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论文

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绕月探测器的自主光学导航研究

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Autonomous Optical Navigation for Spacecraft Around Moon

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摘要

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摘要 提出了一种利用高斯-马尔科夫过程和Unscented卡尔曼滤波的绕月探测器自主光学导航算法。针对很难事先确定精确地绕月探测器轨道动力学模型问题,提出利用高斯-马尔科夫过程来近似轨道动力学中的无模型加速度,进而提高了轨道动力学模型的精度;考虑到基于扩展卡尔曼滤波的轨道确定存在的问题,提出利用基于Unscented卡尔曼滤波来估计探测器的位置、速度及无模型加速度,提高了轨道估计精度和保证了算法的稳定性。最后,通过数学仿真验证了自主光学导航算法的有效性。

关键词: 自主光学导航 绕月探测器 高斯-马尔科夫过程 Unscented卡尔曼滤波

Abstract: The autonomous optical navigation algorithm for spacecraft around Moon using the Gauss-Markov process and Unscented Kalman filter is presented. For the problems arising from the absence of exact orbit dynamics models of spacecraft around Moon, the un-modeled acceleration of orbit dynamics is approximated by using the Gauss-Markov process in order to improve the precision of orbit dynamics. Considering the problems of orbit determination algorithm based on extended Kalman filter, the position, and velocity of spacecraft and the un-modeled acceleration are estimated by using the Unscented Kalman filter to improve the precision of orbit estimation and ensure the stability of algorithm. And the autonomous optical navigation algorithm is validated using the numerical simulation.

Keywords: autonomous optical navigation spacecraft around moon Gauss-Markov process Unscented Kalman filter

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