A Comparison study of Drag correlations for a Dispersed Multiphase flow in a Fluidized bed

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Abstract

The aim of this research is to identify the most reliable drag correlation for computational modelling of dispersed Multiphase flows in a 2D Fluidized bed. The present study employs the open-source CFD toolbox, OpenFOAM, to investigate the effect of various drag correlations in the literature on the Mean Eulerian particle velocity distribution of the gas-solid fluidized bed. Superficial gas velocities of 2.19 m/s and 3.28 m/s are considered at the inlet for the transient multiphase simulation. The time-averaged particle velocity is estimated at five lateral locations of the fluidized bed for validation against the experimental data of the National Energy Technology Laboratory (NETL). The geometry and boundaries of the 2D fluidized bed used for this study are shown in Figure 1 along with few important parameters in Table 1. Finally, the particle velocity distribution is compared between a drag correlation proposed by Syamlal O'Brien and two combined drag correlations of Gidaspow.

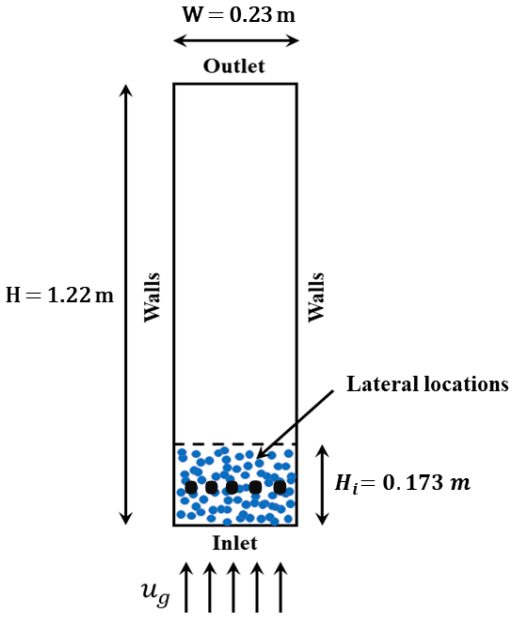

Figure 2: Fluidized bed model

Parameters	Value
Superficial gas velocity (u_g)	2.19 m/s & 3.28 m/s
Gas density (ρ_g)	1.204 kg/m^3
Particle diameter (d_p)	3256 μm
Particle density (ρ_p)	1131 kg/m^3
Specularity coefficient (ϕ_s)	0.125 ($\mathbf{U}g = 2.19$) 0.05 ($\mathbf{U}g = 3.28$)
Particle – Wall restitution coefficient (e_W^1)	0.92

Table 1: Fluid and Particle parameters