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Preferential Concentration Driven Instability of Sheared Gas-Solid Suspensions MOHAMED KASBAOUI, Sibley School of Mechanical and Aerospace Engineering, Cornell University, DONALD KOCH, School of Chemical and Biomolecular Engineering, Cornell University, GANESH SUBRAMANIAN, JNCASR, Bangalore, India, OLIVIER DESJARDINS, Sibley School of Mechanical and Aerospace Engineering, Cornell University — Through a linear stability analysis of a gas-solid suspension of particles with low Stokes number and moderate mass loading, we demonstrate that the modulation of the gravitational force exerted on the suspension due to preferential concentration of particles in regions of low vorticity can destabilize a homogeneous linear shear flow of a gas-solid suspension. Since the fastest growing modes are found to be those with wavelengths small compared with the characteristic length scale (U/Γ) where U is the settling velocity and Γ is the shear rate, we apply an asymptotic multiple scale analysis using the WKB method. This analysis reveals that the instability comes from the coupling of a particle number density mode driven by preferential concentration in regions where the velocity disturbance reduces the base state vorticity and a momentum mode driven by the particle number density variations. The growth of the amplitude of particle concentration and fluid velocity disturbances is characterized as a function of the wave number and Reynolds number using both the asymptotic theory and a numerical solution of the linearized equations.

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