Applied Mathematics

McGill Applied Mathematics Seminar Series

Monday 6 October 2003

Prof Weiwei Sun
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City University, Hong Kong

Title: "Fast algorithms for the electromagnetic scattering from a large cavity"

Time: 2:35 pm **Room: Burnside 1205**

Coffee and refreshments will be served after the seminar

Abstract: We present a fast algorithm for solving electromagnetic scattering from a rectangular open cavity embedded in an infinite ground plane. The medium inside the cavity is assumed to be (vertically) layered. By introducing a transparent (artificial) boundary condition, the problem in the open cavity is reduced to a bounded domain problem. A simple finite difference method is then applied to solve the model Helmholtz equation. The fast algorithm is designed for solving the resulting discrete system in terms of the discrete *Fourier transform* and a preconditioning conjugate gradient (PCG) method with a complex diagonal preconditioner for the indefinite interface system. The existence and uniqueness of the finite difference solution is proved for arbitrary wave numbers. Our numerical experiments for large numbers of mesh points, up to 16 million unknowns, and for large wave numbers, *e.g.*, between 100 and 200 wavelengths, show that the algorithm is extremely efficient. The cost for calculating the Radar Cross Section, which is of significant interest in practice, is $O(M^2)$ for an $M \times M$ mesh. The proposed algorithm may be extended easily to solve discrete systems from other discretization methods of the model problem.