Advanced Power Transmission Technologies Training

Description

Course Description

The world’s electric power supply systems are interconnected in one way or another and in various regional and in many cases inter-regional and international connections. The reason behind such complex operation of the power network is to reduce costs of operation and increase the reliability and security of the power supply.

Today, a revolution is underway in the Electrical Supply Industry. Economics, increasingly sophisticated consumers of electrical energy and the continuous demand for renewable energy have created one of the greatest challenges and opportunities the electricity supply industry has ever had to face. This is to provide substantially increased quality and security of supply, with respect to the environment (as emphasised at the Kyoto summit), in the rapidly emerging de-centralised market for electricity worldwide.

Power Electronics Control of De-regulated Power Systems will play a significant role in the near future and companies need to be positioned to take a lead in this globally competitive technology. The management of the integration of new generation power electronic systems worldwide will affect enormously all sectors of the market:

- Power generation.
- Transmission.
- Distribution
- Utilisation
- Equipment manufacturers.

Course Objective

- To present fundamental concepts of compensation of transmission networks.
- To discuss the state-of-the-art of power electronics equipment available to transmission engineers to improve the operation of the said networks.
- To become familiar with latest developments in transmission systems

- In addition the principles learnt from this seminar can be applied into work environment where known problems of operating the network can be studied and dealt with the equipment discussed and presented in this seminar.

Course Outline

DAY One

- Introductions, Goals discussion.
- Introduction and review of seminar objectives, power system overview and the new challenges affecting the technical and business operation of the system.
- Transmission interconnections, the need for such interconnection.
- Opportunities for FACTS into the transmission networks.
- Review of basic concepts associated with power flow in an AC system, parallel paths and meshed systems.
- Limitations of loading capability.
- Power flow and dynamic stability of transmission interconnection.
- Introduction of various types of FACTS, shunt, series and combined connections.
- Introduction to HVDC technology.
- Comparison of HVDC and FACTS.

DAY Two

- Power semiconductors devices.
- Diode. Thyristor. Gate-Turn-Off Thyristor. MOS-Turn-Off Thyristor (MTO). Integrated Gate-Commutated Thyristor (IGCT). Insulated Gate Bipolar Transistor (IGBT). MOS-Controlled Thyristor (MCT). Voltage-source converters. Single-phase leg operation. Square-wave operation and associated harmonics. Three-Phase Full-Bridge.
- Transformer connections for 12-pulse operation. Operation with 24 and 48 pulse systems. Three-Level systems. Multilevel systems. Pulse-Width Modulation systems.
- Current-source converters. Thyristor-based converters.
- Current-source line commutated systems. Current-source forced commutated systems.
- Comparison between voltage-source and current-source systems.

DAY Three

- Objectives of shunt compensation and voltage regulation. End of line voltage support.
- Methods of controllable VAr generation. Variable impedance
- Static VAr generators. Switching converter VAr generators. The regulation slope. Static shunt compensators: SVC and STATCOM. Comparison of V-I and V-Q characteristics. Real power exchange. Operation under unbalance conditions.
- Static Series Compensators: GCSC, TSSC, TCSC, SSSC. Objectives of Series compensation. Series capacitive compensation. Variable impedance series compensators. Switching converter series compensators.

DAY Four

- Dynamic Voltage Restorer (DVR).

- Combined compensators: Unified Power Flow Controller and Interline Power Flow Controller.
- Basic operation principles. Conventional transmission control capabilities. Independent real and reactive power flow control.
- Comparison of combined controllers and separate series/shunt ones.

DAY Five

- Application and Case Studies of FACTS controllers.
- Modern advanced HVDC systems based on voltage-source converters and PWM concepts and discussion of worldwide existing applications.
- Industry standards and approaches.
- Deregulated power systems and opportunities, requirements and operation of transmission networks to enhance stability, operation and improve return on investment for newly installed equipment. Selection examples of equipment and studies.