A Review of Numerical Methods for Rough Surface Scattering

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Numerical methods allow studies of electromagnetic scattering from rough surfaces without approximation, so that insights beyond those available from traditional approximate theories can be obtained. Although the necessity of Monte Carlo simulations for capturing stochastic effects increases computational demands beyond those of typical numerical electromagnetic applications, recent developments in highly efficient algorithms have made large scale computations possible. For surfaces modeled as being rough only in one direction (two-dimensional scattering problems), the use of numerical methods is reaching a relatively mature state. Computational complexity however still has limited studies in the three-dimensional scattering problem to only a few examples.

In this talk, recent developments in numerical methods for rough surface scattering will be reviewed. Several efficient algorithms will be discussed, and results from previous studies presented. Results in the areas of sea surface remote sensing, ground penetrating radar analysis, target/surface clutter interactions, low grazing angle scattering, radar imaging of surfaces, and backscattering enhancement will be illustrated. Comments on current issues in the area will be provided, along with suggested other applications where numerical surface scattering methods may play an important role. The relative importance of numerical versus approximate methods in differing areas will also be discussed.