Mathematical Physics

A Direct Sampling Method for Inverse Scattering Using Far-Field Data

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This work is concerned with a direct sampling method (DSM) for inverse acoustic scattering problems using far-field data. The method characterizes some unknown obstacles, inhomogeneous media or cracks, directly through an indicator function computed from the measured data. Using one or very few incident waves, the DSM provides quite reasonable profiles of scatterers in time-harmonic inverse acoustic scattering without a priori knowledge of either the physical properties or the number of disconnected components of the scatterer. We shall first derive the DSM using far-field data, then carry out a systematic evaluation of the performances and distinctions of the DSM using both near-field and far-field data. The numerical simulations are shown to demonstrate interesting and promising potentials of the DSM: a) ability to identify not only medium scatterers, but also obstacles, and even cracks, using measurement data from one or few incident directions, b) robustness with respect to large noise, and c) computational efficiency with only inner products involved.

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