

雷達適應性與穩定性分析

李樹旺、鍾翼能

E-mail: 9605021@mail.dyu.edu.tw

摘要

雷達追蹤系統變速度偵測技術必須詳加考慮，不然系統將產生巨大的誤差，甚至無法完成追蹤任務。本論文提出一種適應性偵測器，來做多重變速移動式目標追蹤，以結合不同位置的動態偵測器資料，此演算法運用一個適應性的濾波器與資料融合技術，改善追蹤上的問題，進而產生一個總體的估測值。此外本論文亦加入適應性程序進行適應性及穩定性分析。模擬結果顯示本論文之演算法則將使追蹤系統獲得更精確的追蹤結果，並驗證此追蹤系統的效率確有提升，電腦模擬結果顯示，此法可以成功而精確地追蹤多重目標。

關鍵詞：變速度偵測；適應性濾波器；適應性及穩定性分析

目錄

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.....	x	第一章 緒論	
1.1 簡介.....	1	1.2 雷達應用.....	1	1.3 研究背景及目的.....	2	1.4 研究方法.....	3
1.5 論文架構.....	4	第二章 系統模型定義		2.1 前言.....	5	2.2 系統模式定義.....	6
2.3 卡門濾波器.....	7	2.4 擴展式卡門濾波器.....	10	第三章 追蹤架構及資料相關結合技術		3.1 前言.....	13
3.2 資料相關結合技術.....	14	第四章 雷達適應性與穩定性分析		4.1 前言.....	22	4.2 適應性理論.....	22
第五章 電腦模擬結果與分析		5.1 前言.....	27	5.2 模擬分析.....	27	第六章 結論.....	44
參考文獻.....	45	圖目錄		圖2.1 多目標追蹤系統的工作流程圖.....	5	圖2.2 卡門濾波器示意圖.....	8
圖3.1 適應性多目標追蹤理論流程圖.....	13	圖3.2 目標追蹤幾何圖.....	15	圖5.1 (a) 演算法一之雙目標追蹤圖 (T=1s).....	32	圖5.1 (b) 演算法二之雙目標追蹤圖 (T=1s).....	32
圖5.1 (c) 雙目標位置與速度誤差圖 (T=1s).....	33	圖5.2 (a) 演算法一之四目標追蹤圖 (T=1s).....	34	圖5.2 (b) 演算法二之四目標追蹤圖 (T=1s).....	34	圖5.2 (c) 四目標位置與速度誤差圖 (T=1s).....	35
圖5.3 (a) 演算法一之六目標追蹤圖 (T=1s).....	36	圖5.3 (b) 演算法二之六目標追蹤圖 (T=1s).....	36	圖5.3 (c) 六目標位置與速度誤差圖 (T=1s).....	37	圖5.4 (a) 演算法一之雙目標追蹤圖 (T=2s).....	38
圖5.4 (b) 演算法二之雙目標追蹤圖 (T=2s).....	38	圖5.4 (c) 雙目標位置與速度誤差圖 (T=2s).....	39	圖5.5 (a) 演算法一之四目標追蹤圖 (T=2s).....	40	圖5.5 (b) 演算法二之四目標追蹤圖 (T=2s).....	40
圖5.5 (c) 四目標位置與速度誤差圖 (T=2s).....	41	圖5.6 (a) 演算法一之六目標追蹤圖 (T=2s).....	42	圖5.6 (b) 演算法二之六目標追蹤圖 (T=2s).....	42	圖5.6 (c) 六目標位置與速度誤差圖 (T=2s).....	43
表目錄		表5.1 目標追蹤之目標初始狀態.....	28	表5.2 二目標追蹤模擬結果 (T=1s).....	28	表5.3 四目標追蹤模擬結果 (T=1s).....	29
表5.4 六目標追蹤模擬結果 (T=1s).....	29	表5.5 二目標追蹤模擬結果 (T=2s).....	30	表5.6 四目標追蹤模擬結果 (T=2s).....	30	表5.7 六目標追蹤模擬結果 (T=2s).....	31

參考文獻

- [1] K.C. Chang, C.Y. Chong, and Y. Bar-Shalom, "Joint Probabilistic Data and Association Distributed Sensor Networks," IEEE Trans. Auto-ma.Contr., Vol. AC-31, pp.889-897, Oct .1986.
- [2] Y. Bar-Shalom and T. Edison, "Sonar Tracking of Multiple Targets Using Joint Probabilistic Data Association," IEEE Journal of Oceaning Engineering, Vol. OE-8, No 3 July 1983.
- [3] Y. Bar-Shalom and T.E. Fortmann, "Tracking and Data Association," Academic Press, INC. 1989.
- [4] K. Mehrotra & P.R.Mahapatra, "A Jerk Model for Tracking Highly Maneuvering Targets," IEEE Trans. Aerosp. Electron. Syst., Vol AES-33, pp.1094-1106, 1997.
- [5] H.Lee & I-J Tahk, "Generalized Input-Estimation Technique for Tracking Maneuvering Targets," IEEE Trans. Aerosp. Electron. Syst. Vol AES-35, pp.1388-1403, 1999.
- [6] M. R. Morelande & S. Challa, "Manoeuvring Target Tracking in Clutter using Particle Filters," IEEE Trans. Aerosp. Electron. Syst., Vol AES-41, pp.252-270, 2005.

- [7] E. Emre, and J. Seo, "A Unifying Approach to Multi-Target Tracking," IEEE Trans. Aerosp. Electron. Syst., Vol AES-25, pp.520-528, 1989.
- [8] A. Howard & H. Seraji, "Multi-Sensor Terrain Classification for Safe Spacecraft Landing," IEEE Trans. Aerosp. Electron. Syst. Vol.40, No.4, pp.1122-1131, 2004.
- [9] R.E.Bethel & G.J.Paras, "A PDF Multisensor Multitarget Tracker," IEEE Trans. Aerosp. Electron. Syst. Vol AES-34, pp.153-169, 1998.
- [10] K.A.Fisher & P.S.Maybeck, "Multiple Adaptive Estimation with Filter Spawning," IEEE Trans. Aerosp. Electron. Syst. Vol.38, No.3, pp.755-768, 2002.
- [11] M. Kalandros & L. Y. Pao, "Multisensor Covariance Control Strategies for Reducing Bias Effects in Interacting Target Scenarios," IEEE Trans. Aerosp. Electron. Syst., Vol AES-41, pp.153-172, 2005.
- [12] R.E Lefferts, "Adaptive Correlation Regions for Alpha-Beta Tracking Filters", IEEE Trans. Aerosp. Electron. System, Vol.AES-17, pp.738-747, Nov. 1981.
- [13] P. Swerling, "Radar Probability of Detection for Some Additional Fluctuating Target Cases", IEEE Trans. Aerosp. Electron. Syst. Vol AES-33, pp.698-709, 1997.
- [14] P.D. Hanlon and P.S. Maybeck, "Interrelationship of Single-Filter and Multiple-Model Adaptive Algorithms", IEEE Trans. Aerosp. Electron. Syst. Vol. AES-34, pp.934-946, 1998.
- [15] E. Conte, M. Lops, and G. Ricci, "Adaptive Detection Schemes in Compound-Gaussian Clutter", IEEE Trans. Aerosp. Electron. Syst. Vol. AES-34, pp.1058-1069, 1998.
- [16] 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.
- [17] D. J. Kershaw & R. J. Evans, "Waveform Selective Probabilistic Data Association", IEEE Trans. Aerosp. Electron. Syst. Vol AES-33, pp.1180-1189, 1997.
- [18] P. D. Hanlon & P. S. Maybeck, "Interrelationship of Single-Filter and Multiple-Model Adaptive Algorithms", IEEE Trans. Aerosp. Electron. Syst. Vol AES-34, pp.934-947, 1998.
- [19] 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.
- [20] 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.
- [21] R. E. Bethel & G. J. Paras, "A PDF Multisensor Multitarget Tracker", IEEE Trans. Aerosp. Electron. Syst. Vol AES-34, pp.153-169, 1998.
- [22] H. Lee & I-J Tahk, "Generalized Input-Estimation Technique for Tracking Maneuvering Targets", IEEE Trans. Aerosp. Electron. Syst. Vol AES-35, pp.1388-1403, 1999.
- [23] Magarini, M. and Spalvieri, A., "Optimization of decentralized quantizers in rate constrained data fusion systems", Geoscience and Remote Sensing Symposium, 2000. Proceedings. IGARSS 2000. IEEE 2000 International, Volume: 3, 24-28 July 2000.
- [24] Koval, V., "The competitive sensor fusion algorithm for multi sensorsystems", Intelligent Data Acquisition and Advanced Computing Systems: Technology and Applications, International Workshop on, 2001., 1-4 July 2001.
- [25] Vershinin, Y.A. and West, M.J., "A new data fusion algorithm based on the continuous-time decentralized Kalman filter", Target Tracking: Algorithms and Applications (Ref. No. 2001/174), IEE, Volume: 1, 16-17 Oct. 2001.
- [26] Jae-Jun Kim and Singh, T. and Llinas, J., "Large scale simulation of a distributed target tracking system", Information Fusion, 2002. Proceedings of the Fifth International Conference on, Volume: 1, 8-11 July 2002.
- [27] K. A. Fisher & P. S. Maybeck, "Multiple Adaptive Estimation with Filter Spawning", IEEE Trans. Aerosp. Electron. Syst. Vol. 38, No.3, pp.755-768, 2002.
- [28] N. Okello & B. Ristic, "Maximum Likelihood Registration for Multiple Dissimilar Sensors", IEEE Trans. Aerosp. Electron. Syst. Vol. 39, No.3, pp.1074-1083, 2003.
- [29] Chamberland, J.-F. and Veeravalli, V.V., "Decentralized detection in sensor networks", Signal Processing, IEEE Transactions on [see also Acoustics, Speech, and Signal Processing, IEEE Transactions on], Volume: 51, Issue: 2, Feb. 2003.
- [30] Khawsuk, W. and Pao, L.Y., "Decorrelated state estimation for distributed tracking using multiple sensors in cluttered environments", American Control Conference., 2003. Proceedings of the 2003, Volume: 4, June 4-6, 2003.
- [31] Huimin Chen and Kirubarajan, T. and Bar-Shalom, Y., "Performance limits of track-to-track fusion versus centralized estimation: theory and application [sensor fusion]", Aerospace and Electronic Systems, IEEE Transactions on, Volume: 39, Issue: 2, April 2003.
- [32] Chang K.C., and Chong C.Y., and Bar-Shalom Y. "Joint Probabilistic Data and Association Distributed Sensor Networks," IEEE Trans. Automa. Contr. Vol. AC-31, (Oct. 1986), pp.889-897, 1989 [33] Bar-Shalom Y., and Fortmann T.E. "Tracking and Data Association," Academic Press, Inc., 1989.
- [34] Blackman S.S. "Multiple Hypothesis Tracking for Multiple Target Tracking," IEEE Aerosp. Electron. Syst. Magazine., Vol.19, (Jan. 2004), pp5-18, 2004.

[35] Hue C., and Le Cadre J.P., and Perez P. " Sequential Monte Carlo methods for multiple target tracking and data fusion, " IEEE Trans. On Signal Processing, Vol. 50, (Feb. 2002), pp309-325, 2002.