STUDY OF THE TURBULENCE INDUCED BY CAVITATION PHENOMENON IN DIESEL INJECTOR NOZZLES BY LARGE EDDY SIMULATION (LES)

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Abstract

Due to high injection pressures used in modern Diesel engines, cavitation often appears in Diesel injector nozzles. It is known that cavitation has a strong influence on the injection and combustion process, so the study of this phenomenon become fundamental to improve the performance and emissions of the engines.

In the present paper, a homogeneous equilibrium model with a barotropic equation of state has been used for modeling cavitation in a multi-hole microsac nozzle, taking into account the turbulence effects by Large Eddy Simulation (LES). This technique, which captures the large scale motions of the flow and models the small scale motions that occur on length scales smaller than the mesh spacing, has been performed with a Smagorinsky Model as the sub-grid scale turbulent model and the van Driest model for the wall damping.

Initially, the code has been validated with experimental data in terms of mass flow, momentum flux and effective velocity, showing that the model is able to predict with a high level of confidence the behavior of the internal flow. Once it has been validated, the code has allowed to study in deep the turbulence in the discharge orifices at cavitating conditions. The results obtained shows that turbulence is strong affected by the presence of vapour induced by cavitation phenomenon.

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