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Using a single zone thermodynamic model in an HCCI engine to predict effective controlling parameters

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ABSTRACT

Nowadays, the homogenous charge compression ignition (HCCI) engine is a new idea to satisfy two main strategies in the design of internal combustion engines: reducing the fuel consumption and emissions. The robust control of combustion phasing in HCCI engines is a main challenge limiting the automotive industry for the mass production. In controlling combustion phasing and the IMEP (as two main controlling parameters) in the HCCI engine, some parameters are more effective than others. Effects of these parameters such as the inlet temperature and pressure, the equivalence ratio, the engine speed and also PRFs on the start of the ignition and the IMEP have been investigated in this study using a thermo-kinetic zero-dimensional model. This model coupled to a full kinetic mechanism of PRFs. The model was validated with a large number of experimental data taken from the Ricardo engine. Results show that the start of the combustion depends on the inlet temperature, the octane number, the engine speed and the equivalent ratio. On the other hand, the IMEP depends on the fuel mass flow rate, the inlet temperature and the equivalent ratio. As a result, a correlation has been presented to predict the start of the combustion and the IMEP; and its accuracy has been checked with some experimental data.