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Modeling and Simulation of Secondary Breakup and Its Influence on Fuel Spray in High Torque Low Speed Diesel Engine

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Abstract : High torque low-speed diesel engine has a wide range of industrial and commercial applications. In literature, it's found that lot of work has been done for the high-speed diesel engine and research on High Torque low-speed is rare. The fuel injection plays a key role in the efficiency of engine and reduction in exhaust emission. The fuel breakup plays a critical role in air-fuel mixture and spray combustion. The current study explains numerically an important phenomenon in spray combustion which is deformation and breakup of liquid drops in compression ignition internal combustion engine. The secondary breakup and its influence on spray and characteristics of compressed gas in-cylinder have been calculated by using simulation software in the backdrop of high torque low-speed diesel like conditions. The secondary spray breakup is modeled with KH - RT instabilities. The continuous field is described by turbulence model and dynamics of the dispersed droplet is modeled by Lagrangian tracking scheme. The results by using KH - RT model are compared against other default methods in OpenFOAM and published experimental data from research and implemented in CFD (Computational Fluid Dynamics). These numerical simulation, done in OpenFoam and Matlab, results are analyzed for the complete 720- degree 4 stroke engine cycle at a low engine speed, for favorable agreement to be achieved. Results thus obtained will be analyzed for better evaporation in near nozzle region. The proposed analyses will further help in better engine efficiency, low emission and improved fuel economy.

Keywords : diesel fuel, KH-RT, Lagrangian , Open FOAM, secondary breakup
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