399a Modelling of Solid Stress in Gas-Solid Flow Systems

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Gas-solid flow systems are found in many industrial applications such as catalytic reactions, pneumatic conveying, granulation, crystallisation, mineral classification etc. These operations can show a number of hydrodynamic features, from fast dilute flow, dominated by collisional particle-particle contacts, to dense slow flow, dominated by sustained frictional contacts. For many years, the former has been successfully modelled using the classic kinetic theory for granular flow, while the latter has been modelled based on soil mechanics principles. At the intermediate regime, three different modelling approaches have been attempted: (1) the ad hoc combination of the solid stress from the two limiting regimes at a specific solid fraction; (2) The switching from one regime to another using different solid stress formulations; (3) the smooth transition from one regime to another using a unified shear model. In this study, a one-dimensional fully developed gas-solid flow model will be used to review the various treatments and analyse the sensitivity of the flow predictions to the frictional stress in vertical and horizontal flow.