

基于小波多尺度分析的光纤陀螺振动误差分析与建模

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摘要:

针对振动环境对光纤陀螺性能的影响, 对某型号的光纤陀螺进行了线振动实验并对实验结果进行了Allan方差分析。利用小波分析提取了Allan方差分析误差系数中的量化噪声、角度随机游走以及零偏误差与误差速率斜坡之间的对应关系。随后利用RBF神经网络对小波多尺度分析提取的零偏误差建立模型并进行了补偿。仿真结果表明下各误差项对光纤陀螺性能的影响, Allan方差分析结果中的五个误差系数均有较大下降, 其中两项误差系数下降了一个数量级, 对光纤陀螺在振动环境下的误差研究具有重要指导意义。

关键词: 光纤陀螺, 振动误差, Allan方差分析, 小波多尺度分析, RBF神经网络建模

Error Analysis and Modeling for Fiber Optic Gyroscope under Vibration Based on Wavelet Multi-scale Analysis

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Abstract:

To analyze the performance of fiber optic gyroscope (FOG) under vibration environment, Wavelet multi-scale analysis and Allan variance analysis are used to extract the error terms of FOG signal which obtained under vibration environment. Wavelet multi-scale transform is used to extract the error terms of FOG signal between the error term and the error coefficient which obtained by Allan variance analysis is pointed out. Then RBF neural network zero-bias error of FOG signal. The simulation results show that the proposed method can resolve the zero-drift, the noise and the zero-rate slope of FOG signal greatly, which has important guiding significance on the research of FOG performance in vibration environment.

Keywords: Fiber optic gyroscope, Vibration errors, Allan Variance Analysis, Wavelet multi-scale analysis, RBF neural network

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