ECET 282 Digital Signal Processing

Instructor: Joyce van de Vegte
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Text: Fundamentals of Digital Signal Processing (Van de Vegte)

Objectives:

This course provides an introduction to the field of digital signal processing. It includes the process of digitizing signals, extracting information using various transforms and designing digital filters using recursive and non-recursive techniques.

Evaluation:

Tests (2)   30%
Labs   25%   (final lab is 10%)
Final Exam   45%
Note that problem sets will be assigned but not graded. Solution sets will be posted.

Important Dates:

Problem Set 1 Solutions Posted   Monday 29 January 2018 (week 4)
Test 1   Tuesday 6 February 2018 (week 5)
Problem Set 2 Solutions Posted   Monday 5 March 2018 (week 9)
Test 2   Tuesday 13 March 2018 (week 10)
Problem Set 3 Solutions Posted   Tuesday 3 April 2018 (week 12)
Final Exam   16 - 24 April 2018

Laboratory Exercises

Week	Lab Number	Lab Title
1	1	Applications of DSP
2	2	Spectra of common signals
3	3	Sampling and quantization
4	4	Signal and spectra in MATLAB
5	5	Filtering in MATLAB
6		Reading break
7	6	Familiarization with the DSP board TMS320C6713
8 - 9	7	FIR filters and filtering out noise
10 - 11	8	Audio effects
12 - 14	9	DTMF tone generation and detection using IIR filters and FFTs

Topics:

Review (0.25 weeks)
- Fourier Series
- Complex Fourier Spectra
- Fourier Transform
- Impulse Function and Impulse Response
- Convolution

Introduction to Digital Signal Processing (Ch. 2) (1.25 weeks)
- A Simple DSP System
- Sampling
- Quantization

Digital Signals (Ch. 3) (0.5 weeks)
- Notation
- Basic Digital Signal Types

Filtering (Ch. 4 & 5) (1 week)
- Analog vs Digital Filters
- Difference Equations
- Impulse and Step Responses
- Convolution
- Moving Average Filters

z Transforms (Ch. 6) (1 week)
- Definition
- Transfer Functions
- Computing Filter Outputs
- Inverse z Transforms
- Poles and Zeros
- Stability

Frequency Responses and Spectra (Ch. 7 & 8) (1 week)
- Fourier Transform
- Filter Shape using Fourier Transform
- Filter Shape using Poles and Zeros
- Spectra for Digital Signals (Ch. 8)

FIR Filters (Ch. 9) (1.75 weeks)
- Moving Average Filters
- Characteristics of FIR Filters
- Windowing
- Design of Low, Band, and High Pass FIR Filters
- Equiripple FIR Filters

IIR Filters (Ch. 10) (1 week)
- Characteristics of IIR Filters
- IIR Filters Derived from Analog Designs
- Bilinear Transformation
- Impulse Invariance IIR Design

Discrete and Fast Fourier Transform (Ch. 11) (1 week)
- DFT
- DFT Resolution
- Spectrograms
- FFT

DSP Hardware (Ch. 12) (0.5 weeks)
- DSP Architectures
- Special Hardware Units
- Special Instructions

Applications of DSP (Ch. 14 & 15) (1 week)
- Signal Processing
- Image Processing

Practice Problems

Chapter 2:	2.1 - 2.7, 2.9, 2.11, 2.13, 2.15, 2.19, 2.21, 2.25, 2.27
Chapter 3:	3.1 - 3.6, 3.9, 3.10, 3.16 - 3.19, 3.23
Chapter 4:	4.9, 4.11, 4.13, 4.15, 4.16, 4.24, 4.25, 4.27, 4.28, 4.30, 4.32
Chapter 5:	5.4, 5.5, 5.6, 5.13, 5.17, 5.18, 5.19
Chapter 6:	6.15abdef, 6.6 - 6.8, 6.17, 6.18, 6.23, 6.28, 6.30, 6.31, 6.34
Chapter 7:	7.7, 7.10, 7.17, 7.24, 7.25
Chapter 8:	8.1 - 8.3
Chapter 9:	9.1, 9.4, 9.6ab approx c, 9.12, 9.13, 9.16, 9.20a, 9.21, 9.23, 9.26
Chapter 10:	10.3, 10.4abcd, 10.5, 10.6a, 10.7, 10.8, 10.13, 10.14a, 10.15, 10.16
Chapter 11:	11.2a, 11.4, 11.12, 11.13, 11.15, 11.16, 11.18, 11.21