Convexification and experimental data for a 3D inverse scattering problem with the moving point source

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Abstract.

Reconstruction of physical properties of a medium from boundary measurements is one of the substantially challenging inverse scattering problems. In this talk, we present a convexification method to find the dielectric constant as an unknown coefficient of a three-dimensional Helmholtz equation for the case when the backscattering data are generated by a point source running along an interval of a straight line and the wavenumber is fixed. Using a special Fourier basis, the method of this work strongly relies on a new derivation of a boundary value problem for a system of coupled quasilinear elliptic equations. We then introduce a cost functional in the partial finite difference, weighted by a suitable Carleman weight function. This numerical setting allows us to verify the performance of the method using experimental data in which the spatial discretization is fixed. The experimental data were collected using a microwave scattering facility at The University of North Carolina at Charlotte.