汽車行駛動態模擬與實驗

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摘 要

本研究推導一七自由度的車輛運動數學模型，其中包含車輛 縱向運動、側向運動、偏擺運動，以及四個輪子的滾動，探討車 輛於煞車狀態下，輪胎作用力對車體動態之影響。 在所推導數學模式模擬方面，本文主要在探討車輛在煞車狀 態使用煞車控制器之控制性能，並分別以滑差及輪速回授作為控 制指標設計控制器，在控制器設計過程中，利用潮濕路面及乾燥路面測試控制器之控制性能，再針對控制效果不佳之區域對控制 器加以修正，期望可在不同路面下皆可有效縮短煞車時間及煞車 本研究運用硬體模擬迴路之觀念，將輪速與控制器運算結果 利用CAN-bus 做資料之傳送與接收，並透過將所設計之控制器與 實際煞車系統元件結合，測試控制器於硬體上實際之運作情形， 以減少模擬與實際之誤差。

關鍵詞 : 防鎖死煞車系統，煞車控制器，模糊控制，車輛行駛動態，硬體模擬迴路

目錄

參考文獻

[1] Chamaillard, Y., Gissinger, G. L., Perronne, J. M., and Renner, M.“ An original braking controller with torque sensor, ” Proc. of the Third IEEE Conference on Control Applications., vol. 1, pp.619-625, 1994.

[2] Cho, J. M., Hwang, D. H., Lee, K. C., Jeon, J. W., Park, D. Y., Kim,Y. J., and Joh, J. S.,“ Design and Implementation of HILS System for ABS ECU of Commercial Vehicles, ” IEEE International Symposium, vol. 2, pp. 1272-1277, 2001.

[3] Drakunov, S. , O zguner, U., Dix, P., and Ashrafi, B.,“ ABS Control Using Optimum Search via Sliding Modes, ” IEEE Trans. on control systems technology., vol. 3, no. 1, 1995.

[4] Drakunov, S. V., Ashrati, B., and Rosiglioni, A.,“ Yaw Control Algorithm via Sliding Mode Control, ” Proc. of the American Control Conference., vol. 1, no. 6, pp. 580-583, 2000.

[5] Dugoff, H., Fancher, P. S., and Segel L.,“ An Analysis of Tire Traction Properties and Their Influence on Vehicle Dynamics Performance, ” SAE paper, no. 700377.

[6] Harned, J. L., Johnston, L. E., and Scharpf, G.,“ Measurement Of Tire Brake Force Characteristics As Related To Wheel Slip(Antilock) Control System Design ”, SAE paper, no. 69214.

[7] Jonner, W. D., Winner, H., and Dreilich, L.,“ Electro-hydraulic Brake System-The First Approach to Brake-By-Wire Technology, ” SAE paper. , no. 960991.
[8] Kaoru, S., Yoshiaki S.,“ Application of active yaw control to vehicle dynamics by utilizing driving/breaking force, ” JSAE Review., vol. 20, no. 2, pp. 289-295, 1999.
[9] Kiencke, U., and Nielsen, L.,“ Automotive Control Systems, ” Springer, 2000.
[10] de Koker, P. M., Gouws, J., and Pretorius, L.,“ Fuzzy Control Algorithm for Automotive Traction Control System, ” IEEE Trans. on control system technology., vol. 1, pp. 226-229, 1996.
[11] Kuang, M. L., Fodor, M., Hrovat, D., and Tran, M.,“ Hydraulic Brake System Modeling and Control For Active of Vehicle Dynamics, ” Proc. of the American Control Conference., vol. 6, pp. 4538-4542, 1999.
[12] Layne, J. R., Passino, K. M., and Yurkovich, S.,“ Fuzzy Learning Control For Anti-skid Braking System, ” IEEE Trans. on control systems technology., vol. 1, no. 2, pp.122-129, 1993.
[13] Lee, J. C., and Suh, M. W.,“ Hardware-in-the Loop Simulator for ABS/TCS, ” Proc. of the 1999 IEEE International Conference on Control Applications., pp. 652-657.
[14] Lennon, W. K., and Passino, K. M.,“ Intelligent Control for Brake Systems, ” IEEE Trans. on control systems technology., vol. 7, no. 2,pp. 188-202, 1999.
[15] Mauer, G. F.,“ A Fuzzy Logic Controller for an ABS Braking System, ” IEEE Trans. on Fuzzy systems., vol. 3, no. 4, pp.381-388, 1995.
[16] Mazumdar, S. K., and Lin, C. C.,“ Investigation of the Use of Neural Networks for Anti-Skid Brake System Design, ” Proc. of the 1995 IEEE International Symposium., pp. 505-510.
[17] Ozdalyan, B., and Blundell, M. V.,“ Anti-lock Braking System Simulation and Modeling in Adams ”, IEEE International Conference on Simulation, no. 457, pp. 140-144., 1998.
[18] Qiao, W. Z., Mizumoto, M.,“ PID type fuzzy controller and parameter adaptive method, ” Fuzzy Sets and Systems., pp. 23-35 1996.
[19] Robert, K. H., and Kenneth, A. M.,“ Analysis of Traction Control Systems Augmented by Limited Slip Differentials, ” SAE paper, no.940831.
[20] Shih, M-C., and Wu, M-C.,“ Hydraulic anti-lock braking control using the hybrid sliding mode pulse width modulation pressure control method, ” ImechE Proc. Instn. Mech. Engrs., vol. 215, part1, pp. 177-187, 2001.
[21] Shih, M-C., and Wu, M-C.,“ USING THE SLIDING MODE PWM IN AN ANTI-LOCK BRAKING SYSTEM, ” Asian Journal of Control., vol. 3, no. 3, pp. 255-261, 2001.
[22] Shih, M-C., and Wu, M-C.,“ Simulated and experimental study of hydraulic anti-lock braking system using sliding mode PWM control, ” Mechatronics., pp. 331-351, 2003.
[23] Shih, M-C., Wu, M-C., and Lee, L-C.“ Neuro-Fuzzy Controller Design of the Anti-lock Braking System, ” JSME International Journal., Series C, vol. 41, no. 4, pp. 836-843, 1998.
[24] Teng, F. C.,“ Real-time control using Matlab Simulink, ” 2000IEEE Int. Conf. on Systems, Man, and Cybernetics., vol. 4 , pp.2697-2702.
[25] Wong, J. Y.,“ Theory of Ground Vehicle, ” John Wiley & Son, Third edition, 1993.
[26] Yuan, F., Puskorius, G. V., Feldkamp, L. A., and Davis, L. I.,“ Neural Network control of a Four-Wheel ABS Model, ” Proc. ofthe 1995 IEEE Int. Symp. on Intelligent Control., vol. 2pp.1503~1506, 1995.
[27] Zanten, D. A., Erhardt, D. R., Pfaff, D. G., and Wiss, D. H.,“ ESPElectronic Stability Program, ” BOSCH, First Edition, 1999.
[28] 李連春,“ 液壓防止鎖死剎車系統控制器設計之研究, ” 成功大學碩士論文, 1997.
[29] 張瑞宗,“ 模糊脈寬調變控制液壓防鎖死煞車系統之研究 ”, 成功大學碩士論文, 1999.
[30] 林秋豐, 林劍鳴,“ 差分煞車導向控制系統之研究 ”, 中國機械工程學會第十五屆全國學術研討會, 自動化工程類, p. 477~484,1998
[31] 吳金華,“ 汽車防鎖定煞車系統, ” 全華科技圖書股份有限公司， 1997.
[32] 趙治勇, 楊成宗,“ 汽車煞車系統ABS 理論與實際 ”, 全華科技圖書股份有限公司, 1998.
[33] 賴耿陽,“ 車輛驅動及控制 ”, 復漢出版社, pp. 5-50, 1993.
[34] 洪士超,“ 防鎖死煞車系統之模糊控制 ”, 大葉大學碩士論文,1997.
[35] 裕隆公司,“ A32 車系修護手冊（上） ”, 裕隆汽車製造股份有限公司, 1995.
[36] 黃俊源,“ CAN-bus 應用於車輛安全控制系統之研製 ”, 大葉大學碩士論文, 2003.