Study Of Reinforced Composite Structure For Bus Frame

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ABSTRACT

Recently, a new bus frame material is rarely proposed by domestic and foreign scholars or manufacturers. In this study, a composite reinforced structure used in the bus frame was developed for improving the deformation of bus superstructure and residual space during rollover impact. Moreover, the composite reinforced frame is able to reduce the weight and oxidation level of bus frame. Based on the Economic Commission for Europe No.66 regulation (ECE R66), the numerical rollover test model was developed to assess the strength of bus superstructure. The rollover simulations were conducted using the LS-DYNA finite element code. First of all, the numerical model of joint test for bus frame was created based on the ECE R66 specifications. To confirm the accuracy of the proposed numerical model of joint test, simulation result is compared with those obtained from experimental test. Furthermore, the numerical simulation of joint test for composite reinforced frame was performed to assess the frame strength improvement. Finally, the numerical simulations of body section and full-scale rollover test for composite reinforced frame were implemented to examine that the residual space during and after the rollover test on complete vehicle is unharmed. The composite reinforced bus frame proposed here have potential for reducing the intrusion into the residual space and passenger injury. Additionally, the bus with composite reinforced structures not only can reduce the bus weight and lower the vehicle's center of gravity but also improve bus driving safety. This research works indicate that the proposed composite reinforced structure has considerable potential for improving the business performance of bus manufacturers and guiding future development of bus structure technologies.

Keywords : Bus、Frame、Composite Reinforcement Structure、Joint Test、Roll-over、Residual Space

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REFERENCES

參考文獻 [1]行政院交通部， http://www.motc.gov.tw/ (2012-07) [2]UNECE， http://www.unece.org/stats/stats_h.html(2012-07) [3]S.Vincze,“ European Test Methods for Superstructures of Buses and Coaches Related to ECE R66(The Applied Hungarian Calculation Method) ”,Society of Automotive Engineers 2000-01-3520(2000) [4]Savaidis“ Hot-Spot Stress Evaluation of Fatigue in Welded Structural Connections Supported By Finite Element Analysis ”International Journal of Fatiguee 22.85-91(2000) [5]Wittenberg“ Desighn of Fiber Metal Laminate Shear Panels For Ultra-High Capacity Aircraft ”Aircraft Design 4(2001)99-113 [6]Matolcsy“ Protection of Bus Drivers in Frontal Collisions ” The 18th International Technical Conference on the Enhanced Safety of Vehicles (ESV), Paper Number:359 (2003) [7]Belinggardi,“ Multibody Analysis of M3 Bus Rollover: Structure Behaviour and Passenger Injury Risk ”The 18th International Technical Conference on the Enhanced Safety of Vehicles (ESV),Paper number:288(2003) [8]Castejon,Jesus Cuartero,Antonio Miravete and Marco Carrera Carrera“ Simulation and Testing of Composite Buses Roll over ”SAE 2004-01-0741(2004) [9]吳昌明，“ 大客車車身結構之翻覆強度分析 ”，大葉大學車輛工程研究所碩士班論文，2004。
[10]梁卓中，林育正，吳昌明，“ 歐規ECE R66大客車車身段翻覆試驗之數值模擬 ”，第二十一屆全國學術研會論文集，pp.3269-3274，2004。
[11]M.Meo,“ Numerical Simulations of Low-Velocity Impact on An Aircraft Sandwich Panel ”Composite Stucture 62(2005)353-360
[12]Yu-Cheng Lin and Hong-Chi Nian,“ Structural Design Optimization of the Bodysection Using the Finite ElementMethod ”Society of Automotive Engineers,2006-01-0954(2006)，第11屆ABAQUS Taiwan User ’ s Conferevce，2006。
[13]林育正，“ 建立大客車骨架擠壓分析測試與優化之設計方法 ”，第11屆ABAQUS Taiwan User ’ s Conferevce，2006。
[14]胡惠文，“ 大客車車體結構之翻覆碰撞強度分析 ”第十一屆車輛工程學術研討會，2006彰化。
[15]Su-Jin Park, Yuen-Ju Kwon,hyun-Woo Kimand Wan-Suk Yoo“ OMPARISON OF BEAM MODEL AND SHELL MODEL FOR ROLLOVER SIMULATION OF BUS WITH THE LS-DYNA PROGRAM ” Proceedings of ACMD06(2006) Paper Number:A00654 [16]張瑞宏，“ 提升大客車車體結構強度之研究 ”，大葉大學車輛工程研究所碩士班畢業論文，2005。
[17]黏鴻祺，“ 大客車車身結構強度之碰撞性研究 ”，第十一屆車輛工程學術研討會，2006。
[18]Liu Bo，“ Composite Materials Commonly Used in Modern Automobiles ”，Hi-Tech Fiber & Application，2007 [19]邱筱婷，“ 大客車骨架結構補強型式之設計與評估 ”，大葉大學機械工程研究所碩士班論文，2007。
[20]Sebastian Heimbs,Sven Heller, Middendorf“ Simulation of Low Velocity Impact on Composite Plates With Compressive Preload ”EADS,Innovation Works, 81663 Munich,Germany(2008) [21]宋毅，“ 複合材料層合圓柱殼體緩衝吸能的實驗與模擬 ”華南理工大學學報1000-565X(2009)。
[22]機械工程師學會， http://www.imeche.org/Home。
[23]財團法人車輛研究測試中心，大客車設計應用技術研討會，2004。
[24]車輛研究測試中心， http://www.artc.org.tw/。
[25]LS-DYNA THERETICAL MANUAL，1998 [26]LS-DYNA KEYWORD USE ’ S MANUAL，V970，2003