

Sensitive Regions and Optimal Perturbations in the Floating Zone Using the Adjoint System

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Thermocapillary convection arises in free surface systems, particularly in non-isothermal cylindrical liquid bridges. The floating zone process is used as a containerless crystal growth process to produce high quality material, but defects can appear in the crystal when the flow is unsteady. In this study, the geometrical configuration is 2D axi-symmetric. The parameters of the model are the Prandtl number, the Marangoni number and the aspect ratio. The mechanisms of the growth of instabilities are analyzed using an adjoint technique. It allows to determine the most sensitive regions of the flow to local perturbations. As far as we know, this work is the first attempt to identify the region of the steady thermocapillary flow where a local disturbance has the largest response, by the use of the adjoint technique. This is also the first application of this method to a highly confined geometrical configuration. The most sensitive regions to thermal perturbations are presented.

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