

Self Tuning Controller for Reducing Cycle to Cycle Variations in SI Engine

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Abstract : The cyclic variations in spark ignition engines occurring especially under specific engine operating conditions make the maximum pressure variable for successive in-cylinder pressure cycles. Minimization of cyclic variations has a great importance in effectively operating near to lean limit, or at low speed and load. The cyclic variations may reduce the power output of the engine, lead to operational instabilities, and result in undesirable engine vibrations and noise. In this study, spark timing is controlled in order to reduce the cyclic variations in spark ignition engines. Firstly, an ARMAX model has developed between spark timing and maximum pressure using system identification techniques. By using this model, the maximum pressure of the next cycle has been predicted. Then, self-tuning minimum variance controller has been designed to change the spark timing for consecutive cycles of the first cylinder of test engine to regulate the in-cylinder maximum pressure. The performance of the proposed controller is illustrated in real time and experimental results show that the controller has a reliable effect on cycle to cycle variations of maximum cylinder pressure when the engine works under low speed conditions.

Keywords : cyclic variations, cylinder pressure, SI engines, self tuning controller

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