Development of the Dynamic Model for Infantry Fight Vehicle

周耿民、鄧作樑

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

ABSTRACT

Wheeled infantry fighting vehicle does not have a large contact area with road surface and a lower center of gravity, compared with tracked armored vehicle. Therefore, the stability of wheeled infantry fighting vehicle is inferior against the tracked armored vehicle. Moreover, the recoil force of large-caliber cannon may also affect the stability of vehicle. In order to investigate the dynamic stability of wheeled fighting vehicle in the case of hill driving and cannon firing, the rigid model and hot-point model of single suspension system were created using the ADAMS software. The experimental data of suspension system test platform were used to verify the accuracy of the proposed suspension system model. According to the specification of vehicle body, turret, wheel distance, center of gravity and tire, this study constructs a full-scale vehicle model by using the 3D cartography software and ADAMS. Furthermore, whether wheeled fighting vehicle will induce slip and turnover on a hill driving and cannon firing test was discussed herein. These results and procedures can be applied as a reference for research unit to study the stability design of the wheeled infantry fighting vehicle. Also, the analysis of spring stiffness and damping coefficient of suspension system model provides a valuable basis for analyzing human body comfort and applying to the maintenance stage on the fixed component.

Keywords : Infantry Fight Vehicle ; Suspension System ; Dynamic Simulation

Table of Contents

REFERENCES

[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 Stablilization 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., Heimburger, 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，“ 戰車火砲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] 傅增棣，電腦輔助工程設計—ADAMS基礎應用手冊。