Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Euler-Euler anisotropic Gaussian mesoscale direct numerical simulation of homogeneous and wall-bounded cluster-induce gas-particle turbulence BO KONG, Department of Chemical and Biological Engineering, Iowa State University, Ames, IA, USA, HENG FENG, Department of Thermal Engineering, Tsinghua University, Beijing, China, JESSE CAPECELATRO, Center for Exascale Simulation of Plasma-coupled Combustion, University of Illinois at Urbana-Champaign, Urbana, IL, USA, OLIVIER DESJARDINS, Sibley School of Mechanical and Aerospace Engineering, Cornell University, Ithaca, NY, USA, RODNEY FOX, Department of Chemical and Biological Engineering, Iowa State University, Ames, IA, USA — In our previous works,the exact Reynolds-averaged equations for the particle phase were derived to develop a new mutilphase turbulence model with a rigorous conceptual foundation, and detailed Euler-Lagrange(EL) particle simulations of cluster-induced turbulence (CIT) were performed to aid its development. However, sophisticated filtering techniques have to be used to extract Eulerian particle-phase statistics from the EL simulations, which can be directly provided by Euler-Euler approaches. In this work, a novel Euler-Euler anisotropic Gaussian (AG) approach was used to perform mesoscale DNS of the CIT cases. A three-dimension Hermite Quadrature formulation is used to calculate finite-volume kinetic flux for ten velocity moments. Bhatnagar-Gross-Krook model is applied to account for the inelastic particle collisions. Detailed comparisons with EL simulations demonstrate that the AG particle velocity assumption is valid and this novel method can be used to perform mesoscale DNS for gas-particle flows with high fidelity.

Bo Kong
Department of Chemical and Biological Engineering,
Iowa State University, Ames, IA, USA

Date submitted: 01 Aug 2015 Electronic form version 1.4