Nonlinear Sciences > Chaotic Dynamics

On stability of rolls near the onset of convection in a layer with stress-free boundaries

Olga Podvigina

(Submitted on 12 Mar 2010)

We consider a classical problem of linear stability of convective rolls in a plane layer with stress-free horizontal boundaries near the onset of convection. The problem has been studied by a number of authors, who have shown that rolls of wave number k are unstable with respect to perturbations of different types, if some inequalities relating k and the Rayleigh number R are satisfied. The perturbations involve a large-scale mode. Certain asymptotic dependencies between wave numbers of the mode and overcriticality are always assumed in the available proofs of instability. We analyse the stability analytically following the approach of Podvigina (2008) without making a priori assumptions concerning asymptotic relations between small parameters characterising the problem. Instability of rolls to short-scale modes is also considered. Therefore, our analytical results on stability to space-periodic perturbations are exhaustive; they allow to identify the areas in the (k,R) plane, where convective rolls are stable near the onset. The analytical results are compared with numerical solutions to the eigenvalue problem determining stability of rolls.

Comments:	32 pages, 2 figures
Subjects:	**Chaotic Dynamics (nlin.CD)**; Fluid Dynamics (physics.flu-dyn)
Journal reference:	Podvigina O.M. On stability of rolls near the onset of convection in a layer with stress-free horizontal boundaries. Geophys. Astrophys. Fluid Dyn. 104, 2010, 1-28.
Cite as:	**arXiv:1003.2579v1 [nlin.CD]**

Submission history

From: Olga Podvigina [view email]

[v1] Fri, 12 Mar 2010 16:45:23 GMT (34kb)

Which authors of this paper are endorsers?

Link back to: arXiv, form interface, contact.

Download:

- PDF
- PostScript
- Other formats

Current browse context:

nlin.CD

< prev | **next >**

new | recent | 1003

Change to browse by:

nlin

physics

   physics.flu-dyn

References & Citations

- CiteBase

Bookmark(what is this?)

CiteULike logo	
Connotea logo	
BibSonomy logo	
Mendeley logo	
Facebook logo	
del.icio.us logo	
Digg logo	Reddit logo