

微机械陀螺的误差抑制电路研究

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基金项目：国家863计划

摘要：

分析了微机械陀螺的正交误差和同相误差的来源及特点，提出了利用静电力反馈控制来抑制误差的技术方案。该方案利用反馈静电力在检测模态上产生等效电刚度和电阻尼，从而影响陀螺仪驱动和检测模态之间的刚度和阻尼耦合系数，进而抑制误差。为实现误差抑制设计了带有反馈校正环节的闭环检测电路并完成了仿真，仿真结果表明校正环节能够使系统的幅值和相位裕度达到25dB和36.5°。对微机械陀螺进行频谱分析和性能测试比较，结果表明闭环检测情况下，误差量较开环测试减小了50%，标度因子的非线性度从2.89%减小到1.47%、带宽增加了15HZ、零偏稳定性提高了1.3倍。

关键词：闭环检测电路，误差抑制，反馈控制，校正环节

Error suppression circuit for micromachined gyroscope

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Abstract:

In this paper, the quadrature error and in-phase error of micromachined gyroscope were analyzed in detail, and an electrostatic force feedback control scheme was presented to suppress the errors. The equivalent stiffness and damping in the sense mode generated by electrostatic feedback force were used to change the coupling between the two modes of the gyroscope. Thus the errors can be suppressed. A closed-loop detective circuit with feedback compensation was designed and implemented, and the simulation results showed that the gain margin and the phase margin could reach 25dB and 36.5° respectively. The effect of the error suppressing circuit was verified by spectrum analysis and performance testing. The errors were decreased by 50%, the nonlinearity of scale factor decreased from 2.89% to 1.47%, the bandwidth increased 15 Hz, and the bias stability increased by 1.3 times.

Keywords: close-loop detective circuit, error suppression, feedback control, compensation

投稿时间：2010-03-21

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