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ON PERTURBATION OF ACOUSTIC MODES BY INHOMOGENEITIES OF THE BATHYMETRY IN A SHALLOW SEA

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Modeling of sound propagation in ocean acoustics can be performed using the modal-analysis method. If solving task has bathymetry inhomogeneities, the vast majority of computational time is spent calculating modal functions and numbers in several cross-sections of the studied waveguide. An implementation of the perturbation theory to the computational process can save a significant part of this time. The work forms a theory of perturbations by solving the Sturm-Liouville problem for modal functions and numbers caused by variations of the sea depth. This issue can be narrowed down to the conventional task about a potential disturbance in the stationary Schroedinger equation by a specific change of variables. The work presents formulas of the perturbation theory of the first and second orders for modal functions and numbers in an explicit form. The example of these formulas' implementation is presented, and its accuracy is analyzed. The described approach allows to significantly increase the computational effectiveness of modeling the sound propagation in irregular waveguides of the shallow sea, securing the same accuracy level, which can be achieved by solving the Sturm-Liouville problem for every cross-section.

Key words: ocean acoustics, modal-analysis method, perturbation theory, bathymetry inhomogeneities.

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