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杯形波动陀螺高稳定度正弦驱动技术研究

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基金项目：基于弹性波传递效应的杯形波动陀螺设计理论及制造技术研究

摘　要：

杯形波动陀螺具有极高的Q值，一般都在20000以上，因此仅仅0.3‰的驱动信号频率误差都会使陀螺机械灵敏度降低99%以上。针对这一问题实现了一种基于直接数字频率合成的高性能正弦信号生成算法，以此为基础从统计域的角度对引起频率源抖动的根源进行了估计分析，并给出了一种具有针对性的抖动分离方法，为频率源的设计提供了理论指导和依据，降低了修正和优化频率源的盲目性。由阿伦方差可知采用抖动分离方法优化后，频率源短期稳定度提高约为20%。通过对设计的频率源进行一系列时域和频域测试分析，证明最终的驱动信号频率稳定在1mHz以内.

关键词：杯形波动陀螺；高稳定度正弦信号；抖动分离；频率直接合成；优化方法；

The study on cupped wave gyro sinusoidal drive technology with high stability

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Abstract:

Cupped wave gyro has a very high Q factor which ranges from 20000 to 100000 generally. Consequently, only 0.3 ‰ of the drive signal frequency error causes the gyro mechanical sensitivity reduced by 99%.To solve this problem a high-performance sine signal generation algorithm based on direct digital frequency synthesizer is proposed. Then the root causes of frequency jitter are estimated and analyzed from statistical domains, and a kind of jitter separation method for the design of frequency source is presented. This method provides a theoretical guidance and basis for reducing the blindness of the frequency source correction and optimization. After optimized by jitter separation method, the short-term stability of frequency source improves about 20% from Allan variance. Finally, the test of time domain and frequency domain demonstrates that the final drive signal frequency stability maintains at a level of 1mHz.

Keywords: cupped wave gyro; high stability sine signal; jitter separation; direct digital frequency synthesize; optimization method;

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