Scalable Three-Dimensional Inverse Scattering of a Dielectric Target Embedded in a Lossy Half Space

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A modified iterative-Born method is applied for three-dimensional low-frequency inversion of a lossless dielectric target embedded in a lossy half space. The forward solver employs a modified form of the extended-Born method and the half-space Green's function is computed efficiently via the complex-image technique. Example results are shown, with all scattering data based on a computational model, utilizing a rigorous forward solver distinct from that employed in the inversion. In addition, distinct gridding schemes are used in the forward and inverse solvers. Simple Tikhonov regularization is found to yield adequate results, for inversion of noisy data.

To allow consideration of large problems, the forward and inverse software have been implemented in a scalable framework via the message passing interface (MPI). Algorithm scalability is addressed in this talk, considering . In addition, using the scalable software we consider three-dimensional inversion of large and realistic subsurface-sensing problems.

In addition to the iterative-Born inversion method, we also consider regression algorithms for inversion of subsurface targets. In particular, we extend the recently developed relevance-vector machine (RVM) algorithm to vector regression. The RVM algorithm was first developed for scalar regression. Here the vector components are the parameters of the subsurface target. Vector regression is considered for inversion, the results from which are then used to initialize the more-general iterative-Born formulation.