

Design of a 3-Stage Voltage Controller for EMV Actuation in SI Engines

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Abstract

Variable valve timing (VVT) provides SI engines several significant benefits in fuel economy, exhaust emission, and engine performance. Among all VVT mechanisms, electromagnetic valve (EMV) is a positive one by providing very high flexibility in valve timings and possibility of cylinder-by-cylinder VVT control. This paper presents a simple 3-stage voltage control method for EMV actuation to effectively reduce the contact velocity between EMV and valve seat. A voltage pattern for EMV actuation is derived first by a fuzzy logic controller. Then, this pattern is simplified into 3 level voltage in which the voltage magnitude and duration are analyzed and optimized. Simulation results show that the 3-stage voltage controller offers simple control algorithms and acceptable performance with low impact velocity.

Keywords: 3-stage voltage control, variable valve timing, electromagnetic valve

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