具保護行人之引擎蓋結構設計研究

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摘 要

每年有數以千計的行人在車禍事故中傷亡，在這些死亡人數中有60%係因頭部及臉部的損傷所致，又頭部及臉部的損傷有17.3%是碰撞到汽車引擎罩引起，上述數據顯示考慮汽車引擎罩對行人 頭部安全的必要性。本論文首先分析行人頭部與引擎罩撞擊時頭部合成加速度的組成與變化，正 確的計算頭部合成加速度各分量的比例，並且探討引擎罩結構設計參數對各加速度分量的影響； 進一步依據最佳的加速度曲線分析頭部合成加速度特性變化因素。此部份研究分析結果可提供汽車引擎罩結構設計與研發行人防護裝置之參考。由於各種車型的引擎罩結構設計皆不同，故選擇 引擎罩外板結構及內板加強結構一較佳的厚度是非常重要。接著本研究依據EEVC/WG17測試標準 使用頭部衝擊器進行模擬分析，探討引擎罩外板結構及內板加強結構厚度對行人頭部損傷的影響。 再提出引擎罩外板結構及內板加強結構之厚度最佳化設計，並且依標準對引擎罩外板表面結構多 點進行測試，以確保行人頭部安全。基於本研究之引擎罩外板結構及內板加強結構之厚度設計結果，已完成一可確保行人頭部安全的引擎罩結構，此引擎罩結構可使撞擊時頭部合成加速度接近 最佳的加速度曲線。本研究設計之引擎罩結構厚度不僅可減少行人頭部損傷，並具足夠的結構剛 性可有效保護汽車乘員安全。

關鍵詞 : 行人，頭部衝擊器，頭部損傷，引擎罩，引擎罩內板加強結構，最佳化設計

目錄

參考文獻

REFERENCES [1]Ciaran Simms and Denis Wood (2009) Pedestrian and Cyclist Impact- ISBN 978-90-481-2742-9 e-ISBN 978-90-481-2743-6, Springer Dordrecht Heidelberg London New York.
[2]National Center for Statistics & Analysis. (2009). Motor Vehicle Traffic Crash Fatality Counts and Estimates People of Injured for 2007, Annual Assessment of Motor Vehicle Crash, National Highway Traffic Safety Administration. USA.
[3]Mark O. Neal, Heui-Su Kim, J.T. Wang - General Motors Corp, USA; Takanobu Fujimura, Katsumi Nagai - Development of LS-DYNA FE Models for Simulating EEVC Pedestrian Impact - Suzuki Motor Corp, Japan, Paper Number 335.
[4]L. Astrid, M. Clay, C. Anthony, Y. Jikuang, O. Dietmar, Mathematical Simulation of Real-World Pedestrian-Vehicle Collisions, Paper No. 05-285, 2005.
[5]Mohan, D., Safety and health in Indian cities. Journal of Transport and Infrastructure 9, 79 – 92, 2002.
[6]Jacobs, G., Aeron-Thomas, A., and Astrop, A., Estimating Global Road Fatalities. UK Transport Research Laboratory, TRL-445, 2000.
[7]Road Accidents Great Britain 1998: The Casualty Report. Department of the Environment, Transport and the Regions, 1998.
[8]Oh, C., Kang, Y., and Kim, W., Assessing the safety benefits of an advanced vehicular technology for protecting pedestrians. Accident Analysis and Prevention 40(3), 935 – 942, 2008.
[9]RSA. Road Collision Facts Ireland, 2006, Road Safety Authority Ireland, 2007.
[10]National Statistics Online. Available from: http://www.statistics.gov.uk.
[11]Mabunda, M., Swart, L.-A., and Seedat, M., Magnitude and categories of pedestrian fatalities in South Africa. Accident Analysis and Prevention 40, 586 – 593, 2008.
[12]Road Safety and Motor Vehicle Regulation Directorate, Pedestrian Fatalities and Injuries in Canada -1992-2001, December 2004 [13]F. A. Berg, M. Egelhaaf, J. Bakker, H. Burkle, R. Herrmann, J. Scheerer, Pedestrian Protection In Europe-The Potential of Car Design and Impact Testing.
[14]K. Ingo, F. Flavio, Improvements to Pedestrian Protection as Exemplified on a Standard-Sized Car, Report No. 283, Germany, 2000.
[15]Toshihiro Ishikawa, Haruhisa Kore, Arihiro Furumoto, Susumu Kuroda-Evaluation of Pedestrian Protection Structures Using Impactors and Full-Scale Dummy Tests - ESV 18th Conference, paper No. 271.
[16]Yutaka Okamoto, Akihiko Akiyama, Masayoshi Okamoto, Yuji Kikuchi, 2001, A Study of The Upper Leg Component Test Compared with Pedestrian Dammy Tests, 17th ESV Conference.
[17]M. Yoshiuki, I. Hirotoshi, Summary of IHRA Pedestrian Safety WG Activities-Proposed Test Methods To Evaluate Pedestrian Protection Afforded by Passenger Cars, Paper Number 280.
[18]Ingenieria Y A Sistemas S.A: www.arise-ingenieria.com [19]Directive 2003/102/EC of the European Parliament and of the Council, Nov 17th, 2003.
[20]EEVC/WG 17 Report. (1998, updated 2002). Improved Test Methods to Evaluate Pedestrian Protection Afforded by Passenger Cars, European Enhanced Vehicle-safety Committee.
[21]Da-Yeh Institude of Technology- Safety and Crash Behavior-AE & ICE series, Volume 21 (1993).
[22]Fuerstenberg, K. Ch. (2005). Pedestrian Protection using Laserscanners, 8th International IEEE Conference on Intelligent Transport Systems, Vienna, Austria.
[23]Fuerstenberg, K. Ch., and Klaus Dietmayer. (2004). Object Tracking and Classification for Multiple Active Safety and Comfort Applications using a Multilayer Laserscanner, IEEE Intelligent Vehicles Symposium.
[24]Philomin, V., Duraiswami, R., and Davis, L. (2000). Pedestrian Tracking from a Moving Vehicle, IEEE Intelligent Vehicles Symposium.
[25]Curio, C., Edelbrunner, J., Kalinke, T., Tzomakas, C., and von Seelen, W. (2000). Walking Pedestrian Recognition, IEEE Transactions on Intelligent Transportation.
[26]Aessandro Zanella, Francesco Butera, Enrico Gobetto, Centro Ricerche - Smart Bumper for Pedestrian Protection - FIAT, Italy.
[27]Rikard Fredriksson, Yngve Haland, Jikuang Yang. Evaluation of a New Pedestrian Head Injury Protection System with a Sensor in the Bumber and Lifting of the Bonnet ' s Rear Part . ESV 17th Conference [28]Tetsuo Maki - Development of Pedestrian Protection Technologies for ASV- Vehicle Research Laboratory, Nissan Research Center, Nissan Motor Co., Ltd, Natsushima-cho 1, Yokosuka-shi, Kanagawa, 237-8523, Japan.
[29]Hexcel Composite: Hexcel ' s Product for Automotive Pedestrian Impact Protection: Automotive Pedigree and Efficient Energy Absorbing Solutions.
[30]C.K. Simms and P.J. Prendergast (Eds.), Perspectives on Design and Bioengineering: Essays in Honour of C.G. Lyons, pp. 39-55. c 2008 Trinity Centre for Bioengineering.
[31]Yong Ha Han and Young Woo Lee. (2003). Development of a Vehicle Structure with Enhanced Pedestrian Safety. SAE World Congress,

Detroit, Michigan, USA.
[32]Kerkeling C, Schaefer J, Thompson G (2005): Structural Hood and Hinge Concepts for Pedestrian Protection. Experimental Safety Vehicles Conference, Washington D.C.
[33]S. Jiri, C. Viktor, Pedestrian – Vehicle Collision: Vehicle Design Analysis, 2003-01-0896 [34]Abayomi Otubushin, and John Green. (1998). An analytical assessment of pedestrian head impact protection, 16th ESV Conference, Windsor, Ontario, Canada.
[35] Balandin, D. V., Bolotnik, N. N., Purtsezov S. V. (2005). Purtsezov Optimal Control of Impact Isolation Systems for Injury Prevention with the Head Injury Criterion Being Taken into Account, Journal of Computer and Systems Sciences International, Vol.44, No.2, 247-258.
[36]Payne, A. R. and S. Patel. (2001). Occupant Protection and Egress in Rail Systems, Motor Industry Research Association (MIRA).
[37]FHWA/NHTSA National Crash Analysis Center. The George Washington University www.ncac.gwu.edu/vml/models.html.
[38]Teng, T. L., and Nguyen, T. H. (2008). Development and Validation of FE Models of Impactor for Pedestrian Testing. Journal of Mechanical Science and Technology, Vol.22, No.9, 1660-1667.
[39]Nielen Stander,Willem Roux, Tushar Goel and Ken Craig. A Design Optimization and Probabilistic Analysis Tool for Engineering Analyst. In: LS-OPT User ' s Manual. Version 3.3 (2008). Livermore Software Technology Corporation.
[40]Col, D., Furini, F., Mueller, O., Trivero, R. Static-Vibrational Design of a Bonnet with Frame Topological Optimization. MSC User-Conference; 1998; Turin, Italy.