Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

A Model for Solid-Solid drag in Bidisperse Gas-solid Flows[1] ERIC MURPHY, SHANKAR SUBRAMANIAM, Iowa State University — Computational models for gas-solid mixtures often require closures for interphase momentum and energy transfer. One of the most important interactions for polydisperse systems is a so-called solid-solid drag, i.e. the momentum transfer between different particulate phases traveling at different mean velocities. Modeling of these, and additional terms has been a focus of the granular physics community for nearly three decades and is no easy task. Flows of bidisperse particles are often high Mach number, Ma>>1. As a result, many theories developed for low Mach number applications using the Chapman-Enskog(CE) theory are not strictly applicable. Still, many other analytic moment methods did not properly couple granular temperature and slip between particulate phases. We have developed a moment theory for the slip and temperature evolution employing the pseudo-Liouville operator technique, which correctly accounts for the coupling between phasic slip and temperatures. The theory is compared with other existing moment models for solid-solid drag. It is found that the drag model is a weighted sum of terms arising in both (CE) and existing moment theories. Additionally, new phase specific temperature evolution terms are obtained that shed light on phenomena such as non-equipartition of energy in bidisperse granular gases. Lastly, we explore some of the segregation behavior implied by the model for homogeneous gas-solid flows with bidisperse particles.

[1]This work was supported through DOE award number DE-FE0007260 and NSF grants CMMI 0927660 and CBET 1134500.

Eric Murphy
Iowa State University

Date submitted: 01 Aug 2014 Electronic form version 1.4