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论文

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基于SVD 的改进抗差UKF 算法及在组合导航中的应用

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SVD aided improved robust UKF algorithm and its application for integration navigation

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摘要

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摘要

针对GPS/INS 组合导航中因观测异常导致系统状态先验信息矩阵失去对称正定性, 及传统等价权函数抗差算法易遇到病态矩阵, 引起滤波性能下降的问题, 提出一种基于奇异值分解的改进抗差UKF 算法。该算法克服了先验协方差矩阵负定性变化, 通过判断矩阵病态性实现智能选取抗差策略。最后利用车载实测数据进行验证, 所得结果表明, SVD-UKF 导航解精度稍优于EKF 算法, 改进的抗差策略能够极大减弱单独、连续以及混合的观测异常对导航解的影响, 提高了导航解精度和可靠性。

关键词 : GPS/INS 组合导航, 无迹卡尔曼滤波, 改进抗差策略, 奇异值分解

Abstract :

Aiming at the priori estimated covariance of states turns into a non-positive definite matrix resulted from anomalies of observation, and the equivalent weight function in robust estimation can suffer from the ill-conditioned matrix in unscented Kalman filter(UKF), which leads to the accuracy decrease of the filter performance. A singular value decomposition(SVD) aided improved robust UKF algorithm for integration navigation is proposed, which solves the non-positive definite matrix for unscented transformation. The improved robust algorithm takes different strategy by judging the ill-condition matrix. Finally, field data on the vehicle are collected to verify the algorithm. The results show that, the performance of SVD-UKF navigation solution is slightly superior to the EKF algorithm. The improved robust algorithm can greatly weaken the influence of separate, continuous and hybrid observation anomalies for enhancing the reliability and accuracy of navigation solutions.

Key words : GPS/INS integrated navigation unscented Kalman filter improved robust algorithm singular value decomposition

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