Topics in analysis: Harmonic analysis
MWF12:00-12:50pm
CP397
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MWF 11-12
and by appointment.

Topic: Harmonic analysis. What is harmonic analysis? Harmonic analysis is the study of functions defined on groups by decomposing the function into irreducible representations. Harmonic analysis is proving L^p estimates for operators that arise in differential equations. Harmonic analysis is a large subject. Depending on who you ask, you might receive either of the above answers, or something completely different. In this course, the only group we will consider is $\mathbf{R}^n$ and we will show how to decompose functions defined on $\mathbf{R}^n$ using the Fourier transform. The Fourier transform is a unitary operator on $L^2(\mathbf{R}^n)$ that diagonalizes many of the operators of interest in analysis. We will study some of these operators and learn a variety of techniques for proving the continuity of these operators. We will discuss the solution of inverse problems for partial differential equations.

Text: There will be no text. Lecture notes are being prepared. Students with nothing better to do, may enjoy reading a β-version of the notes at http://www.ms.uky.edu/∼rbrown/courses/ma773 *caveat lector*.

Work: Students will not be required to do much of anything except learn mathematics. The visible signs of learning that I hope to see are: questions, finding errprs in my notes, reading above and beyond the lecture notes and attempting exercises from the notes. This should make you look fondly back at the old days when all you had to do was homework. See me if you would like suggestions for further reading. Some homework will be assigned.

Additional references: Below are some additional references you may wish to consult.

- Kenig, C. E.; Ruiz, A.; Sogge, C. D. Uniform Sobolev inequalities and unique continuation for second order constant coefficient differential operators. Duke Math. J. 55 (1987), no. 2, 329–347.
- Sylvester, John; Uhlmann, Gunther A global uniqueness theorem for an inverse boundary value problem. Ann. of Math. (2) 125 (1987), no. 1, 153–169.
- Stein, E. *Harmonic Analysis*
- Stein, E. *Singular integrals and differentiability properties of functions*
- Stein, E. and Weiss, G. *Introduction to Fourier analysis on Euclidean spaces*

- Isakov, V. *Inverse problems for partial differential equations.* Applied Mathematical Sciences, 127. Springer-Verlag, New York, 1998. xii+284 pp. ISBN: 0-387-98256-6
- Hörmander, L., *The analysis of linear partial differential operators v. 1-4*
- Uhlmann, G. *CBMS lecture notes on inverse problems.* See me for a copy.

January 9, 2001