Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

Intrusive Method for Uncertainty Quantification in a Multiphase Flow Solver[1] BRIAN TURNQUIST, MARK OWKES, Montana State University — Uncertainty quantification (UQ) is a necessary, interesting, and often neglected aspect of fluid flow simulations. To determine the significance of uncertain initial and boundary conditions, a multiphase flow solver is being created which extends a single phase, intrusive, polynomial chaos scheme into multiphase flows. Reliably estimating the impact of input uncertainty on design criteria can help identify and minimize unwanted variability in critical areas, and has the potential to help advance knowledge in atomizing jets, jet engines, pharmaceuticals, and food processing. Use of an intrusive polynomial chaos method has been shown to significantly reduce computational cost over non-intrusive collocation methods such as Monte-Carlo. This method requires transforming the model equations into a weak form through substitution of stochastic (random) variables. Ultimately, the model deploys a stochastic Navier Stokes equation, a stochastic conservative level set approach including reinitialization, as well as stochastic normals and curvature. By implementing these approaches together in one framework, basic problems may be investigated which shed light on model expansion, uncertainty theory, and fluid flow in general.

[1]NSF Grant Number 1511325

Brian Turnquist
Montana State University

Date submitted: 29 Jul 2016 Electronic form version 1.4