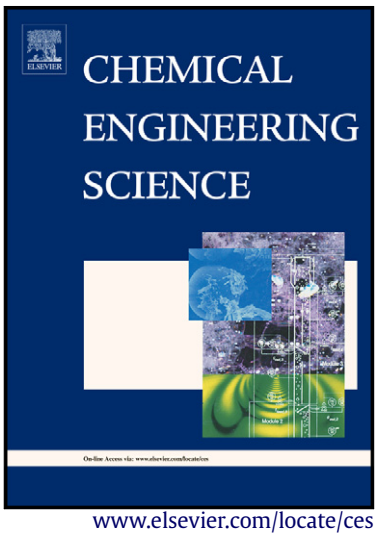

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Avik Sarkar, Xin Sun, Sankaran Sundaresan

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Verification of sub-grid *filtered* drag models for gas-particle fluidized beds with immersed cylinder arrays

Avik Sarkar[a,*], Xin Sun[a], Sankaran Sundaresan[b]

[a]Fundamental and Computational Sciences Directorate, Pacific Northwest National Laboratory, PO Box 999, MSIN: K7-90, Richland, Washington 99352, United States

[b]Chemical and Biological Engineering, Princeton University, A-315 Engineering Quadrangle, Princeton University, Princeton, New Jersey 08544, United States

[*]Corresponding author. Tel.: +91 509-371-7359. Email address: aviksarkar2@gmail.com, avik.sarkar@pnnl.gov.

Abstract

The accuracy of coarse-grid multiphase CFD simulations of fluidized beds may be improved via the inclusion of filtered constitutive models. In our previous study (Sarkar et al., Chem. Eng. Sci., 104, 399-412), we developed such a set of filtered drag relationships for beds with immersed arrays of cooling tubes. Verification of these filtered drag models is addressed in this work. Predictions from coarse-grid simulations with the sub-grid filtered corrections are compared against accurate, highly-resolved simulations of full-scale turbulent and bubbling fluidized beds. The filtered drag models offer a computationally efficient yet accurate alternative for obtaining macroscopic predictions, but the spatial resolution of meso-scale clustering heterogeneities is sacrificed.

Keywords: Computational fluid dynamics (CFD); Cylinder arrays; Filtered models; Fluidization; Multiphase flow; Scale-up.

1. Introduction

Resolving meso-scale structures such as particle clusters and gas bubbles in computational fluid dynamics (CFD) simulations of commercial-scale fluidized beds is prohibitively expensive (Agrawal et al., 2001).