Deterministic and Stochastic Inverse Scattering Problems Using Fast Direct Solvers

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Inverse scattering problems arise in many areas of science and engineering, including medical imaging, remote sensing, ocean acoustics, nondestructive testing, geophysics and radar. This talk will focus specifically on the deterministic and stochastic inverse acoustic scattering medium problem in two dimensions. Several challenges arise in the solution of such problems, including nonlinearity, ill-posedness, and computational cost. Addressing these challenges with fast direct solvers and low-rank approximations of distant interactions, this talk will present a fast, stable algorithm that can be applied as a framework for the solution of both the discrete and the stochastic inverse scattering problems. Given full-aperture far-field measurements of the scattered field for multiple angles of incidence, we use the Gauss-Newton method together with the recursive linearization algorithm (RLA) to reconstruct a band-limited approximation of the domain solving a sequence of linear least-square problems of successively high frequencies using fast direct solvers.