

H_{∞} Filter with Fuzzy Logic Estimation: An Analysis to Refrain Finite Escape Time (FET)



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Abstract Aiming to refrain the present of Finite Escape Time (FET) issue in H_{∞} Filter (HF) during mobile robot observations, a new approach based on H_{∞} Filter with fuzzy logic (FHF) based on mobile robot localization and mapping are proposed in this paper. Over pass decade, the famous Extended Kalman Filter (EKF) are aggressively use in mobile robot observation, however its capabilities are limited to Gaussian noise only. Despite to this limitation, the H_{∞} Filter is choose and offer better solution. However, the shortcoming of Finite Escape Time may limit the H_{∞} Filter estimation capabilities. Finite Escape Time issue may lead to inaccurate estimation result. Hence, in order to guarantee no Finite Escape Time, a new H_{∞} Filter with Fuzzy Logic is developed by using fuzzy logic approach. The design focusses on adding a fuzzy logic rules and fuzzy set in the H_{∞} Filter innovation stage. The fuzzy logic membership will focus on trapezoid membership. The analysis on H_{∞} Filter is done in two stage, which are without and with implementation of fuzzy logic. The simulation result convinces that fuzzy logic effectively capable in reducing the Finite Escape Time and simultaneously improve the estimation between mobile robot and landmarks.

Keywords Mobile robot · H_{∞} filter · Fuzzy logic · Finite escape time (FET)

1 Introduction

The development of mobile robot in navigation system has attracted increasing attention among researcher for decades in wide broad application prospect. They attempt to build an autonomous mobile robot which capable to discover and identify an unknown surrounding. This knowledge about the position and orientation of the mobile

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