ECE 140: Linear Circuits

Catalog description: 3.0 units

Circuit analysis techniques for networks with both independent and dependent sources. Network topology. Natural and forced response for RLC circuits. Complex frequency, poles and zeros. Magnetically coupled circuits and two-port networks.

Prerequisites: ECE 095, ECE 097 (may be taken concurrently), MATH 007D (may be taken concurrently)

Course objectives

1. Teach AC/DC circuit analysis with dependent and independent sources using Superposition, Thevenin and Norton theorems
2. Teach students to calculate/plot the transient response of first-order and second-order networks
3. Explain phasors, impedance, complex frequency, and resonance
4. Teach students to calculate AC steady-state response, AC power, power factor, rms signal levels, and frequency response of networks
5. Teach the analysis of circuits that include mutual inductance and transformers
6. Teach students to derive and analyze two-port networks with y, z, t, and h parameters
7. Demonstrate the use PSpice® to find transient and frequency response of networks

Course Outcomes: Students shall be able to

1. Analyze linear circuits using Superposition Theorem
2. Analyze Thevenin and Norton equivalent circuits with independent and dependent sources
3. Calculate solution of 1^{st} order linear differential equations for R-L and R-C circuits with or without forced sources (natural and complete responses)
4. Calculate solution of 2^{nd} order linear differential equations for R-L-C circuits with or without forced sources (natural and complete responses)
5. Analyze over-damped, critically damped, and under-damped parallel and series RLC circuits
6. Determine complex frequency for AC circuits, find H(s) for V_{out}/V_{in}, I_{out}/I_{in}, etc.
7. Find frequency response of circuits, including low-pass, high-pass, and band-pass filters
8. Calculate power, current, voltage, and impedance in magnetically coupled circuits
9. Derive admittance, impedance, and hybrid parameters in two-port networks
10. Simulate the operation of RLC networks using PSpice®

Topics covered

1. Circuits with independent/dependent sources
2. Introduction to PSpice®
3. Node and mesh analysis
4. Superposition with dependent sources
5. Thevenin and Norton Theorems

6. Graphical circuit analysis
7. RL, RC, and RLC circuits
8. Complex frequency
9. Bode plots
10. Magnetically coupled coils
11. Two port networks

Class/Laboratory schedule

One hundred fifty minutes of lecture per week

Contribution of course to meet the Professional Component

This course contributes to the student's ability to work professionally analyzing and designing complex electrical and electronic devices.

Relationship of course to Mechatronic Engineering Program Outcomes

This course contributes principally to Program Outcome A.