**Master programme on**
**"Mathematics and Applications"**
Department of Mathematics (UAM)
Academic Year 2010-2011

**Wavelets and Signal Treatment**
**Tutor:** M. Teresa Carrillo

Scope of the course

The aim of this course is to cover the techniques used in signal processing such as cosine transform, wavelets and multiresolution directional methods: Contourlets, Crisp-Contourlets, Nonsubsampled Contourlets, Uniform quincux DFB (uqDFB), Non-Uniform quincux DFB (nuqDFB), etc.
We will use MATLAB to practice the previous topics on image processing, denoising, etc.

Contents

**1. Introduction**

1.1 Hilbert Spaces. Frames and Riesz bases.

1.2 Fourier series and Fourier Transform.

1.3 Shannon Sampling Theorem.

**2. Cosine Bases**

2.1 Cosine I Basis, Cosine IV Basis.

2.2 Discrete Cosine Bases.

2.3 Lapped Orthogonal Transform.

2.4 JPG 80

**3. Wavelets**

3.1 Orthogonal Wavelet Bases.

3.2 Filter Banks.

3.3 Mallat Algorithme.

3.4 Biorthogonal Wavelet Bases.

**4. Trees**

4.1 Binary Wavelet Packet Tree.

4.2 Biorthogonal Wavelet Packets.

4.3 Best Bases. Entropy.

4.4 Cosine Best Basis.

4.5 JPG 2000

**5. Signal Compression**

5.1 Quantization

5.2 Entropy Coding.

5.3 Huffman Code.

5.4 Arithmetic Code.

**6. Multiresolution Directional Methods**

6.1 Directional Filter Banks (DFB).

6.2 Perfect Reconstruction.

6.3 Maximally Decimation. Permisibility.

6.4 Ċontourlets Nonsubsampled. Crisp-Contourlets.

6.5 Uniform Quincux DFB (uqdfb). Nonuniform Quincux DFB (nuqdfb).

**7. Simulations**

7.1 Simulation on JPG 80.

7.2 Simulation on JPG 2000.

7.3 Simulation on Frequency.

7.4 Simulation on Trees.

7.5 Simulation on contourlets.

7.6 Simulation on crisp-contourlets.

7.7 Simulation on Uniform and Nonuniform quincux.

## Bibliography

### Books


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### Articles


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