（論文博士用）
(for Degree earned by Submitting Doctoral Thesis)

千葉大学審査学位論文（要約）（Summary）

Engineering　研究科　　審査専攻　Artificial Systems Science
Graduate School　　Thesis Advisor's Division

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Name

論文題名（外国語の場合は、その和訳を併記） Thesis Title（foreign language title must be accompanied by Japanese translation）
Control-oriented modeling and model-based control a blowdown supercharged HCCI engine ブローダウン過給エンジンをモデリングとモデルベース制御

Control-oriented modeling and model-based control a blowdown supercharged HCCI engine

ブローダウン過給エンジンをモデリングとモデルベース制御

Michael Jagsch

Summary

This PhD introduces model-based design tools for design and tests of model-based closed-loop control schemes of a Blowdown Supercharge (BDSC) Homogeneous Charge Compression Ignition (HCCI) engine. It first introduces common control concepts for automotive combustion engines, after which detailed modeling, in the commercial 1-D software tool AVL BOOST, and additionally a control-oriented 0-D modeling approach with a pressure wave functionality to provide a suitable model-based platform for model-based closed-loop control tests.

For the design of advanced control concepts, a Mean-Value Engine Model (MVEM) for the BDSC HCCI engine is introduced for linearization to obtain an LTI state-space model, together with a concept of an automated parameterization scheme for the MVEM.

A framework for the design of a robust control scheme based on H-Infinity theory was presented, where the simplicity and a special feature of the MVEM was exploited for a better robustness analysis based on structured singular values (SSV).

Additionally, the potential of Sliding-Mode Control for the BDSC HCCI engine was analyzed and compared to the robust controller in simulation.

The thesis ends with an extensive literature research for switching strategies between traditional spark-ignition (SI) combustion and HCCI, and switching considerations for BDSC HCCI are given.

Additionally, the application of the previously introduced closed-loop control schemes for combustion mode switch from SI to HCCI are demonstrated in simulation.