Analytic Approaches to Multiple Scattering on Rough Surfaces

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The Single Scatter Subtraction (S^3) method is focused on insuring that the entire single scattering taking place on a rough surface is removed from the integral term in the current integral equation. Following this reasoning, it has been found that there is a single scattering augmentation of the Kirchhoff term that comes from the integral in the current integral equation. The physics associated with this term has been explored for both an infinite and a truncated rough surface along with its range of validity. Consequently, it is time to start exploring the contributions coming from the true multiple scattering integral in the current integral equation.

A valid question is why put effort into developing analytic understanding of this term when there are many very successful numerical methods for producing complete scattered field results. The answer is that the numerical approaches hopefully will permit investigations into parameter ranges for which there are no asymptotic or measured results to corroborate them. It is therefore very important to develop some degree of analytic-based understanding of the multiple scattering that takes place on a rough surface.

In this presentation two analytic approaches for estimating the effects of the multiple scattering integral will be discussed. First, it will be shown why the S^3 method does not lead to a solution by iteration, i.e., the kernel of the multiple scattering current integral equation is not sufficiently altered from it combined scattering form. Attention is then redirected to a Taylor series expansion of the multiple scattering current. For a two dimensional surface, it will be shown that such an expansion about the point x'= x leads to a recursive approximate result for the derivatives of the current. As an aside, this approach also demonstrates the importance of the higher order derivatives of the current to the multiple scattering processes. Finally, attention is redirected to the multiple scatter current integral equation and an integration by parts is developed. The purpose of this approach is to obtain an analytic term that augments the Born term in the multiple scatter integral equation. The capabilities and limitations of this latter resultBldr will be discussed.

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