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研究论文

正交迭代泛函网络在中短期钟差预报中的应用

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Application of Orthogonal & Iterative Functional Networks to Intermediate and Short-term Clock Error Prediction

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摘要 在卫星钟源无法与地面钟源进行实时比对的时段中，准确预报卫星钟差对于维持卫星的稳定运行具有重要意义。针对卫星钟差的中短期预报问题，选择多项式模型对钟差进行建模分析，设计了一种基于滑动窗模型的正交迭代泛函网络算法。利用泛函网络的非线性学习能力对钟差预报模型进行拟合分析，采用正交函数作为泛函网络的基函数簇，并引入滑动窗思想来更新输入层元素进行迭代训练，获得较小的预报误差。分析表明，预报时间小于12 h 时，预报误差为0.2~0.5 ns，预报精度与IGU P精度相当；当预报时间为24 h 时，预报误差总体在1 ns，预报精度略次于IGU P 精度；当预报时间为1 个卫星周时，最大误差达130 ns，难以满足卫星运行对钟源的要求。研究表明：该算法适合于短期卫星钟差预报，不适合中长期钟差预报。

关键词 ： 泛函网络, 钟差预报, 迭代运算, 正交序列

Abstract : Accurate satellite clock error prediction is of vital importance for satellite stable operation when satellites' clocks are not able to compare with those on the ground. Aiming at the problem of intermediate and short-term clock error prediction, a polynomial model is chosen to predict the clock error, and an orthogonal iterative functional networks algorithm based on a sliding window model is designed, which takes advantage of the non-linear learning ability of functional networks to fit and analyze the clock error model. The analysis shows that when the prediction time is less than 12 h, the predicted errors are between 0.2 ns and 0.5 ns, which is equivalent to IGU P. When the prediction time is 24 h, the overall errors are around 1ns, which is slightly less than IGU P. When the prediction time is a satellite week, the maximum error may reach 130 ns, which does not meet the reqirement of the satellites. It is concluded that the algorithm of the paper is suited for the short-term clock error prediction but not the intermediate and longtime prediction.

Key words : functional networks clock error prediction iterative operation orthogonal sequence

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