

# Implicit boundary integral methods for the exterior Neumann problems for the Helmholtz equation

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We proposed a new algorithm for solving scattering problems that involve Helmholtz equations in the exterior domain with sound-hard boundary condition on the scattering surfaces. The algorithm not only combines the advantages of implicit surface representation and the boundary integral method, but also provides a new way to compute a class of the so-called hypersingular integrals. The keys to the proposed algorithm are the derivation of the volume integrals which are equivalent to any given integrals on smooth closed hypersurfaces, and the ability to approximate the natural limit of the singular integrals via seamless extrapolation. We present numerical results for both two and three dimensional scattering problems at near resonant frequencies as well as with non-convex scattering surfaces.