Department of Electrical and Computer Engineering
The Johns Hopkins University

520.646 Wavelets and Filter Banks
Spring 2005

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Course Homepage  http://thanglong.ece.jhu.edu/Course/646/

Lectures  Thursday Friday 10:30 – 12:00, Barton 114.

Prerequisites

- 520.435 Digital Signal Processing.
- C/C++ and Matlab.
- An undergraduate course in Linear Algebra.

Textbook

- G. Strang and T. Q. Nguyen, Wavelets and Filter Banks,

- M. Vetterli and J. Kovačević, Wavelets and Subband Coding,

- P. P. Vaidyanathan, Multirate Systems and Filter Banks,

- C. S. Burrus, Ramesh A. Gopinath, and Haitao Guo, Introduction to Wavelets and Wavelet
Outline of Topics

- Multirate Signal Processing: filter banks, multirate systems, filtering, decimation, upsampling, polyphase, perfect reconstruction, aliasing cancellation, signal representation and signal decomposition using vectors and matrices.

- Wavelets: wavelets from filter banks, bases, frames, orthogonality, biorthogonality, multiresolution, smoothness, vanishing moments, time-frequency and time-scale analysis, continuous-time and discrete-time wavelet transform, famous wavelet pairs, wavelet packet, symmetric extensions, complexity issues.

- Design methods: spectral factorization, polyphase matrix factorization, lattice structure, ladder structure (lifting scheme), integer wavelets, cosine modulation, time-domain optimization.

- Applications: Audio/Image/Video compression – lossy and lossless, subband coding, quantization effects, signal denoising, inverse halftoning, multicarrier modulation, transmultiplexers, edge detection, database retrieval and indexing.

Additional References


Homework

- There will be written problem sets as well as computer assignments.

Final Project

- Students are expected to work in team of 2 or 3 on a related topic of choice.
- The topic can be chosen from a list of suggestions provided by the instructor.
- A final project report and an oral demonstration/presentation are required from each team.

Grades

- Homework: 30%
- Midterm exams: 40%
- Final project: 30%