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**Efficient High-Fidelity Simulation of Pressure Swirl Injection**
MARK OWKES, OLIVIER DESJARDINS, Cornell University — Atomization of hydrocarbon fuels is of critical importance to air-breathing, liquid-fueled internal combustion engines used in the transportation sector. While atomizers can take widely different forms and operate under a wide range of conditions, pressure swirl atomizers are essential as they represent the main component of most air-blast spraying systems for gas turbines. Experimental investigations of pressure swirl injectors are challenging due to their often-intricate geometry, and due to the formation of a conical liquid sheet that complicates optical access to the central injector region. Hence, numerical simulations have the potential to shed light on the physics of such injectors. To tackle such a task computationally, methods are needed for efficiently handling of complex geometries, and robustly and conservatively handle high-density ratio turbulent two-phase flows. In this work, a computational study of pressure swirl injection is presented based on an efficient approach that combines ideas from immersed boundary, level set, volume of fluid, and ghost fluid methods. The flow dynamics within the injector as well as the spray cone are discussed.

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