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Role of Weber number in the primary breakup of liquid jets in crossflow MADHUSUDAN PAI, I. BERMEJO-MORENO, Stanford University, OLIVIER DESJARDINS, University of Colorado, HEINZ PITSCH, Stanford University — Atomization of liquid fuel controls the combustion efficiency and pollutant emissions from internal combustion engines and gas turbines. A liquid jet injected into a crossflow breaks up by developing liquid surface instabilities and deformations due to aerodynamic sources and liquid jet turbulence, among other causes. There is a pressing need to understand the origin and role of these instabilities in the breakup of a liquid jet. These instabilities can be accurately quantified in detailed numerical simulations of liquid jets. A spectrally-refined interface (SRI) tracking scheme for interface transport coupled to an accurate and robust Navier-Stokes/Ghost-fluid method gas-phase solver is employed to perform large-scale detailed numerical simulations of liquid jets in a laminar crossflow. The liquid Weber number controls the tendency of a liquid jet to break up, while the liquid Reynolds number controls the range of length scales in the liquid jet turbulence. The interplay and role of these phenomena in the primary breakup of liquid jets is quantified through a parametric study. Existing models for turbulent primary breakup of liquid jets in crossflow are reviewed based on the numerical results.

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