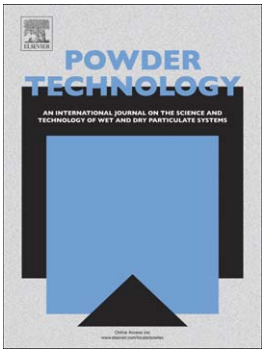

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Regimes of Liquid Transport through Sheared Beds of Inertial Smooth Particles

Bhageshvar Mohan,[a] Christoph Kloss,[b,c] Johannes Khinast,[a,d] and Stefan Radl[a*]

[a]Institute for Process and Particle Engineering, Graz University of Technology, Inffeldgasse 13/III, 8010 Graz, Austria

[b]DCS Computing GmbH, Linz, Austria

[c]Christian-Doppler Laboratory on Particulate Flow Modeling, Johannes Kepler University, Linz, Austria

[d]Research Center Pharmaceutical Engineering GmbH, Inffeldgasse 13/III, 8010 Graz, Austria

*Corresponding author: E-mail: radl@tugraz.at; Tel.: +43 316 873 30412

Abstract

Liquid transport in moving particle beds occurs due to liquid transfer upon particle-particle collisions, as well as due to convective transport caused by the particle motion. These transport mechanisms are typically described with rather simplistic models, and expensive discrete particle simulations need to be used for their evaluation. In this article, we analyze the effect of a variety of liquid transfer models in several flow configurations. After selecting an appropriate transfer model, we perform a large set of homogeneous shear flow simulations involving soft, frictional spheres. Based on the results of these simulations, we build regime maps of the effective liquid flux through sheared particle beds. We then draw an analogy to the transport of thermal energy in these systems, and find good agreement of the computed dimensionless conductive fluxes. Our results constitute the foundation for the future development of continuum models to describe liquid and thermal transport through moving granular materials.

Keywords

Granular flow; Liquid Bridge; Discrete Element Method; Flow regimes; Shear flow; Coordination number.