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Experimental investigation into the effects of two-stage injection on diesel combustion and emissions in a high-speed optical diesel engine

Mohammad Reza Herfatmanesh, Mohammadreza Anbari Attar and Hua Zhao
Brunel University, UK

Due to ever increasing concern over the environmental impacts of exhaust pollutants, emissions legislations have been progressively enforced since the 1960s. In response to legislative, social and environmental pressures, there is a large body of engine research work demonstrating the energy saving and emissions reducing benefits of advanced fuel injection strategies. However, the effects of such injection modes on the fuel injection system's performance must be thoroughly examined and compensated for since the combustion and the formation of exhaust pollutants are directly influenced by the spatial and temporal distribution of the fuel within the combustion chamber of an internal combustion engine. The aim of this study was to investigate the hydraulic effects of two-stage injection in a high-speed direct injection single-cylinder optical diesel engine. The fuel injection system was characterised for all the tested strategies through the measurement of the fuel injection rate and quantity, in particular, the interaction between the two consecutive fuel injection events was quantified. The effects of two-stage injection and dwell angle on diesel combustion and emissions were investigated using heat release analysis and direct high-speed imaging technique. The results indicated that the total fuel injection quantity can vary by as much as 40% under certain operating conditions. Nevertheless, the results indicated that this injection mode has the potential to improve fuel economy and engine performance while substantially reducing the combustion noise, provided that the fuel injection system is thoroughly calibrated and the injection timings are appropriately selected.

Biography

Mohammad Reza Herfatmanesh obtained a first-class honors degree in Mechanical engineering (BEng) from Brunel University in 2006. He completed his Ph.D. in Mechanical engineering (internal combustion engines) in 2011 at Brunel University. He has been a research fellow at the Centre for Advanced Powertrain and Fuels (CAPF), Brunel University, since 2011. He has been appointed as the principal research engineer for several internal and external projects at CAPF.

Mohammad.Herfatmanesh@brunel.ac.uk