

# One week short term course on Multi-phase Drive and Generation Systems for Advanced Industrial Applications

February 12-16, 2018

## Registration Form

Please complete the details below and mail along with the registration fee.

1. Name(Prof./Dr./Mr./Ms.)  
\_\_\_\_\_
2. Category: **Academic/Industry/Student**  
  
[For registration as student, please enclose a bonafide certificate from parent institution]
3. Organization: \_\_\_\_\_
4. Address:  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
5. Tel. No. (Mob): \_\_\_\_\_
6. E-mail ID: \_\_\_\_\_
7. Highest Acad. qualification: \_\_\_\_\_
8. Bank Draft No.: \_\_\_\_\_ Date: \_\_\_\_\_  
Name of the Bank: \_\_\_\_\_
9. Amount Rs. \_\_\_\_\_ drawn on \_\_\_\_\_
10. Accommodation Required: Yes /No

Signature of the Candidate

Signature of the Head of the Department/Institution

## Registration:

Mode#1: Demand draft in favor of Director VNIT Nagpur, payable at Nagpur  
Mode#2: Electronic Payment (NEFT)  
Name of the Beneficiary: Director, VNIT  
Name of Bank: State Bank of India  
Branch Name: VRCE Branch, Nagpur  
Branch Code: 06702  
Beneficiary Account No. 10259420288  
Bank MICR Code: 440002005  
Bank IFSC: SBIN0006702

Note:

For NEFT transfers mail scanned copy of receipt. Preferable mode of Payment is Demand Draft.

For the confirmation of registration, the proof of payment (*a scanned copy of the Demand Draft/ NEFT transaction Details*) along with the registration form and Copy of PDF generated at GIAN portal are to be sent to [gianvnit18@gmail.com](mailto:gianvnit18@gmail.com)

### Registration fee:

- Participants from abroad : **US \$300**
- Professionals from Industry & R&D Units: **Rs. 7000/-**
- Students and full time research scholars : **Rs. 2000/-** (For SC/ST students course fee is **Rs. 1000/- only**)
- Academicians/Faculty : **Rs. 5000/-**

### Important dates:

- Last date for registration: **31<sup>st</sup> January, 2018**  
[Complete application should be sent to the coordinator by this date]
- Selection intimation to the applicant: **1<sup>st</sup>, February 2018**

### Boarding and lodging

Accommodation can be arranged in the Institute Guest House subject to availability and on twin sharing basis per person per day @**Rs.600/-**

#### Patron

**DR. N. S. CHAUDHARI,**  
Director, VNIT, Nagpur

**Local GIAN Coordinator**  
**Prof. K. M. BHURCHANDI,**  
ECE, VNIT, Nagpur

#### Advisor

**Prof. M. K. KHEDKAR, Prof. & HOD, EED, VNIT, Nagpur**

#### Program coordinators:

**Prof. M. V. AWARE,**  
Electrical Engineering Department, VNIT, Nagpur  
**Dr. ANJALI JUNGHARE,**  
Electrical Engineering Department, VNIT, Nagpur

**FOR MORE INFORMATION - CONTACT PERSON:**

Phone: +91-9422831642 (Apekshit)

E-mail: [gianvnit18@gmail.com](mailto:gianvnit18@gmail.com)

# One week short term course on Multi-phase Drive and Generation Systems for Advanced Industrial Applications - 2018

February 12-16, 2018

## FOREIGN EXPERT (SPEAKER)

**Prof. Emil Levi**

Fellow, IEEE

Liverpool John Moores University, Liverpool, UK

## COURSE COORDINATORS

**Prof. M. V. Aware**

**Dr. Anjali Junghare**



## GLOBAL INITIATIVE ON ACADEMIC NETWORK (GIAN)

An  
Initiative  
of:



Ministry of Electronics and  
Information Technology  
Government of India

सत्यमेव जयते



Department of Electrical Engineering  
Visvesvaraya National Institute of Technology  
Nagpur, Maharashtra (India) - 440 010

## Course Instructor



Prof. Emil Levi (*Fellow, IEEE*) Emil Levi received his Dipl. Ing. degree in Electrical Engineering in 1982 from the University of Novi Sad and Masters and PhD degrees in 1986 and 1990, from the University of Belgrade (Yugoslavia). In the period from 1982 until 1992 he worked in the Department of Electrical and Electronics Engineering at the University of Novi Sad. He joined Liverpool John Moores University in 1992 and is (since 2000) Professor of Electric Machines and Drives. Emil is a Fellow of IEEE (Class of 2009) and the recipient of the Cyril Veinott award of the IEEE Power and Energy Society for 2009 and the Best Paper Award of the IEEE Transactions on Industrial Electronics for 2008. In 2014, he received the "Outstanding Achievement Award" from the European Power Electronics Association. He served as Co-Editor-in-Chief of the IEEE Trans. on Industrial Electronics in the period 2009-2013 and currently serves as an Editor of the IEEE Trans. on Energy Conversion and as Editor-in-Chief of the IET Electric Power Applications (since 2010). Emil leads the Electric Machines and Drives Research Group at the Liverpool John Moores University, which is widely regarded as a center of excellence for research in the areas of multiphase electric machine and power electronic converter modelling and control. The work of the Group is characterized with a high level of international collaboration, and it regularly accommodates academics from leading European Universities for research stays.

### Overview of the Course:

Although multiphase (more than three phases) machines have been known for almost half a century, it is only in recent times that they are becoming more wide-spread in industrial applications. In addition to the obvious advantage of reducing the required power-per-phase and hence required semiconductor rating, multiphase systems offer a number of other advantages that make them suitable for specific but important niche applications. These all stem from the fact that, regardless of the number of stator phases, independent flux and torque control of an ac machine always requires only two independently controllable currents (two degrees of freedom). The remaining degrees of freedom can then be used for other purposes and this will be the subject of this course.

The course will commence with an introduction to the types of multiphase machines, principles of multiphase machine modelling, vector control, and multiphase voltage source inverter PWM schemes. 'Classical' (i.e. older) uses of additional degrees of freedom will be addressed next, including the multi-motor multiphase series-connected drive systems with reduced-switch-count inverter supply, use of the additional degrees of freedom for the purposes of achieving fault-tolerant operation, and torque enhancement or torque ripple smoothing by low order stator current harmonic injection. Next, more recent applications of the additional degrees of freedom will be considered. This encompasses capacitor voltage balancing in machines with multiple three-phase windings and multiple three-phase converters connected in series, realisation of fully integrated on-board fast (three-phase) and slow (single-phase) battery charging systems in electric vehicles, a braking method for induction motor drives with diode front-end rectifier, and stator winding temperature estimation. Basic concepts will be explained and illustrative examples will be provided throughout.

### Course Objectives

- **Revealing to the field of multi-phase motor drives.**
- **Application of PWM techniques for multi-phase drives.**
- **Highlighting various key issues in fault tolerant operation of multi-phase drives.**
- **Providing exposure to the practical problems and their solutions, through case studies and projects in electrical drives.**
- **Introduction to fully integrated on-board battery chargers.**

### Course Highlights

- **Multiphase machine modelling**
- **Vector control of multiphase IM and PMSM**
- **PWM control of 2-level VSI**
- **PWM control of multiphase 2-level VSI**
- **Multi-motor series connected multiphase drive**
- **Torque enhancement using additional DOF in machines**
- **Fault tolerant operation in multiphase machines**
- **Multiphase generation systems in series connected VSI**
- **Fully integrated on-board battery chargers**
- **Novel application of additional DOF**

### Who Can Attend?

- If you are a student (B.Tech/M.Sc./M.Tech/Ph.D.) and aspiring researcher within broad domain of Electrical engineering.
- If you are an Executive/engineer or researcher from manufacturing, service and Government organizations including R&D laboratories.
- If you are Faculty and staff from reputed academic/technical institutions.

## About the Institute

Visvesvaraya National Institute of Technology, Nagpur is one of the thirty one National Institutes of Technology in the country. The Government of India by Act of Parliament (National Institutes of Technology Act, 2007 (29 of 2007)) declared VNIT Nagpur as an Institute of National Importance along with other NITs. The Institute was established in the year 1960 as Regional College of Engineering. In 1962, the Governing Board of the College resolved to name it after the eminent engineer, planner, and statesman of the country Sir Mokshagundam Visvesvaraya. The Institute offers eight B. Tech., one B. Arch., sixteen M.Tech., three M.Sc., and Ph. D. programs in various disciplines of Engineering, Architecture, Science, Humanities and Social Science.

## About the Department of Electrical Engineering

The Electrical Engineering department was established in 1960 with a UG (B. Tech) program in Electrical Engineering and PG (M. Tech) program with specialization in 'Integrated Power System' and 'Power Electronics and Drives'. The Department also offers Ph.D in all areas of Electrical Engineering. The Department is recognized as QIP Centre for M.Tech and Ph.D. programs.

## Co-ordinators – GIAN course MDGSAIA 2K18

Prof. Mohan S. Aware received the B.E. degree in electrical engineering from the College of Engineering, Amravati, India, in 1980, the M.Tech. degree from the Indian Institute of Technology, Bombay, India, in 1982, and the Ph.D. degree for his research work on "Direct Torque Controlled Induction Motor Drives" from Nagpur University, Nagpur, India, in 2002. From 1982 to 1989, he was a Design Officer with Crompton Greaves Ltd., Nasik,



India. From 1989 to 1991, he was a Development Engineer with Nippon Denro Ispat Ltd., Nagpur, India. From 2001 to 2002, he was a Research fellow with the Department of Electrical Engineering, Hong Kong Polytechnic University, Hong Kong. He is currently working as a Professor in the Department of Electrical Engineering, Visvesvaraya National Institute of Technology, Nagpur, India. He has published more than 100 technical papers in different journals and conference proceedings. His current research interests include electrical drives, distributed generation, energy storage systems, and power electronics.

Dr. Aware is a Commonwealth Academic Fellow.

**Dr. Anjali S. Junghare** received the B.E. and M.Tech degree from Visvesvaraya Regional College of Engineering (VRCE), Nagpur, India, in 1981 and 1985, respectively. She received the Ph.D. degree from VRCE in 2007. She is currently an associate professor in the Department of Electrical Engineering, Visvesvaraya National Institute of Technology, Nagpur, India. She has 13 years of industrial experience and 19 years of academic



Her research areas are control system, fractional order controllers, fuzzy Logic and its applications. She is having more than 30 papers in international conferences and journals.