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MODEL BASED AIR-FUEL RATIO CONTROL FOR PFI SI ENGINES FUELED WITH ETHANOL-GASOLINE BLENDS

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Abstract

The ethanol-gasoline blends have brought new challenges to the in-cylinder mixture air-fuel ratio control for the variable fuel characteristics especially in the traditional PFI (Port Fuel Injection) SI (Spark Ignition) engines. This paper studied all the dynamic links in the intake fuel transfer process from the fuel injectors to cylinders, including the wall-wetting effect and injector fuel flow characteristics. A wall-wetting fuel film evaporation model and an injector fuel flow model were then built, and a new intake port fuel dynamic model was constructed. All of these models have considered the impact of ethanol component in the blend fuels. On this basis, a model based air-fuel ratio control strategy for PFI SI engines fueled with ethanol-gasoline blends was proposed. The strategy combined the traditional fuel feedforward and feedback corrections, and introduced a linear oxygen sensor based blend fuels' mixing ratio self-learning algorithm, to achieve the fuel adaptive compensation for the intake wall-wetting effect and injector fuel flow characteristics. The test results show that, the model based air-fuel ratio control strategy can always adjust the in-cylinder mixture air-fuel ratio near the stoichiometric one. The maximum relative control deviation of air-fuel ratio under steady conditions has not exceeded ±2%, while for transient conditions, the control deviation is still less than ±4%, much better than traditional map based control strategy. Moreover, the control strategy has a good adaptability to different ethanol-gasoline blends.

Key words: air-fuel ratio control, ethanol-gasoline blends, fuel adaptive control, model based control, spark ignition engine

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