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THE ATOMIZING PULSED JET

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Abstract. Atomization is a complex phenomenon involving multiscale dynamics of fragmentation. For decades until today, diverse experiments and numerical simulations have been developed to deepen our understanding of the mechanisms that drive these ubiquitous types of flows. This presentation shares some insights over Direct Numerical Simulations of the injection of a pulsed round liquid jet in a stagnant gas are performed in a series of runs of geometrically progressing resolution. The Reynolds and Weber numbers, and the density ratio are sufficiently large to reach a complex high-speed atomization regime, but limited minimize the range of scales to capture. The simulations are performed using octree adaptive mesh refinement with a finite volume method and height-function computation of curvature, implemented in the Basilisk platform. Qualitative analysis of the flow and its topology reveals a complex structure of ligaments, sheets, droplets and bubbles that evolve and interact through impacts, ligament breakup, sheet rupture and engulfment of air bubbles in the liquid. Most processes occurring in this type of atomization are reproduced in detail, except at the instant of thin sheet perforation or breakup. We analyze droplet statistics, how the grid resolution affects it, and we propose a controlled breakup strategy that allows convergence of the droplet frequency above a certain critical diameter.

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