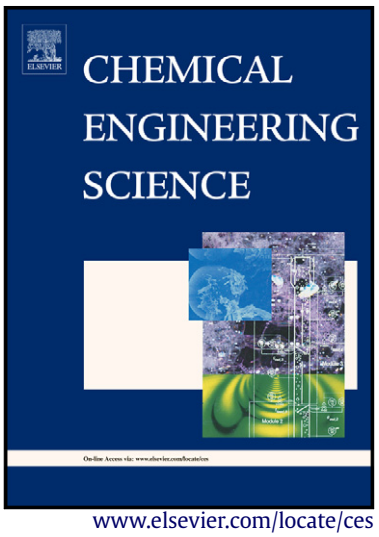

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PII: S0009-2509(14)00265-6
DOI: http://dx.doi.org/10.1016/j.ces.2014.05.039
Reference: CES11666

To appear in: *Chemical Engineering Science*

Received date: 20 March 2014
Revised date: 13 May 2014
Accepted date: 24 May 2014

Cite this article as: Niels G. Deen, E.A.J.F. Peters, Johan T. Padding, J.A.M. Kuipers, Review of direct numerical simulation of fluid-particle mass, momentum and heat transfer in dense gas-solid Flows, *Chemical Engineering Science,* http://dx.doi.org/10.1016/j.ces.2014.05.039

Review of Direct Numerical Simulation of Fluid-Particle Mass, Momentum and Heat Transfer in Dense Gas-Solid Flows

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Abstract

This paper reviews the use of direct numerical simulation (DNS) models for the study of mass, momentum and heat transfer phenomena prevailing in dense gas-solid flows. In particular, we consider the DNS models as the first important step in a multiscale modeling strategy. Both the merits and the limitations of different DNS methods are discussed, in particular for the field of fluidized bed modeling. The importance of the closures for interfacial transfer of mass, momentum and heat, obtained from DNS and applied in coarser scale models, is demonstrated with illustrative examples. Finally, we present our view on required future developments of DNS models for the investigation of various chemical engineering problems.

Key-words

Direct Numerical Simulation; Immersed Boundary Method; Fluidization; Fluid-Particle Momentum and Mass and Heat Transfer; Multi-Scale Modeling