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Continuum modeling of segregation for tridisperse granular materials in developing chute flow ZHEKAI DENG, PAUL UMBANHOWAR, RICHARD LUEPTOW, Northwestern University — Predicting segregation and mixing of size polydisperse granular material is a challenging problem and is relevant to many industrial applications. We develop and implement a continuum-based theoretical model that captures the effects of segregation, diffusion and advection on size tridisperse granular flow in developing quasi-two-dimensional chute flow. Unlike segregation models that rely on arbitrary fitting parameters, our model uses parameters based on kinematics measured using discrete element method (DEM) simulations. The model depends on both the Péclet number, Pe, which we defined as the ratio of the segregation rate to the diffusion rate, and the relative segregation strength between particle species. At large Pe, segregation dominates and chute flow consists of distinct stratified regions of small(bottom), medium(center) and large (top) particles, whereas at small Pe, diffusion dominates, which results in a well mixed flow. As relative segregation strength between any two particle species is increased, the segregation between them becomes quicker. However, as relative segregation strength between them is decreased, they remain mixed with each other. Preliminary results from DEM simulations support our theoretical model.

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