Math 650. Fourier Analysis

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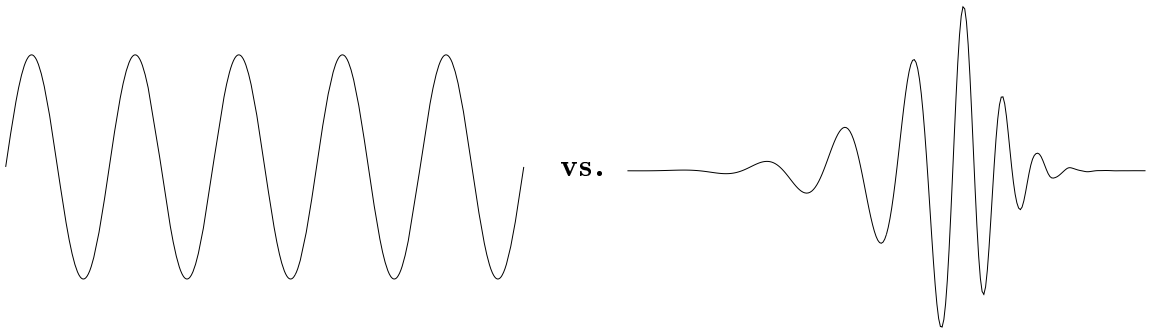

Fourier analysis is a subject of mathematics which originated with the study of Fourier series and integrals. Nowadays Fourier analysis is a vast area of research with applications ranging in several branches of science such as partial differential equations, potential theory, mathematical physics, number theory, signal analysis, and tomography. An important recent development in Fourier analysis is the study of a new type of orthogonal expansions in wavelet bases. Theory of wavelets has become a very active area of research with many far reaching applications.

This course is an introduction to the theory of Fourier series, Fourier integrals, wavelets, and related topics. More specifically, we are planning to cover the following topics:

1) The general properties of orthogonal systems, Riesz bases, frames.
2) Convergence and summability theory of Fourier series, lacunary series.
3) Fourier transforms of L^2 functions, inversion formula, Plancherel's theorem.
4) Multivariable Fourier series, the Poisson summation formula.
5) Theory of distributions, Fourier transforms of tempered distributions, the Paley-Wiener theorem.
6) General theory of wavelets, scaling functions, multiresolution analysis.
7) The construction of Strömberg wavelets, Meyer wavelets, and compactly supported Daubechies wavelets.
8) Multivariable wavelets, tensor products.
9) Wavelets and Calderón-Zygmund operators in various function spaces.
10) Applications to signal processing, discrete Fourier and wavelet transforms.

Prerequisites: Math 597 and Math 602.

Grading: There will be a couple of homework assignments. Since there will be no final exam each student will give an oral presentation on a subject of his/her choice from a list of several topics in Fourier Analysis.

Textbook: P. Wojtaszczyk, A Mathematical Introduction to Wavelets (Cambridge Univ. Press, 1997)