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Scattering from rotationally-symmetric objects using only free space Green's functions

Ahmad Abawi and Michael Porter
HLS Research, Inc., 3366 N. Torrey Pines Ct., Ste. 310, La Jolla, CA 92037, USA

To compute scattering from an object, one has to solve the wave equation and impose the appropriate boundary conditions on the surface of the object. For objects for which the wave equation can be separated, like cylinders, spheres and spheroids, this problem can be solved analytically. For more general objects, methods like the finite element or boundary element techniques can be employed. The use of free space Green's functions offers another method for computation of scattering from a general-shaped object. This method, which is known as the method of field superposition or the virtual source technique, can be used to impose the appropriate boundary conditions on the surface of the object by using free space Green's function with complex amplitudes. These amplitudes are determined from a matrix equation that results when boundary conditions are imposed. In this paper we apply this technique to compute scattering from rotationally symmetric objects. These objects can be homogeneous solids or shells, filled with a homogeneous fluid. The versatility and robustness of the method is demonstrated by applying it to various objects in free space and in a waveguide.