Reconstruction of small electromagnetic inhomogeneities

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We consider solutions to the (full) time-harmonic Maxwell's equations. Our first goal is to provide a rigorous derivation of the leading order boundary perturbations resulting from the presence of a finite number of interior inhomogeneities. Our second goal is to apply these asymptotic formulae for the purpose of identifying the location and certain properties of the shapes (polarization tensors) of the inhomogeneities from boundary measurements. In contrast to a boundary least squares fit to the measured data, we present a method based on appropriate averaging, using particular background solutions as weights. We also discuss the reconstruction of the small inhomogeneities in the time-dependent case and generalize our approach to treat the case where we are only in possession of boundary measurements on a part of the boundary. Our main idea for solving these inverse problems is to reduce them to calculations of inverse Fourier transforms.

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