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The Effect of Varying Stokes Number on the Growth Rate of Instabilities in Particle-Laden Shear Layers SEAN DAVIS, GIACOMO SENATORE, GUSTAAF JACOBS, San Diego State University — The growth rates of instabilities in the shear layer of a stratified particle-laden flow are analyzed using both a Linear Stability Analysis (LSA) of a stochastic Eulerian-Eulerian (EE) model and a high-order Eulerian-Lagrangian (EL) computation. In the LSA, a modified Rayleigh equation is derived, which governs the linear growth rate of a spatially periodic disturbance while the EL method solves the inviscid Euler equations using a particle source in cell method. A study of the particle response time shows that small-inertia particles ($St < 0.2$) may destabilize the inviscid mixing layer development as compared to a pure-gas flow. Energy is transferred globally from the particle phase to the fluid phase triggering this destabilization. The maximum stabilizing effect occurs at intermediate St ($1 < St < 10$), while multiple unstable modes coexist at larger St. These small, medium and large St effects are validated with numerical experiments using the EL code, showing very good agreement with the growth rates computed using the LSA.

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