaturvedi (SM'17)** received the B. E. degree in Electrical Engineering from Samrat Ashok Technological Institute, Vidisha, M.P., India, in 1996 and M. E. degree in Power Electronics from Rajiv Gandhi Technical University, Bhopal, M.P., India in 2001. He has been awarded Ph. D. degree by National Institute of Technology, Bhopal, M.P., India in 2010. He is currently working as Assistant Professor in the Department of Electrical Engineering, Visvesvaraya National Institute of Technology, Nagpur, (India). He is having more than 16 years of teaching experience. He has published more than **70** research papers in International refereed Journals/International/National Conferences. He is Senior Member IEEE USA, Life Member ISTE India, Member IET UK.

He holds the position of Member, Asian Council of Science Editors, Dubai. He is Member, International Editorial Board, International Journal "IOSR Journal of Electrical and Electronics Engineering". His Biography is included in "Marquis Who's Who in the World, 32nd Edition, 2015". He is also Member, International Scientific Committee, International Conference on Applied Mathematics, Simulation and Modelling (AMSM-2016), 28-29 May 2016, Beijing, China. He has been appointed as Expert Member of Doctoral Committee at various universities in India. He is also Track Chair/Session Chair in various national and international conferences (IEEE PEDES 2016, IEEE ITC India 2017, IEEE ICIT 2018). He is holding the position Member, Executive Committee, IEEE Nagpur Subsection. He is also actively involved in IEEE conferences as Member, Technical Program Committee and Advisory Committee. He is regular Reviewer of research articles for IEEE Transaction on Power Electronics, IEEE Transaction on Industrial Informatics, Electrical Engineering (Springer's), International Journal of Electronics (Taylor & Francis), International Journal of Power Electronics (Inderscience Publisher), Electric Power Components & Systems, IEEE Student Conference SCECS. He has Completed **02** R & D Projects Sponsored by BITS Pilani and Industry. Under his supervision 01 Ph.D. have been awarded and 02 are ongoing. His research interests include Power Electronics, Improved Power Factor Converter, Power Quality Improvement, Multilevel Converters, Electric Drives, Renewable Energy Harvesting and Fault Tolerant Converters.