Inverse Elastic Surface Scattering with Near-Field Data

Peijun Li
Purdue University, USA
Email: lipeijun@math.purdue.edu

Consider the scattering of a time-harmonic plane wave by a one-dimensional periodic surface. A novel computational method is proposed for solving the inverse elastic surface scattering problem by using the near-field data. Above the surface, the space is filled with a homogeneous and isotropic elastic medium, while the space below the surface is assumed to be elastically rigid. Given an incident field, the inverse problem is to reconstruct the surface from the displacement of the wave field at a horizontal line above the surface. Based on the Helmholtz decomposition, the wave field is decomposed into its compressional and shear parts by using two scalar potential functions. The transformed field expansion is then applied to each component and a coupled recurrence relation is obtained for their power series expansions. By solving the coupled system in the frequency domain, simple and explicit reconstruction formulas are derived for two types of measurement data. The method requires only a single illumination with a fixed frequency and incident angle. Numerical experiments will be shown that it is capable of reconstructing the scattering surfaces with subwavelength resolution.