

# Study of the Electronic Cooling Constant Temperature Control System for Motorcycle

曾嗣恩、張舜長

E-mail: 9806428@mail.dyu.edu.tw

## ABSTRACT

The temperature of cylinder is a very important parameter. It can affect engine life, reduce fuel consumption and emission. Using an electronic water pump and electronic valve which control the flow rate to obtain the constant temperature between the radiator and its bypass. The MATLAB/Simulink Real-Time windows Target and MATLABFuzzy Logic Toolbox controller is applied to the Electronic cooling system. Finally, the experiment results showed that the electronic cooling system allows to improve fuel consumption about 4.95% and 1.15% during low speed and heavy load.

Keywords : Constant Temperature Control、 system、 system

## Table of Contents

封面內頁

簽名頁

博碩士論文暨電子檔案上網授權書 iii

中文摘要 iv

ABSTRACT v

誌謝 vi

目錄 vii

圖目錄 ix

表目錄 xii

第一章 緒論 1

1.1前言 1

1.2文獻回顧 2

1.3研究動機 14

1.4論文架構 16

第二章 電子式冷卻恆溫控制系統建構 18

2.1電子式冷卻系統恆溫控制系統架構簡述 18

2.2冷卻系統實驗平台設計 22

2.3 ADVISOR 電子式冷卻恆溫控制系統建構 24

第三章 控制器設計 30

3.1模糊控制理論 30

3.2模糊控制器之設計 33

3.3引擎溫度管理系統 43

第四章 模擬實驗結果分析 48

4.1 ADVISOR冷卻系統模擬結果 48

4.2電子式冷卻系統平台測試結果 54

4.3電子式冷卻系統實車測試 57

第五章 結論與建議 62

5.1結論 62

5.2建議事項與未來研究項目 63

參考文獻 65

## REFERENCES

[1]林宗達和張志偉， " 經濟型智慧引擎冷卻系統介紹 "， 機械工業月刊， 第296期， 第69-79頁， 2007。

- [2]Yoo, I. K., Simpson, K., Majkowski, S. and Bell, M., " An Engine Coolant Temperature Model and Application for Cooling System Diagnosis ", SAE Technical Paper, No. 2000-01-0939.
- [3]Wagner, J. R., Marotta, E. E. and Paradis, I., " Thermal Modeling of Engine Components for Temperature Prediction and Fluid Flow Regulation ", SAE Technical Paper, No. 2001-01-1014.
- [4]Brace, C. J., Burnham-Slipper H., Wijetunge R. S., and Wright Ken., " Integrated Cooling Systems for Passenger Vehicles ", SAE Technical Paper, No. 2001-01-1248.
- [5]郭新民、霍麗、高平和王新源, " 汽車發動機智能冷卻系統的研究 ", 內燃機工程學刊, 第22卷, 第一期, 第20-21頁, 2001。
- [6]Ap, N. S., Guerrero, P. and Jouanny, P., " Influence of Fan System Electric Power on the Heat Performance of Engine Cooling Module ", SAE Technical Paper, No. 2003-01-0275.
- [7]Robert, D. C., " Thermal Comfort and Engine Warm-Up Optimization of a Low-Flow Advanced Thermal Management System ", SAE Technical Paper, No. 2004-01-0047.
- [8]Wagner, J. R., Eberth J. F., Afshar B. A. and Foster, R. C., " Modelling and Validation of Automotive Smart Thermal Management System Architectures ", SAE Technical Paper, No. 2004-01-0048.
- [9]尹靜、孫燕和郭新民, " 發動機冷卻系統驅動方式的現狀及發展方向 ", 山東農業大學機械電子學院, 第四期, 2003。
- [10]Kenny, A. A., Bradshaw, C. F. and Creed, B. T., " Electronic Thermostat System for Automotive Engine ", SAE Technical Paper, No. 880265.
- [11]Cou?oux, H. and Gentile, D., " Cooling System Control in Automotive Engine ", SAE Technical Paper, No. 920788.
- [12]Cortona, E. and Onder, C. H., " Engine Thermal Management with Electric Cooling Pump ", SAE Technical Paper, No. 2000-01-0965.
- [13]Rocklage, G. M., Riehl, G. and Vogt, R., " Requirements on New Components for Future Cooling System ", SAE Technical Paper, No.2001-01-1767.
- [14]Wagner, J. R., Ghone, M. C., Dawson, D. W. and Marotta, E. E., " Coolant Flow Control Strategies for Automotive Thermal Management System ", SAE Technical Paper, No. 2002-01-0713.
- [15]解潘祥和林宗達, " 智慧型引擎冷卻系統技術發展介紹 ", 機械工業月刊, 第272期, 第75-86頁, 2005。
- [16]林宗達, " 智慧型引擎冷卻系統技術發展介紹 ", 機械工業月刊, 第284期, 第54-62頁, 2006。
- [17] <http://www.visteon.com>[18] <http://www.valeo.com>[19] <http://www.dana.com>[20]Ap, N. S. and Michelle T., " Innovative Engine Cooling Systems Comparison ", SAE Technical Paper, No.2005-01-1378.
- [21]Ap, N. S. and Michelle T., " UltimateCoolingTM System for New Generation of Vehicle ", SAE Technical Paper, No.2005-01-2005.
- [22]Robert, W. P., Hnatzuk, J. W. and Jeffrey K., " Thermal Management for the 21st Century – Improved Thermal Control & Fuel Economy in an Army Medium Tactical Vehicle ", SAE Technical Paper, No.2005-01-2068.
- [23]Robert, D., Chalgren, J. and David, J.A., " Light Duty Diesel Advanced Thermal Managemen ", SAE Technical Paper, No.2005-01-2020.
- [24]Brian, J. L., John, A. O., Johnson, H. and Gordon, G. P., " Development of the Enhanced Vehicle and Engine Cooling System Simulation and Application to Active Cooling Control ", SAE Technical Paper, No.2005-01-0697.
- [25]Ribeiro, E. G., Filho, A. P. and Meira, J. L., " Electric Water Pump for Engine Cooling ", SAE Technical Paper, No.2007-01-2785.
- [26]鄭守安, " 機車智慧型冷卻系統設計與模擬 ", 大葉大學, 車輛工程研究所碩士論文, 2008。
- [27]梁乃文譯, " 內燃機 ", 文京圖書, 1999。
- [28]李進修和王漢英, " 汽機車引擎設計與分析技術 ", 國立清華大學出版社, 2005。
- [29]The MathWorks, Inc., " Real-Time Windows Target User ' s Guide; Version 2 ", 2001.
- [30]Wagner, J. R., Venkat, S., Dawson, D. M. and Marotta, E. E., " Smart Thermostat and Coolant Pump Control for Engine Thermal Management System ", SAE Technical Paper, No. 2003-01-0272.
- [31]Wipke, K. B., Cuddy, M. R. and Burch, S. D., " ADVISOR 2.1 : A User-Friendly Advanced Powertrain Simulation Using a Combined Backward/Forward Approach ", IEEE Transactions on Vehicular Technology, Vol. 48, No. 6, pp. 1751-1761, 1999.
- [32] <http://www.doe.gov>[33]趙清風, " 控制之系統識別 ", 全華科技圖書, 2001。
- [34]林群超, " 自動控制系統設計與MATLAB語言 ", 全華科技圖書, 2001。
- [35]孫宗瀛、楊英魁, " Fuzzy控制:理論、實作與應用 " 全華科技圖書, 台北, 1999。
- [36]孫宗瀛、楊英魁、鄭魁香、林建德、蔣旭堂, " 模糊控制理論與技術 ", 全華科技圖書, 2001。
- [37]李允中、王小璠、蘇木春, " 模糊理論及其應用 ", 全華科技圖書, 2008。
- [38]Alexandre, C. and Matthieu, C., " Automatic Control of Electronic Actuators for an Optimized Engine Cooling Thermal Management ", SAE Technical Paper, No. 2001-01-1758.
- [39]Choi, K. W., Kim H. M., Cho W. J. and Lee, K. H., " Investigation of Emission Reduction Effect by Controlling Cooling System in a Diesel Engine ", SAE Technical Paper, No. 2007-01-4064.
- [40]Park, S. and Hung, D., " Numerical Modeling and Simulation of the Vehicle Cooling System for a Heavy Duty Series Hybrid Electric Vehicle ", SAE Technical Paper, No. 2008-01-2421.
- [41]何英傑, " 智慧型雨刷系統之研究 ", 大葉大學, 車輛工程研究所碩士論文, 2005。