332:521 – Digital Signals and Filters – Fall 2010

Course Description:

This course is a basic introduction to digital signal processing. It covers sampling and reconstruction; antialiasing prefilters and anti-image postfilters; discrete-time signals and systems; convolution and FIR filtering; circular delay-line buffers; z-transforms; filter realizations; DFT/FFT for spectrum computation and fast convolution; FIR and IIR digital filter design and implementation; signal processing applications, such as digital audio effects, noise reduction, and signal enhancement; interpolation, decimation, oversampling, sample rate conversion, noise shaping delta-sigma quantizers. Discrete-cosine transforms and discrete-wavelet transforms, if time permits.

Topics	*Lectures*
sampling theorem, antialiasing prefilters, anti-image postfilters (ch. 1 & 2)	3
convolution, FIR filters, circular delay-line buffers (ch. 3 & 4)	3
z-transforms, transfer functions, filter realizations (ch. 5 & 6)	4
spectral analysis, windowing, DFT, FFT, fast convolution (ch. 9)	4
FIR digital filter design (Kaiser window) (ch. 10)	2
IIR digital filter design including elliptic filters (ch. 11 + notes)	4
digital audio effects, class demonstrations (class notes)	1
decimation, noise-shaping delta-sigma quantizers (ch. 2 & 12)	2
interpolation, sample rate conversion (ch. 12)	3

Text:

S. J. Orfanidis, *Introduction to Signal Processing*, originally published by Prentice Hall, 1996. The book is freely available online from the course web page.

Prerequisites:

Familiarity with the concepts of a linear system, convolution, Fourier, Laplace, and z-transforms is assumed. Familiarity with a high-level programming language, such as C, Fortran, or MATLAB is necessary.

Course Requirements:

The final grade is based on:

1. Final exam.
2. Two in-class exams.
3. Computer assignments.

The GNU C compiler `gcc` as well as MATLAB and its Signal Processing and Control toolboxes are available on the departmental computers (in room ELE-103.)

Exam Dates:

Exams dates: *Thursday, October 7, 2010* and *Thursday, November 18, 2010*. The final exam is scheduled by the Department for the period of December 16–23, 2010.

Instructor:

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Course web page: `www.ece.rutgers.edu/~orfanidi/ece521`
Time & Place: TTh 5:00–6:20 PM, SEC-206