ECEG-6402: Power System Operation and Control

COURSE OUTLINE

1. Review of background material

1.1 Basic relationships and equivalent circuits of power system elements

1.2 Power flow analysis

1.3 Short circuit analysis

2. Operation, monitoring and control of power systems

2.1 Power system monitoring and control

2.2 Power system operation

2.3 Energy management system (EMS) functions

- 2.3.1 State estimation
- 2.3.2 Optimum power flow
- 2.3.3 Security assessment and contingency analysis

3. Modelling of power system elements for dynamic studies

3.1 The synchronous machine model

3.2 Excitation systems

3.3 Prime movers and governing systems

3.4 Power system loads

4. Power system voltage and frequency control

4.1 Reactive power and voltage control

- 4.1.1 Series and shunt compensation
- 4.1.2 Introduction to FACTS devices

4.2 Active power and frequency control

5. Power system stability

5.1 Classification of power system stability

5.2 Transient (angle) stability

5.3 Voltage stability

5.4 Frequency stability

5.5 Small-signal (oscillatory) stability

REFERENCES:

1. **Power System Stability and Control** by P. Kundur, McGraw-Hill, Inc., 1994, ISBN 0-07-035958-X
2. **Power System Dynamics and Stability** by J. Machowski, J. W. Bialek and J. R. Bumby. John Wiley & Sons Ltd, 1997, ISBN 0-471-97174-X
3. **Power System Dynamics, Stability and Control** by K. R. Padiyar, John Wiley & Sons Ltd, 1996, ISBN 0-471-19002-0
4. ***Power System Dynamics and Stability*** by P. W. Sauer and M. A. Pai, Prentice Hall, 1998, ISBN 0-13-678830-0
5. **Definition and Classification of Power System Stability**, IEEE/CIGRE Joint Task Force on Stability Terms and Definitions, 2002.
6. **Dynamic Models for Turbine-Governors in Power System Studies** by IEEE Task Force on Turbine-Governor Modeling, IEEE Power & Energy Society, Jan 2013
7. **IEEE Recommended Practice for Excitation System Models for Power System Stability Studies,** IEEE Std 421.5™-2005, 21 April 2006
8. **Hydraulic Turbine and Turbine Control Models for System Dynamic Studies,** Working Group on Prime Mover and Energy Supply Models for System Dynamic Performance Studies, Transactions on Power Systems, Vol. 7, No. 1, February 1992
9. **A Fundamental Study of Inter-Area Oscillations in Power Systems by** M. Klein, G. J. Rogers and P. Kundur, Transactions on Power Systems, Vol. 6, No. 3, August 1991
10. **IEEE Recommended Practice for Calculating Short-Circuit Currents in Industrial and Commercial Power Systems**, IEEE Power Systems Engineering Committee, 2006