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Fast and Accurate Calculation of Acoustic Potentials with Application to Scattering from Periodically Rough Surfaces

We introduce highly accurate and efficient algorithms for the calculation of single and double layer acoustic potentials corresponding to the problem of scattering from parametric (possibly non-smooth) one-dimensional periodic surfaces. The scattering problem is formulated in terms of a second-kind surface integral equation. Left untreated, corner singularities in the surface profile seriously affect the convergence rate of the solution. We show that using appropriate regularization of the integral operators leads to arbitrarily high order asymptotic convergence rates for the surface density, and hence the scattered field. Numerical examples are given in the case of an incident plane wave with various wave numbers. With Oscar Bruno, Caltech.