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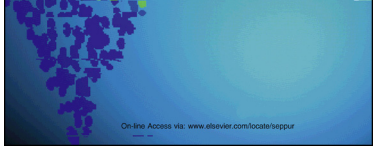

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Numerical simulation of industrial hydrocyclones performance: Role of turbulence modelling

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ABSTRACT

Flow in industrial hydrocyclones is always turbulent, selection of suitable turbulence model is key for accurate predictions. This paper aims to find the appropriate turbulence model for the hydrodynamic predictions in industrial hydrocyclones. Two-phase and multiphase simulations are conducted in various size industrial size hydrocyclones using volume of fluid and modified mixture models coupled with Reynolds Stress Model (RSM), Detached Eddy Simulation and Large Eddy Simulation (LES) turbulence models. Assessment of turbulence model effect on two phase flow field is made with respect to air-core, flow split, mean and turbulent velocities. The simulated flow field in 75 and 250 mm hydrocyclones is validated against literature based Laser Doppler Velocimetry, in-house high speed video and Electrical Resistance Tomography measurements. Mean density segregation contours and radial density profiles variation at different axial positions in a 350 mm dense medium cyclone is compared against Gamma Ray Tomography data. Turbulent intensity profiles are compared to display the turbulence levels. Further turbulence effect on the particles in various size hydrocyclones is analyzed by dispersion index formulation. Multiphase flow predictions in 75 and 250 mm hydrocyclones with RSM and LES models are compared against classical experimental classification performance in terms of cut size and sharpness of separation.

Keywords: Air-core, CFD, hydrocyclone, multiphase, turbulence

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