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Flow Characteristics of Lid-Driven Cavities with Particle Suspensions using an Eulerian-Lagrangian Modeling Approach MORAKINYO ADESEMOWO, JOHN SHELTON, Northern Illinois University — Previous experimental and numerical investigations involving lid-driven cavity flows with particle suspensions have primarily focused on particle tracking and the visualization of complex three-dimensional structures that compose the flow field. However, these particle suspensions and their resulting particle-particle interactions could also be viewed as a system of time-dependent perturbation equations to the steady-state Navier-Stokes equations and could affect both the stability and steady-state characteristics of the two-dimensional lid-driven cavity system. In this investigation, an Eulerian-Lagrangian approach to modeling particle suspensions in the lid-driven cavity is utilized in FV-CFD simulations to investigate the effect particle density, area fraction, and Reynolds number have on the two-dimensional flow characteristics of a laminar fluid. Observations have indicated that the development of the primary vortex in the lid-driven cavity varies according to the area fraction of particle suspensions in the system; transitioning from development via an adverse pressure gradient at the top-right corner of the cavity towards particle-laden behavior where particle-particle interactions dominate the development of the primary vortex. Dynamic responses were also observed for particle systems of less dense particles. Finally, a comparison between flows perturbed using disturbance velocities and from particle interactions was performed.

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