Numerical Study on the Combustion and Performance Characteristics of a HCCI Engine Resulting from the Autoignition of Gasoline Surrogate Fuel

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Abstract: The objective of this study is to investigate the effect of engine speed, intake air temperature, intake air pressure, and compression ratio on combustion and performance characteristics in a homogeneous-charge compression-ignition (HCCI) engine fueled with gasoline surrogate using numerical simulations. The operating range of HCCI combustion with regards to speed and load is fixed considering that the start of ignition together with the heat release rate cannot be controlled directly. In order to design an engine for extended operational range, accurate models are needed that are able to model both combustion and performance. This paper states the outcomes of a modeling study of HCCI combustion using gasoline surrogate, a mixture of hydrocarbons with perfectly acknowledged fuel chemistry. A zero-dimensional single-zone numerical simulation with reduced fuel chemistry was developed and validated. The simulations reveal good agreement aided by the experimental results and capture essential combustion phase trends when engine parameters vary with a minimum percentage of error that is significantly less than 4%. The combustion phase advances and the combustion duration becomes shorter with the increase of intake charge temperature and the decrease of the engine speed. The maximum load successfully increased with increasing the intake pressure. The highest load in this study was 1,086 kPa (10.86 bar) in gross indicated mean effective pressure (IMEPg) at the condition of 200 kPa in intake air pressure and 393 K in intake air temperature. At last, it is found that the intake air pressure gives the most sensitive influence on the HCCI gasoline combustion and performance characteristics. **DOI: 10.1061/(ASCE)EY.1943-7897.0000478.**

Author keywords: Homogeneous-charge compression-ignition (HCCI); Single zone; Gasoline surrogate; Engine parameters; Combustion; Performance.