Abstract

The problem of state estimation of the mobile robot’s trajectory being a nonlinear one, the intent of my thesis is to go beyond the realm of the basic Extended Kalman Filter (EKF) and study the more recent nonlinear Kalman Filters for their application to the problem at hand. The various filters that I employ in this study are:

- Extended Kalman Filter (EKF)
- Iterated Extended Kalman Filter (IEKF)
- Unscented Kalman Filter (UKF) and its various forms and alternate editions

The UKF is proven to be a better filter in terms of accuracy for the nonlinear cases such as inertial navigation systems, but this thesis tests it out on the system dynamics of the Mobile Robot. The results that are obtained are quite contrasting to the otherwise belief that the UKF should give better accuracy.

The study also provides a comparison of the computational costs involved in each of the filters above. Pre-established numerically efficient and stable techniques to lower the computational costs of the UKF are employed and their performance in accuracy and computational time is documented.