Simulation and Experiment of Vehicle Collision Avoidance System

金仲浩、陳志鏗

E-mail: 345438@mail.dyu.edu.tw

ABSTRACT

In this thesis, a Radar-Based Vehicle Collision Avoidance System (VCAS) is established to help the vehicle from collision by providing light alarms when the vehicle is at a danger of collision. Also, the Active Braking System (ABS) is activated in emergency braking. The simulation system has been implemented by cooperating vehicle model with sensor equipment in CarSim with a controller built in Simulink/MATLAB. The VCAS has also been validated through an experimental vehicle equipped with a millimeter-wave radar using MotoTron ECU microcontroller. In design of VCAS controller, three collision avoidance algorithms from automobile manufacturers are used to estimate the safe distance from the front vehicle. A light-braking status will be triggered when the actual distance from the front vehicle is smaller than safe distance. Similarly, a heavy-braking with ABS control, will be triggered if the estimated collision time is smaller than 1.5 sec. A curve lane collision avoidance strategy is also proposed to detect if the front vehicle is in the same lane or not. The VCAS controller program built in MotoTron ECU is developed according to the proposed algorithm. A vehicle road running test is utilized to verify the effectiveness of the proposed algorithm.

Keywords : Active Brake、Avoidance Collision Controller、Millimeter-wave radar

Table of Contents

REFERENCES

[1]中華民國內政部統計處，99年致人傷亡之道路交通事故統計。
[2]張光仁，日本ASV之發展現況,「車輛研測資訊」，第四十三期，2004，第22-27頁。
[3]Fukashi Sugasawa, Hiroshi Ueno, Masayuki Kaneda, Jun Koreishi, Ryouta Shirato, Hiroshige Fukuhara, "Development of NISSAN'S ASV," Intelligent Vehicles Symposium, Japan, 1996, pp.254-259.
[4]Tetsushi Mimuro, Yoshiki Miichi, Takahiro Maemura, Kazuya Hayafune, "Functions and Devices of Mitsubishi Active Safety ASV," Intelligent Vehicles Symposium, Japan, 1996, pp.248-253.
[5]Hiroyuki Kamiya, Yasuhiko Fujita, Takahiro Tsuruga, Yukinobu Nakamura, Shouhei Matsuda, Kouji Enomoto, "Intelligent Technologies of Honda ASV," Intelligent Vehicles Symposium, Japan, 1996, pp.236-241.
[6]Hirofumi Watanabe, Satoru Kondo, Kikuo Hirano, "Introduction to Suzuki ASV Technologies," Intelligent Vehicles Symposium, Japan, 1996, pp.219-223.
[7]A. P. Wang, J. C. Cheng, P. L. Hsu, "Intelligent CAN-based Automotive Collision Avoidance Warning System, "IEEE International Conference on Networking, Sensing and Control 1,pp. 146-151, 2004.
[8]H. Peng and A.G. Ulsoy, ” Vechine Control System, ” Lecture Notes for Mechanical Engineering 568，University of Michigan, U.S.A. 1997.
[9]高峰,李克強,王建強,連小?，車速控制系統適應性油門控制器設計，汽車工程期刊，Vol.27 No2，2005。
[10]張志遠,万沛霖，”汽車適應性巡航系統智能控制策略”，遼寧工程技術大學學報，Vol.25 No2，2006 [11]A. Ishida, M. Takada, Narazaki K. and Ito O.,“ A Self-Tuning Automotive Cruise Control System Using the Time Delay Controller, ” SAE Paper No. 920159, 1992.
[12]R. Muller and G. Nocker,“ Intelligent Cruise Control with Fuzzy Logic, ” Proceedings of the IEEE 1992, pp.173-178, 1992.
[13]J. K. Sang, J. L. Ju,“ Fuzzy Logic Based Adaptive Cruise Control with Guaranteed String Stability, ” Proceedings of the IEEE International Conference on Control, Automation and Systems 2007.
[14]鄭山川，鄭國祥，“ 智慧型速度控制應用於適應性巡航控制系統開發”，機械工業雜誌第296期，智慧車輛技術專輯，2007。
[15] W. D. Jonner, H. Winner, L. Dreilich, and E. Schunck,“ Electrohydraulic Brake System-The First Approach to Brake-By-Wire Technology, ” SAE 960991.
[16]蘇建彰，“ 汽車ABS控制之硬體迴路模擬與實驗，” 大葉大學碩士論文 2004 [17]黃俊仁,“ 應用駕駛模擬器開發智慧型運輸系統實驗平臺之軟硬體規劃設計 ”交通部運輸研究所 2005 [18]嚴豪緯，“ CAN匯流排即時訊息排程與頻寬分配，” 大葉大學碩士論文 2005。
[19]張凱傑，“ 線傳電子節氣門應用於適應性巡航控制技術之整合研究，”大葉大學車輛工程研究所碩士論文，2006。
[20]林俊維，“ 車輛模擬駕駛之硬體迴路模擬與實車測試比較之研究，” 大葉大學碩士論文 2010