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Research Paper

# Numerical study of engine parameters on combustion and performance characteristics in an *n*-heptane fueled HCCI engine

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## HIGHLIGHTS

- HCCI combustion was achieved easily for very lean mixture.
- The phasing of combustion was advanced with increasing intake air temperature.
- Turbocharging effect on the phasing of low temperature reaction is relatively weak.
- Better performance was found with increasing compression ratio.
- Peak pressure location was retarded with increasing engine speed.

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## ABSTRACT

Homogeneous charge compression ignition (HCCI) is an alternative combustion concept which offers significant benefits in terms of its high efficiency. However, the operational range using HCCI combustion in terms of speed and load is restricted due to the absence of the direct control of the onset of ignition and the heat release rate. In this work, a zero-dimensional single-zone numerical simulation with reduced fuel chemistry was developed and used to investigate the effect of various engine parameters on combustion and performance characteristics in an HCCI engine fueled with *n*-heptane. The simulations show good agreement while comparing the results with the published experimental results and capture important combustion phase trends as engine parameters are varied with a minimum percentage of error which is less than 6%. The combustion phase was advanced and the combustion duration was shortened with the increase of intake air temperature and the decrease of the engine speed. The maximum load was successfully increased with increasing the intake air pressure. The highest load in this work was 11.27 bar in IMEPg at the condition of 200 kPa in intake air pressure and 333 K in intake air temperature.



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