Characterization of the Mixture Formation Process in a GDI Engine Operating under Stratified Mode

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Abstract

The paper is intended at an experimental and a numerical study of the mixture formation process in a GDI engine equipped with a high-pressure seven-hole injector. One of the 4 engine cylinders is modified to allow two optical accesses that leave unvaried the combustion chamber configuration, hence the performance and emissions of the real engine. A first optical access is through the piston head and a second one is through an endoscopic fiber probe inserted in the cylinder head. Under a medium-speed, medium-load working condition, the gasoline injection phase is experimentally characterized by image acquisition with high temporal resolution.

The considered injector is also preliminary experimentally characterized as delivering gasoline into an optically accessible confined vessel under various injection strategies. Spray images are collected to derive information relevant to penetration length and cone angle. The issuing mass flow rate is measured by means of a Bosch tube. The measurements data base is used to develop a 3D numerical model of the spray dynamics, whose validation is performed through an automatic procedure. The spray model is included within a 3D model of the in-cylinder processes to realize a reliable description of mixture formation and combustion.

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