ECE 682: Microwave Systems Engineering

Spring 2020,
TTh 4:00 – 5:15 pm (106 Hasbrouk)
Instructors: P. Siqueira
Office: KEB 113E

Goal: To explore concepts related to the design, analysis, and construction of microwave systems. This course will discuss the fundamental tradeoffs governing system design: the hardware components and technologies that comprise working systems, the models used for characterizing the transmission and reception of signals, the physics of wave propagation and interaction, and estimation theory which seeks to separate signals from sources of error and guide algorithms for extracting information from received signals.

Course Text: None. Notes will be made available on Moodle.
Recommended Texts:

Pozar, Microwave Engineering, 4th Ed., Wiley Pozar, Microwave Engineering & RF Design of Wireless Sys., Wiley Luzzato and Shirazi, Wireless Transceiver Design, Wiley Vizmuller, RF Design Guide, Academic Press	Whalan, Detection of Signals in Noise, Academic Press Couch, Digital & Analog Comm. Systems, Macmillan Haykin, Communications Systems, Wiley

Course Website is on Moodle
Grading: 25% Homework, 25% Midterm, 25% Final, 25% Project
Recommended Prerequisites: Probability and Statistics, Microwave Engineering I

Course Outline:

I. Detection in the presence of uncertainty (2.5 weeks)
   a. Hypothesis testing: Radar speed trap example
   b. Receiver Operating Characteristic
   c. Digital Communication
   d. Probability of error (Performance Curves)
II. Receiver Systems (2 weeks)
   a. Receiver Architectures: Super Heterodyne Receiver, Direct Conversion, Very Low IF
   b. Sensitivity, Selectivity, Image rejection
III. Link Analysis (1.5 week)
   a. Friis equation
   b. Antennas, EIRP
   c. Radar Range Equation
   d. System Noise: Antenna, amplifier, oscillator, quantization
   e. Link budget
   f. Propagation Modeling
IV. Dynamic Range (3 weeks)
   a. Noise Temperature, Noise Figure
   b. Effect of nonlinearity: IIP3, P1dB, blocking
   c. Gain control
   d. Phase noise
   e. Quantization noise
V. Design Example (1 week)
VI. Transmitting Systems (1 week)
   a. Transceiver architectures
   b. Efficiency, PAR, Error Vector Magnitude
VII. Advanced Systems (1.5 weeks)
VIII. Estimation in the presence of uncertainty (1.5 weeks)