On the Effect of GDI Injector Configuration on Charge Preparation

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Abstract

A Gasoline Direct Injection (GDI) engine typically operates on multiple fuel-preparation modes. In general, at higher loads a homogeneous mixture is favoured whereas a stratified mixture is preferred at part and low load conditions. This is usually achieved by altering the injection timing with respect to load and speed. In this paper the effect of injector configuration on the mixing process has been studied systematically. Two different injector configurations are considered, one with a central-hole injection and other with a 6-hole injection. The objective is to investigate the effect of initial fuel distribution inside the engine cylinder on charge preparation at the onset of ignition. This study also aims to explore a better solution for mixing in GDI engines by optimizing the GDI injector for both stratified and homogeneous mode of operations. An engine with a pentroof combustion chamber with centrally mounted injector and upright straight intake port and flat piston is selected. The computation begins from the start of the induction process and continued till the point of ignition. The dynamics of the mixing process is studied by grouping the in-cylinder charge in different bins in terms of the equivalence ratio, as a function of time. It is seen from the results that the fuel impingement generally increases with an early SOI. This is more significant for the 6-hole injector. For a homogeneous mode of operation the six-hole injector with an early start of injection gives a better homogeneity of the mixture. For low overall equivalence ratio a central injection seems to be preferable with late injection timing to ensure a stratified charge with a near-stoichiometric region around the spark gap.

Key words: Fuel spray, Injector, GDI Engine

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