Abstract Submitted
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multiUQ: An intrusive uncertainty quantification tool for gas-liquid multiphase flows[1] BRIAN TURNQUIST, MARK OWKES, Montana State University — Uncertainty quantification (UQ) can improve our understanding of the sensitivity of gas-liquid multiphase flows to variability about inflow conditions and fluid properties, creating a valuable tool for engineers. While non-intrusive UQ methods (e.g., Monte Carlo) are simple and robust, the cost associated with these techniques can render them unrealistic. In contrast, intrusive UQ techniques modify the governing equations by replacing deterministic variables with stochastic variables, adding complexity, but making UQ cost effective. Our numerical framework, called multiUQ, introduces an intrusive UQ approach for gas-liquid flows, leveraging a polynomial chaos expansion of the stochastic variables: density, momentum, pressure, viscosity, and surface tension. The gas-liquid interface is captured using a conservative level set approach, including a modified reinitialization equation which is robust and quadrature free. A least-squares method is leveraged to compute the stochastic interface normal and curvature needed in the continuum surface force method for surface tension. The solver is tested by applying uncertainty to one or two variables and verifying results against the Monte Carlo approach.

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