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NONLINEAR CONVECTIVE OSCILLATIONS IN TWO-LAYER SYSTEMS WITH AN INTERFACIAL HEAT RELEASE

Abstract

The interfacial convection in two-layer systems is a widespread phenomenon that is of great importance in space technologies. A scientific interest in such systems is due to the fact that the interfacial convection is characterized by a variety of physical mechanisms and types of instability. There are various physical phenomena that can be the origin of a heat release on the interface. For example, the interfacial heat release accompanies an interfacial chemical reaction and the evaporation. It is known that the presence of a constant, spatially uniform heat release or consumption at the interface can lead to the appearance of an oscillatory instability. In the present work, the influence of the interfacial heat release on nonlinear oscilla- tory convective regimes, developed under the joint action of buoyant and thermocapillary effects in the 47v2 silicone oil - water system, is studied. The system is bounded from above and from below by two isothermal rigid plates kept at constant different tem- peratures (the system is heated from below). It is assumed that the interfacial tension decreases linearly with an increase of the temperature. A constant heat release is set on the interface. The boundary-value problem is solved by the finite-difference method. The wide range of the modified Grashof number values, corresponding to heat sources and heat sinks at the interface, is considered. It is found that the presence of the inter- facial heat release can change the sequence of bifurcations and lead to the appearance of specific oscillatory regimes with different symmetry properties. It is shown that the period of oscillations changes in a non-monotonic way for symmetric and asymmetric oscillations. The region of nonlinear convective oscillations is observed in a finite interval of the Grashof number values bounded from below and from above.