EE-4221

Power System Analysis 1

Curricular Designation: CpE: N/A EE: Elective

Catalog Description: Covers power transmission line parameters and applications, symmetrical components, transformer and load representations, systems faults and protection, and the per unit system. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall Prerequisites: EE3120

Textbook(s) and Other Required Materials:


Prerequisites by Topic:

1. Mastery of DC and AC circuit analysis.
2. Familiarity with three-phase circuits and the power triangle.
3. Familiarity with basic electric machine theory.
5. Mastery of manipulation of complex numbers and phasors.
6. Introduction to power system terminology and relationship of real and reactive power flow to system voltages and currents.

Course Objectives:

1. Become familiar with the history and recent restructuring and reregulation of the power industry and its effect on engineering decisions.
2. Master the development and application of power system models of transformers, transmission lines, machines, and loads, including their per unit representations.
3. Study transmission line design, to;
   a. master the principles relating physical representation of a line to the steady-state parameters of resistance, inductance and capacitance.
   b. become familiar with the problems associated with loading lines and methods of compensation to mitigate these problems.
4. Become familiar with the steady-state admittance matrix system model of a power system.
5. Master solving the power flow problem in a power system.
Topics Covered:

1. History and present and future trends in the electric utility industry.

2. Power transformer circuit models, including:
   a. 3-phase and 3-phase, 3-winding transformers, including the auto-transformer
   b. per unit representations, including off-nominal turns ratios
   c. phase shift in three-phase transformers

3. Electric Power Transmission lines, including:
   a. design considerations
   b. from the physical representation, determine the steady-state impedance and admittance parameters.
   c. develop steady-state two-port models of short, medium and long lines.
   d. solve the receiving end power flow problem; maximum power, voltage regulation, and line compensation methods.

4. The methods for developing the bus admittance matrix representation of the power system.

5. Introducing methods of nonlinear analysis, including Jacobi, Gauss-Seidel, and Newton-Raphson.

6. Applying non-linear methods to the solution of the power flow problem.

Relationship of Course to Program Objectives (See UPAC SOP, Tables 1 and 2):

- EE: Outcome: a, k, e via topics 1-6
- CpE: N/A

Contribution of Course to Meeting the Professional Component

- EE: Engineering Topics
- CpE: N/A

Class/Laboratory Schedule (note: 1 hour = 50 minutes):

Lecture: 45 hours = 3 hours/week for 15 weeks

Prepared by:

Dennis Wiitanen, Professor, February 12, 2004