Rader Adaptive Data Association Algorithm And Gating Technique Research

陳世峰、鍾翼能

E-mail: 9019867@mail.dyu.edu.tw

ABSTRACT

Gating technique plays an important role among radar tracking systems. The key developments of this subject are data association techniques and maneuvering target detection algorithm. In the radar system, it usually has more measurement plots than the number of target tracks because of the complicated tracking environment and noise outside. This will cause the false data association and then lead to tracking error. In this thesis, the author intends to combine Data Association Algorithm and Gating techniques to improve the accuracy of tracking multiple maneuvering targets and to avoid the overloarding of tracking system caused by exceeding observation values. Under the circumstances, the radar tracking system will work more effectively. The main structure of the ideas is to change the size of Gating data and reduce the system manipulating time in order to collect the complete data and to modify the track of the maneuvering targets in the shortest period of time so that the forecast errors can be minimized.

Keywords : Gating Technique ; Radar Tracking System

Table of Contents

封面內頁 簽名頁 授權書.....iii 中文摘要.....iv 英文摘要.....v 誌謝.....vi 目錄.....vii 圖目錄.....ix 表目錄.....xi 第一章　緒論.....1 1.1 研究動機.....1 1.2 研究方法.....3 1.3多目標追蹤程序之簡介.....4 1.4論文章節簡介.....5 第二章　濾波器原理.....6 2.1 卡門濾波器基本簡介.....6 2.2 卡門濾波器系統模式.....7 2.3 卡門濾波器之理論推導.....9 2.4 卡門濾波器重要性質探討.....12 2.5擴展型卡門濾波器.....15 第三章　資料相關結何技術與Gating技術.....20 3.1 多目標與資料結合.....20 3.1.1 PDA理論.....21 3.1.2 JPDA理論.....26 3.1.3 Gating理論.....32 3.1.4 資料相關結合.....34 第四章　適應性Gate追蹤程序與變速度理論.....36 4.1前言.....36 4.2 適應性多目標追蹤程序.....36 4.2.1 追蹤起始.....37 4.2.2追蹤互相關係.....38 4.2.3 追蹤更新.....39 4.2.4 軌跡刪除.....40 4.3 數學模式的建立.....41 4.4 1-step Conditional Maximum Likelihood.....44 4.5 變速度追蹤理論.....46 第五章 模擬與分析.....52 5.1變速度單一目標追蹤模擬分析.....52 5.2 追蹤兩平行變速度目標.....59 5.3 追蹤兩交越之變速度目標.....64 第六章　結論.....69 參考文獻.....70

REFERENCES

1. R.A. Singer, ” Estimating Optimal Tracking Filter Performance for Manned Maneuvering Targets, ” IEEE Trans. On Aerosp. and Electron. Syst., Vol. AES-5, pp. 473-483, July 1970. 2. R. A. Singer, and K.W. Behnke, ” Real-Time Tracking Filter Evaluation and Selection for Tactical Applications, ” IEEE Trans. on Aerosp. and Electron. Sys., Vol. AES-7, No.1, pp. 100-110, March 1970. 3. Bar-Shalom, Y. , ” Tracking Methods in a Multi-Target Environment, ” IEEE Trans. Automa. Contr. , Vol., AC-23, pp. 618-626, Aug.1978. 4. Reid, D. B., “ An Algorithm for Tracking Multiple Targets, ” IEEE Trans. Automa. Contr., Vol. AC-24, pp. 843-854, Dec. 1979. 5. B.D.O. Anderson , and J.B. Moore, ” Optimal Filtering, ” Pretice Hall Inc., 1979. 6. Y. Bar-Shalom and T. Edsion, “ Sonar Tracking of Multiple Targets Using Joint Probabilistic Data Association, ” IEEE Journal of Oceaning Engineering, Vol. OE-8, No.3, 1983. 7. Hovanessian, S. A., “ Radar System Design and Analysis, “ Artech House, Inc., 1984. 8. A.Farine, and F. A. Studer, “ Radar Data Processing, ” Research Studies Press Ltd., 1985. 9. Chang, K. C., Chong, C.Y., and Bar-Shalom, Y., “ Joint Probabilistic Data Association in Distributed Sensor Networks, ” IEEE Trans. Automa. Contr., Vol. AC-31, pp. 889-897, Oct. 1986. 10. Y. Bar-Shalom, and T.E. Formann, “ Tracking and Data Association, ” Artech House,1988. 11. E. Emre, and J. Seo, ” A Unifying Approach to Multi-Target Tracking , ” IEEE. Trans. Aerosp. Electron. Syst., Vol. AES-25, pp. 520-528, 1989. 12. Y.N. Chung, D.L. Gustafson, and E. Emre, “ Extended Solution to Multiple Maneuvering Target Tracking, ” IEEE Trans. Aerosp. Electron. Syst. Vol.

AES-25, pp.876-887,1990. 13. S. Haykin, “ Adaptive Filter Theory, ” Prentice-Hall Inc.1991. 14. Byron, Eddle., “ Radar Principles, Technology, Applications, ” Prentice-Hall Inc. 1993. 15. R.L.Popp,K.R.Pattipati,Y.Bar-Shalom&M.Ysddanapudi , "Parallelization of a Multiple Tracking Algorithm with Superlinear Speedups,"IEEE Trans. Aerosp. Electron. Syst. Vol AES-33 , pp.281-290,1997.3 16. S-T.Park&J.G.Lee, ” Design of a Practical Tracking Algorithm with Radar Measurements, ” IEEE Trans. Aerosp. Electron. Syst. Vol AES-34,pp.1337-1345,1998. 17. E.Mazor,J Dayan,A.Averbuch &Y.Bar-Shalom, ” Interacting Multiple Model Methods in Target Tracking: A Survey, ” IEEE Trans.Aerosp.Electron. Syst. Vol AES-34,pp.103-124,1998. 18.Anderson, B.D.O and J.B. Moore, Optimal filtering, Prentice-Hall, Englewood Cliffs, NJ(1979). 19.Bar-Shalom, Y. and T.E. Fortmann, Tracking and Data Association Press, San Diego, CA(1988). 20.Blackman, S.S., Multi-Target Tracking with Radar Applications, Artech-House, Norwood, MA(1986). 21.Chang, K.C. and Y. Bar-Shalom, “ Joint Probabilistic Data Association for Multi-target Tracking with possibly Unresolved Measurements and Maneuvers, “ IEEE Trans.Automat. Contr., Vol. AC-29, No.7 pp. 585-594 (1984). 22.Chang, C.B. and J.A. Tabaczynki, “ Application of State Estimation to Target Tracking, ” IEEE Trans. Automat. Contr., Vol. AC-29, pp. 98-109 (1984). 23.Chung, Y. N., D.L.Gustafson and E.Emre, “ Extended Solution to Multiple Maneuvering Target Tracking, ” IEEE Trans. Aerosp. Electron. Syst., Vol. 26,No. 5, pp. 876-887 (1990). 24.Farian, A. and F.A. Studer, Radar Data Processing, Vol. 1-Introduction and Tracking,Research Studies Press, England (1985). 25.Lin, C.F., Modern Navigation Guidance, and Control Processing, Prentice-Hall,Englawood Cliffs, NJ (1991). 26.Roecker, J.A. and C.D. McGillem, “ Target Tracking in Maneuver Centered Coordinates, “ IEEE Trans. Aerosp. Electron. Syst., Vol. 25, No.6 pp. 836-843 (1989).