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NUMERICAL LINEAR ALGEBRA FOR NONLINEAR MICROWAVE IMAGING*

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Abstract. A nonlinear inverse scattering problem arising in microwave imaging is analyzed and numerically solved. In particular, the dielectric properties of an inhomogeneous object (i.e., the image to restore) are retrieved by means of its scattered microwave electromagnetic field (i.e., the input data) in a tomographic arrangement. From a theoretical point of view, the model gives rise to a nonlinear integral equation, which is solved by a deterministic and regularizing inexact Gauss-Newton method. At each step of the method, matrix strategies of numerical linear algebra are considered in order to reduce the computational (time and memory) load for solving the obtained large and structured linear systems. These strategies involve block decompositions, splitting and regularization, and super-resolution techniques. Some numerical results are given where the proposed algorithm is applied to recover high resolution images of the scatterers.

Key words. inverse scattering, microwave imaging, inexact-Newton methods, block decomposition, regularization.

AMS subject classifications. 65F22, 65R32, 45Q05, 78A46

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