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BIE and coupled BIE-FEM methods for scattering from underwater objects

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Two techniques are described for computation of acoustic scattering by a smooth elastic object in a fluid space or a fluid layer of a layered fluid-solid medium. Both techniques use a frequency-domain boundary integral equation (BIE) method for the exterior layered medium, with the Green's function computed numerically by adaptive high-order transform integration and exact finite elements. The surface of the object is parameterized by a smooth map of the unit sphere, and the BIE is discretized by B-splines, point collocation and numerical integration in polar-like coordinates centered at the collocation point.
Two approaches for handling the interior dynamics of the object are described. In the first, applicable to objects structured into homogeneous layers separated by closed smooth interfaces, the interior dynamics is formulated as a system of BIEs with displacements and tractions at the interfaces as unknowns. In the second, the interior is discretized by a general-purpose finite element (FEM) method, and an impedance matrix connecting tractions and displacements on the exterior surface is computed by eliminating interior degrees of freedom by Gaussian elimination.
Computational results on test cases of the 2006 target strength benchmark workshop at NURC are presented.