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Immersed Boundary Simulations of Shear and Buoyancy Driven Flows in Complex Enclosures PRATAP VANKA, AARON SHINN, MARK GOODWIN, University of Illinois at Urbana-Champaign — Driven cavity flows are rich in complexity, consisting of a hierarchical organization of corner eddies called Moffat eddies with a nearly precise ratio of vortex strengths and distances between vortex centers. The driven square cavity flow has been extensively studied as a canonical problem. Likewise, natural convection flows in enclosures with differential heating of two side-walls and adiabatic conditions at the other boundaries have been extensively studied. While the square enclosure has enjoyed the most attention, natural convection in other complex-shaped enclosures have attracted relatively less attention. In the present study, we have used the Immersed Boundary Method in conjunction with a staggered Cartesian grid fractional step procedure to simulate two-dimensional shear-driven and buoyancy-induced flows in several complex cavities. The selected cavity shapes are chosen to illustrate the rich complexity of shear and buoyancy induced flows in general and the ability to predict such complex flows with the Immersed Boundary Method. In the present study, we have limited the Reynolds numbers and Rayleigh numbers to keep the flow from becoming time-periodic or chaotic. In all cases, a time-invariant state has been achieved, and results are displayed for such a steady state.

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