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Numerical study of impact of evaporation on liquid jet in cross-flow MARIOS SOTERIOU, XIAOYI LI, MARCO ARIENTI, United Technologies Research Center — Atomization of a liquid fuel jet by a high speed cross-flowing gas plays a critical role in many propulsion devices. High fidelity simulation offers the potential of a better understanding and enhancement of this atomization process. In this work, a computationally efficient hybrid Eulerian-Lagrangian approach is coupled with a droplet evaporation model and is used to probe the impact of evaporation on the spray development. The Coupled Level Set and Volume of Fluid (CLSVOF) method is used to directly calculate the breakup and coalescence of the liquid-gas interface. Adaptive Mesh Refinement (AMR) is adopted to achieve high resolution at the interface. Small fuel droplets in dilute regions are removed from the Eulerian description, transformed into Lagrangian particles and tracked by a discrete phase transport model. The coupling of the spray evaporation to the gas phase is examined with respect to jet blockage, spray penetration, and overall far-field spray dispersion. The calculation is validated with flow rate, spray size distribution and velocity data acquired in a spray rig at high-Weber, high-Reynolds number injection conditions. The effect of evaporation on spray distribution is also discussed.

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