Design of Kalman filters for mobile robots - DTU Orbit (11/08/2019)

Design of Kalman filters for mobile robots: Evaluation of the kinematic and odometric approach

Kalman filters have for a long time been widely used on mobile robots as a location estimator. Many different Kalman filter designs have been proposed, using models of various complexity. In this paper, two different design methods are evaluated and compared. Focus is put on the common setup where the mobile robot is equipped with a dual encoder system supported by some additional absolute measurements. A common filter type for this setup is the odometric filter, where readings from the odometry system on the robot are used together with the geometry of the robot movement as a model of the robot. If additional kinematic assumptions are made, for instance regarding the velocity of the robot, an augmented model can be used instead. This kinematic filter has some advantages when used intelligently, and it is shown how this type of filter can be used to suppress noise on encoder readings and velocity estimates. The Kalman filter normally consists of a time update followed by one or more data updates. However, it is shown that when using the kinematic filter, the encoder measurements should be fused prior to the time update for better performance.

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