An Experimental Investigation On The Combustion And Performance Of An HCCI-DI Engine

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ABSTRACT

Homogeneous charge compression ignition (HCCI) engine is a relatively new mode of combustion and have challenges that need to be solved before it can be commercially used. Among the challenges are knocking, limited operating load and difficult to control of ignition timing. A combination of HCCI with direct injection (DI), which is called HCCI-DI in this study may help improve the engine combustion and performance. The aim of this study is to investigate a fundamental effect of an engine operating in an HCCI-DI mood. A single-cylinder compression ignition (CI) engine was modified by installing port fuel injection (PFI) in the intake manifold, where the engine can simultaneously run on DI and PFI. The fuel used in the study was a commercial grade EURO 5 Diesel. Based on the findings, the effect of PFI yields a high peak in-cylinder pressure. PFI enables the air-fuel mixture to enter the combustion chamber at a premixed condition and thus, enhances the combustion behaviour. The in-cylinder peak pressure rises as pulsewidth increased. Also, by decreasing the lambda (λ) results in a higher in-cylinder peak pressure and combustion is advanced with respect to crank angle. When the λ is rich, the heat release rate shows more energy is released at a higher amount of pulsewidth. For a higher pulsewidth, the brake mean effective pressure (BMEP) and brake power (BP), are decreasing, while fuel consumption slightly increases. The study reveals that there are optimal pulsewidth and λ to be used for a stable HCCI-DI engine operation, so that the combustion and engine performance can be fully utilised.