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Inertial particle behavior in unsteady separated flow GUSTAAF JACOBS, San Diego State University — We study the inertial particle dynamics in particle-laden unsteady separated flows inspired by the recent findings of an innovative, kinematic fluid particle separation theory. It was established that a flow that moderately fluctuates around an averaged flow state features separation of fluid particles along a material surface that emanates from a fixed starting location. Particles with small mass and size behave like fluid particles and their dispersion behavior near separation is the same. Larger and heavier particles (or droplets) with significant inertia have a slower response to the carrier fluid than fluid particles. The unresponsiveness of the fluid particles' ejection location to a fluctuating flow field is thus surely emulated by the even less responsive inertial particles. In flows with large (turbulent) fluctuations, fluid particles no longer separate from a fixed location. However, the slower responding inertial particles are likely to feature fixed separation. We show that inertial particles in a turbulent separated particle-laden flow eject away from the wall along distinct surfaces at a fixed location that coincides with the averaged carrier flow separation location. We illustrate this behavior by means of Direct Numerical Simulation of particle-laden two-dimensional shedding flows over backward-facing step and in a diffuser.

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