Course Description

This is a core course on digital communications, presenting the basic principles of communication systems and the analysis of their performance. The following topics will be covered: Different types of baseband and passband modulation, signal and receiver design, noise and its effects, detection and probability of error calculations, source and channel coding, Shannon capacity, ISI and maximum likelihood sequence detection.

Course Requirements

The student is assumed to have a working knowledge of transforms (especially the Fourier transform), linear systems, probability and random processes (correlation, spectrum). This background material will be reviewed, but not taught.

Course Outline

The following is a preliminary course schedule.

- Week 1: Introduction, Fourier Transform, Signals and Systems, Spectrum, Sampling theorem
- Week 2: Hilbert transforms, complex envelopes and analytic signals, Passband PAM and baseband PAM
- Week 3: Nyquist pulses and eye diagrams, passband and baseband noise, random PAM
- Week 4: Alphabet design, PSK and differential coding, spectral efficiency, extensions of PAM: multipulse, OFDM
- Week 5: Decoding and error analysis, systematic analysis of digital modulation
- Week 6: Source and Channel coding
- Week 7: Shannon capacity
- Week 8: Vector representation of continuous time signals, Time-bandwidth product and the number of independent signals
- Week 9: Waveform communications, N-orthogonal signaling, etc.
- Week 10: ISI and ML sequence detection, the Viterbi algorithm
Calendar

- First class: January 6, 2014 (Monday)
- Last class: March 17, 2014 (Wednesday)
- Holidays: January 20, 2014 (Monday), February 17, 2014 (Monday)

Class Time and Location M W 5:00-6:45pm, Baskin Engineering Room 165.

Reference Books