航空学报
ACTA AERONAUTICA ET ASTRONAUTICA SINICA
ISSN 1000-6893
CN 11-1929/V

航空学报 » 1996, Vol. 17 » Issue (1) :42-50 DOI:

航天器相对运动估计的一种并行推广卡尔曼滤波方法

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A PARALLEL EXTENDED KALMAN FILTER FOR SPACECRAFT RELATIVE MOTION ESTIMATION

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摘要 从并行的观点出发，研究应用推广卡尔曼滤波估计航天器交会对接寻的期相对位置和速率问题。推导出交会推广卡尔曼滤波公式；提出了基于奇异值分解（ＳＶＤ）和Ｆａｄｄｅｖ算法的并行平方根算法；给出了其脉动阵列（Ｓｙｓｔｏｌｉｃ）实现结构；并对阵列所需的处理单元数目和执行一次迭代所需的时间步进行了分析，说明了其实现的优越性。为航天器相对运动估计提供了一种新的有效方法

关键词： 交会对接 卡尔曼滤波器 脉动阵列

Abstract： A method of estimating the relative position and rate between a passive spacecraft and a target spacecraft during the home phase of a typical rendezvous and docking mission using a parallel extended Kalman filter (EKF) is proposed. The paper discusses the formulation of EKF for the problem. The proposed parallel square-root algorithm is designed based on the updated singular value decomposition and the Faddeev algorithm. A new systolic array acrchitecture is developed for its implementation. This architecture is more numerically stable than other square-root algorithms, and has higher efficiency and uses fewer time steps for a complete iteration.

Keywords： rendezvous-docking Kalman filters systolic array

Received 1993-11-25; published 1996-02-25

引用本文:

陈根社;文传源;陈新海. 航天器相对运动估计的一种并行推广卡尔曼滤波方法[J]. 航空学报, 1996, 17(1): 42-50.

Chen Genshe;Wen Chuanyuan;Chen Xinhai. A PARALLEL EXTENDED KALMAN FILTER FOR SPACECRAFT RELATIVE MOTION ESTIMATION[J]. Acta Aeronautica et Astronautica Sinica, 1996, 17(1): 42-50.