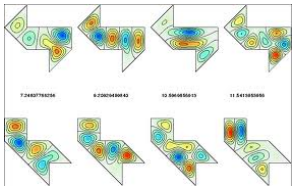
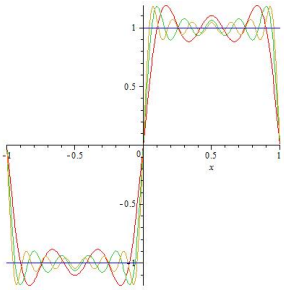


Math 131B, Fall 2013: Hilbert Spaces and applications



Can you hear the shape of a drum?
What are the laws of quantum mechanics?
What's the optimal way to price a stock option?
Do the equations of fluid flow have stable solutions?
What's the mathematics behind Auto-Tune?

And what do all of these questions have in common? Their answers all take place inside *spaces of functions*, and many of them take place in the function spaces known as *Hilbert spaces*.

This course will combine a study of the fundamentals of Hilbert spaces, harmonic analysis (e.g., Fourier series), and spectral theory, with applications like the heat equation, the wave equation, and Schrödinger's equation. Additional topics, like operator theory, the Lebesgue integral, and the questions listed above, will be selected based on the interests of students in the class.

We will assume students are familiar with the fundamental ideas of calculus and analysis I (sequences, limits, continuity, differentiation, integration); the point of this course is to see what that theory is good for in practice. The course will also be well-suited to master's students who want to review analysis, but also want to learn something new and look into interesting topics for thesis work.

Prerequisites: Math 131A (Introduction to Analysis), equivalent course, or instructor permission.

Texts: *Applied Analysis by the Hilbert Space Method*, Holland, (ISBN 0486458016); and *Introduction to Spectral Theory in Hilbert Space*, Helmberg (ISBN 0486466221). Both are from Dover Publications; together, they should cost less than $55 total.