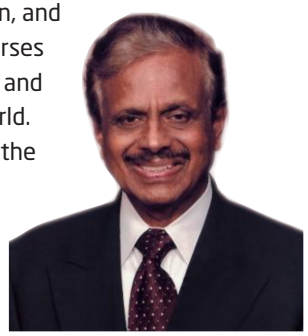
Power System Stability and Control Course

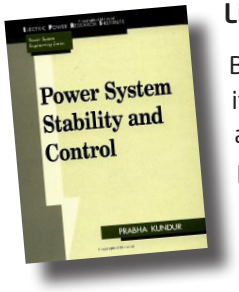
This course will provide a comprehensive overview of power system stability and control problems. This includes the basic concepts, physical aspects of the phenomena, methods of analysis, examples of incidents of system instability, challenges to the secure operation of present-day power systems, and comprehensive approach to enhancing system security.

The book Power System Stability and Control by Prabha Kundur, McGraw-Hill, Inc., 1994 will be used as reference for the course.

Lecturer Dr. Prabha S. Kundur

Dr. Prabha S. Kundur has over 40 years of experience in the electric power industry. He has performed extensive international consulting related to power system planning and design, and has delivered technical courses for utilities, manufacturers and universities around the world. Dr. Kundur is the author of the book Power System Stability and Control (McGraw-Hill, 1994), which is a standard modern reference for the subject.





Literature

Book "Power System Stability and Control" by Dr. Kundur and other material will be provided to each participant.

Course Organizer

Technical University of Denmark
Center for Electric Power and Energy
Elektrovej, Bygning 325
2800 Kgs. Lyngby
Associate Professor Qiuwei Wu
Telephone: +45 4525 3529

Registration

Preferably no later than May 31st, 2014 by contacting Associate Professor Qiuwei Wu
e-mail: qw@elektro.dtu.dk

Hotels and travel information

A list of hotels and travel information will be provided during registration.

Course location

Technical University of Denmark
Meeting Room S1, Building 101A
Anker Engelunds Vej 1
DK-2800 Kgs. Lyngby
Denmark

Fee

The fee is 19500 DKK excl. VAT for participants from the industry. PhD students get a 50% discount. The fee includes all the material provided, coffee and lunch for the four days.

ETCS

Points 4 ETCS

DTU

Power System Stability and Control Course

by Dr. Prabha S. Kundur

July 1-4, 2014 in Kgs. Lyngby

DTU Electrical Engineering
Department of Electrical Engineering

Day 1

1. Introduction to Power System Stability

- Definition and classification of power system stability
- Brief description of each category of system stability
- Conceptual relationship between power system stability, security and reliability
- Traditional approach power system security assessment
- Challenges to secure operation of prsent-day power systems

2. Review of Equipment Characteristics and Modelling

- Synchronous machines: theory and modelling, machine parameters, saturation modelling, synchronous machine representation in stability studies, reactive capability limits.
- Excitation systems: elements of an excitation system, types of excitation systems, control and protective functions, modelling.
- Prime movers and governing systems: hydraulic turbines and governing systems, steam turbines and governing systems, gas turbines and combined-cycle units.
- Generating unit testing and model validation: test procedures, current industry practices.
- AC Transmission: performance equations and parameters, surge impedance loading, voltage-power characteristics, reactive power requirements, loadability characteristics, factors influencing transfer of active and reactive power.
- Power system loads: basic modelling concepts, static and dynamic models, acquisition of load model parameters.

3. Control of Active Power and Frequency

- Fundamentals of frequency control
- Composite regulating characteristics of power systems
- Automatic generation control
- Under-frequency load shedding

Day 2

4. Control of Reactive Power and Voltage

- Control objectives
- Production and absorption of reactive power
- Methods of voltage control
- Principles of reactive compensation in transmission systems
- Static and dynamic compensators
- Coordinated control of reactive power and voltage

5. Transient (angle) Stability

- An elementary view of the transient stability problem
- Simulation of power system dynamic response
- Numerical integration methods
- Performance of protective relaying
- Case Studies
- Transient stability enhancement
- Examples of major system blackouts due to transient instability

Day 3

6. Small-Signal (angle) Stability

- Nature and description of small-signal stability (SSS) problems
- Methods of analysis; modal analysis approach
- Characteristics of local-plant mode and inter-area mode oscillations
- Case studies
- SSS enhancement
- Examples of major system disturbances due to small-signal instability

7. Subsynchronous Oscillations

- Steam turbine generator torsional characteristics
- Torsional interaction with power system controls: PSS, HVDC converter controls
- Subsynchronous resonance
- Impact of network-switching disturbances

8. Voltage Stability

- Description of the phenomenon
- Factors influencing voltage stability
- Methods of analysis
- Typical scenarios of short-term voltage instability and long-term voltage instability
- Prevention of voltage instability
- Case studies
- Examples of major system disturbances due to voltage instability

Day 4

9. Frequency Stability

- Nature and description of frequency stability problems
- Examples of system disturbanes caused by frequency instability
- Analysis of frequency stability problems
- Case studies
- Mitigation of frequency stability problems.

10. Wind Turbine Generators

- Wind turbine characteristics
- Types of wind turbine generator technologies
- Protection systems
- Impact on power system dynamic performance

11. Major Power Grid Blackouts in 2003

- Description of events
- Causes of blackouts
- Lessons learned

12. Comprehensive Approach to Power System Security

- Application of robust power system controls
- Defense plan against extreme contingencies
- Restoration plans
- On-line security assessment
- Reliability management system
- Wide-area monitoring and control
- Widespread use of distributed generation