Linear Stability of a Capillary-Korteweg Fluid in Presence of an Elastic Potential Energy

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We perform a linear stability analysis of the equilibrium solution of a suitable Korteweg model for a two-phase fluid endowed with a stress tensor that contains first and second order gradients of density which accounts for capillary effects. This formulation corresponds to the class of the so-called diffuse interface fluid models used to describe complex spatial interaction effects like those present in liquid-vapor phase transition such as spontaneous growth of vaporous bubbles as well as their coalescence. Moreover, a suitable barotropic state law contributes to the composition of localized density inhomogeneities. By perturbing the fluid at rest and applying the Principle of Exchange of Stabilities, we prove that at the onset of instability a stationary cellular convection of bubbles prevails in correspondence of suitable values of the frequency of the elastic potential. We analyze the disturbances in normal modes and find the dimension of the cells in terms of the physical parameters characteristic of the particular fluid considered [1]. [2].
