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Convective Thermal Transport in Near-Critical Fluids NUSAIR HASAN, BAKHTIER FAROUK, Department of Mechanical Engineering and Mechanics, Drexel University — Convective thermal transport in a pure fluid (carbon dioxide) near its gas-liquid critical point is investigated using a two-dimensional numerical model. A square enclosure is considered with bottom heating. The model considers the strong variable property effects (functions of both temperature and pressure) near the critical point, including the bulk viscosity variations. Although thermal diffusivity approaches zero near the critical point, the divergence of thermophysical properties near the critical point gives rise to large Grashof-number flows even for very small temperature differences. The convective heat transfer coefficient near the critical point is investigated and a correlation for the Nusselt number is developed as a function of the Rayleigh number and the ratio $(p_m T_m / p_{cr} T_{cr})$ where the subscripts "m" and "cr" denote the mean and critical values respectively. As the critically diverging bulk viscosity plays a significant role on the transport processes near the critical point, effect of bulk viscosity on the flow field and heat transport induced by buoyancy in near-critical fluids is also investigated.

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