System Identification Study of the Multiple Injection System Parameters Effects on Combustion Cylinder Pressure Predict

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ABSTRACT

The purpose of this study is to apply different system identification methods on the multiple injection system parameters effects to combustion cylinder pressure prediction of a multi-cylinder four-stroke Direct Injection Common Rail (DICR) diesel engine. The engine combustion pressure and performances under different operating conditions affected by the engine fuel injection control parameters were recorded. The system identification simulation analysis output the engine system response transfer function and used for multiple injection condition to predict the corresponding engine combustion pressure.. The fuel injection nozzle solenoid ’ s current signals are inputs, whereas the corresponding engine combustion pressure signals at the same crank angle recorded by combustion analyzer as the outputs. The single impulse-like injection signal is used to produce the system Impulse Response Function (IRF), then, the system response of combustion pressure can be predicted by using different injection signals and IRF. Different system identification methods, such as Auto-Regression model (ARX), Auto-Regressive Moving Average model (ARMAX), Output Error method (OE), Box-Jenkins method (BJ) were used to find the corresponding predicted combustion pressure transfer function of the system. DICR diesel engine system identification experiments were conducted for three different speed : 1500rpm, 2000rpm, 2500rpm under different loads : 60 Nm、80 Nm、100 Nm for both single and double injection control conditions. Observation and comparison in a variety of engine operating condition ’ s experimental data with the results of simulated various system identification methods can be useful to verify the correctness of the model combustion pressure prediction. Using system identification, one can quickly identify the predictive model of combustion pressure system transfer function, the resulting combustion pressure prediction model can be applied to DICR diesel engine tuning for control and engine research and development reference.

Keywords : Direct Injection Common Rail Diesel Engine、Fuel Injection Control、System Identification Method、Combustion Pressure Prediction Model

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