The User Interface for Testing Implement of Performance Simulation and Analysis for Four-Stroke SI Engine

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ABSTRACT

This study is proposed to establish a simulation program to evaluate the real-time performance of a four-stroke spark-ignited gasoline engine. The purpose of this study is to establish the relationship between the engine performance and the operation variable and control parameters. The engine combustion output performance were tested under different testing conditions to analyze the internal correlation between performance and variables such as engine speed, intake manifold pressure, and spark advance etc. The implement of the control system dynamic models needs to find out the model constants and functions by which the dynamic performance of the engine can be predicted. The assumptions and the approaching methods were then modified by the experimental data to validate and improve the performance predictions. With this dynamic performance simulation program, engineer can evaluate the variation in engine dynamic performance due to design change and different control settings, reducing the corresponding trial-and-error effort, saving the research and development time and cost. The simulation program was based on the specific four-stroke SI engine test data. The related control system principles were incorporated to modify the dynamic performance response of the engine. The output of this simulation program including the engine speed and manifold pressure variation according to the variation of model input variables such as throttle position, engine load torque and fuel and spark control settings. The simulation program contains several submodels to calculate the needed parameters such as air-fuel ratio; volumetric efficiency to ensure different fuel mixture requirement can be achieved. 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, which showed reasonable matched trend. Measured dynamic performance data correlation can be used for future reference of the engine design and engine management controller settings.

Keywords : Engine Dynamic Performance Simulation ; The User Interface for Testing Implement ; Performance Integration Evaluation.

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