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Effectiveness of the Extended Kalman Filter Through Difference Equations

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Abstract: The extended Kalman filter is extensively used in the nonlinear state estimation systems. As long as the system characteristics are correctly known, the extended Kalman filter gives the best performance. However, when the system information is partially known or incorrect, the extended Kalman filter (EKF) may diverge or give the biased estimates. To overcome this problem we introduced the new Riccati difference equation (RDE) which is used to study and examine the performance analysis of extended Kalman filter. We consider the special case of tracking a target with cluster, but with a probability arrival of small value. Finally the convergence analysis and stabilizing solution of Riccati difference equations arising from the standard extended Kalman filter is studied. Simulations results for convergence of EKF for the class of nonlinear filters are done through MATLAB.

Keywords: *convergence; extended Kalman filter; Riccati difference equations; feasibility and stabilizing solution.*

Mathematics Subject Classification (2010): 39A10, 39A30, 39A60, 39B82, 39B99.

1 Introduction

Several recent papers have been devoted to a study of nonlinear Riccati difference equations. The family of Kalman filters have been applied for state as well as parameter estimation for numerous linear as well as nonlinear systems. Though the standard Kalman filter is considered in an optimal estimator (in case of linear systems) with Gaussian noise characters, its nonlinear (extended Kalman filter) suboptimal counterpart is known to diverge under the influences of severe nonlinearities and uncertainties [4,7]. As a solution to this problem robust form of the EKF have been formulated for a wide class of uncertainities [13] in the form of new RDE.

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