

# EE-274 - INTRODUCTION TO WAVELETS & FILTER BANKS

*Spring Semester 2007*

## COURSE SYLLABUS<sup>1</sup>

- Chapter 1* Introduction to Wavelets. Essence of Wavelet Analysis. The Continuous Wavelet Transform (CWT) and the Discrete Wavelet Transform (DWT).
- Chapter 2* - Review of Fourier Theory and Filters.
- Chapter 3* - Orthonormal Transforms of Time Series. Basic Theory. The Orthonormal Discrete Fourier Transform.
- Chapter 4* - The Discrete Wavelet Transform. Qualitative Description. Concept of Multiresolution Analysis. The Wavelet Filter.  
The Scaling Filter. Daubechies Wavelet & Scaling Filters. Coiflet Wavelet & Scaling Filters.  
**Example:** Electrocardiogram Data- ECG Time Series.  
**Practical Considerations.** *Choice of wavelet Filter.*
- Chapter 5* - The Maximal Overlap Discrete Wavelet Transform.  
**Examples:** Electrocardiogram Data, Subtidal Sea Level Fluctuations, Nile River Minima, Ocean Shear Measurements.  
**Practical Considerations** *Choice of wavelet filter. Handling boundary conditions.*
- Chapter 6* - The Discrete Wavelet Packet Transform. Basic Concepts. The Best Basis Algorithm  
**Examples:** DWPT of Solar Physics Data, Best Basis for Solar Physics Data, MODWPT of Solar Physics Data  
Matching Pursuits.

**Text:** *Wavelet Methods for Time Series Analysis*, Donald B. Percival & Andrew T. Walden. Cambridge University Press 2002, ISBN 0 521 64068 7

*Other Reference Texts:*

- *a Wavelet tour of signal processing*, Stéphane Mallat, Academic Press, Second Edition, 1999
- *Wavelets & Filter Banks*, Gilbert Strang and Truong Nguyen, Wellesley-Cambridge Press, 1995
- *Wavelet Transforms, Introduction to Theory & Applications*, R.M.Rao and A.S.Bopardikar, Addison-Wesley, 1998
- *Wavelets & Subband Coding*, Vetterli & Kovačević, Prentice Hall, 1995
- *Ten Lectures on Wavelets*, I.Daubechies, CBMS-NSF Regional Series in Applied Mathematics, SIAM, 1992

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<sup>1</sup>Follows the Percival & Walden Text

- *Wavelets Through A Looking Glass - The World of the Spectrum*, O. Bratteli, P. Jorgensen, Birkhauser, 2002