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NONLINEAR OSCILLATORY FLOWS IN A TWO-LAYER SYSTEM WITH A TEMPERATURE - DEPENDENT HEAT RELEASE

Abstract

It is known that two-layer liquid systems are subject to numerous instabilities. Several classes of instabilities have been found by means of the linear stability theory for purely thermocapillary (or thermal Marangoni) flows and for buoyant-thermocapillary flows. In these systems there are various physical phenomena that can be the origin of a heat release on the interface; the presence of a constant, spatially uniform heat release at the interface can lead to the appearance of an oscillatory instability. In the present work, nonlinear convective flows developed under the joint action of buoyant and thermocapillary effects in a two-layer system with rigid heat-insulated lateral walls, have been investigated. The influence of a temperature-dependent interfacial heat release/consumption on nonlinear oscillatory convective regimes, has been studied. It is shown that in the case of heat consumption, the region of oscillatory flows can be restricted by the values of the heat transfer parameter, both from below and from above, by the regions of the steady flows. We have found that sufficiently strong temperature dependence of interfacial heat sources and heat sinks can lead to the change of the sequence of bifurcations and the development of new nonlinear regimes in the system.