MA692: Inverse Scattering Problems for Wave Propagation

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Time: TTh 12:00-01:15PM

Room: REC 302

Office hour: TTh 1:30-2:30 pm

Course website

`www.math.purdue.edu/~lipeijun/math692.html`

Prerequisite: Basic knowledge of functional and numerical analysis, and partial differential equations.

Description: Scattering problems are concerned with the effect that an inhomogeneous medium has on an incident field. In particular, if the total field is viewed as the sum of an incident field and a scattered field, the direct scattering problem is to determine the scattered field from the incident field and the differential equation governing the wave motion; the inverse scattering problem is to determine the nature of the inhomogeneity, such as location, geometry, or material property, from a knowledge of the scattered field. These problems have played a fundamental role in diverse scientific areas such as radar and sonar (e.g., stealth aircraft design and submarine detection), geophysical exploration (e.g., oil and gas exploration), medical imaging (e.g., breast cancer detection), near-field optical microscopy (e.g., imaging of small scale biological samples), and nano-optics.

This course introduces mathematical models and computational methods for four classes of inverse problems that arise from the acoustic and electromagnetic wave propagation in complex and random media, which include the inverse surface scattering problem, inverse obstacle scattering problem, inverse medium scattering problem, and inverse source scattering problem.

Text: No textbook is required. Lecture notes will be made available to students.

Course grade: No exams. Students are required to present course-related material in class.

References

1. D. Colton and R. Kress, *Inverse Acoustic and Electromagnetic Scattering Theory*
2. H. Engle, M. Hanke, and A. Neubauer, *Regularization of Inverse Problems*
3. J.-C. Nédélec, *Acoustic and Electromagnetic Equations: Integral Representations for Harmonic Problems*