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High Fidelity Simulation of Liquid Jet in Cross-flow Using High Performance Computing MARIOS SOTERIOU, XIAOYI LI, United Technologies Research Center — High fidelity, first principles simulation of atomization of a liquid jet by a fast cross-flowing gas can help reveal the controlling physics of this complicated two-phase flow of engineering interest. The turn-around execution time of such a simulation is prohibitively long using typically available computational resources today (i.e. parallel systems with $\sim$O(100) CPUs). This is due to multiscale nature of the problem which requires the use of fine grids and time steps. In this work we present results from such a simulation performed on a state of the art massively parallel system available at Oakridge Leadership Computing Facility (OLCF). Scalability of the computational algorithm to $\sim$2000 CPUs is demonstrated on grids of up to 200 million nodes. As a result, a simulation at intermediate Weber number becomes possible on this system. Results are in agreement with detailed experiment measurements of liquid column trajectory, breakup location, surface wavelength, onset of surface stripping as well as droplet size and velocity after primary breakup. Moreover, this uniform grid simulation is used as a base case for further code enhancement by evaluating the feasibility of employing Adaptive Mesh Refinement (AMR) near the liquid-gas interface as a means of mitigating computational cost.

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