Modeling and Management of Inverter-Based Resource (IBR) Integrated Electric Grid

Department of Electrical Engineering

July 07th – 11th, 2025

Motilal Nehru National Institute of Technology Allahabad, Prayagraj, Uttar Pradesh – 211004 (India)

Course Overview

This course will introduce concepts and techniques associated with modeling of electric grid (transmission and distribution system) with Inverter Based Resources (IBRs) and methods to manage the IBR-integrated electric grid. Techniques for various time scale-based analyses will be discussed with numerical examples.

The course will then present the fundamental concepts and techniques for electric grid modeling including bulk grid and distribution grid integrated with IBRs, starting with IBR-integrated bulk electric grid modeling for power flow, optimal power flow, and moving on to interconnected power systems that integrate transmission and distribution system models and concluding with modeling of distribution grid with grid-edge devices. Numerical examples will be used to illustrate the techniques. Cost/benefit considerations of various generation resource mix including renewables will also be covered in the course.

Course Objectives

The primary objectives of the course are as follows:

i) Exposing participants to the fundamentals of modeling electric power grids considering both transmission and distribution systems.

ii) Developing knowledge on integrating IBRs in the bulk power grid and as Distributed Energy Resources (DERs) in the distribution grid.

iii) Building confidence and capability amongst the participants in modeling the integrated transmission and distribution of electric grid with renewable energy resources for analysis and management.

iv) Providing exposure to real-life electric grid, grid management through case studies in power systems.

v) Enhancing the capability of the participants to be able to evaluate power grid for optimal management of the electric grid considering IBRs.

Course participants will learn these topics through lectures and hands-on experiments. Also, case studies and assignments will be shared to stimulate research motivation of participants.

You Should Attend If...

- you are a student at the levels (BTech/MSc/MTech/PhD) or Faculty from reputed academic institutions and technical institutions interested in learning the modelling and management of IBR integrated electric grid and scope of R & D works in the domain.
- you are an executive, engineer, and researcher in the power engineering field from universities, and government organizations including R&D laboratories and interested to learn the applications of IBR integrated electric grid.

Course Modules

- Power Flow of integrated power grid considering both transmission and distribution system.
- Optimal Power flow modeling of electric grid for electric transmission system and distribution system.
- Advance Optimal Power flow models considering convex optimization.
- Modeling of power grid for power flow and time series power flow with distributed energy resources.
- Modeling of electric grid for integrated transmission and distribution system with Inverter based resources considering electric grid stability.
- Management and Control of IBRs in the integrated electric grid for improving grid reliability.
- Management and Control of IBRs along with legacy system in the integrated electric grid considering grid stability.
- Integrated Optimal Power flow and management of IBRs for improving system reliability and resilience.
- Advanced Topics and Real-time Based Modeling Indices, Radial Systems, Parallel and Meshed Networks, Inclusion of Maintenance and Transient Failures. Weather Effects.

Registration Fee

The participation fees (including GST@18%) for taking the course is as follows:

Participants from abroad	USD 106.2
Industry/ Research Organizations	Rs. 590
Academic Institutions	Rs. 590
Students	Rs. 118

- The above fee includes all instructional materials, computer use for tutorials and assignments, laboratory equipment usage charges, 24 hr free internet facility.
- No TA, DA will be provided to the participants. Participants have to arrange their own accommodation and food. However, limited shared accommodation may be made available (subject to availability) in the Institute Executive Centre/ Guest Rooms of Hostels, etc. on request on first come first serve basis. Payment for accommodation & food is extra & as per actual.
- **Last Date of Registration: June 16, 2025**
- **Number of participants for the course will be targeted to 70 only on first come first serve basis.**

The fee can be paid to the account number mentioned under bank details. After successful payment of the requisite participation fee, the participants must have to register to the GIAN course by filling the registration form after clicking on the link: https://forms.gle/337nQEiaZiGMED4m6

The International Faculty

Dr. Sukumar Kamalasadan is Professor and Distinguished Scholar Department of Electrical & Computer Engineering at University of North Carolina at Charlotte, USA. His research interests include Smart Grid Design, Renewable Energy Integration, Power Grid Modernization, Real-time Modeling and Control of Energy Systems and Devices, Energy Storage and Wind Energy Modeling and Control and Microgrid Management. Prof. Kamalasadan's research for the last 19 years has resulted in tools and methods that have a high-level impact in electric utility modernization with a fleet-wide deployment of his tools that enabled modern grid management and control integrating renewable energy and energy storage. His research work has secured more than $13M with his direct supervision from the US Department of Energy, National Science Foundation, Siemens Research, Duke Energy Corporation, Schweitzer Engineering Lab, and several other industries. He is the chief architect of Duke Energy Smart Grid Laboratory at UNCC, a $5M facility. He has published more than 260 papers and has supervised 34 Ph.D. students, 28 M.S. Thesis and projects, and more than 60 undergraduate projects. He has about 25 years of teaching and research experience. He is a recipient of the National Science Foundation (NSF) CAREER Award and ten (10) IEEE Best Paper Awards. He is a Distinguished Lecturer of the IEEE Power and Energy Society (PES) and past Chair of the Power and Energy Education Committee and Industrial Automation and Controls Committee (IACC).

The Local Faculty

Dr. Asheesh K. Singh is Professor in the Department of Electrical Engineering, Motilal Nehru National Institute of Technology Allahabad, Prayagraj, India. Prof. Singh joined the MNNIT Allahabad, Prayagraj, in 1995. He holds a B.Tech. in Electrical Engineering from HBTI Kanpur (1991), an M.Tech. in Control Systems from REC Kurukshetra (1994), and a Ph.D. from IIT Roorkee (2007). His research focuses on power quality, e-mobility, smart metering, AI in power systems, energy management, and smart grids. Prof. Singh has organized numerous faculty development programs on power systems, delivered over 70 lectures at national and international forums, and supervised 13 Doctoral and 64 M.Tech. theses. He was honored with the Outstanding Engineer Award (OEA) – 2020 by the IEEE PES UP Section Chapter.

Dr. Prashant Kumar Tiwari is an Associate Professor in the Department of Electrical Engineering, Motilal Nehru National Institute of Technology Allahabad, Prayagraj, India. His research interests include Power System, Deregulation & Restructuring of Power Sector, Renewable Energy Sources integration in competitive power markets, Risk Assessment & Mitigation in Competitive Power Markets, FACTS Devices, etc. He has published more than 100 research papers, book chapters, etc. & guided 5 Ph.D. students, 27 M. Tech. theses, and many UG projects. He has about 12 years teaching & research experience. He is executing a project sponsored by the Govt. funding agency.

Contact Details

Course Co-ordinators

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Local Co-ordinator

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Website

https://gian.iith.ac.in/

Bank Details

Registration fee can be directly deposited through NEFT to the designated account as given below:

Bank Details	**Account Name:** SNFCE MNNIT Allahabad	**Bank & Branch:** SBI, MNNIT Allahabad
	Account No.: 10424975574	**IFSC Code:** SBIN0002580 **Swift Code:** SBININBB828