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Detailed Spray Modeling of an Outwardly Opening Injector and its Impact on the Performance of a GDI Engine Operating in a Lean Stratified Combustion Mode LINDSEY WADSWORTH, Montana State University - Bozeman, TAARESH SANJEEV TANEJA, SUO YANG, University of Minnesota, Twin Cities — Outwardly opening hollow cone injectors feature a simple design, and with a piezoelectric actuator, can also offer fast and precise actuation. These injectors are suitable for use in gasoline direct injection (GDI) engines, which necessitates high fidelity spray modeling to accurately model the ignition delay and the resultant pressure trace. These can be highly sensitive to spray atomization in engines running with a globally lean, yet stratified mixture, achieved using very late injections in the compression stroke. A modified injection strategy is studied with precise modeling of breakup, collisions, and evaporation of the fuel. Both, the Eulerian - Lagrangian, and the Eulerian – Eulerian (using the VoF method) models in ConvergeCFD are used for detailed simulation of the hollow cone spray. Further, the effect of cavitation and turbulence-based instabilities on spray breakup are investigated, in addition to aerodynamic instabilities. The results from these models are compared with experimental data at constant temperature and pressure conditions. The model is finally simulated in GDI combustion conditions to assess ignition delay, pressure trace, and soot prediction using the method of moments with interpolative closure (MOMIC).

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