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LARGE EDDY SIMULATION OF EVAPORATING SPRAY USING UNSTRUCTURED MESHING

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The evaporating process of a non-reacting spray is studied numerically using an Eulerian-Lagrangian framework. The case is simulated using Large Eddy Simulation (LES) where all the large scale structures of the flow are well resolved, but the subgrids scales must be modeled. Although LES has been widely used for modeling combustion since late 80's, the application of LES to combustion problems where the fuel is injected in liquid phase, i.e. in IC-Engines, is a relatively new field and still need to be further developed. Nowadays, it is found that many LES IC-Engine simulations employ LES models for turbulence but the remaining models (spray injection, droplet evaporation, combustion, etc.) are RANS-based models [1], or sometimes the unresolved velocity fluctuations on droplet paths are simply ignored [2]. In this context, it is of interest to account for the influence of these models in the context of LES. Thus, in the present work, the well-known spray diesel-like configuration named Spray-A is simulated using Large Eddy Simulation in an unstructured mesh where kinetic-energy preserving schemes are employed. The influence of the submodels employed in the simulation are assessed and the numerical results have been compared against the experimental data available for the reproduced spray configuration.

When a Lagrangian approach is used to model the dispersed phase (liquid phase), some scalar and vectorial fields of the carrier phase (gas phase) that are stored in the nodes of the Eulerian mesh, i.e. the velocity or the temperature, need to be interpolated in the particle/droplet location. As was reported in [3], this interpolation could represent almost half of the computational effort dedicated to the dispersed phase. Therefore, any gain or improvement in this part of the algorithm will impact directly in a noteworthy benefit in terms of computational time. In the present work, several interpolation approaches for Lagrangian particles in unstructured meshes are implemented and compared, in order to identify which method is the most efficient and accurate interpolation method for multiphase flows with droplets and particles when unstructured meshes are used, where multidimensional data stored in non-regular grids need to be interpolated.

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