Abstract Submitted
for the DFD08 Meeting of
The American Physical Society

Large-eddy simulation of particle-laden flow over a backward-facing step using a spectral multidomain method KAUSTAV SENGUPTA, Univ. of Illinois at Chicago, GUSTAAF JACOBS, San Diego State University, FARZAD MASHAYEK, Univ. of Illinois at Chicago — We present an investigation into the particle-laden flow in a dump-combustor configuration. An accurate prediction of particle dispersion within the combustors is necessary for improved design of spray combustion. The instantaneous local particle concentration and turbulent mixing provide insights into the physio-chemical processes that would be encountered in a reacting scenario. The principal difficulty in prediction of particle transport in the dilute flow regime, lies in the accurate description of the underlying complex, turbulent gas flow field featuring reattaching shear layers. Here, we present large-eddy simulations (LESs) of a particle-laden flow over an unconfined and confined backward-facing step at Reynolds numbers of 5000 and 28,000, respectively, using a spectral multidomain LES methodology. The LES captures the carrier flow accurately, while being computationally affordable. One-way coupled equations are considered and particles with different Stokes numbers are studied. The inlet turbulence is modeled using a novel stochastic model that reproduces the second order moments of the fully developed flow upstream of the step. The effects of the turbulent recirculating flow behind the step on particle dispersion are investigated in detail.

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Date submitted: 06 Aug 2008 Electronic form version 1.4