Multi-Level Fast Multipole Algorithm for Dielectric Targets in the Presence of a General Layered Background

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There are many radar-sensing applications for which one is interested in electromagnetic scattering from general dielectric targets embedded in a multi-layered medium, including scattering from buried pipes and land mines. Such a analysis may also be applied to analyze scattering from a model tree and general surface and subsurface inhomogeneities (*e.g.* rocks). Despite this wide range of applications, there has been relatively little research published on rigorously analyzing scattering from general dielectric targets embedded in a layered medium, especially for electrically large targets. With regard to an integral-equation analysis, the principal challenge in a surface-integral-equation analysis involves efficient computation of the layered-medium Green's function, this representing a problem of long-term interest. We consider several different techniques for evaluating the layered-medium Green's function for dielectric targets, particularly with regard to their applicability for the multi-level fast multipole algorithm (MLFMA).

In this talk we consider the MLFMA analysis of a general dielectric target situated in an arbitrary layered medium. Several example results are presented, with comparison to reference solutions. Moreover, careful attention is given to the approximations employed when evaluating the layered-medium Green's function. In particular, we carefully consider the importance of the surface-wave poles and their importance as a function of target and layered-medium type.