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Eulerian and Lagrangian predictions of particulate two-phase flows: a numerical study

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Abstract

To predict particulate two-phase flows, two approaches are possible. One treats the fluid phase as a continuum and the particulate second phase as single particles. This approach, which predicts the particle trajectories in the fluid phase as a result of forces acting on particles, is called the Lagrangian approach. Treating the solid as some kind of continuum, and solving the appropriate continuum equations for the fluid and particle phases, is referred to as the Eulerian approach.

Both approaches are discussed and their basic equations for the particle and fluid phases as well as their numerical treatment are presented. Particular attention is given to the interactions between both phases and their mathematical formulations. The resulting

computer codes are discussed.

The following cases are presented in detail: vertical pipe flow with various particle concentrations; and sudden expansion in a vertical pipe flow. The results show good agreement between both types of approach.

The Lagrangian approach has some advantages for predicting those particulate flows in which large particle accelerations occur. It can also handle particulate two-phase flows consisting of polydispersed particle size distributions. The Eulerian approach seems to have advantages in all flow cases where high particle concentrations occur and where the high void fraction of the flow becomes a dominating flow controlling parameter.

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Keywords

mathematical model; two-phase flow; turbulent flow; Euler predictions; Lagrange predictions

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