Simulation Analysis and Control for Electronic Throttle of Intelligent Vehicle System

吳名倫、張一屏

E-mail: 9405657@mail.dyu.edu.tw

ABSTRACT

This study is proposed to establish an integration methodology for intelligent cruise control system design and evaluation. This study explored the relationship between the electronic throttle control input and powertrain performance under different operating conditions. System identification method was used to build the electronic throttle model according to the variation of input signals and output responses. With the electronic throttle model and powertrain system simulation program, engineer can predict and control electronic throttle response due to design change and different control settings of vehicle safe speed requirement. The vehicle powertrain dynamic models were established by using object-oriented simulation program Matlab/SimulinkR. The proper powertrain dynamic models were incorporated with electronic throttle model to analyze relationship between the vehicle and cruise control performance for different variables and control parameters. Intelligent cruise controllers were designed individually by using traditional PID control method and adaptive control theory. Simulation results of adaptive controller and PID controller were compared and validated by experiments under the same operation condition. Different vehicle speed-following modes due to load variation were compared with the simulation results, which showed reasonable matched trend. Results showed that adaptive controller were better than the PID controller responses. This study also applied the Matlab/ Real-Time Windows (RTW) Target, to establish the Hardware-In-Loop (HIL) system simulation environment. This viiapproach reduces the corresponding trial-and-error efforts in setting parameters of controller, and saves the research and development time and cost.

Keywords : System Identification, Powertrain System Simulation, Adaptive Controller, Hardware-In-Loop

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