Method for Seamless Mode Shifting Between Hydrogen-Diesel Dual Fuel and Reactivity-Controlled Compression Ignition Combustion

1. Technology:

The patented reactivity controlled compression ignition (RCCI) technology uses a dual-fuel system with hydrogen as the primary fuel and diesel as the secondary, enabling efficient, controlled combustion to significantly reduce NOx emissions. The engine begins in diesel mode with a single pulse injection, reaching a coolant temperature of 80°C at 50 MPa. Diesel injection is then split into double pulses, with the second pulse fixed close to TDC and the first pulse varied between dual-fuel and RCCI timings in 10° CA steps. Hydrogen is introduced based on load, adjustable between 0% and 90%. For RCCI mode, the first pulse advances in 10° CA steps while the second remains close to TDC, allowing smooth transitions between dual-fuel and RCCI modes. This approach enhances fuel efficiency and performance, making it ideal for medium and heavy-duty vehicles.

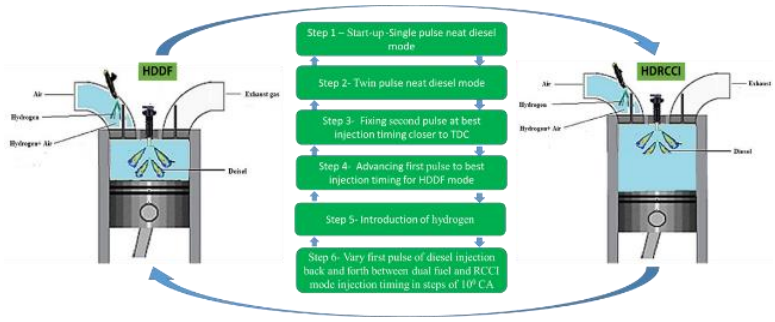

Fig.1 Steps involved in combustion mode switch over between hydrogen-diesel dual fuel (HDDF) and hydrogen-diesel reactivity controlled compression ignition (HDRCCI) mode

2. Problem Addressed:

The RCCI technology tackles fossil fuel depletion and vehicle emissions with an efficient, cleaner combustion process. By using a dual-fuel system of hydrogen and diesel, RCCI achieves low-temperature combustion that significantly reduces NOx emissions. With hydrogen as the primary fuel, the system allows seamless transitions between dual-fuel and RCCI modes through variable injection timing, all without major engine modifications.

3. Industrial Applications:

The RCCI technology, designed for medium and heavy-duty vehicles, could also be adapted for low-emission, efficient combustion in industrial generators, marine engines, heavy machinery, and off-road vehicles used in sectors like forestry, agriculture, and mining.

4. Patent Application Number: 202441062388