Spectral stability of internal solitary waves in continuously stratified fluids

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Abstract

Internal solitary waves (ISWs) are ecologically important since they are involved in mixing and energy transport in lakes and oceans. From the mathematical point of view, ISWs are exact solutions of the 2D Euler equations for incompressible, inviscid fluids with non-constant density. This talk is concerned with the study of their spectral stability, which has not yet received attention at a rigorous mathematical level.
In the first part of the talk, after introducing the physical model, I will present an Evans-function approach to spectral stability of ISWs. Starting from the full Euler eigenvalue problem associated with an ISW, this approach is based on a formal spatial-dynamics formulation and a formal Galerkin procedure to obtain finite-dimensional truncations for which we can rigorously define Evans functions on the closed right complex half-plane. For small-amplitude ISWs, the Evans functions have no zeros in a neighbourhood of the origin apart from the origin itself.
In the second part of the talk, I will present recent investigations that allow to define a "moment of instability" for ISWs (of arbitrary amplitude), a classical tool in the stability theory of solitary waves, and directions of research.

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