

Topics in Harmonic Analysis - Math 542

Fall 2007

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- **Office hours:** To be announced on the course website.
- **Web page :** The course website is

<http://www.math.ubc.ca/~malabika/teaching/ubc/fall07/math542/index.html>

Homework assignments and all relevant course information (such as changes to office hours if any, or solutions to homework problems if needed) will be posted here.

- **Lectures :** Monday, Wednesday, Friday 11-12 am in Mathematics Building, Room 102.
- **Prerequisites :** Introductory analysis sequence (consisting of Math 507, 510, 601D) or equivalent. A working knowledge of Fourier transform, convolution, Plancherel theorem, Fourier inversion, Schwartz functions, and tempered distributions will be assumed.
- **Syllabus :** Harmonic analysis is one of the most powerful tools in modern analysis, with applications to a wide variety of fields, such as partial differential equations, mathematical physics, differential geometry, and combinatorial number theory. The purpose of this course is to introduce some fundamental techniques of harmonic analysis, and give a glimpse of their applications. Apart from graduate students in harmonic analysis, this course should be of interest to those intending to specialize in PDE, mathematical physics, applied harmonic analysis and inverse problems.

The core topics to be covered in this course are the following :

- Method of stationary phase: asymptotics, Fourier transform of surface measures.
- Oscillatory integral operators: $L^2 - L^p$ estimates, restriction theorems, Riesz means.
- Pseudodifferential operators: symbol calculus; L^p , Sobolev, Hölder estimates.
- Fourier integral operators: regularity properties, wave front sets and propagation of singularities, local smoothing, variable-coefficient Keakeya maximal theorems.

In order to motivate the study of the above topics, we will use examples from

- Partial differential equations: Parametrix for elliptic boundary-value problems, Strichartz estimates via restriction theorems,
- Mathematical physics: half-wave operator, the sharp Weyl formula, L^p estimates of eigenfunctions,
- Inverse problems, integral geometry: X -ray and generalized Radon transforms, application to seismic imaging.

Time permitting, we will also introduce more current research topics.

- **Grading Policy :** Homework will be assigned regularly, and will be collected at approximately two-week intervals. Every student will be required to give an oral presentation at the end of the course in lieu of a final exam, on a topic to be decided on by the student and the instructor. Homework constitutes 70% of your grade in this class, and the oral presentation 30%.