

电磁激励谐振式MEMS压力传感器闭环控制研究

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摘要:

在谐振器动力学分析的基础上, 系统地比较了谐振式压力传感器检测速度谐振频率和检测位移谐振频率的优缺点。设计出一种零相移的电磁激励谐振式MEMS压力传感器闭环控制系统, 该系统利用检测速度谐振频率提高传感器的信号检测稳定性, 并且控制电路无需移相环节即可保证传感器在工作频率范围内实现稳定可闭环自激。实验结果表明, 采用该闭环控制系统的传感器具有较高的稳定性, 传感器长时漂移低于0.025%F.S., 在10hPa~1050hPa范围内非线性度为0.06%。

关键词: 谐振式压力传感器, 电磁激励, 检测速度谐振频率, 闭环控制, 零相移

Research on Closed-loop Control for Resonant MEMS Pressure Sensor with Electromagnetic Excitation

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Abstract:

Based on dynamic analysis of resonator, speed resonant frequency detection for the resonant pressure sensor is compared to displacement resonant frequency detection systematically. A zero-phase shift closed-loop control system for electromagnetic excited resonant MEMS pressure sensor is designed and speed resonant frequency is used, with which the stability of the resonant frequency detection is improved. And without any phase-shift unit, the control circuitry can achieve stable and reliable self excitation over the working frequency range of sensors. Experimental results show that sensor with the closed-loop control system designed works stably, the long time drift is below 0.025% F.S. and the non-linearity of the sensor is 0.06% from 10hPa to 1050hPa.

Keywords: Resonant pressure sensor, Electromagnetic excitation, Speed resonant frequency, Closed-loop control, Zero-phase shift

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