Optimization Control Study of Engine Management System for Direct InjectionCommon Rail Diesel Engine

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ABSTRACT

The main purpose of this study is to establish a simulation and analysis methodology for multi-cylinder four-stroke direct-injection common-rail diesel engine management system and to verify the dynamic performance response. The hardware and software of the engine control were combined to display real-time performance parameters with the engine control parameter tuning and multi-objective optimization rules and to verify the engine performance by dynamometer experiments. This study has built the search program for multi-cylinder four-stroke common rail direct injection diesel engine multi-objective goal attainment optimization control parameters. The fuel consumption and pollution of vehicle driving cycle was converted into engine torque and speed by using the real vehicle parameters. Several key points were sorted from the corresponding map data for steady state estimation measurement. The selected key points control parameters were changed to reduce the overall exhaust emissions. Simulation module and combustion analysis models were used to explore injection pressure, injection timing and the injection duration of engine management system. Engine torque, speed and the relationship between the response of pollutants in the exhaust were optimized and compared with the baseline engine measurement data. Real-time display and record of the engine hardware and software parameters, and control parameters under different engine operating conditions were measured. The engine combustion heat release and its rate were calculated by using engine combustion pressure data and validated with combustion analyzer under different engine operating conditions. The dynamic relationship between control and the response data can be used as future reference for developing of engine management systems. By experimental design and multi-objective optimization search, the experiments time and expanse can be reduced and the efficiency of engine parameters calibration and adjustment can thus be improved.

Keywords : Common Rail Direct Injection diesel engine management system design、Multi-cylinder diesel engine and vehicle driving cycle dynamic simulation、Multi-objective optimization search、Diesel engine combustion analysis

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