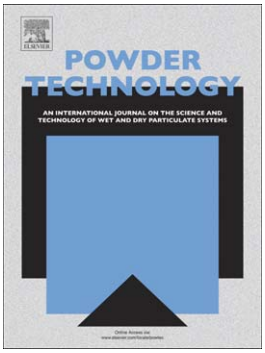

Coupling CFD-DEM with dynamic meshing: A new approach for fluid-structure interaction in particle-fluid flows

Yi. He, Andrew E. Bayly, Ali Hassanpour

PII: S0032-5910(17)30919-1
DOI: doi:10.1016/j.powtec.2017.11.045
Reference: PTEC 12964

To appear in: *Powder Technology*

Received date: 2 August 2017
Revised date: 29 October 2017
Accepted date: 13 November 2017

Please cite this article as: Yi. He, Andrew E. Bayly, Ali Hassanpour, Coupling CFD-DEM with dynamic meshing: A new approach for fluid-structure interaction in particle-fluid flows, *Powder Technology* (2017), doi:10.1016/j.powtec.2017.11.045

Coupling CFD-DEM with Dynamic Meshing: A New Approach for Fluid-Structure Interaction in Particle-Fluid Flows

Yi. He*, Andrew E. Bayly, Ali Hassanpour

School of Chemical and Process Engineering, University of Leeds, Leeds, S2 9JT, UK

Abstract

Many important engineering applications involve the interaction of free-moving objects with dispersed multi-phase flows, however due to the challenge and complexity of modelling these systems, modelling approaches remain very limited and very few studies have been reported. This work presents a new method capable of addressing these problems. It integrates a dynamic meshing approach, used to explicitly capture the flow induced by free-moving large object(s), with a conventional CFD-DEM method to capture the behaviour of small particles in particle-fluid flow. The force and torque acting on the large object due to the fluid flow are explicitly calculated by integrating pressure and viscous stress acting on the object's surface and the forces due to collisions with both the smaller particles and other structures are calculated using a soft-sphere DEM approach. The developed model has been fully implemented on the ANSYS/Fluent platform due to its efficient handling of dynamic meshing and complex and/or free-moving boundaries, thus it can be applied to a wide range of industrial applications. Validation tests have been carried out for two typical gas-solid fluidization cases, they show good qualitative and quantitative agreement with reported experimental literature data. The developed model was then successfully applied to gas fluidization with a large immersed tube which was either fixed or free-moving. The predicted interacting dynamics of the gas, particle and tube were highly complex and highlighted the value of fully resolving the flow around the large object. The results demonstrated that the

* Corresponding author.

E-mail address: Y.He1@leeds.ac.uk (Yi. He)