ECE 464/564 – Digital Signal Processing

Catalog Description: Analysis and design of discrete-time linear-time invariant systems for processing discrete-time signals: DT-LTI system properties, DT signal analysis using Discrete-Time Fourier Transform, Discrete Fourier Transform and z-Transform, frequency response and transfer function. Signal sampling and reconstruction, digital processing of continuous-time signals, FIR and IIR digital filter design, and filter structures.

Credits: 4 **Terms Offered:** Winter

Prerequisites: ECE 351, ECE 352

Courses that require this as a prerequisite: ECE 567

Structure: Two 110-minute lectures per week

Instructors: H. Liu

Course Content:

- Review of discrete-time (DT) signals: linearity, time-invariance, causality, stability, and convolution; discrete-time Fourier transform; and difference equations
- Sampling theorem; reconstruction of continuous-time signals from discrete-time signals; interpolation and decimation
- z-transform; and inverse z-transform
- Image blurring and sound synthesis
- Discrete Fourier transform and circular convolution
- Finite impulse response (FIR) and infinite impulse response (IIR) networks
- IIR filter design using analog prototypes, and transforms from continuous-time to discrete-time
- FIR design techniques: frequency sampling and windowing method

Measurable Student Learning Outcomes:

At the completion of the course, students will be able to…

1. **Design** FIR and IIR filters by hand to meet specific magnitude and phase requirements (ABET Outcome A, C, m, n)
2. **Perform** Z and inverse Z transforms using the definitions, Tables of Standard Transforms and Properties, and Partial Fraction Expansion (ABET Outcome A, m, n)
3. **Determine** if a DT system is linear, time-invariant, causal, and memoryless; **determine** asymptotic, marginal and BIBO stability of systems given in frequency domain (ABET Outcome A, m, n)
4. **Design and implement** digital filters by hand and by using Matlab (ABET Outcomes B,C, K, m, n)
5. **Use** computers and MATLAB to **create, analyze and process** signals, to **simulate and analyze** systems, and to **plot and interpret** magnitude and phase of LTI system frequency responses (ABET Outcomes B, K)

Graduate students are expected to complete additional homework assignments involving the design of equiripple linear-phase FIR filters with the Parks-McClellan Algorithm.

Learning Resources:

- *Digital Signal Processing: A Computer based Approach*, K. S. Mitra, Berkeley McGraw-Hill, 1998

Students with Disabilities:

Accommodations are collaborative efforts between students, faculty and Services for Students with Disabilities (SSD). Students with accommodations approved through SSD are responsible for contacting the faculty member in charge of the course prior to or during the first week of the term to discuss accommodations. Students who believe they are eligible for accommodations but who have not yet obtained approval through SSD should contact SSD immediately at 737-4098.

Link to Statement of Expectations for Student Conduct:
http://oregonstate.edu/admin/stucon/achon.htm

Revised: 9/24/07
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