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Onset of Oscillations in High-Prandtl Thermocapillary Liquid Bridges: Linear-stability Analysis vs. Experiment

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The float-zone crystal growth process is studied in the framework of the half-zone model. Linear-stability analysis is used to compare the onset of oscillations in liquid bridge thermocapillary convection upon liquid bridge volume with experimental data for high-Prandtl fluid. Well-known structure of neutral stability curve for high-Prandtl fluid, consisting of two branches separated by an overstability gap, has been clearly reproduced. Travelling hydrothermal waves with unit azimuthal wave number correspond to critical perturbations for both branches. An influence of the temperature-dependent viscosity, the heat loss through free surface and the gravity level is determined.

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