

Near-field Electromagnetic Holography: The inverse problem of electromagnetic continuation

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Abstract

We consider the problem of reconstructing the surface tangential components of the electromagnetic field from electric (or magnetic) measurements on a nearby surface. Mathematically the electric (or magnetic) measurements satisfy the Maxwell system. We show that any solution to this equation admits a unique representation by a magnetic dipole, so that the problem is reduced to the solution of a linear integral equation of the first kind. This integral equation is discretized using the method of equivalent sources and conjugate gradients is utilized as a regularization method for the numerical solution. We study uniqueness of the reconstruction and obtain stability estimates. In addition we report numerical reconstructions obtained from data measured over a cylindrical shell and a plate with a circular slot excited by an electromagnetic horn. This work was supported by the Office of Naval Research.