Course Syllabus

ECE 130A  Signal Analysis and Processing  4 units

(Required)

Catalog Description:

Prerequisites:
Mathematics 5A and ECE 2C with a minimum grade of C– in both; open to EE and computer engineering majors only.

Text, References, and Software:

Topics Covered and Course Goals:

1. Understand and apply basic concepts and terminology related to signals and systems, including energy, power, linear versus nonlinear system, stable system, time-invariant versus time-varying system, delta function, complex exponentials and sinusoids
2. Understand properties of linear time-invariant (LTI) systems, including concept of impulse response and convolution, and eigenfunction property for complex exponentials. Become proficient in computing convolutions for simple waveforms.
3. Understand and apply basic properties of Fourier series for periodic signals, become proficient in computing Fourier series for simple waveforms, including the use of the differentiation property to simplify computation.
4. Understand and apply basic properties of Fourier transform; become proficient in applying properties, including time-frequency duality, to compute Fourier transform, building on a few basic Fourier transform pairs. Exposure to concept of bandlimited systems and the role of the sinc function.
5. Become proficient in going back and forth between time and frequency domains, integrating convolution, Fourier series and Fourier transform, e.g., when computing time domain output of an LTI system whose input is a periodic signal.
6. Understand and apply basic properties of Laplace transform; review partial fractions method for inverting rational Laplace transforms; become proficient in inferring system properties from pole-zero plots for rational Laplace transforms; geometric evaluation of Fourier transform from pole-zero plot and review of Bode plots
7. Become proficient in solving differential equations with constant coefficients and initial conditions using the unilateral Laplace transform
8. Work in Laplace domain to build complex systems by interconnecting simpler systems, including canonical realizations of rational transfer functions, and elementary exposure to the role of feedback in stabilization
9. Become exposed to Matlab through problems interspersed through the course, including plotting signals, numerical computation of integrals, convolutions and Fourier transform. The emphasis is on a intuitive application of discretization to continuous-time systems, without any sampling theory.

Class/Laboratory Hours:
Lecture, 3 hours; discussion, 2 hours.

Contribution to Criterion 5
Contributes to one and one-half years of engineering topics, primarily engineering sciences

Contribution to Program Outcomes:

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Prepared by: Upamanyu Madhow
Date: January 10, 2008