

Qualitative Methods in Inverse Electromagnetic Scattering

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Since the invention of radar, scientists and engineers have striven not only to detect but also to identify unknown objects through the use of electromagnetic waves. A significant step forward in the resolution of this problem was the use of synthetic aperture radar (SAR). However, (SAR) suffers from limitations arising from the incorrect model assumptions which ignore both multiple scattering and polarization effects. In recent years, in an effort to overcome the limitations of such an incorrect model, considerable effort has been put into the development of nonlinear optimization techniques which avoids incorrect modeling assumptions. The success of such an approach is based on strong a priori knowledge of the scattering object and hence is inappropriate for many, if not most, practical applications. In view of the problems inherent in the weak scattering and nonlinear optimization approaches to target identification, a new class of methods has been developed in the past few years loosely called qualitative methods in inverse scattering theory. The main theme of this talk is the use of one such qualitative method, the linear sampling method, to solve inverse electromagnetic scattering problems. In particular, we will discuss the imagining of objects imbedded in a known inhomogeneous media using electromagnetic radiation at a fixed frequency.