



E9 213 January 3:0

Time-Frequency Analysis

Instructor

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Teaching Assistant

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Department: Electrical Engineering

Course Time: Tuesday, Thursday; 11-12.30 (tentative)

Lecture venue: B 306 or Multimedia Classroom

Detailed Course Page: <https://sites.google.com/site/chandrasedkharseelamantula/teaching/e9-213-time-frequency-analysis>

Announcements

Done on Google group mailing lists and Piazza.

The announcements are related to assignments, class tests, demos, lab sessions, etc.

Brief description of the course

The course is ideal for students who have taken courses in Digital Signal Processing and Signals and Systems in their undergraduate study.

Prerequisites

Digital Signal Processing, Signals and Systems

Syllabus

Local/global averages, Time-frequency distributions, The Heisenberg uncertainty principle, short-time Fourier transform, Wigner-Ville distribution, Cohen's class of distributions, Spaces and Bases, Hilbert spaces, Banach spaces, Riesz bases, Biorthogonal bases, orthogonal bases, orthonormal bases, Shift-invariant spaces, splines, frames, dual frames, Wavelets, scalogram, wavelet frames, multiresolution analysis, wavelet orthogonal bases, relation with filterbanks, biorthogonal wavelet bases, applications of wavelets

Course outcomes

The students would be equipped with the tools and techniques to handle nonstationary signals arising in

various real-world contexts.

Grading policy

Assignments: 10%

Term project: 10%

Class tests: 30%

Finals: 50%

Assignments

Handwritten assignments related to problem-solving.

Assignments related to the implementation of various time-frequency distributions. Assignments related to applications of wavelets. In some editions of the course, we have considered a term project instead of various assignments.

Resources

L. Cohen, Time-Frequency Analysis. Prentice Hall, 1995.

S. Mallat, A Wavelet Tour of Signal Processing - The Sparse Way. Elsevier, Third Edition, 2009.

M. Vetterli, J. Kovacevic, and V. K. Goyal, Fourier and Wavelet Signal Processing. Book site:

<http://fourierandwavelets.org/terms.php>

M. Unser, "Sampling - 50 Years After Shannon," Proceedings of IEEE, vol. 88, No. 4, April 2000. Download from: <http://bigwww.epfl.ch/publications/unser0001.html>

M. Unser, "Splines - A Perfect Fit for Signal and Image Processing," IEEE Signal Processing Magazine, pp. 22-38, Nov. 1999. Download from: <http://bigwww.epfl.ch/publications/unser9902.html>

D. Gabor, "Theory of communication," pp. 429-457, Proceedings of IEE, pp. 429-457, 1946. A scanned copy of this document is available for download from <http://bigwww.epfl.ch/sekhar/gaborscannedpages.pdf>

Computational resources

Time-frequency toolbox (MATLAB) is available for download from <http://tftb.nongnu.org/>