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HIGH MANEUVERING TARGET TRACKING USING A NOVEL HYBRID KALMAN FILTER-FUZZY LOGIC ARCHITECTURE

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Abstract. *In this paper, a fast target maneuver detection technique and high accurate tracking scheme is proposed with the use of a new hybrid Kalman filter-fuzzy logic architecture. Due to the stressful environment of target tracking problem such as inaccurate detection and target maneuver, most of existing trackers do not represent desired performance in different situations. In practice, while the conventional Kalman filters (KF) perform well in tracking a target with constant velocity, their performance may be seriously degraded in the presence of maneuver. To reach an accurate target tracking system in such a stressful environment, fuzzy logic-based algorithms with intelligent adaptation capabilities have recently been issued. Although these methods yield reasonable performance in tracking maneuvering targets, their accuracy in non-maneuvering mode was not satisfactory. In this research, based on information about the target maneuver dynamics, a new hybrid tracker (HT) is introduced. The proposed algorithm combines two methodologies into one architecture synergistically. In other words, the KF is used when the target velocity is approximately constant, whereas fuzzy estimator is used when the target maneuvers. Simulation results show that the proposed method is superior to some conventional approaches in tracking accuracy.*

Keywords: High maneuver target tracking, Kalman filter, Fuzzy logic, Hybrid tracker

1. **Introduction.** Tracking maneuvering targets is required in a wide range of civilian applications such as intelligent transportation system, air traffic control and surveillance. Therefore, researchers have concerned about this issue during the past several decades and introduced many different tracking filters. However, there are still many challenges that make this issue difficult.

The linear Kalman filter (KF) has been widely used in tracking problem but its performance may fatally degrade in the presence of maneuver [1,2]. To be more precise, a short-term maneuver may lead to a bias in the estimation sequence. To cope with unknown target maneuvers, Input Estimation (IE) techniques have been introduced. The first IE approach was proposed by Chan, et al. [3]. IE techniques consist of three steps; input estimation, maneuver detection and state estimate correction. To clarify, in this approach, the standard KF is used merely during periods of no maneuver movement. When