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Detailed Numerical Simulation of Liquid Jet in Cross Flow Atomization with High Density Ratios[1] SINA GHODS, MARCUS HERRMANN, Arizona State University — Atomization of a liquid fluid jet by a high speed cross-flowing gas has many applications such as gas turbines and augmentors. The mechanisms by which the liquid jet initially breaks up, however, are not well understood. Detailed numerical simulation can offer a better understanding of the underlying physical mechanisms that lead to the initial breakup of the injected liquid jet. In this work, we present detailed numerical simulation results of turbulent liquid jets injected into turbulent gaseous cross flows at varying momentum flux ratios and crossflow Weber numbers. We employ a finite volume, balanced force fractional step flow solver to solve the Navier-Stokes equations coupled to a Refined Level Set Grid method to follow the phase interface. To ensure discrete consistency between the solution of the conservative momentum equation and the level set based continuity equation, we employ a novel Rescaled Conservative Momentum Method. We analyze the impact of the previously-mentioned characteristic numbers on jet penetration, atomization mechanism, liquid mass flux distribution, and resulting drop size distribution and compare our numerical results to those obtained experimentally by Brown & McDonell (2006).

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