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A MIXED KALMAN/H-INFINITY FILTERING APPROACH FOR AUGMENTED PROPORTIONAL NAVIGATION GUIDANCE

Abstract

The Augmented Proportional Navigation Guidance (APNG) approach is widely used for autonomous terminal-phase guidance in space missions, maneuvering targets interceptions and robotic operations. The aim of this paper is to present an alternative filtering method for the APNG. There are two particular aspects analyzed in the proposed approach. The first one is to use a model with *state-dependent noise* for the filter design. This is motivated by the fact that some of the measurements used for filtering are corrupted both with additive and multiplicative white noises (for instance the range between the interceptor and the target). The second particularity is the design of a *mixed Kalman/H-infinity* filter corresponding to the class of models with state-dependent noise considered for the APNG problem. The reason of imposing a certain H-infinity norm level of attenuation for the state estimation error is the requirement of accurate knowledge of the noises statistics in the case of Kalman filtering. Moreover, the proposed mixed Kalman/H-infinity filter provides good filtering performance in the situations when the unknown target maneuvers are generated either by stochastic or by deterministic exogenous inputs. The paper is organized as follows: after an introductory section, the model with state-dependent noise for the APNG problem is presented in the second section of the paper. In the third section, the mixed Kalman/H-infinity filtering problem is formulated and solved. It is shown that the gain of the mixed Kalman/H-infinity filter depends on the solutions of a specific system of filtering Riccati and Lyapunov-type equations. In the absence of the multiplicative noise and of the H-infinity norm constraint these results simply reduce to the classical Kalman filter. Numerical simulations are presented and comparatively analyzed in the fourth section. The paper ends with some final remarks and future developments.