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Modeling of Dense Particle Flows in Pneumatic Conveying Systems

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Typically three main multiphase flow regimes are observed for particle flows in pneumatic conveying systems: Solid like behavior in regions with densely packed particles due to strong frictional contact (A), fluidized flow characterized by particle collisions and drag forces between air flow and particles (B) as well as almost pure air flow in regions with a low particle concentration (C). In this work the solid like material is assumed to be at rest due to wall contact and is modeled by the Navier-Lamé equations for an elastic solid body material in an Eulerian framework. For the fluidized flow the Navier-Stokes equations are applied in the same Eulerian framework. In this contribution the modeling issues of the friction dominated regime and the transition to fluidized flow for a particle volume fraction close to unity are considered. Furthermore, the modeled coupling of the two regimes and some numerical results of examined test cases are presented.

Keywords: Dense Particle Flow, Multiphase Coupling, Pneumatic Conveying, Granular Flow