EEL 4421C RF Devices and Circuits

Credits: 3 credits

Textbook, title, author, and year: RF Circuit Design: Theory and Applications, 2nd ed., R. Ludwig and G. Bogdanov, Prentice Hall, 2015

Reference materials: Course Notes, posted on Canvas.

Specific course information

Catalog description: RF filter design, active RF components and component modeling, matching and biasing networks, RF oscillators, mixers and frequency synthesizers, use of RF CAD software for system simulation.

Prerequisites: EEL 3470 Electromagnetic Fields and Waves

Specific goals for the course: To introduce students to modern computer-aided RF design procedures for RF communication devices and circuits, enabling them to enter the field of RF design in industry and research

Brief list of topics to be covered:

1. Introduction, RF behavior of passive elements (1 lecture)
2. Microstrip transmission lines (2 lectures)
3. YZ Smith chart (2 lectures)
4. Multiport parameter sets, scattering parameters (2 lectures)
5. RF filter design (10 lectures as below)
   - Filter types and parameters (1 lecture)
   - Butterworth and Chebyshev filters (1 lecture)
   - Denormalization of prototype LPF, Richards transformation, Kuroda's identities (1 lecture)
   - Coupled-line bandpass filters (1 lecture)
   - Stepped-impedance LPF (1 lecture)
   - Even-odd mode analysis of power dividers and couplers (1 lecture)
   - Wilkinson divider (1 lecture)
   - Quadrature hybrid (1 lecture)
   - Coupled-line directional coupler (1 lecture)
   - Lange coupler and 180^{o} hybrid coupler (1 lecture)
6. Active RF components (3 lectures as below)
   - Schottky, PIN, varactor, IMPATT, Gunn diodes (1 lecture)
   - RF BJTs (1 lecture)
   - RF FETs, MOSFETs, HEMTs (1 lecture)
7. Matching and biasing networks (3 lectures as below)
   - Discrete and microstrip networks (1 lecture)
   - Amplifier classes and efficiency (1 lecture)
   - Biasing networks for BJTs and FETs (1 lecture)
8. Oscillators and mixers (2 lectures as below)
   - Oscillator models and negative resistance and feedback oscillators (1 lecture)
   - Quartz, DRO and YIG oscillators and phase locked loops (1 lecture)