THE RESEARCH OF RADAR ADAPTIVE SAMPLING RATE FOR TRACKING SYSTEMS

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ABSTRACT

IN ORDER TO SOLVE TARGET-MANEUVERING PROBLEMS, AN IMPROVED TRACKING ALGORITHM HAS BEEN DEVELOPED IN THIS THESIS. IN TRACKING SYSTEM, IF THE SAMPLING RATE OF SYSTEM IS TOO FAST THEN THE OPERATION QUANTITY OF SYSTEM WILL BE BIGGER. HOWEVER, IF THE SAMPLING RATE OF SYSTEM IS TOO SLOW THEN THE TRACKING ERROR WILL BE BIGGER. SO WE WANT TO CREATE A TRACKING ALGORITHM TO REDUCE THE OPERATION QUANTITY OF SYSTEM WHILE KEEP A LOW TRACKING ERRORS. THE MAJOR FRAME OF THIS THESIS CONTAINS AN ADAPTIVE SAMPLING RATE TRACKING ALGORITHM, ADAPTIVE EXTENDED KALMAN FILTER AND TO UTILIZE A DATA ASSOCIATION TECHNIQUE DENOTED 1-STEP CONDITIONAL MAXIMUM LIKELIHOOD. VIA THIS APPROACH, TARGET-MANEUVERING PRODUCTIVE GREAT ERRORS CAN BE DECREASED AND THE TRACKING SYSTEM WILL OBTAIN BETTER PERFORMANCE. MOREOVER, IN ORDER TO VERIFY THE APPROACH OF THIS THESIS IS REALLY IMPROVED. WE DETAIL TO ANALYZE AND TO COMPARE WITH THREE TYPES OF SIMULATIONS OF TRACKING ALGORITHM AND TO HYPOTHESIS MANY DIFFERENT TARGET TRACK SITUATIONS. WE CONVINCE THAT THE PROPOSED APPROACH WILL ENHANCE THE RADAR TRACKING PERFORMANCE AND OBTAIN BETTER TRACKING RESULTS.

Keywords: ADAPTIVE SAMPLING RATE TRACKING ALGORITHM, EXTENDED KALMAN FILTER, MANEUVERING.

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REFERENCES

1   K.C. CHANG, C.Y. CHONG, AND Y. BAR-SHALOM, "JOINT PROBABILISTIC DATAAND ASSOCIATION DISTRIBUTED SENSOR NETWORKS" IEEE TRANS. AUTOMA. CONTR., VOL. AC-31, P.P.889- 897, 1986.   2   K.C. CHANG AND Y. BAR-SHALOM, "JOINT PROBABILISTIC FOR MUTI-TARGET TRACKING WITH POS -SIBLY UNRESOLVED MEASUREMENT AND MANEUVERS," IEEE TRANS. AUTOMA. CONTR., VOL. AC-29 , P.P 585-594, 1984.   3   K.C. CHANG AND Y. BAR-SHALOM, "DISTRIBUTED ADAPTIVE ESTIMATION WITH PROBABILISTIC DA -TA ASSOCIATION," IEEE TRANS. AUTOMA. CONTR., VOL. AC-25, P.P 359-369, 1989.   4   R.E LEFFERTS, "ADAPTIVE CORRELATION REGIONS FOR ALPHA-BETA TRACKING FILTERS," IEEE TRANS. AREOSP. ELECTRON. SYSTEM, VOL. AES-17, P.P.738-747, 1981.   5   C.B. CHANG AND J.A. TABACZYNSKI, "APPLICATION OF STATE ESTIMATION TO TARGET TRACKI -NG," IEEE TRANS.VOL.AC-29, NO 2, P.P.98-109, 1984.   6   H. GISH, MUCCI AND RONALD, "TARGET STATE ESTIMATION IN A MULTITARGET ENVIRONMENT USI -NG MULTIPLE SENSORS," IEEE TRANS. AEROSPACE. ELECTRON. SYST., VOL. AES-23, P.P.60- 72, 1987.   7   E. EMRE AND J. SEO, "A UNIFYING APPROACH TO MULTI-TARGET TRACKING," IEEE TRANS. AERO -SP. ELECTRON. SYST., VOL AES-25, P.P.520-528, 1989.   8   Y.N. CHUNG AND D.L. GUSTAFSON , AND E. EMRE, "EXTENDED

SOLUTION TO MULTIPLE MANEUVER -ING TARGET TRACKING," IEEE TRANS. AEROSP ELECTRON. SYST.VOL AES-25, P.P.876-887, 1990.   9   Y.N. CHUNG AND Y.N. HU, "A DECENTRALIZED ESTIMATION APPROACH FOR TARGET TRACKING PRO -BLEMS," TO APPEAR IN JOURNAL OF CONTROL SYSTEMS AND TECHNOLOGY, VOL. 1, NO.4, P.P.303-310, 1993.   10   Y.N. CHUNG AND JOY CHEN, "APPLYING BOTH KINEMATIC AND ATTRIBUTE INFORMATION FOR A TA -RGET TRACKING ALGORITHM," J. OF CONTROL SYST. AND TECHNOLOGY, VOL.5, NO.3, P.P.203- 209, 1997.   11   S. BLACKMAN, "MULTIPLE TARGET TRACKING WITH RADAR APPLICATIONS," ARTECH HOUSE, 1986.   12   B. EDDE, "RADAR PRINCIPLES, TECHNOLOGY, AND APPLICATION," PRENTICE-HALL INC., 1993.   13   S. HAYKIN, "ADAPTIVE FILTER THEORY," PRENTICE-HALL INC., 1991.   14   Y. BAR-SHALOM AND X. RONG-LI, "ESTIMATION AND TRACKING PRINCIPLES, TECHNIQUES AND SO -FTWARE," ARTECH HOUSE, 1993.   15   M. GREWAL AND A. ANDEREWS, "KALMAN FILTER THEORY AND PRACTICE," PRENTICE HALL, 1993.   16   G. VAN KEUK, "SOFTWARE STRUCTURE AND SAMPLING STRATEGY FOR AUTOMATIC TARGET TRACKING WITH A PHASE ARRAY RADAR," AGARD CONF., PROC. NO. 252, STRATEGIES FOR AUTOMATIC TRAC -K INITIATION, MONTEREY CA., P.P.11-1 TO 11-13, 1978.   17   P.W. SARUNIC, "ADAPTIVE VARIABLE UPDATE RATE TARGET TRACKING FOR A PHASED ARRAY RADA -R," IEEE INTERNATIONAL RADAR CONF., PP.317-322, 1995.   18   M. EFE AND D.P. ATHERTON, "MANEUVERING TARGETS TRACKING USING ADAPTIVE TURN RATE MOD -ELS IN THE INTERACTING MULTIPLE MODEL," 35TH IEEE CONF. ON DECISION AND CONTROL, P. P. 3151- 3156, 1996.   19   K. MEHROTRA AND P.R. MAHAPATRA, "A JERK MODEL FOR TRACKING HIGHLY MANEUVERING TARGE -TS," IEEE TRANS. AEROSP. ELECTRON. SYST. VOL. AES-33, P.P.1094-1106, 1997.   20   N. SHOHEI, M. TAKANOBU AND S. YUSUKE, "KALMAN FILTER WITH TIME-VARIABLE GAIN FOR MUL -TISENSOR FUSION SYSTEM," 1999 IEEE CONF. ON MULTISENSOR FUSION AND INTEGRATION FOR INTELLIGENT SYSTEMS, P.P.56-63, 1999.   21   E. MAZOR, J. DAYAN, A. AVERBUCH AND Y. BAR-SHALOM, "INTERACTING MULTIPLE MODEL METH -ODS IN TARGET TRACKING A SURVEY," IEEE TRANS. AEROSP. ELECTRON. SYST. VOL AES-34, P.P.103-124, 1998.   22   S-T. PARK AND J.G. LEE, "DESIGN OF A PRACTICAL TRACKING ALGORITHM WITH RADAR MEASUR -EMENTS," IEEE TRANS. AEROSP. ELECTRON. SYST. VOL AES-34, P.P.1337-1345, 1998.   23   H.LEE AND I-J TAHK, "GENERALIZED INPUT-ESTIMATION TECHNIQUE FOR TRACKING MANEUVERING TARGETS," IEEE TRANS. AEROSP.ELECTRON. SYST. VOL AES-35, P.P.1388-1403, 1999.   24   F. GINI, M.V. GRECO, M. DIANI AND L.VERRAZZANI, "PERFORMANCE ANALYSIS OF ADAPTIVE RADAR DETECTOR AGAINST NON-GAUSSION REAL SEA CLUTTER DATA," IEEE TRANS. AEROSP. ELE -CTRON. SYST. VOL. AES-36, P.P.1429-1438, 2000.   25   Y.N. CHUNG, C.C. YU AND T.W. HUANG, "AN ADAPTIVE ALGORITHM FOR RADAR TRACKING SYSTE -MS," 4TH PACIFIC INTERNATIONAL CONF. ON AEROSPACE SCIENCE AND TECHNOLOGY, P.P.207- 211, 2001.