REFLECTION OF SOUND WAVES AT INTERFACES. NON–SELF–ADJOINT MODEL STATEMENT

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On the basis of the mathematical definition of a non-self-adjoint operator and the physical meaning of a specific boundary value problem, a non-self-adjoint model statement of boundary value problems in acoustics is formulated. As an example, boundary value problems for the reflection of a plane wave and a spherical wave at the interface between two liquid media are considered. The definition of the reflection coefficient of a spherical wave is introduced. In the region of subcritical angles of incidence, the new definition takes into account the appearance in the total sound field of converging recoil waves corresponding to the eigenfunctions of the adjoint operator. In the region of supercritical angles of incidence, the participation of the eigenfunctions of two conjugate operators in the total sound field forms a nonzero power flux through the interface and its transformation into the vortex component of the intensity vector at the total internal reflection horizon. The definition of the total internal reflection horizon is given. The new definition of the reflection coefficient and the physical correctness of the non-self-adjoint model statement are confirmed by the presented experimental data.

Keywords: non-self-adjoint model statement, converging recoil waves, transformation horizon, hybrid waves, vortex component of the intensity vector.

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