
Power Systems Engineering Seminar Series

POWER SYSTEMS TRANSIENTS AND SURGE PROTECTION

TOPICS COVERED: The seminar is divided into two parts and can be presented individually or together.

1. POWER SYSTEM TRANSIENTS

Summary

- This course covers lumped and distributed parameter analysis of electrical transients in power systems.

Goals of Course

- To develop an understanding of how surges and electrical transients originate and propagate throughout a power system.
- To develop the capability to understand the nature and calculation of such surges and transients.
- To be able to understand transients issues related to power system apparatus and overvoltage protection schemes for acceptable system operation w.r.t. insulation performance.

Course Overview

1. Fundamental Notions about Electrical Transients
2. Simple Switching Transients and Damping
3. Transient Solutions by Laplace Transform and by Deduction
4. Transmission Line Equations and Traveling Waves
5. Behavior of Traveling Waves at Junctions - Surge Impedance Terminations
6. Behavior of Traveling Waves at Junctions - Complex Terminations and Bifurcation
7. Lattice (Bewley) Diagrams
8. Attenuation and Distortion of Traveling Waves
9. Transients on Practical Power Systems

2. SURGE PROTECTION

Summary

- This course presents theory and methods for the specification of insulation coordination.

Goals of Course

- To develop an understanding of the principles of insulation coordination (surge protection).

- To gain the necessary knowledge for the study and simulation of power systems transients and to be able to interpret system study results related as they apply to insulation coordination.
- To be able to specify and design power system apparatus and overvoltage protection schemes for acceptable system operation w.r.t. insulation performance.

Course Overview

1. Specifying Insulation Strength - Concepts and Practices
2. Surge Arresters - Principles and Applications
3. Fundamentals of Insulation Coordination
4. Protection of Transmission Lines from Switching Surges
5. Case Study on Transmission Line Switching Surges
6. System Protection from Capacitor Bank Switching Surges
7. Case Study on Capacitor Bank Switching Surges
8. Temporary Overvoltages (TOV) - Principles, Causes, and Protection
9. Transient Recovery Voltages (TRV) - Principles, Causes, and Protection
10. Introduction to Lightning Phenomena
11. Impacts of Lightning - Backflash
12. Impacts of Lightning - Shielding of Transmission Lines
13. Case Study on the Protection of Air Insulated Substations from Lightning Events
14. Case Study on the Protection of Gas Insulated Substations from Lightning and Internal Switching Events - Very Fast Front Waves
15. Summary of the Fundamentals of Insulation Coordination

LENGTH: This seminar can be presented in a 1 week full-day version or can be presented a 2 week half-day versions. Shorter customized versions (2-4 days) can also be presented on a subset of the listed topics.