FM7S_13005

XXI International Congress of Theoretical and Applied Mechanics
Warsaw, Poland, August 15–21, 2004

The Influence of Vibration on the Onset of Marangoni Convection in Horizontal Fluid Layer

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The influence of oscillations of hard or “soft” (free undeformable) wall on the onset of Marangoni convection in horizontal layer of viscous incompressible fluid with deformable boundary is considered. The oscillations are assumed to be translational and harmonical with frequency ω and amplitude a. Two cases were studied: 1) oscillations of arbitrary direction, large frequency ω and small amplitude $a = O(1/\omega)$; 2) vertical oscillations of finite frequency and amplitude. In the first case by application of averaging method it was shown that oscillations of any other direction than longitudinal smoothen the free boundary. In the second case the stability analysis of the quasiequilibrium was carried out utilizing Floquet theory. Continuous fractions method was applied to obtain the dispersion equations for computing the critical parameter values for main types of loss of stability – synchronous, subharmonic and quasiperiodic. Neutral curves $Ma(k, \omega)$ (k is the wave number) were computed for the case of weightlessness.

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