

輪型甲車動態模型之建立與分析 = Development of the dynamic model for infantry fight vehicle

周耿民、鄧作樑

E-mail: 9707924@mail.dyu.edu.tw

摘要

輪型裝甲車不像履帶甲車具有履帶與路面的接觸面大以及車身重心較低等優點，使得輪型裝甲車在行駛各種路面時穩定性未較履帶裝甲車為佳，在加上大口徑武器射擊後座力亦對裝甲車穩定性造成影響。本論文為能進一步地了解輪型裝甲車在斜坡行駛與射擊過程之動態穩定性，首先在研究過中利用ADAMS軟體建構單一承載系統之實體模型與特性點模型，並以承載系統測試平台實驗數據驗證本文所建構承載系統數值模型的正確性。接著依據輪型裝甲車車身、砲塔結構設計圖、輪軸距、全車重心、輪胎規格等標準規格，利用3D繪圖軟體與機構模擬軟體ADAMS建立完整輪型甲車全車模型，再考量裝甲車行駛於正前坡與側斜坡路面，針對砲塔無射擊與射擊狀況下，探討輪型裝甲車模型是否會造成滑移或翻覆等現象進行。本論文之研究成果除可提供輪型裝甲車研發單位對搭配大口徑武器之裝甲車在行駛與射擊過程的穩定性設計參考，另對承載系統模型中彈簧剛性與阻尼係數等參數的調整與分析，亦可作為裝甲車乘員舒適性之依據與裝甲車零組件整體後勤補給之參考。

關鍵詞：輪型裝甲車；承載系統；動態模擬

目錄

封面內頁 簽名頁 授權書 中文摘要 英文摘要 誌謝 目錄 圖目錄 表目錄 第一章 緒論 1.1前言 1.2文獻回顧 1.3研究目的 1.4論文架構 第二章 ADAMS分析軟體 2.1 ADAMS分析軟體 2.2 ADAMS之基本假設 2.3 ADAMS之模組 第三章 承載系統模型 3.1承載系統 3.2承載系統模型 3.2.1實體模型法 3.2.2特性點法 3.2.3輪胎模型 3.3承載系統測試實驗 3.3.1測試系統功能 3.3.2測試系統組成 3.3.3承載系統測試步驟 3.3.4承載系統實驗結果 3.4承載系統測試數據模擬 第四章 輪型裝甲車全車模型 4.1全車模型 4.2全車動態模擬分析 4.2.1路面模型建立 4.2.2全車動態模擬 第五章 輪型裝甲車之穩定度分析 5.1裝甲車於斜坡路面之穩定度分析 5.1.1裝甲車之正前坡穩定度分析 5.1.2裝甲車之側斜坡穩定度分析 5.2裝甲車於平地路面射擊時之穩定度分析 5.2.1 12點鐘方向射擊之車體動態模擬 5.2.2 3點鐘方向射擊之車體動態模擬 5.3裝甲車於正前坡射擊時之穩定度分析 5.3.1正前坡12點鐘方向射擊之車體動態模擬 5.3.2正前坡3點鐘方向射擊之車體動態模擬 5.4裝甲車於側斜坡射擊時之穩定度分析 5.4.1側斜坡12點鐘方向射擊之車體動態模擬 5.4.2側斜坡3點鐘方向射擊之車體動態模擬 第六章 結論與未來展望 參考文獻

參考文獻

- [1] Sattinger, I. J., " Analysis of The Suspension System of The M47 Tank by Means of Simulation Techniques ", Mich. Report 2023-2-T, 1954.
- [2] Sattinger, I. J., Smith, D. F. " Computer Simulation of Vehicle Motion in There Dimensions ", AD237249, 1964.
- [3] Schuring, D., Belsdorf, M. R., " Anlysis an Simulation of Dynamical Vehicle-Terrain Inter-action ", AD690841, 1969.
- [4] Sun, P. F., (1974) " Weapon-vechice Modeling and Solution ", AD780921.
- [5] Binroth, W., Cornoll, G. A., Presley, R. W., " Closed-loop Optimization Program for The M60A1 Tank Gun Stabilization System ", ADA007135, 1975.
- [6] Turkat, M. P., Nuttall, C. J., Halay, P. W., " The AMC-71 Mobility Model Summary report ", Appendix A, B, C. ADA766733, 1973.
- [7] Turkat, M. P., Nuttall, C. J., Halay, P. W., " The Amc-74 Mobility Model ", ADA014278, 1975.
- [8] Turkat, M. P., Muttall, C. J., Haley, P. W., " The U. S. Army Mobility Model(AMM~75) ". ADA012653~52, 1975.
- [9] Lessen, A., Ahlvin, R., " Stochastic Vehicle Mobility Forecasts Using the NATO Refer-ence Mobility model ", Report 2 Extension of Procedures and Application to Historic Studies, ADA268797, 1993.
- [10] Saxon, N. L., " Simulation in the Role of Suspension Development. Proceedings of The 1994 SCSC ", pp.280-285, 1994.
- [11] Chung, J. W., " SIMNET M1 Abrams Main Battle Tank Simulation ", Software Description and Documentation, ADA201970, 1987.
- [12] Melzer, K. E., " Analytical Methods and Modeling State-of-The-Art Report ", Journal of terra mechanics, pp.31-53, 1982.
- [13] Wheeler, P., " Tracked Vehicle Ride Dynamics Computer Program ", SAE Paper NO.770048, 1977.
- [14] Chace, M. A., Angell, J. C. " Interaction of Machinery with Friction and Impact Using Dram ", SAE Paper NO.770050, 1977.
- [15] Sheth, P. N., Uicker, J. J., " A Computer-Aided Design Analysis System for Mechanisms and Linkage ", ASME Journal of Engineering Industry, pp.454-464, 1972.

- [16] Orlandea, N. V., " Theory and Application Dynamics on Tracks " , pp.121-166, 1987.
- [17] McCullough, M. K., Haug, E. J., " Dyamics of High Moblility Track Vehicles " , Journal of Mechanisms Transmissions and Automation in Design, pp.189-196, 1986.
- [18] Schiehlen, W., " Multibody System Handbook Springer-Verlag Berlin Heidelberg " , 1990.
- [19] Gear, C. W., " Simultaneous Numerical solution of Differential Algebraic Equations " , IEEE Transactions on Circuit Theory, pp.89-95, 1971.
- [20] Park, T. W., Haug, E. J., " A Hybrid Numerical Integration Method for Machine Dynamic Simulation " , ASME Paper NO.85-DET-59, 1986.
- [21] Wielenga, T. J., " The Effect of Numerical Stiffness on the Simulation of Mechanical Systems " , Mechanical dynamics Inc, Paper MI 48105, 1986.
- [22] Jacobson, R. W., Heimbürger, D. A., " Propulaion System Performance Simulation Computer Simulation to Evaluate Tank-Automotive Engine and Transmissipn Performance " , ADA203264, 1988.
- [23] Guo, K. H., " Statically Analysis of Vehicle Vibration and Dynamic Load and Selection of Suspension Design Parameters ' ' , Report No. UM-MEAN-82-15, 1987.
- [24] Lu, X. P., Li, H. L., Papalambros, P., " A Design Procedure for the Optimization of Vehicle Suspensions " , Vehicle Design, Vol.5, No.1, pp. 129-142, 1984.
- [25] Potter, R. A., Willmert, K. D., " Optimum Design of Vehicle Suspension System " , ASME 73-DET-46, 1985.
- [26] Dahlberg, T., " Comparison of Ride Comfort Criteria Computer Optimization of Vehicles Traveling on Randomly Profiled Roads " , Vehicle System Dynamic, pp. 291-307, 1980.
- [27] Connair, K. M., " Development of a Common Vehicle Model for Chassis Control Design " , SAE Paper No. 990732, 1999.
- [28] 居乃駿, 劉同慶, 陳政, " 運用車輛三維隨機動態系統數學模型和計算機模擬程序 " , 兵工學報, pp.2-9.
- [29] 馮蟻剛, " 戰甲車火控系統整合模組研發與性能評估 " , 國科會研究計畫, 2000.
- [30] 張一屏, 林振昱, " 軍用覆帶車輛懸吊系統設計參數之乘適性最佳化分析研究 " , 陸軍軍官學校七十五週年校慶綜合學術研討會 , pp. 648-657 , 1999.
- [31] 張旭明, 劉慶雄, 王高樑, " 戰甲車動力系統匹配與性能評估之計算模式 " , 第七屆三軍軍官學校基礎學術研討會, pp.971-988 , 2000.
- [32] 侯光煦, " 戰車引擎潤滑油之磨潤實驗研究 " , 陸軍軍官學校七十五週年校慶綜合學術研討會, pp. 618-623 , 1999.
- [33] 宋貴銘, " 戰甲車履帶運動模擬分析 " , 國科會研究計畫, 1998.
- [34] 鈕健, 劉瑞榮, " 戰車火炮穩定系統數學模式之建立及射擊時受承載系統性能影響之分析 " , 中正嶺學報, Vol.20, pp.113-121 , 1992.
- [35] <http://www.qdedu.net/sb/47/w4.htm> [36] <http://fas.org/man/dod-101/sys/land/m2.htm> [37] http://www.armyrecognition.com/europe/Danemark/vehicules_legers/M-113/M-113_Danemark_01.jpg [38] <http://www.costind.gov.cn/n435777/n435943/n435948/n436016/26024.html> [39] http://www.zgjunshi.com/world2/Article_Show.asp?ArticleID=632 [40] <http://www.army-technology.com/projects/patria/> [41] <http://www.army-technology.com/projects/pandurII/> [42] <http://www.army-guide.com/eng/product.php?prodID=2131> [43] http://www.armyrecognition.com/Amerique_du_nord/Etats_Unis/vehicules_a_roues/Stryker/Stryker_Etats-Unis_description.htm [44] <http://www.kitsune.addr.com/Rifts/Rifts-Earth-Vehicles?D=A> [45] <http://homepage3.nifty.com/tompei/Russia.htm> [46] http://www.1ofthefew.com/john_pope.htm [47] <http://www.kitsune.addr.com/Rifts/Rifts-Earth-Vehicles?D=A> [48] 徐正會, 張慶瑞, " 車輛懸吊系統之回顧與分析 "。
- [49] MICHELN, 395/85R20 XML LRG, 2000.
- [50] 居乃鶴, " 裝甲車輛動力學分析與仿真 " , 國防工業, 2002.
- [51] 傅增隸, 電腦輔助工程設計 ADAMS基礎應用手冊。