عنوان مقاله:

Numerical Simulations of Turbulent Gas-solid Flow in a Gradual Expansion

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خلاصه مقاله:

Modeling efforts on turbulent gas-solid flows have mainly focused on studying particle-laden flows in channels and pipes. Despite its significance for industrial applications, the study of gas-solid flows in sudden or gradual expansions is less common in the literature. This paper challenges current two-phase flow models to compute the dilute turbulent gas-solid flow in a vertically oriented ۱۲° conical diffuser. The solids phase is modeled in two ways: the Two-Fluid Model approach that incorporates closure relations derived from the kinetic theory of granular flow, and the Euler-Lagrange particle tracking model with two-way coupling. In both cases, turbulence in the gas phase is estimated by the Reynolds stress model with additional modulation terms that account for the effect of the particles on the gas-phase turbulence. Simulation results are validated versus experimental benchmark data not only for gas axial velocity but also for streamwise and radial turbulence intensity, as comparison with such turbulent variables has not been detailed in previous studies. Nevertheless, due to the lack of experimental data for validation, profiles of solids axial velocity are only compared numerically. Contours of turbulence kinetic energy and granular temperature in the diffuser region reveal a high shear area responsible for the production of turbulence in both phases. Moreover, results obtained from the Euler-Lagrange model show an intense particle fluctuating velocity in the streamwise direction downstream of the diffuser.

کلمات کلیدی:

Two-fluid model, Kinetic theory of granular flow, Two-way coupling, Turbulence modulation, ANSYS-Fluent