Structured Matrices in Nonlinear Microwave Imaging

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Structured matrices arise in a lot of emerging applications related to nonlinear inverse problems, such as microwave imaging for nondestructive evaluations and characterization of materials, medical imaging, and subsurface prospecting. In this talk we discuss the solution of the Lippman-Schwinger integral equation of the inverse scattering theory for microwave imaging, where the dielectric properties of the object under test (i.e., the image to restore) are retrieved by means of the scattered microwave electromagnetic field (i.e., the input data).Since the model is nonlinear, in our approach a regularizing Inexact-Newton method is applied. At any step, the obtained linearized system is multilevel structured and extremely large, so that strategies of structured numerical linear algebra are analyzed in order to reduce the computational (time and memory) load. The regularization properties of the method are also assessed by means of a number of simulations, in which multilayer cylinders are reconstructed. Real input data, measured by the Institut Fresnel of Marseille, France, are also used to validate the approach under real conditions.

This is a joint work with Professors F. Di Benedetto, M. Pastorino, A. Randazzo and G. Bozza, of the University of Genoa, Italy.

References

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