高速鐵路列車之強健巡弋控制與主動式懸吊系統

徐萬權、林志哲

E-mail: 9314963@mail.dyu.edu.tw

摘 要

高速鐵路是指營運時速在200 公里以上之鐵路系統，為了能 在如此高的營運速度下保證列車的安全性及舒適性，需藉由自動 行車控制系統來監控列車。由於台灣屬於多山之地形，彎曲的軌 道路線是無法避免的，因此高速鐵路的安全性問題更須加強注意 才行。 高速鐵路列車之控制系統大致可歸納為列車之運動規劃系 統、列車之巡弋控制系統以及列車之主動式懸吊系統等。本文將 以巡弋控制系統及主動式懸吊系統探討為主，針對HST 之簡化模 型及ADAMS之全車模型進行控制器之設計與模擬探討。

關鍵詞 : 高速鐵路列車，巡弋控制器，主動式懸吊系統，順滑控 制，自動行車控制系統

目錄

參考文獻

[1] Hertz, H.,“ U& & ber die Beruhrung fester elastischer K o& & rper, ”-Angewandate Math. Crelle 92, pp. 155-171, 1882.

[2] Carter, F. W.,“ On the Action of a Locomotion Driving Wheel, ”-Proc. R. Soc. London. A112, pp. 151-157, 1926.

[3] Kalker, J.J.,“ On the Rolling Contact of Two Elastic Bodies in the -Presence of Dry Friction, ” Thesis, Delft, 1967.

[4] Kalker, J.J.,“ Simplified Theory of Rolling Contact, ” Delft Progress -Report1,vol.5, pp. 317-358, 1973.

[5] Kalker, J.J.,“ A Fast Algorithm for the Simplified Theory of -Rolling Contact, ” Vehicle System Dynamic, pp. 1-13, 1982.

[6] Zboinski, K.,“ Dynamical investigation of railway vehicles on -curved track, ” Eur. J. Mech. A/Solid, 17, pp. 1001-1020, 1998.

[7] Haque, I. And Leih, J.,“ Parameterically Excited Behavior of a -Railway Wheelset, ” J. of Dynamic Systems Measurement, and -Control, ASEM, Vol.110, pp. 8-17, 1988.

[8] 張世福,“ 非線性接觸力對於行駛於彎曲軌道車輛系統之動態穩 定性效應, ” 成功大學機械工程所碩士論文, 2001.

[9] 徐正會, 許益誠,“ 積極滾動控制之車輛半主動式懸吊系統之設 計與分析, ” 中華名國第二十屆機械工程研討會, 2003.

[10] 徐正會, 馬光杰,“ 軌道車輛單軸轉向架之分類與分析, ” 中華名 國第二十屆機械工程研討會, 2003.

[11] 徐正會, 楊瑋弘, “軌道車輛自導式轉向架之研發, ”中華名國第 二十屆機械工程研討會, 2003.
[12] 徐正會, 李明晟, “軌道車輛可傾式轉向架之創新設計, ”中華名 國第二十屆機械工程研討會, 2003.
[13] ISO, “Mechanical vibration - Measurementand analysis of -vibration to which passengers and crew are exposed in railway -vehicles, ” ISO10056, 1996.
[14] ISO, “Mechanical vibration and shock - Evaluation of human -exposure to whole-body vibration - Part4:Guidelines for the -evaluation of the effects of vibration and rotational motion on -passenger and crew comfort in fixed guideway transport system, ”-ISO2631-4, 1999.
[15] Andersson, E., and Nilstam, N., “The development of advanced -high speed vehicles in Sweden, ” Proceedings of the Institution of -Mechanical Engieers, Part D, 198(15), pp.229-237, 1984.
[16] Chappel, T., “Passenger comfort test (APT) of April 1984: -Planning and conduct, ”BRR TR DOS 036, British Rail Research, -1986.
[17] Harborough, P. R., “Passenger comfort during high speed -curving:Analysis and conclusions, ”BRR TR DOS 017, British -Rail Research, 1986.
[18] Koyanagi, S., “Ride quality evaluation of a pendulum car, ”-Quarterly report of RTRI, 26:3, pp.89-92, 1985.
[19] Suzuki, H., Shiroto, H., Tanka, A., Tezuka, K., Nakagawa, S., -“Effects of vibrational factors on riding comfort evaluation of -tilting train passing curve transitions, ”In proceedings of World -Congress on Railway Research (WCRR ’99) , Tokyo, 1999.
[20] Ohno, H., “What aspect is needed for a better understanding of tilt -sickness?, ” Quarterly report of RTRI, 37(1), pp.9-13, 1996.
[21] 孫允平, “混何￥ H H / 2 控制器設計及其應用:高速鐵路列車巡 弋控制及微衛星姿態控制, ”成功大學航空大空工程研究所博 士論文, 2001.
[22] Pratt, I., and Goodall, R., “Controlliing the ride quality of the -central portion of a hight-speed railway vehicle, ” American -Control Conference, 1997. Proceedings of the 1997, pp.719-723 -vol.1.
[23] Fukao, T., Yamawaki, A., Adachi, N., “Adaptive control of -Partially Known Systems Usin Backstepping:Application to ￥ H -Design of Active Suspension, ” Decision and Control, 1998. -Proceedings of the 37th IEEE Conference on, pp.481-486 vol.1.
[24] Sasaki, K., Kamoshita, S., Enomoto, M., “A design and bench test -of multi-modal active suspension of railway vehicle, ” Industrial -Electronics, Control and Instrumentation, 1994. IECON '94., 20th -International Conference on , pp.2011-2016 vol.3.
[25] Mei, T. X., Foo, T. H. E., Goodall, R. M., “Genetic algorithms for -optimising active controls in railway vehicles, ” Optimisation in -Contro l:Methods and Applications (Ref. No. 1998/521), IEE -Colloquium on, 10 Nov. 1998.