Study of Optimal Design and Implement of the Multiple-Cylinder SI Engine Management System

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ABSTRACT

This study is proposed to integrate methodologies for four stroke multiple-cylinder gasoline engine management system (EMS) control and performance dynamic response. EMS control and performance parameters are displayed and monitored by using proper software and hardware simulation and implementation. The effects of control parameters on performance were observed and optimized by using experimental design multi-objective optimization method. The designed multiple-cylinder gasoline EMS was validated by the Hardware-In-Loop (HIL) environment with the experimental data from engine dynamometer. This study established dynamic simulation models for multiple-cylinder SI engine and explored relationship between the spark advance (SA) angle, injection pulse duration (ID) and injection timing (IT) with engine torque, engine speed and exhaust gas emissions response. This study also developed the graphic user interface for data acquisition and measure monitored for different engine and dynamometer control operation modes. The observed different engine dynamic performance during acceleration and deceleration were compared with the simulation results. Measured dynamic performance data correlation can be used for future reference of the engine design and engine management controller settings. The optimized controller parameters were collected by using multi-objective experimental optimization design method which was validated by experimental data to ensure better engine performance and enhance the tuning parameters efficiency. The multi-cylinder SI engine EMS was designed and implemented by this study. The multi-objective optimized engine control parameters were implemented into the memories of this EMS hardware. This study established the integration technology and methodology for four stroke SI engine EMS dynamic simulations HIL system. This approach can provide helpful information for the EMS engineers and reduce the corresponding trial-and – error effort, saving the research and development time and cost.

Keywords : Optimal Design, Multiple-Cylinder SI Engine Management System.

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