Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Filtered Mass Density Function for Large-Eddy Simulations of Multiphase Turbulent Reacting Flows FARHAD JABERI, Michigan State University, ZHAORUI LI, Texas A&M University-Corpus Christi, ARAZ BANAEIZADEH, Altair Engineering Inc., ABOLFAZL IRANNEJAD, Alcon-Novartis Inc. — Honoring Ted O'Brien. The filtered mass density function (FMDF) methodology is further extended and employed for large-eddy simulations (LES) of multiphase turbulent reacting flows. The two-phase LES/FMDF model is implemented with a unique Lagrangian-Eulerian-Lagrangian mathematical/computational methodology. In this methodology, the filtered carrier gas velocity field is obtained by solving the filtered form of the compressible Navier-Stokes equations while the gas scalar (e.g. temperature and species mass fractions) field and the liquid (spray) phase are obtained by solving two different sets of Lagrangian equations. The two-way interactions between the phases and all the Eulerian and Lagrangian fields are included in the two-phase LES/FMDF methodology. The accuracy and reliability of the model is demonstrated by comparing the two-phase LES/FMDF results with those obtained from the direct numerical simulation (DNS) and experimental data for a range of fundamental and practical multiphase flows including a spatially developing turbulent mixing layer with evaporating and reacting droplets and spray combustion in a preheated high-pressure closed chamber, a dump combustor, a double-swirl burner, and an internal combustion engine.

Zhaorui Li
Texas A&M University-Corpus Christi

Date submitted: 02 Aug 2019 Electronic form version 1.4