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Engine performance and optimum injection timing for 4-cylinder direct injection hydrogen fueled engine.

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Summary: This paper presents the engine performance and optimum injection timing for 4-cylinder direct injection hydrogen fueled engine. The 4-cylinder direct injection hydrogen engine model was developed utilizing the GT-Power commercial software. This model employed one dimensional gas dynamics to represent the flow and heat transfer in the components of engine model. Sequential pulse injectors are adopted to inject hydrogen gas fuel within the compression stroke. Injection timing was varied from 110° before top dead center (BTDC) until top dead center (TDC) timing. Engine speed was varied from 2000 rpm to 6000 rpm, while the equivalence ratio was varied from 0.2 to 1.0. The validation was performed with the existing previous experimental results. The negative effects of the interaction between ignition timing and injection duration was highlighted and clarified. The results showed that optimum injection timing and engine performance are related strongly to the air fuel ratio and engine speed. The acquired results show that the air fuel ratio and engine speed are strongly influence on the optimum injection timing and engine performance. It can be seen that the indicated efficiency increases with increases of AFR while decreases of engine speed. The power and torque increases with the decreases of AFR and engine speed. The indicated specific fuel consumption (ISFC) decreases with increases of AFR from rich conditions to lean while decreases of engine speed. The injection timing of 60° BTDC was the overall optimum injection timing with a compromise.

Keywords: direct injection; injection timing; air fuel ratio; speed; hydrogen fuel
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