電流變液半主動式承載系統研究

許益彰、李春穎

E-mail: 9314786@mail.dyu.edu.tw

摘 要

智慧型車輛已是下一世代道路運輸工具主要發展方向之一，而 整個智慧型車輛系統中，行車通訊管理、車輛動力與動態控制、安 全裝置及駕駛舒適度的提升等，都是不可或缺的一環。本論文主要 目標在於研究提高行車舒適度的核心技術，我們使用電流變液為工 作流體來設計避震器，以電流變液半主動式承載系統提高行駛之穩 定性及過彎之操控性，以提升承載系統之功能。首先我們推導一 2D 與3D 全車系統動態方程式，並以Fortran 程式建立一2D 與3D 全車模擬系統，導入車體各種性能參數，模擬車身加速、減速、撞 擊及過彎等行駛狀況，可供作設計避震器之參考。最後，我們製作 出一組可安裝於實車上之電流變液半主動式承載系統，系統包含其 控制電路與避震器本體，並進行安裝於實車性能測試，以取代原車 傳統避震器，並提供承載系統之功能。

關鍵詞 : 智慧型車輛、半主動式承載系統、電流變液避震器

目錄

參考文獻

[1] T. R. Weyenberg, J. W. Pialet, and N. K. Petek, “ The Development of Electrorheological Fluids for An Automotive Semi-Active Suspension System, ” International Journal of Modern Physics B, 10(23 & 24), 1996, pp.3201-3209.

[2] 程志堅, “ 電黏性流體的動態特性量測及智慧型結構模擬, ” 大葉大學碩士論文，中華民國八十六年六月。

[3] D. J. Peel, R. Stanway and W. A. Bullough, “ Dynamic Modelling of an ER Vibration Damper for Vehicle Suspension Applications, ” Smart Materials and Structures, 5, 1996, pp.591-606.

[4] A. Crowson, “ Smart Materials and Structures: An Army Perspective, ” in Recent Advances in Adaptive and Sensory Materials and Their Applications, Technomic Com., 1992, p.811.

[5] K. D. Weiss, J. P. Coulter, and J. D. Carlson, “ Electrorheological Materials and Their Usage in Intelligent Material Systems and Structures, Part 1: Mechanisms, Formulations and Properties, ” in Recent Advances in Adaptive and Sensory Materials and Their Applications, Technomic Com., 1992, p.811.

[6] Z. P. Shulman, R. G. Gorodkin, E. V. Korobko, and V. K. Gleb, “ The Rheological Effect and its Possible Uses, ” Journal of Non-Newtonian Fluid Mechanics, 8, 1981, pp.29-41.

[7] A. J. Simmond, “ Electro-Rheological Valve in a Hydraulic Circuit, ” IEE Proceedings-D, 138(4), 1991, pp.400-404.

[8] S. Morishita, and J. I. Mitsui, “ Controllable Squeeze Film Damper - An Application of Electro-rheological Fluid ” Journal of Vibration and Acoustics, 114, 1992,pp.354-357.

[9] 蔡博文，1998，以電流變液作結構動態特性修正之研究，碩 士論文，大葉大學機械工程系，彰化 [10] 粘鴻祺，2003，電流變液在轉盤間之擠壓承載研究，碩士論 文，大葉大學機械工程系，彰化 [11] K. Ohashi, C. Hamada, H. Kawakawi, r. Hirano, and Z. Murakami, “

Suspension Controller for Improved Turning,” U.S. patent, No.4761022, Aug. 2, 1998.
[12] G. Nagel, and M. Winkler,“ Active Suspension System,” U.S. Patent, No.5743553, Apr. 28, 1998.
[13] K. Reybrouck, ” Active Suspension System,” U. S. Patent, No.5682980, Nov. 4,1997.
[14] W. T. Yopp, ”Vehicle Active Suspension System,” U.S. Patent, No. 5322321, Jun.21, 1994.
[15] R. I. Davis, and P. B. Patil, ”Electrically Powered Active Suspension for A Vehicle,” U.S. Patent, No.5060959, Oct.29,1991.
[16] M. Izawa, H. Ito, T. Fukuzato, and T. Nakamura,“ Active Suspension System,” U. S. Patent, No. 5678847, Oct. 21, 1997.
[17] N. M. Wereley and L. Pang,“ Nondimensional Analysis of Semi-Active Electrorheological and Magnetorheological Dampers Using Approximate Parallel Plate Models,” Smart Materials and Structures, 7, 1998, pp.732-743.
[18] H. P. Gavin, R. D. Hanson and F. E. Filisko,“ Electrorheological Dampers, Part Ⅰ Analysis and Design,” Journal of Applied Mechanics, 63, 1996, pp.669-675.
[19] H. P. Gavin, R. D. Hanson and F. E. Filisko,“ Electrorheological Dampers, Part Ⅱ:Testing and Modeling,” Journal of Applied Mechanics, 63, 1996, pp.676-682.
[20] S. B. Choi, Y. T. Choi, E. G. Chang, S. J. Han, and C. S. Kim“ Control Characteristics of Continuously Variable ER Damper, ”Mechatronics, 8, 1998, pp.143-161.
[21] S. B. Choi, H. K. Lee, and E. G. Chang,“ Field Test Results of A Semi-Active ER Suspension System Associated With Skyhook Controller, ” Mechatronics, 11, 2001, pp.345-353.
[22] D. A. Brooks and G. L. Bach, ”Electro-rheological Fluid Decelerator,” UK Patent, GB 2267140 A, 1993.
[23] 陳義男、吳聰能、郭文化和黃照傑“ 流動式電流變液阻尼器 設計與性能分析， ”中國機械工程學會第十七屆學術研討 會，固力與設計，2000。
[24] 陳義男、郭振華、郭文化和曾敦彥“ 剪切式電流變液阻尼器 設計與性能分析， ”中國機械工程學會第十七屆學術研討 會，固力與設計，2000。
[25] R. Stanway, J. L. Sproston and A. K. El-Wahed,“ Application of Electro-Rheological Fluid in Vibration Control: A Survey,” Smart Materials and Structures, 5, 1996, pp.464-482.
[26] C. Y. Lee , G. J. Chao and J. D. Wu,“ Effect of Curvature on the Flow of an Electrorheological Fluid Through an Annular Duct ,” Journal of the Chinese Society of Mechanical Engineers, 23(4), 2002,pp.345~353