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Geometric VOF-PLIC simulations of Hollow Cone Sprays THOMAS NELSON, MICHAEL BENSON, BRETT VANPOPPEL, US Military Acad, LUIS BRAVO, Army Research Lab, USMA TEAM SPRAY COLLABORA-TION, ARL VEHICLE COMBUSTION LAB COLLABORATION, STANFORD UNIVERSITY COLLABORATION — This work examines a Computational Fluid Dynamics (CFD) approach to provide temporally resolved simulations of a novel pressure swirl atomizer presently studied at Stanford University [1]. In a pressure swirl atomizer, the liquid spreads out to form an air-cored vortex within the nozzle and an emerging thin annular film. Due to instabilities the film breaks up to form a hollow cone spray. The numerical simulations focus on the near field nozzle flow physics and primary atomization of the spray. An incompressible flow formulation is adopted with a geometric unsplit Volume of Fluid (VOF) method to track the interface between two immiscible fluids in interfacial flow simulations. Here, the interface is modeled via an advection equation implicitly tracked using a discrete indicator function, f, with values representing the volume fraction of the tagged fluid within a cell. An Adaptive Mesh Refinement (AMR) scheme is also employed to efficiently capture the shear layers near the liquid-gas interface. The study is carried out for two atomizers with 2mm and 3mm diameters at intermediate Re = $2.6-3.9 \times 103$, We=0.11-0.17 \times 105. An in depth comparison is then provided between the CFD results and measurements obtained via shadowgraphy and CT scans.

[1] P.A. Vazques, J. Eaton, R. Fahrig, et al, ILASS, 2014.

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