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DNS of coflowing planar jet atomization: can one reach convergence?[1] YUE LING, STEPHANE ZALESKI, Institut d'Alembert, UPMC-Paris 6, GRETAR TRYGGVASON, University of Notre Dame, DANIEL FUSTER, Institut d'Alembert, UPMC-Paris 6, RUBEN SCARDOVELLI, MATTEO CENNI, Universita di Bologna, TOMAS ARRUFAT, Institut d'Alembert, UPMC-Paris 6
— Atomization of a liquid jet assisted by a coflowing fast gas jet is commonly seen in fuel injection systems. Three-dimensional direct numerical simulations are performed to investigate the turbulent multiphase flow characteristics in coflowing planar jet atomization, with the interface tracked by the Volume-of-fluid method. Although many numerical simulations of atomization were reported in the recent years, whether the atomization characteristics such as droplet formation and size distribution are fully resolved is often unclear. In this work, a series of very large-scale simulations of different grid resolution (up to four billion grid points) are conducted and particular attention is focused on examining whether we can achieve converged results on the statistical atomization characteristics. The statistical characteristics of the turbulence (such as turbulence kinetic energy) and of the spray (such as droplet size distribution, liquid volume fraction, and gas-liquid interfacial area) are calculated by averaging the DNS data spatially and temporally. The complex multiscale droplet formation mechanisms due to the interaction between the interface and the turbulence are also revealed by the simulation results.

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