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Jet Simulation in a Diesel Engine ZHILIANG XU, BrookHaven National Lab., JAMES GLIMM TEAM, MYOUNG-NYOUN KIM TEAM, XIALIN LI TEAM, ROMAN SAMULYAK TEAM — We present a numerical study of the jet breakup and spray formation in a diesel engine by the Front Tracking method. The mechanisms of jet breakup and spray formation of a high speed diesel jet injected through a circular nozzle are the key to design a fuel efficient, nonpolluting diesel engine. We conduct the simulations for the jet breakup within a 2D axis-symmetric geometry. Our goal is to model the spray at a micro-physical level, with the creation of individual droplets. The problem is multiscale. The droplets are a few microns in size. The nozzle is about 0.2 mm in diameter and 1 mm in length. To resolve various physical patterns such as vortex, shock waves, vacuum and track droplets and spray, the Burger-Colella adaptive mesh refinement technique is used. To simulate the spray formation, we model mixed vapor-liquid region through a heterogeneous model with dynamic vapor bubble insertion. The formation of the cavitation is represented by the dynamic creation of vapor bubbles. On the liquid/vapor interface, a phase transition problem is solved numerically. The phase transition is governed by the compressible Euler equations with heat diffusion. Our solution is a new description for the Riemann problem associated with a phase transition in a fully compressible fluid.

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