The Study of Vehicle Handing Control with Streer-by-wire System

E-mail: 9607877@ mail.dyu.edu.tw

ABSTRACT

The main purpose of this study is to focus on the handing control of vhicle with Steer-by-Wire System(SBW).Vehicle with steer-by-wire system are get rid of limitations of traditional steering syetem, which can be devdloped the vehicle handing control.In vehicle handing control,the main purpose is to focus on sideslip angles at C.G. control.Under this control system,the vehicle would always have the minimal sideslip angle in C.G. range,and the vehicle would have stable handing at high speed or low speed in corneing. There are two methods for vehicle handing control.First,it is the front wheel control.Because there are only two tires in the front wheel steering system vehicle,we can not efficiently reduce the sideslip angle at C.G..Therefor,we designed the vehicle handing control of four wheels which can control the rear wheel. First,we used the CarSim software to verify the proposed method for the vehicle handing control. Next,apparatus of the Hardware-In-the-Loop(HIL)is connected to the steer-by-wire system platform and the controller of steering motor. Through the hardware-in-the-loop test result,we can verify that the vehicle can obtained a stable steering as vehicle (Focus),and achieved a satisfactory result.

Keywords : Vehicle handing control,Sideslip angle,Streer-by-Wire System,CarSim, Hardware-In-the-Loop

Table of Contents

REFERENCES

[1] T.Kaufmann, S. Millsap, B. Murray and J. Petrowski,"Development Experience with Steer-by-Wire,"SAE Paper 2001-01-2479 [2] M.Segawa, R.Hayama and S.Nakano,"A Study on Reactive Torque for Steer-by -Wire System(SBW) with Mechanical Fail-safe Device,"Koyo Engineering Journal English Edition No.162E,2003.

[3] T.J. Park, S.H. Lee and C.S.Han,"Design of the Electronic Control Unit for the Rack-Actuating Steer-by-Wire Using the Hardware-In-the-Loop Simulation System,"Mechatronics,Vol.15pp.899-918,2005.

[4] E.Ono,S.H.D.Tuan and S.Doi,"Bifurcation in Vshicle Dynamics," IEEE Trans.Contr.Syst.Technol,Vol.6,No.3,pp.113-132,198.

[5] M.Segawa,S.Nakano,O. Nishihara and H. Kumamoto,"Vehicle Stability Control Strategy for Steer-by-Wire System,"SAE Review,Vol.22,pp.383-388, 2001.

[6] M.Yamamoto,"Active Control Strategy for Improved Handling and Stability," SAE Paper,No.911902,2002.

[7] M.Hosaka,T.Murakami,"Yaw Rate Control of Electric Vehicle Using Steer-by- Wire System,"IEEE PO-7803-8300-1AMC2004-Kawasaki,Japan [8] H.J.Kim and Y.P.Park,"Investigation of Robust Roll Motion Control Considering Varying Speed and Actuator Dynamics,"IEEE Paper, Mechatronics,Vol.14,99.35-54,2004.

[9] B.L.Boada et al."Fuzzy-logic Applied to Yaw Moment Control for Vehicle" Stability,"Vehicle System Dynamics,Vol.43,No.10,pp.753-770,October 2005.

[10]　　　　　　"　　　　　　　　　　　　　　　　　　"　　　　　（　　　）　28　　　　　2007

[11]　　　　　"　　　　　　　　　　　　　　　　　　"　　　　　　　　　　　2003

[12] N. Irie and J. Kuroki,"4WS Technology and the Prospects for Improvement of Vehicle Dynamics,"Society of Automotive Engineers, Vol.6,No.901167,pp.1334-1342,1990.

[13]　　　　　"　　　　　　　　　　　　　　　"　　　　　　　　　　　2006

[14] Sam Sang You and Seok Kwon Jeong,"Controller Design and Analysis for Automatc Steering of Passenger Cars,IEEE,"Mechatronics,Vol.12,pp.427- 446,2002.

[15] E.Bakker,L.Nyborg and H.B.Pacejka,"Tyre Modelling for Use in Vehicle" Dynamics Studies,"SAE Paper,No.840421,1987.

[16] A.Stotsky and X.Hu,"Stability Analysis of Robustly Decoupled Car Steering System with Nonlinear Tire Model,"IEEE,Proc.of the 36th Conference on Decision and Control,San Diego,California USA,Decemder 1997.

[17]　　　　　"　　　　　　　　　　　　　　　　　"　　　　　　　　　　　2006

[18] Dr.D.Hanselman, "Brushless Permanent Magnet Motor Design,"Electrical and Computer Engineering University of Maine Orono,ME 04469 USA.

[19] http://sine.ni.com/nips/cds/view/p/lang/ja/nid/13117 [20] M. Shino,M. Nagai,"Yaw-Moment Control of Electric for Improving Handling and Stability," JSAE Paper,pp.473-480,2001.

[21]　　　　　"　　　　　　　　　　　　　　　　　"　　　　　　　　　　2003.11

[22] Z. van, A.T.,"Bosch ESP Sydtem:5 Years of Experience,"SAE paper, NO.2000-01-1633.

[23]　　　　　"　　　　　　　　　　　　　　　　　"　　　　　　　　　2005

[24] 2007 Microchip Technology Inc. MCP2510 Data Sheet.

[25] G. Zuo et al."Quantitative Reliability Analysis of Different Design Alternatives for Steer-by-Wire System,"Elsevier Ltd.All rights reserved.

[26] http://china5.nikkeibp.co.jp/china/news/200511/auto200511030112.html.

[27]　　　　　"　　　　　　　　　　　　　　　　"　　　　　　　　　2006　5

[28] xPC Targetuse's Guide,The Mathworks.Inc.

[29] http://usl.webpublications.au.Steering wheel and tire angle at 20,40,60, 80 and 100km/hr,2000.