

低真空封装的新型变电容面积MEMS惯性传感器阶跃响应特性分析

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摘要:

一种新型变电容面积MEMS惯性传感器与传统的梳齿电容传感器相比,具有对梳齿电容不平行敏感度低,可加测试电压高等优点。本文通过对该传感器在低真空封装条件下的惯性阶跃响应特性分析,着重研究了不同梳齿电容倾斜角度对该传感器的阶跃惯性信号响应的影响,以及不同倾斜角度梳齿的位移响应和测试电压、空气真空度的关系,并把该结果和梳齿结构的情况进行比较。结果表明,工艺因素对变电容面积MEMS惯性传感器在低真空封装下的阶跃惯性响应影响很小;另外,该结构上可加的测试电压可以是梳齿电容结构上可加测试电压的近10倍,这有利于减小接口电路的噪声。以上分析论证了该新型传感器有利于降低器件的工艺要求和提高传感器的分辨率。

关键词: MEMS; 高精度微传感器; 阶跃响应分析; 倾斜梳齿;

Study of Inertial Step Response of a Novel MEMS Capacitive Accelerometer with Variable Areas in Low Vacuum

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Abstract:

A new kind of MEMS capacitive inertial sensor with variable overlapping area is insensitive with the non-parallel of the combs and can work under a much larger testing voltage compared with traditional comb capacitive sensor. In this paper, an inertial step response of MEMS area changed capacitive accelerometer with non-parallel combs is analyzed considering the air damping in low vacuum, and the relation between the testing voltage and the displacement response of the sensor with different angles between the combs and the effects of different air pressure to displacement response are also analyzed. The results are compared with the one of the comb capacitive sensor. It shows that the effects of non-parallel comb on the MEMS capacitive sensors with the variable overlapping area are much smaller. In addition, the designed structure can work under a very large testing voltage which is nearly ten times larger than the one of capacitive sensor with the variable distance, which is very useful for reducing the noise of the interface circuit. It is concluded that the new kind sensor is insensitive with the technology errors and can improve the resolution of MEMS capacitive sensor.

Keywords: MEMS; High precision micro-accelerometer; inertial step response analyze; non-parallel combs

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