

ECE 7200 (Approved): Signal Processing

Course Description

Multi-rate signal processing, filter banks, perfect reconstruction, time-frequency analysis, and wavelets and applications.

Prior Course Number: 700

Transcript Abbreviation: Signal Processing

Grading Plan: Letter Grade

Course Deliveries: Classroom

Course Levels: Graduate

Student Ranks: Masters, Doctoral

Course Offerings: Spring

Flex Scheduled Course: Never

Course Frequency: Even Years

Course Length: 14 Week

Credits: 3.0

Repeatable: No

Time Distribution: 3.0 hr Lec

Expected out-of-class hours per week: 6.0

Graded Component: Lecture

Credit by Examination: No

Admission Condition: No

Off Campus: Never

Campus Locations: Columbus

Prerequisites and Co-requisites:

Exclusions: Not open to students with credit for 700.

Cross-Listings:

Course Rationale: Existing course.

The course is required for this unit's degrees, majors, and/or minors: No

The course is a GEC: No

The course is an elective (for this or other units) or is a service course for other units: Yes

Subject/CIP Code: 14.1001

Subsidy Level: Doctoral Course

Course Goals

Implement filter bank and wavelet based analysis of signals and images using MATLAB
Master multi-rate signal processing concepts, sample rate changes and applications, design of multi-rate systems
Develop an understanding of filter banks, conditions for perfect reconstruction, design of perfect reconstruction filter banks and applications
Learn about the time-frequency analysis, the time-frequency uncertainty principle, the short-term Fourier transform and applications
Learn about octave band filter banks and the continuous wavelet transform
Master discrete wavelet transform analysis including multi-resolution analysis, the multi-scale equation, regularity conditions, orthogonal and bi-orthogonal wavelets and the lifting method for designing wavelets
Learn about the extension of wavelets to 2 dimensions and applications to image processing

Course Topics

Topic	Lec	Rec	Lab	Cli	IS	Sem	FE	Wor
Review of CTFT, Laplace transform, DTFT, sampling and reconstruction, LTI systems, filters and Z-transform	2.0							
Upsampling and downsampling, noble identities, polyphase filters, sample rate conversion, multistage filter design	7.0							
Modulated, alias cancellation, quadrature mirror, perfect reconstruction, tree structured filter banks	8.0							
Time-frequency analysis, Uncertainty principle, continuous STFT, discrete STFT	5.0							
Continuous wavelet transform	3.0							
Review of Vector spaces, Hilbert spaces and Frames	3.0							
Discrete wavelet transform, multiscale equations, cascade equation, implementational issues, application	9.0							
Lifting for wavelet design, two dimensional wavelets, applications in image coding	3.0							

Representative Assignments

Weekly homework problems with both analytical and Matlab content will be assigned.

Grades

Aspect	Percent
Homework and MATLAB based computer exercises	50%
One midterm exam	25%
Final exam	25%

Representative Textbooks and Other Course Materials

Title	Author
<i>Fourier and Wavelet Signal Processing</i> http://fourierandwavelets.org (online)	Vetterli and Kovacevic

ABET-EAC Criterion 3 Outcomes

Course Contribution	College Outcome
***	a An ability to apply knowledge of mathematics, science, and engineering.
	b An ability to design and conduct experiments, as well as to analyze and interpret data.
***	c An ability to design a system, component, or process to meet desired needs.
	d An ability to function on multi-disciplinary teams.
**	e An ability to identify, formulate, and solve engineering problems.
	f An understanding of professional and ethical responsibility.
*	g An ability to communicate effectively.
	h The broad education necessary to understand the impact of engineering solutions in a global and societal context.
	i A recognition of the need for, and an ability to engage in life-long learning.
	j A knowledge of contemporary issues.
**	k An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Additional Notes or Comments

updated exclusions, abbreviation, topics and goals to match university format.

Update text 3/30/12

Change course number from 6200 to 7200 9/11/17 BLA

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