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Numerical Investigation on Sensitivity of Liquid Jet Breakup to Physical Fuel Properties with Experimental Comparison[1] DOKYUN KIM, Cascade Technologies, LUIS BRAVO, Army Research Laboratory, KATARZYNA MATUSIK, DANIEL DUKE, ALAN KASTENGREN, ANDY SWANTEK, CHRISTOPHER POWELL, Argonne National Laboratory, FRANK HAM, Cascade Technologies — One of the major concerns in modern direct injection engines is the sensitivity of engine performance to fuel characteristics. Recent works have shown that even slight differences in fuel properties can cause significant changes in efficiency and emission of an engine. Since the combustion process is very sensitive to the fuel/air mixture formation resulting from disintegration of liquid jet, the precise assessment of fuel sensitivity on liquid jet atomization process is required first to study the impact of different fuels on the combustion. In the present study, the breaking process of a liquid jet from a diesel injector injecting into a quiescent gas chamber is investigated numerically and experimentally for different liquid fuels (n-dodecane, iso-octane, CAT A2 and C3). The unsplit geometric Volume-of-Fluid method is employed to capture the phase interface in Large-eddy simulations and results are compared against the radiography measurement from Argonne National Lab including jet penetration, liquid mass distribution and volume fraction. The breakup characteristics will be shown for different fuels as well as droplet PDF statistics to demonstrate the influences of the physical properties on the primary atomization of liquid jet.

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