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基于线性最小二乘方法的主动段目标初值估计

赵砚[①]　程洪玮[②]　易东云[①]　张倩[③]*

[①]国防科技大学理学院数学与系统科学系 长沙 410073　[②]北京跟踪与通信技术研究所 北京 100094　[③]北京航天指挥控制中心 北京 100094

Initial State Estimation for Boost Phase Object Based on Linear Least Square Estimation

Zhao Yan[①]　Cheng Hong-wei[②]　Yi Dong-yun[①]　Zhang Qian[③]*

[①]School of Science, National University of Defense Technology, Changsha 410073, China　[②]Beijing Institute of Tracking and Telecommunication Technology, Beijing 100094, China　[③]Beijing Aerospace Command and Control Center, Beijing 100094, China

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摘要 主动段目标初值估计是导弹目标战术参数估计的重要内容,是监视系统进行实时跟踪的前提条件。在天基观测背景下,该问题是非线性最小二乘求解问题。该文建立了主动段8态重力转弯模型和天基测量模型,通过用常加加速度线性模型来近似目标运动学参数,并对非线性测量进行伪线性化处理,将非线性最小二乘转化为线性最小二乘求解问题。特别地,给出了天基伪线性化测量及其统计特征的详尽推导,并进一步考察了测量伪线性化方法的适用范围。仿真实验中,通过与CRLB和传统的Gauss-Newton迭代方法比较,证明了该文方法在估计精度和运算效率上的优势。

关键词：　目标跟踪　初值估计　最小二乘问题　重力转弯模型　天基观测　伪线性化测量

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Abstract： The initial state estimation for boost phase object is an important issue to estimate the missile's tactical parameters, as well as the precondition for the surveillance system to perform the real-time tracking. In the condition of the space-based observations, the initial state estimation is the solution of the nonlinear LSE problem. Firstly, the 8-state gravity turn model for the boost phase object is established, and then the target's kinematic parameters are approximated by using the linear constant acceleration derivative model, and the nonlinear measurements are pseudo linearized. Therefore, the nonlinear LSE problem is translated into the linear LSE problem after the aforementioned steps . Specially, in this paper, the explicit derivation of the pseudo linearized space-based observation and its statistical moments are deduced, and its application conditions are illuminated. Finally, the advantage of the proposed method is illustrated in the aspects of precision and efficiency by comparing with the CRLB and classical Gauss-Newton iteration algorithm.

Keywords： Object tracking　Initial state estimation　Least Square Estimation (LSE)　Gravity turn model　Space-based observation　Pseudo linearized observation

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