Abstract

The main objective of this thesis has been the study of the *Eulerian-Lagrangian (E-L) 3D-CFD* model as a tool for the analysis of Diesel spray structure and dynamics under engine-like injection and ambient conditions. Free inert diesel spray has been considered as a simplifying assumption.

The research started from a review of the physical processes involved in spray modeling based upon an *E-L 3D-CFD* framework. The characteristics and limitations of this approach have been pointed out based on this review. After that, a spray characterization methodology has been developed based on experimental comparison indicators, mainly spray tip penetration, as well as other parameters that allow the detailed description of spray flow dynamics. Using these indicators, model sensitivity studies concerning numerical parameters, turbulence and spray sub-model effects, have been carry out. Based on those results, a reference set-up configuration has been defined.

On the other hand, *E-L* model limitations for near-nozzle dense flow region modeling, where model basic hypothesis are not longer valid, has led to the development of an approach combining *1D*-Eulerian spray model based on turbulent jet theory and *E-L 3D-CFD*. In this way spray simulations in this region have been improved.

Eventually, assessment of simulation results with experimental data under different operating conditions, using both standard *3D* and *1D3D* model, have been performed to evaluate the proposed approach and to complete a detailed Diesel spray description and analysis.