

Intelligent Electrical Vehicle By-Wire Powertrain and Handling Control Embedded System Study

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ABSTRACT

The purpose of this study is to establish a dynamic simulation and control system for intelligent vehicle driving and handling performance evaluation. By controlling the wheel motor drive and brake and independent steer control motor, the vehicle can have better mobility and safer handling condition. When the vehicle is straight-line driving, the slip and skid control of wheels were used to ensure the wheel torque management to has stabled drive behavior in case of wheel slip or lock conditions. The wheel speed difference, vehicle speed, yaw rate, side slip angle, and lateral acceleration during the turning maneuver conditions were used for wheel motor controller inputs for the wheel motor controller which gives commands to control each wheel speed to reduce the tire abrasive and vehicle unstable conditions. This study has constructed the plant and controller simulation methodology which integrate the control strategies including the traction control, antilock brake control, active steer, wheel motor torque management, and the Four-Wheel Steer, (4WS) control system to evaluate and improve the vehicle drive and handling performance. The active steer control system can adjust the steer gear ratio of front and rear wheels and the ratio between them according to the vehicle speed, steering wheel angle input and the vehicle yaw rate, lateral acceleration, and side slip angle were feedbacked for closed loop control to ensure safer turning maneuver. The by-wire controlled 4WS electric vehicle driving and handling control modules were established by using dynamic simulation program Simulink and the embedded controller Motohawk to form a Hardware-in-Loop, (HIL) environment. The control and design parameters were varied and validated under different operating conditions to assure better electric vehicle handling performance and longer cruise range. This study can integrate and increase the research and development capability in vehicle stability control system design area including mechanical, electronic control, computer, and communication which can then in connect with the world advanced vehicle industries and enhance the competition ability in the future intelligent vehicle electronics market.

Keywords : Intelligent Vehicle Drive-by-Wire Control、 Vehicle Drive and Handling Dynamic Simulation Control System、 Hardware-in-Loop Simulation、 Four Wheel Steer Embedded Control Module

Table of Contents

中文摘要.....	iii	英文摘要.....	v	誌謝.....	
.....	vii	目錄.....	viii	圖目錄.....	xi
表目錄.....	xvii	符號說明.....	xviii	第一章 緒論.....	
1.1.1前言.....	1	1.2文獻回顧.....	1		
1.2.1車輛動態模擬控制相關文獻.....	2	1.2.2車輛線傳控制相關文獻.....	4	1.2.3車輛線傳四輪轉向控制相關文獻.....	6
1.2.4硬體迴路相關文獻.....	7	1.3研究動機.....	10	1.4本文架構.....	11
第二章 車輛動態模型建立及驗證.....	12	2.1電動四輪驅動車輛縱向運動動態模組.....	16	2.1.1車輛輸入參數模組.....	16
2.1.2馬達動態性能輸出模組建立.....	19	2.1.3電池殘電量預估模組.....	22	2.1.4模擬差速器輸出模組建立.....	23
2.2四輪轉向車輛橫擺運動動態模組.....	26	2.2.1輪胎滑移角模組.....	26	2.2.2車輛橫擺運動性能輸出模組.....	28
2.2.3輪胎動態性能模組.....	30	2.2.4前後轉向比例模組.....	33	2.2.5阿克曼 (Ackerman) 轉向幾何模組.....	34
2.3速度位移轉換模組.....	36	2.4預定路徑車速及方向盤轉角預估模組.....	37	2.5牽引力控制系統模組 (Traction Control System, TCS).....	39
2.6電動車輛殘電量預估模組.....	41	第三章 車輛模型驗證與模擬結果討論.....	42	3.1電動四輪驅動車輛縱向動態模組模擬.....	42
3.1.1模擬車輛參數設定.....	42	3.1.2車輛加速性能測試.....	44	3.1.3車輛爬坡性能測試.....	44
3.1.4驅動馬達效率分析.....	46	3.1.5電動車輛電池殘電量分析(State of Charge).....	50	3.2四輪轉向車輛橫擺運動動態模組模擬.....	53
3.2.1與商用軟體CarSimR驗證.....	53	3.2.2於CarSim作90km/hr變換車道(Double Lane Change, DLC).....	54	3.2.3智慧型電動車輛自	

動平行停車模組.....	67	3.2.4牽引力控制模組與電子模擬輸出差速器模組測試.....	72	第四章 四輪電動線
傳驅動轉向硬體迴路平台.....	77	4.1線傳轉向平台周邊硬體與實驗設備介紹.....	77	4.1.1 MotoHawk
硬體介紹.....	77	4.2硬體迴路平台架構.....	81	4.2.1電動車輛線傳驅動馬達硬體
設備介紹.....	84	4.2.2電動車輛線傳轉向馬達硬體設備介紹.....	87	4.3驅動馬達控制程
式.....	89	4.4轉向馬達控制程式.....	91	4.5實驗平台驗
證.....	95	第五章 結論與建議.....	112	5.1結
論.....	112	5.2建議事項與未來研究項目.....	113	參考文
獻.....	116			

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