

# **Workshop on Design and Implementation of Power Converters with EMC/EMI Modelling for Micro Grid & Electric Vehicle Applications**

**18<sup>th</sup> – 21<sup>st</sup> July 2018**



*By- Power Electronics Lab (EE Department)*  
**Indian Institute of Technology, Ropar**

## **About IIT Ropar**

IIT Ropar was established by MHRD in 2008. Since then, institute has put immense emphasis on promoting cutting edge research and publications of high quality. With the mission to foster a transformative learning environment enabling knowledge and development of socially responsible, enterprising leaders contributing to national progress.

## **About the Workshop**

Conversion from renewable energy sources to electrical energy by power electronic devices has played vital role in working of micro grids, grid interfacing, power management for automation, electric vehicles and performance evaluation technology development.

This workshop has been proposed for four days to offer an opportunity to experts from major industries, institutions and distinguished practitioners to discuss recent trends in DC-DC & DC-AC converters for applications in micro grid and electric vehicle technologies. Lectures/presentations will be given by faculty members & invited speakers from ANSYS majorly on the design of power converter with considerations of closed loop implementations and EMC/EMI modelling. Hands on sessions will be on MATLAB for converter designs, and ANSYS tools (Q3D, Simplorer and HFSS) for converter EMC/EMI modelling.

The main motivation of this workshop is to flourish power electronics lab at IIT Ropar as a unique platform for cutting edge technology and attract design practitioners from various industries and research institutes across India by demonstrating in-house product design, modelling and hardware implementation capabilities.

# Course Content

## Day-1 : DC to DC Converters

### Morning Session:

- Overview on lab research activities, institute initiatives on promoting collaborations.
- Concepts of power converter technologies for electric vehicle and micro grid applications.
- DC-DC converter topologies and control techniques.

### Afternoon Session:

- Closed loop control design approach for DC to DC converters.
  - Linearization techniques
  - Small signal analysis
  - Transfer function modelling and frequency response analysis using Bode Plot
  - Controller design techniques for voltage and current loops and integration methods.

**Hands on:** DC to DC converter closed loop validation through simulations and hardware demonstration for micro grid and electrical vehicle applications .

## Day-2 : DC to AC Converters (Inverters)

### Morning Session:

- Concepts of inverters and PWM techniques.
- Open loop Inverter circuit design:
  - DC link capacitor design
  - Topology/Switch selection
  - Filters design methodologies

### Afternoon Session:

- Closed loop design and development:
  - Linearization methods and small signal analysis
  - Transformation techniques
  - Controller tuning methods
  - Integration of voltage and current loops for single stage grid connected inverters.
- Inverter -grid interaction issues:
  - Fault handling capability (LVRT/HVRT)
  - Galvanic isolation and circulating currents in parallel operated inverters.

**Hands on:** DC to AC converter closed loop validation through simulations and hardware demonstration for micro grid applications.

## Day-3 : Converter Modelling for EMC/EMI Analysis

### Morning session:

**Lecture:** Introduction to Computational Electromagnetics with Introduction to ANSYS

Understanding Computational Electromagnetics  
Application of CEM in Power Converter design and EMI-EMC

- Extraction of stray parameters using Q3D and HFSS
- Modelling and simulation workflow in Q3D
- Stray Parameter extraction for Bus bars
- Modelling and simulation workflow in HFSS
- Stray parameter extraction for IGBT using HFSS

### Afternoon Session:

**Lecture:** Introduction to EMC Simulation

Overview of EMI aware Design process  
EMI EMC Simulation Workflow  
Challenges and role of simulation in EMI EMC aware design

**Hands On:** Conducted Emission Simulation using Simplorer

Importing stray parasitic into circuit schematics  
Characterization of IGBTs in Circuit model  
LISN modelling and circuit simulation  
Noise Spectrum analysis and post processing

**Hands on:** Radiated Emission Simulation for IGBT

Excitation feedback to HFSS for radiated emission  
Radiated emission analysis using HFSS

## Day-4 : Battery Management System

### Morning Session:

- Introduction to batteries, cells and cell packs
- Physical and chemical basis of cell degradation
- Functions of Battery Management System
  - Measurement State-of-charge
  - Estimation State-of-health estimation
  - Management cell balancing thermal management
  - Evaluation remaining useful life estimation for battery systems cell, module and system-level performance monitoring .

### Afternoon Session:

Institute Laboratory tour/City tour

## Who can attend?

Practicing engineers from industries & utilities and faculty members, research scholars and students from institutions may attend this course.

## How to Apply?

Interested officials can mail us at “ [peworkshop@iitrpr.ac.in](mailto:peworkshop@iitrpr.ac.in) “ with name, company /institute name, designation. Upon intimation , the registration link will be shared through mail .

## Registration / Course Fee (Non- Refundable)

Industry/ Research Organizations:	Rs 12,000
Faculty from Academic Institutions:	Rs 6,000
Students/research scholars:	Rs 3,000

## Important Dates.

Last date to request for registration:	31 May 2018
Last date for Intimation (by mail):	10 June 2018
Registration by paying fee:	15 June 2018
Workshop material softcopy available:	5 July 2018

Note : Mode of payment will be informed by mail. Accommodation will be provided by the institute on payment basis. No TA/DA will be paid.

## Course Organizers.

Dr. K.R.C. Sekhar	(Assistant Professor, EE, IIT Ropar)
Dr. Kalaiselvi J.	(Assistant Professor, EE, IIT Ropar)
Dr. A.V. Ravi Teja	(Assistant Professor, EE, IIT Ropar)
Dr. Himanshu Paliwal	(Assistant Professor, CHE, IIT Ropar)
Dr. Asad H. Sahir	(Assistant Professor, CHE, IIT Ropar)
Mr. Tushar	(Lead Application Engineer, Ansys)
Mr. Vasanth	(Lead Application Engineer, Ansys)

## Technical Content Organizers:

Mr. Satish Kumar Ancha	(Research Scholar, IIT Ropar)
Mr. Manish Kumar	(Research Scholar, IIT Ropar)
Mr. Ashwani Kumar Rana	(Research Scholar, IIT Ropar)
Mr. Baibhav Kumar Gupta	(Research Scholar, IIT Ropar)
Mr. Satyanarayana M	(Research Scholar, IIT Ropar)
Mr. Amol Ishwarrao Gedam	(Research Scholar, IIT Ropar)
Mr. Satish Kumar Saini	(Research Scholar, IIT Ropar)
Ms. Aakriti Gupta	(Research Scholar, IIT Ropar)
Mr. Sahil sharma	(Research Scholar, IIT Ropar)

## Sponsors:



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