

## 静电驱动MEMS谐振式压力传感器闭环拓扑研究

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摘要:

谐振式压力传感器闭环拓扑结构对保持机械谐振器振荡的稳定性和可靠性起着重要作用。针对一种典型结构的静电驱动电容检测MEMS谐振式压力传感器, 在分析工作原理的基础上, 构建了其混合信号模型。基于该模型搭建了自激振荡、自动增益控制、锁相环和带AGC的自激振荡四种闭环拓扑结构。在混合信号仿真平台上, 对四种拓扑结构在起振状况、自动频率跟踪特性、抗冲击性和频率稳定性四个方面进行了仿真比较。结果表明, 锁相环闭环拓扑结构表现出较好的综合性能。

关键词: MEMS; 谐振式压力传感器; 闭环拓扑; 频率跟踪; PLL

## Closed-Loop Topologies for Electrostatic Drive Resonant Pressure Sensor

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**Abstract:**

Closed-loop topology plays an important role in sustaining reliable oscillation for resonant pressure sensor. A hybrid model of a typical MEMS resonant pressure sensor, which is driven by electrostatic force and sensed by capacitance changes, was constructed to research the influence of closed loop topology. Four closed-loop topologies including self-oscillation, automatic gain controller, Phase-Locked Loop and self-oscillation with automatic gain controller, were employed in the hybrid model. Using a mixed signal simulation platform, performance simulation and comparison among different topologies was implemented in terms of startup capability, automatic frequency tracking performance, shock immunity and frequency stability. The results show that PLL loop has the best overall performance.

**Keywords:** MEMS; resonant pressure sensor; closed-loop topology; frequency tracking; PLL

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