Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Stability of buoyancy-driven flow in a vertical channel with one heated wall SHAHAB ZERAATI DIZJEH, JOSHUA BRINKERHOFF, University of British Columbia - Okanagan campus —

Abstract

The linear stability of the temporally-evolving buoyant flow in a channel between an isothermal vertical wall and an adiabatic vertical wall is investigated by numerical integration of the derived two-dimensional stability equations for the 2D buoyant flow. Stability calculations are carried out for Prandtl number of 0.7 (air) inside four channels with length-to-width aspect ratios of 20, 13.33, 10, and 8 for a Grashof number of $Gr = 6.1 \times 10^{10}$. The buoyant flow is numerically modeled by means of direct numerical simulation (DNS), and the solved temperature and velocity fields are used as the base flow properties in the linear stability equations. The stability of the developing buoyant flow in the channel for the four aspect ratios are compared in terms of the computed phase velocities, wave numbers, and stability envelopes. The predictions of the linear instability theory are compared and validated with the actual behavior of the simulated flow by means of the short-time Fourier transform of the velocity field computed from the DNS.

Shahab Zeraati Dizjeh
University of British Columbia - Okanagan campus

Date submitted: 10 Aug 2020 Electronic form version 1.4