

## MEMS加速度计信号光电检测与电容检测的噪声分析

作者: 曾凡林<sup>1, 2\*</sup>, 钟少龙<sup>1</sup>, 徐静<sup>1</sup>, 吴亚明<sup>1</sup>

单位: 1. 中国科学院上海微系统与信息技术研究所: 传感技术国家重点联合实验室, 微系统技术国家级重点实验室, 上海 200050; 2. 中国科学院研究生院, 北京 100039;

基金项目:

摘要:

在简要介绍高精度MEMS扭摆式加速度计电容检测和光电检测实现原理的基础上, 分析了该加速度计热机械噪声和电学噪声特性。该加速度计结构在品质因数 $Q=1$ 和 $Q=85$ 时, 热机械噪声分别为 $2.4\mu\text{g}/\sqrt{\text{Hz}}$ 和 $0.28\mu\text{g}/\sqrt{\text{Hz}}$ 。对于电学噪声, 电容检测的电学噪声为 $3.27\mu\text{g}/\sqrt{\text{Hz}}$ , 光电检测在只考虑电学噪声时能分辨的最小加速度可达 $0.05\mu\text{g}$ 。对比得出对于扭摆式加速度计结构, 光电检测具有比电容检测更小的系统总噪声。

关键词: 电容检测; 光电检测; 热机械噪声; 电学噪声

## Noise analysis of photoelectric and capacitive detection of MEMS accelerometer signal

**Author's Name:** ZENG Fan-lin<sup>1, 2\*</sup>, ZHONG Shao-long<sup>1</sup>, XU Jing<sup>1</sup>, WU Ya-ming<sup>1</sup>

**Institution:** 1. State Key Laboratory of Transducer Technology, National Key Laboratory of Microsystem Technology, Shanghai Institute of Microsystem and Information Technology, Chinese Academy of Sciences 2. Graduate School of the Chinese Academy of Sciences

**Abstract:**

The thermo-mechanical noise and electrical noise of MEMS torsional pendulum accelerometer are analyzed respectively, in which the sensitive signal is detected by capacitive or photoelectric circuits. The thermo-mechanical noise of the MEMS sensing structure is  $2.4\mu\text{g}/\sqrt{\text{Hz}}$ ,  $0.28\mu\text{g}/\sqrt{\text{Hz}}$  when the quality factor  $Q$  of the sensing structure equals 1, 85, respectively. The electrical noise is  $3.27\mu\text{g}/\sqrt{\text{Hz}}$  for capacitive detection, while the photoelectric detection has a resolution of  $0.05\mu\text{g}$  considering the electrical noise only. So the total noise of MEMS accelerometer with photoelectric detection is smaller than the total noise with capacitive detection.

**Keywords:** capacitive detection; photoelectric detection; thermo-mechanical noise; electrical noise

投稿时间: 2010-04-12

[查看pdf文件](#)