Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Resolving pseudo-cavitation in the nozzle and its effect on spray formation[1] ROHIT MISHRA, DORRIN JARRAHBASHI, Texas A & M University College Station — Pressure drop in the diesel injector nozzle triggers two simultaneous phase-change phenomena: vaporous cavitation where the local pressure drops below the fuel saturation pressure and pseudo-cavitation that is the precipitation of air bubbles dissolved in the fuel. These phenomena modify the internal nozzle flow and significantly affect the spray characteristics. A multi-fluid Eulerian-Eulerian interface-tracking solver is developed that accounts for vaporous cavitation and de-gassing of the dissolved air. A new de-gassing model is created that relates the solubility of the dissolved gases to the drop in pressure along the nozzle and links the rise in bubble number density to the reduction of the gas solubility as de-gassing evolves. The co-existence of the three fluids namely: fuel, vapor and air and their evolution with time in the nozzle are presented. The development of the spray is examined as the fuel leaves the nozzle region. The role of the vaporous cavitation and pseudo-cavitation on the spray cone angle has been illustrated for a wide range of pressures and nozzle diameters. The predicted dynamic mass flow rates, effective diameter, and cone angles provide a more accurate initial conditions required for setting up the traditional Eulerian-Lagrangian spray simulations.

[1]Cummins Inc.

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Date submitted: 03 Aug 2020 Electronic form version 1.4