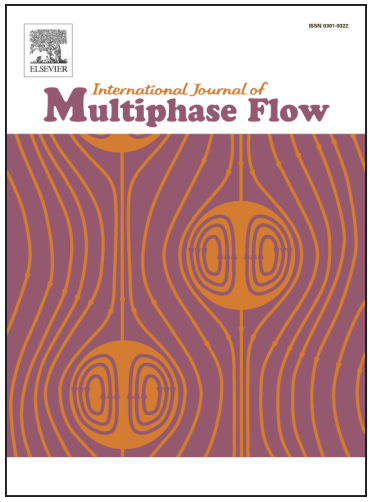

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ABSTRACT

This paper presents a three-dimensional Euler-Lagrange two-phase flow model. The fluid phase is simulated by solving the unsteady Reynolds-averaged Navier-Stokes equations with a k-ε turbulence closure on an unstructured Eulerian grid, and a Lagrangian model integrating the grain trajectory and momentum equations is employed to predict the granular phase in motion. Considering the deterministic nature of the movement of individual grains and the stochastic nature of the behaviour of grain groups, the grain-bed exchanges in terms of the grain entrainment and deposition are modelled with a stochastic approach. The vertical bed sorting and armouring processes are simulated by introducing a layering scheme for static grains in the bed. The numerical model is applied to predict the bed deformation around a spur dyke in a uniform and a non-uniform sediment beds. It is found that both the predicted local scour geometry and the grain size distribution are reasonably consistent with those of the experiments. According to the results, local scour in a non-uniform bed is smaller than that in a uniform one. The non-uniform bed around the spur dyke is coarsened, but sand ribbons occur in the upper part of the scour hole and at the downstream of the spur dyke.

Key Words: Spur dyke, Euler-Lagrange coupling, stochastic model, local scour, grain sorting