Paper draft

Title:

A computational investigation on mixing, ignition and combustion in the frame of Diesel-like dual-fuel sprays

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Abstract

Dual-fuel combustion is gaining interest for engine research community as a promising alternative for improving the performance of highly-premixed low-emission combustion modes. This strategy is based on the injection of fuels with different chemical characteristics, such as gasoline-diesel or ethanol-diesel fuel blends, which allows controlling the mixture reactivity by adjusting the blend composition.

In this work, a numerical investigation has been performed to advance the understanding on the influence of fuel blends on mixture formation processes and also on ignition and flame structure characteristics. The numerical simulations have been carried out using the 3D-CFD open source code OpenFOAM, which has been adapted for analyzing the physical and chemical characteristics of dual-fuel sprays in both inert and reactive conditions. Different fuel surrogates have been considered in order to reproduce the physical and chemical properties of standard gasoline and diesel fuels.

As a general methodology, this study is based on simulating isolated dual-fuel sprays injected into a constant volume vessel where thermodynamic boundary conditions are set close to those expected in current and future diesel engines. An experimental validation of the spray vaporization and mixing predictions has been included and calculation results have also been comparatively evaluated to understand the effects of the mixture properties on spray combustion and their impact on pollutant emission formation.

The results will be used to foreseen the potential of fuel blends as suitable alternative for improving the performance of advanced and also conventional combustion concepts for future compression ignition engines.