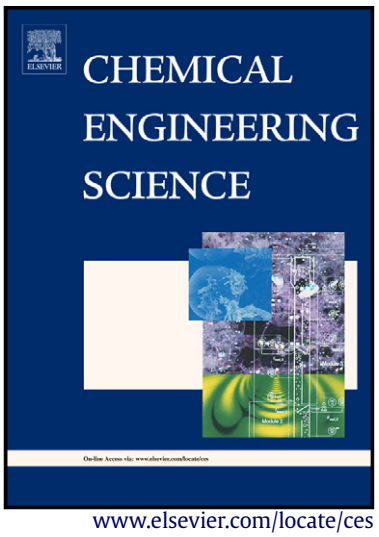

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Characterisation of the particle-wall frictional forces in pseudo-2D fluidized beds using DEM

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Abstract

In this work a numerical study of a pseudo-2D gas fluidized bed is carried out using the MFIX-DEM code with a twofold aim. The first aim is to check whether the DEM code reproduces the overall experimental value of the frictional force of the walls on the particles in the pseudo-2D bed in bubbling regime, previously measured by Hernández-Jiménez et al. (2013) by means of a global force balance in the bed. The second aim of this work is to perform a local study of the wall-particle frictional forces, using the results of the DEM simulations. The results showed that the force balance proposed by Hernández-Jiménez et al. (2013) is consistent with the DEM simulations, corroborating that the particle-wall overall force can be considered equal to the velocity of the centre of mass times a global particle-wall interaction coefficient, c. Besides, it was found that the most probable value of the local coefficient c in the DEM simulations is similar to the global value experimentally obtained. As expected, the DEM results showed that this particle-wall interaction coefficient, c, increases with the particle-wall friction coefficient. Coincidence between simulations and experiments is maximum if an angle of internal friction very close to 30° is considered in the DEM particle-wall interaction.

Keywords: Fluidized bed, Pseudo-2D, Wall friction, Force balance, DEM

1. Introduction

Fluidized beds have various applications in industry, such as fluid catalytic cracking (FCC), gasification, combustion of solid fuels, and Fischer−Tropsch synthesis (Kunii and Levenspel, 1991). Despite the fact that fluidized beds have been used in industry since the 1920s and great progress has been made, some aspects of fluidized bed dynamics are still far from being fully understood.

Beds having small thickness, i.e. pseudo-two−dimensional (2D) beds, have been crucial for the understanding of the dynamics of gas−particle systems. In this regard, pseudo−2D fluidized bed systems typically

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