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

Recommended Texts:


Grading: 30% Midterm, 30% Homework, 40% Project (Each student will choose a project and develop the system design for it.)

Recommended Prerequisites: Probability and Statistics, Microwave Engineering I, Introduction to Communications

Topics:

I. Detection in the presence of uncertainty
   a. Hypothesis testing: Radar speed trap example
   b. Receiver Operating Characteristic
   c. Digital Communication
   d. Probability of error (Performance Curves)

II. Noise and Nonlinearity
   a. Noise Temperature, Noise Figure
   b. Effect of nonlinearity: IIP3, P1dB, blocking
   c. Cascaded stages
   d. Dynamic Range

III. Link Analysis
   a. Friis equation
   b. Antennas, EIRP
   c. Radar Range Equation
   d. System Noise: Antenna, amplifier, oscillator, quantization
   e. Link budget
   f. Sensitivity and probability of error
   g. Dynamic range issues
   h. Propagation Modeling

IV. Receiver Systems
   a. Receiver Architectures: Super Heterodyne Receiver, Direct Conversion, Very Low IF
   b. Sensitivity, Selectivity, Image rejection

V. Transmitting Systems
   a. Transceiver architectures
   b. Efficiency, PAR, Error Vector Magnitude

VI. Estimation in the presence of uncertainty