

Course 301

Generator Testing and Modeling

Course Objectives

The main objective of this 2-day course is to build upon what is covered in Power System Analysis I and II with respect to generators and their impact on power system operation. This course reviews typical generator types, generator capability curves, limiting factors, and generator controls and protection modeling including governor, AVR and excitation control and settings, as well as power system stabilizers and tuning.

Course Delivery

The course will be delivered in classroom presentations, aided by computer software for time domain simulation used for the validation of generators and their associated control parameters. The presentation slides will be handed out to the students as the course notes.

Recommended Prerequisites

Power System Fundamentals I and II

Course Outline

Session 1 – 7.5 hours

- Generators
 - Energy conversion and the synchronous generator theory
 - Generator terminal characteristics
 - Off-line and on-line operation
 - Reactive power capability
 - Testing for determination of generator parameters
- Control Systems
 - Control system definitions
 - Block diagram conventions
 - Feedback control & PID control
 - Control systems operating on synchronous generators
- AVR and Excitation Systems
 - Excitation requirements imposed by the generator and by the power system
 - Common designs - bus-fed static, rotating dc systems, rotating ac systems
 - Automatic voltage regulation (AVR)
 - Reactive current compensation
 - Excitation limiters and relation to generator and system capability

- Coordinating excitation limiters and protective relays
- Testing of excitation systems for performance validation and modeling

Session 2 – 7.5 hours

- Power System Stabilizers (PSS)
 - Effect of excitation system on stability
 - Oscillatory stability of machines
 - Design and tuning of PSS
 - Testing of PSS
- Prime Movers
 - Elements of prime movers
 - Hydraulic turbines
 - Steam turbines
 - Gas turbines
- Governors
 - Speed governing
 - Mechanical-hydraulic governors
 - Electro-hydraulic governors
 - Permanent droop
 - Automatic generation control
 - Testing for performance and modeling