Mathematical Properties of the Resonance of the Inner Waves in Rotating Stratified Three-Dimensional Fluids

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Abstract : We consider the internal oscillations of the ocean which are caused by the gravity force and the Coriolis force, for different models with changeable density, heat transfer, and salinity. Traditionally, the mathematical description of the resonance effect is related to the growing amplitude as a result of input vibrations. We offer a different approach: the study of the relation between the spectrum of the internal oscillations and the properties of the limiting amplitude of the solution for the harmonic input vibrations of the external forces. Using the results of the spectral theory of self-adjoint operators in Hilbert functional spaces, we prove that there exists an explicit relation between the localization of the frequency of the external input vibrations with respect to the essential spectrum of proper inner oscillations and the non-uniqueness of the limiting amplitude. The results may find their application in various problems concerning mathematical modeling of turbulent flows in the ocean.