Cloot, A.; **Lebon, G.**

A nonlinear stability analysis of the Bénard-Marangoni problem. (English) Zbl 0571.76036

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The authors give a nonlinear analysis of Bénard-Marangoni convection in a horizontal fluid layer of infinite extent. The resulting equations are solved by using the Gorkov-Malkus-Veronis technique, which consists of developing the steady solution in terms of a small parameter measuring the deviation from the marginal state. The present work constitutes a generalization of an earlier work of *A. Schlüter*, *D. Lortz* and *F. Busse* [ibid. 23, 129-144 (1965; Zbl 0134.218)] where only buoyancy-driven instabilities were treated. Here, however, both buoyancy and temperature-dependent surface-tension effects are considered. The authors determine the band of allowed steady states of convection near the onset of convection as a function of the Marangoni number and the wave number, and they display supercritical as well as subcritical zones of instability. As a result, it is found that hexagons are allowable flow patterns.

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MSC:

76E15 Absolute and convective instability and stability in hydrodynamic stability
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thermocapillary; instability; Bénard-Marangoni convection; horizontal fluid layer of infinite extent; Gorkov-Malkus-Veronis technique; buoyancy; temperature-dependent surface-tension effects; band of allowed steady states; onset of convection; Marangoni number; wave number; hexagons; flow patterns

Full Text: DOI

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