Applied Mathematics Seminar
INSCC 110, 3:30pm Tuesday
September 5, 2000

High frequency diffraction by smooth and non-smooth obstacles: asymptotics and numerics

by

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Abstract

In high frequency wave propagation the solution rapidly oscillates at the scale of a small wavelength. Geometrical optics provides "two-scale" representations for the solutions and the equations for evolution of slow parameters (the eiconal equations and the transport equations). In the 1960-s J.B. Keller formulated the Geometric theory of diffraction which extended geometrical optics to include the effects of scattering by obstacles, in particular for the effects where geometrical optics fails, e.g. for the "shadow" effects behind smooth obstacles or for scattering by non-smooth obstacles containing edges or conical points. This leads to the need to evaluate certain fundamental objects, called "diffraction coefficients" (which account for the effects of the particular "irregularity") from an appropriate "canonical problem" (which is somewhat analogous to the "unit cell" problems in periodic homogenization). The "edge" canonical problem is relatively simple, it admits an explicit solution (Sommerfeld, 1896) and the diffraction coefficients are found analytically. The "cone" canonical problem (where the cone may have rather arbitrary cross-section), however, does not generally have an analytic solution.

The speaker will review a work done by himself and his collaborators (V.M. Babich, B.A. Samokish and D.B. Dementiev) over the last ten years on evaluation of the conical diffraction coefficients via a combination of analytical and numerical methods. As a result, diffraction coefficients can be evaluated for rather arbitrary conical geometries: an extensive numerical work has been performed, and some numerical results will be presented. Current developments, applications and prospects will be discussed.