



航空学报 » 2009, Vol. 30 » Issue (8) :1460-1465 DOI:

电子与自动控制

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基于天基光学监视的空间目标MSC-SPKF跟踪方法

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MSC-SPKF Tracking Method of Space Object in Space based Optical Surveillance

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摘要

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摘要 在对天基光学监视跟踪特点进行分析的基础上, 提出样点状态转换修正球坐标Sigma点卡尔曼滤波(MSC-SPKF)方法以实现对空间目标的三维被动跟踪。利用修正球坐标系和无迹变换(UT)分别在仅测角被动跟踪和获取非线性系统状态二阶矩方面的优势, 选择在修正球坐标状态空间内进行Sigma点采样, 并利用状态空间转换完成样点矢量非线性预测, 最后在修正球坐标空间内完成滤波更新, 并给出相应的初始化方法。仿真结果表明该方法在收敛性和稳健性上更有优势。

关键词: 空间目标 天基光学监视 无迹变换 卡尔曼滤波 跟踪

Abstract: Based on an analysis of the characteristics of space optical surveillance, this article proposes a modified sphere coordinates Sigma points Kalman filter (MSC-SPKF) approach to realize the three dimensional tracking of a space object which makes use of the state transformation of Sigma points. This approach utilizes the advantages of the modified spherical coordinates on bearing-only tracking and the unscented transformation (UT) of second order approximation of nonlinear systems. The Sigma points are selected in the modified spherical coordinates, and then transformed to Cartesian coordinates to implement the nonlinear prediction. Finally, filter updating is accomplished in the modified spherical coordinates. The corresponding tracking initiation method is also provided. Simulation results indicate that this approach has the advantage of rapidity of convergence and stability over existing methods.

Keywords: space object space based optical surveillance unscented transformation Kalman filter tracking

Received 2008-06-06; published 2009-08-25

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引用本文:

李骏;安玮;周一宇. 基于天基光学监视的空间目标MSC-SPKF跟踪方法[J]. 航空学报, 2009, 30(8): 1460-1465.

Li Jun;An Wei;Zhou Yiyu. MSC-SPKF Tracking Method of Space Object in Space based Optical Surveillance[J]. Acta Aeronautica et Astronautica Sinica, 2009, 30(8): 1460-1465.

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