

Public Abstract

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Title:Stability and instability results for the 2D alpha-Euler equations

We study stability and instability of time independent solutions of the two dimensional alpha Euler equations and Euler equations. The alpha Euler equations arise via an inviscid regularization of the Euler equations.

In the first part of the thesis, for the alpha model, we develop analogues of the classical Arnol'd type stability criteria based on the energy-Casimir method for several settings including multi connected domains, periodic channels, and others. In the second part of the thesis, we study stability of a particular steady state, the unidirectional solution of the alpha Euler equation on the two dimensional torus, having only one non zero mode in its Fourier decomposition. Using continued fractions, we give a proof of instability of the steady state under fairly general conditions. In the third part of the thesis we study various properties of a family of elliptic operators introduced by Zhiwu Lin in his work on instability of steady state solutions of the two dimensional Euler equations. This involves Birman-Schwinger type operators associated with the linearization of the Euler equations about the steady state and certain perturbation determinants.