Experiments and numerical modeling of low to mid-frequency scattering from elastic objects near the sea floor

Mario Zampolli, Alessandra Tesei, Finn Jensen and Gaetano Canepa
NATO Undersea Research Centre, Viale San Bartolomeo 400, 19126 La Spezia, Italy

The scattering of low to mid-frequency sound (1-10's of kHz) from submerged elastic structures of size O(1m) is a topic of interest to the underwater acoustics community. In the first part of the presentation, a brief description of the relevant components of the EVA experiment is given. The purpose of the sea trial was the acquisition of high-fidelity echoes from submerged spherical and cylindrical targets, made of composite materials with internal layered structure. The second part of the presentation is focused on the finite-element modeling technique developed at NURC for investigating the scattering from axially symmetric submerged elastic objects. Particular attention is dedicated to the computation of the far field at a distance from the target via the Helmholtz-Kirchhoff integral, using the near field sampled on the target surface, together with Green’s functions capable of describing a two-layered water-sediment fluid medium. Those geometries, for which the overall axial symmetry is broken by the presence of the water-sediment boundary, can be treated approximately by taking into account the boundary-reflected incident field, as well as the first order interaction between the target-scattered echo and the sea floor. The numerical technique is validated by comparison with data collected during the EVA trial.