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ON THE STABILITY OF THE ROTATING BÉNARD PROBLEM*

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Abstract

In this paper we study the nonlinear Lyapunov stability of the conduction-diffusion solution of the rotating Bénard problem.

We provide a method for a derivation of the optimum nonlinear stability bound. It allows us to derive a linearization principle in a larger sense, i.e. to prove that, if the principle of exchange of stabilities holds, the linear and nonlinear stability bounds are equal.
After reformulating the perturbation evolution equations in a suitable equivalent form, we derive the appropriate Lyapunov function and *for the first time* we find that the nonlinear stability bound is nothing else but the critical Rayleigh number obtained solving the linear instability problem of the conduction-diffusion solution.

MSC: 76E15, 76E30

Keywords: Stability - Bénard problem - Energy Method.

1 Introduction

The convective instability and the nonlinear stability of a homogeneous fluid in a gravitational field heated from below, the classical Bénard problem, is a well known interesting problem in several fields of fluid mechanics [1], [2], [3], [4], [5].

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