**MATH 772–001 (Wavelet Theory)**
**Fall 2007**

**Instructor:** David Walnut

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**Course Web Page:** Access through `http://math.gmu.edu/coursehomepages.htm`

**Office hours:** By appointment.

**Text:** D. Walnut, *An Introduction to Wavelet Analysis*, Birkhäuser Boston (2001). ISBN 0-8176-3962-4.
K. Gröchenig, *Foundations of Time-Frequency Analysis*, Birkhäuser Boston (2001). ISBN 0-8176-4022-3.

**Prerequisites:**

MATH 315 or equivalent and computer literacy (we will use MATLAB). Some knowledge of Fourier Analysis and Functional Analysis is helpful but not required.

**Topics:**

The goal of the course is to introduce the student to some of the basic concepts, constructions and applications of time-frequency decompositions including wavelet bases and Gabor frames. The schedule below may change as circumstances warrant.

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| Week 1: | Review of Orthonormal Bases in Hilbert Spaces |
| Week 2: | Review of Fourier Analysis |
| Week 3: | Wavelet Orthonormal Bases for $L^2(\mathbf{R})$ |
| Week 4: | Multiresolution Analysis |
| Week 5: | Filter Banks and the Discrete Wavelet Transform |
| Week 6: | Daubechies Wavelets |
| Week 7: | Wavelet Packets and Best Bases |
| Week 8: | Application: Image Compression and The BCR Algorithm |
| Week 9: | Local Cosine Bases |
| Week 10: | Nonorthogonal Bases and Frames in Hilbert Space |
| Week 11: | Gabor Systems: Existence and Basic Properties |
| Week 12: | Gabor Systems: Duality and Density |
| Week 13: | The Zak Transform and the Balian-Low Theorem |
| Week 14: | Project Presentations |

**Grading:**

The grade will be based on homework assignments, including some assignments using MATLAB, and on a semester project of the student's own choosing to be presented at the end of the semester. Details on the project will be made available.