

## ABSTRACT

Khola, Nitin . M.S.M.E., Purdue University, May 2015. Correlations for Shear-induced Percolation Segregation in Granular Shear Flows. Major Professor: Carl, Wassgren, School of Mechanical Engineering.

Discrete element method (DEM) computer simulations are used to develop correlations for the mean percolation segregation speed and diffusion coefficient in a steady shear flow of a bidisperse mixture of cohesionless, spherical particles. The simulations span a range of size ratios, dimensionless shear rates, and dimensionless applied normal stresses. The volume concentrations of the smaller species are small, with values between 0.04% and 9.6%. For the investigated set of parameters, the dimensionless mean percolation speed has an exponential dependence on the particle size ratio and is a linear function of the large particle concentration, but is independent of the dimensionless normal stress, at least for dimensionless normal stresses exceeding a critical value. Furthermore, the dimensional mean percolation speed is also independent of the dimensional shear rate. The diffusion coefficient, however, does depend on the shear rate, but asymptotes to the self-diffusion coefficient as the particle size ratio approaches one. The proposed correlations fit the simulation data very well, with coefficients of determination exceeding 0.99 and 0.97 for the percolation speed and diffusion coefficient, respectively. These correlations are intended for use with higher-level models, such as continuum models for granular flow, in order to predict segregation in large systems.