Abstract Submitted
for the DFD08 Meeting of
The American Physical Society

Multiphase multi-velocity discrete population balance model of fragmenting particulate flows MAHESH PANCHAGNULA, PRASAD RAYAPATI, JOHN PEDDIESON, Tennessee Technological University — Fragmenting particulate flows are studied using discrete population balance modeling. The range of particle sizes is divided into N classes with each size class being allowed to behave as an individual fluid-like phase. The particulate phases are embedded in a continuous phase with which they share a pressure field and are coupled through drag forces. The particulate material is therefore modeled as a mixture of N+1 inter-penetrating continua. The fragmentation process is modeled using the population balance approach which allows for parent size-class particles to break up into any of the smaller daughter size-classes following a pre-defined breakage phenomenology. The accompanying mass and momentum exchange between the size-classes is modeled as source terms in the conservation equations. The model is applied to a micro-centrifuge flow field. We show here that the larger particles, while being encouraged to break up are also preferentially transported towards the walls of the centrifuge, owing to the swirl induced radial pressure gradient. By experimenting with various breakage phenomenologies, we show that the classical log-normal particle size distribution can be recovered in the long time limit for all breakage phenomenologies but the short time evolution of the particle size distribution is sensitive to that choice.

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Date submitted: 04 Aug 2008 Electronic form version 1.4