Robust Measurement Planning for Satellite Relative Navigation

This paper introduces a robust measurement scheduling strategy for linear time-varying systems with zero-mean white process and measurement noises. Relying on previous works, the measurement strategy consists of choosing the timing and the measurement noise intensity profile such as to minimize under an integral constraint an upper-bound of the estimation error covariance matrix in a Kalman filter. The measurement strategy is applied against a process noise intensity profile designed to maximize that upper bound under a similar integral constraint. The problem is solved iteratively and is presented here for the case of a scalar process noise intensity. The result is a sequence of (few) epoch times at which measurements should be acquired, along with the optimized accuracy levels, and a sequence of (few) epoch times and intensities, at which the process noise should be active. The proposed planning is valuable in providing guaranteed performances under uncertainty on the process noise intensity. The proposed robust measurement planning methodology is applied to a relative navigation problem for two low Earth orbit satellites flying in formation and equipped with laser ranging capabilities.