

E E 5667-3. Wavelet Theory and Applications.

University of Colorado at Denver
College of Engineering and Applied Science

Term: Fall 2009

Course dates/days/times: MW - 05:30PM to 06:45PM

Course location: NC1408

Office Hours: M, W 2:00-3:30PM

Professor: Jan T. Bialasiewicz

Office location: NC2426

Phone: 303-543-4333

email address:jan.bialasiewicz@cudenver.edu

Course Design

Catalog Description: Topics include: fundamentals of signal decomposition; theory of filter banks; multi-resolution analysis and fast wavelet transforms; applications image and video image and video compression; and denoising and feature detection.

Prereq: graduate standing or permission of instructor

Instructor Description:

The student will learn theoretical basics and design methods involved in signal processing with wavelets. The student will use software design tools provided within Matlab, in particular, wavelet toolbox with graphical user interface (GUI). The student will be provided with some software developed over years by the instructor and his students. The student will get acquainted with the tool that is in the center of modern signal processing research and applications. Some of them such as medical image processing using modulus maxima technique, and implementations of JPEG2000 and Motion JPEG2000 for image compression are among those studied in detail in this course.

The tools mastered in this course may be effectively used in M.S. thesis research.

At least basic knowledge of Matlab is desired to take this course.

Requirements

Required Texts: None. Power Point presentations and journal papers will be e-mailed to students.

Recommended Texts:

Van Fleet, P.J., Discrete Wavelet Transformations, Wiley, 2008

Mallat, S., Wavelet Tour of Signal Processing, Second Edition, Academic Press, 1999.

Jensen A. and A.la Cour-Harbo, Ripples in Mathematics The Discrete Wavelet Transform, Springer, 2001.

Assignments and Examinations: All assignments with deadline are stated below.

Assessment Design

Grades:

Project 1: 25%

Project 2: 30%

Final Project:	35%
Final Pres.	10%
Total:	100%

All projects must be presented in a form of Microsoft Word document and must include all plots with axis properly labeled and with proper titles. All figures must be numbered and explained in the text. The graded assignments with specific comments will be returned to students in maximum two weeks.

Course Policies: No late work and no make-ups. Extensions only for valid reasons and only if agreed before the work is due. No electronic submissions of assignments. **The student must turn-in both project reports and must give a presentation.**

Course Schedule

Class Schedule

Date	Topic	Required Reading	Assignments
August 17 August 19	Introduction		
August 24 August 26	Overview and Software Tools and Applications		
August 31 September 2	Time and Frequency		PROJECT 1, due 09/23
September 9 September 14	Multiresolution Analysis		
September 16 September 21	Multiresolution Analysis		
September 23 September 25	Image Compression with Wavelet Transform Modulus Maxima (WTMM)		PROJECT 2, due 10/26
September 28 September 30	Discrete Wavelet Transform (DWT) and its Representation via Lifting		
October 5 October 7	Discrete Wavelet Transform (DWT) and its Representation via Lifting		FINAL PROJECT Due 12/02
October 12 October 14	Selected Topics in Discrete Wavelet Transform		
October 19 October 21	Wavelet-Based Image Compression System		
October 26 October 28	Wavelet-Based Image Compression System		
November 2 November 4	Foundations of JPEG 2000: Image Coding Algorithms		
November 9 November 11	Foundations of JPEG 2000: Factoring Discrete WT into Lifting Steps		
November 16	JPEG 2000 and Motion JPEG 2000 Standard and Its Implementations		

November 28	JPEG 2000 and Motion JPEG 2000 Standard and Its Implementations		
November 30 December 2	Final Presentations		

Course Communication

- Office hours: M, W 4:00-5:00PM
- E-mail approach: jan.bialasiewicz@ucdenver.edu

Students called for military duty

- If you are a student in the military with the potential of being called to military service and /or training during the course of the semester, you are encouraged to contact Paul Rakowski.