Abstract Submitted
for the SHOCK17 Meeting of
The American Physical Society

Construction of Closure Models for Pseudo-turbulent Stresses in Shock-Particle Interactions OISHIK SEN, The University of Iowa, GUSTAAF JACOBS, San Diego State University, KYUNG K CHOI, H.S. UDAYKUMAR, The University of Iowa — In multiphase flows involving shock-particles interactions, velocity fluctuations in the fluid field arise because of the interaction between the solid and the fluid phases. Macroscale models treat the velocity-fluctuations as subgrid scale phenomenon; the fluctuations are modeled using Reynolds stress equivalence terms (also known as pseudo-turbulent terms) in the homogenized macroscale system of equations. To solve the macroscale systems, the pseudo-turbulent terms require closure. This work shows a method of generating closure laws for the pseudo-turbulent terms from resolved mesoscale computations of shock-particle interaction. Closures are derived from ensembles of high-fidelity mesoscale simulations different Mach number (Ma) and Volume-Fraction (ϕ). The pseudo-turbulent stresses computed from the simulations are used as inputs to a metamodeling technique – a Modified Bayesian Kriging Method (MBKG) - for creating surrogate models. The surrogates show that the pseudo-turbulent kinetic energy (P-TKE) is comparable to the kinetic energy of the mean flow for higher Ma and higher ϕ flows. In summary, this work evaluates the importance of velocity-fluctuations and creates closure for the pseudo-turbulent stresses in shock-particle interactions.

Oishik Sen
The University of Iowa

Date submitted: 02 Mar 2017 Electronic form version 1.4