

## **Effect of fuel injection strategies on performance and emissions in HCCI engines: a review**

### **ABSTRACT**

Homogeneous charge compression ignition (HCCI) technology in internal combustion engines has improved several performance characteristics of engines. For instance, it has improved thermal efficiency and it has lowered the level of engine emissions, too. The application of this technology requires the usage of various blends of fuels, which are popularly injected into the engine using direct injection method at different timings i.e. early direct, late direct, and Single/Split (multiple) injections. This paper reviews the research that has shown that these three types of injection strategies have different impacts on the performance and on the emissions of engines with a particular interest in power output and thermal efficiency, cylinder pressure, heat release, pressure rise, combustion rate, energy consumption, combustion efficiency and brake mean effective pressure. Different researchers have applied varying methods in studying the impacts of these injection strategies, e.g. a method that involved a variation of the injection angles in investigating the rates of emissions at different injection timings. Furthermore, early direct injection timing strategy has proved to be more advantageous if compared to the other two injection timing strategies as it increases ignition delay (ID) thus resulting in the formation of a well-mixed fuel-oxidizer homogeneous mixture. Consequently, the early direct approach is recommended for usage in engines that adopt the HCCI technology.

**Keyword:** HCCI engine; Fuel injection strategies; Performance; Emissions