Suporn Muannou 2010: Development of Fuel Injection Feedback Control System Using PI Gain Scheduler and Artificial Neural Networks. Master of Engineering (Electrical Engineering), Major Field: Electrical Engineering, Department of Electrical Engineering. Thesis Advisor: Associate Professor Peerayot Sanposh , D.Sc. 87 pages.

This research is investigated the optimum air fuel ratio control strategy for a engine running on ethanol-gasoline blend fuel. The control strategy used the combination of neural network and PI Gain-Scheduling controller. The neural network was trained and served as open-loop fuel injection control, while the PI Gain-Scheduling was used as the closed-loop control to add air fuel ratio compensation to achieve its stoichiometric value. The driving conditions varied from RPM 2000 to 9000 and TPS varied from 10%, 15% and 20%. The fuel blends were E0, E20 and E85.

The research aimed to maintain the air/fuel ratio closed to a specified stoichiometric value that can vary according to the ratio between ethanol and gasoline in the fuel blend. While the neural network has a function as an open-loop control, the gain scheduling is a nonlinear feedback control of special type; it has a linear control whose parameters are changed as a function of operating conditions in a preprogrammed way. The gain scheduling based on measurements of operating conditions of the process is often a good way to compensate nonlinear uncertainties in system. This closed-loop fuel injection control were conducted on a motorcycle Yamaha 135 Spark-i four-stroke single-cylinder engine using different gasoline-ethanol blends: E0, E20 and E85. The experiments were performed to determined the optimum injection timing and duration for a specific engine under steady state operating conditions.

Finally, the experimental results show that the combination of neural network and PI Gain-scheduling control can make the engine to achieve the stoichiometric value over a wide range of fuel blends. The control performance can be measured as the settling time 1200 ms and the steady state error between +0.5/-0.5.

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