Meeting: 1003, Atlanta, Georgia, SS 4A, AMS-SIAM Special Session on Theoretical and Computational Aspects of Inverse Problems, I

1003-65-549 **Catalin C Turc*** (turc@math.umn.edu), 127 Vincent Hall, 206 Church St S E, Minneapolis, MN 55455, and **Fernando Reitich** (reitich@math.umn.edu), 127 Vincent Hall, 206 Church St S E, Minneapolis, MN 55455. *High-order solutions of three-dimensional rough-surface scattering problems at high-frequencies.*

We present a new numerical scheme for three-dimensional acoustic and electromagnetic rough-surface scattering simulations that can deliver highly accurate results from low to high frequencies at a cost that is independent of the wavelength of the incoming radiation. The method is based on $high - order$ asymptotic expansions of the oscillatory integrals that enter potential theoretic formulations of the scattering problem at high-frequencies. In this regime, the solution of the integral equation can be expressed as a slow modulation of a highly oscillatory exponential of a *known* phase. The unknown *slowly varying* envelope, in turn, is represented as a series expansion in inverse powers of the wavenumber whose terms are recursively computed in an efficient manner. The resulting algorithms provide significant improvements over classical (e.g. Kirchhoff's) approximations throughout a broad spectrum at a modest additional cost. Results with full double-precision accuracy are presented for configurations of practical interest. (Received September 21, 2004)