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ON EXPERIMENTAL DETERMINATION OF THE ACOUSTIC WAVEFIELD PROPAGATOR

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The problem of sound propagation in the ocean is considered. Properties of any waveguide can be almost completely described using an acoustic wavefield propagator. The propagator is an operator that determines one-to-one relation between acoustic wavefield vertical profiles corresponding to different values of the horizontal coordinate. Knowing the propagator allows one to accurately predict a sound wavefield for any source. Using some orthogonal basis, the propagator can be represented as a matrix. This paper considers the case of a two-layer waveguide, when the upper layer is water and the lower one is sediment. This formulation of the problem corresponds to the conditions of a shallow sea. A method for measuring the matrix elements of a single-frequency propagator in an experiment is presented. This method is based on the usage of two vertical arrays, one emitting and one receiving, spanning the water layer. Sequentially exciting the signals with each of the monopoles of the emitting array, one can directly measure the matrix elements of the propagator. The mathematical basis of the method is the apparatus of the discrete variable representation functions, which provides the link between the point values of an acoustic wavefield and its continuous profile. It is shown that in the case of a horizontally homogeneous waveguide, spectral analysis of the measured propagator allows one to find the normal modes of the waveguide.

Keywords: underwater acoustics, processing of experimental data, discrete variable representation, vertical array, waveguide, acoustic wavefield propagator.

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