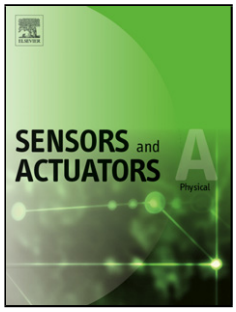

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Using pseudo electrostatic spring constant to improve the resolution of micro-machined accelerometer

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Highlights

- The pseudo electrostatic spring constant was first proposed and it was used to adjust the resonant frequency to optimize the system NTF to improve the resolution.
- This adjustment had no influence on the stability of the closed-loop and it was implemented on FPGA to make the system more flexible.
- After the adjustment, the system noise floor could achieve about 160ng/√Hz within the 50-300Hz signal bandwidth.
- The experimental results confirmed the theoretical analysis and simulation results.

Abstract:

High-resolution accelerometers have commonly used an electrostatic force-feedback sigma-delta closed-loop. In order to improve the resolution of the accelerometers, high-order noise shaping filters has been used. However, it is difficult to trade off between the stability and the noise shaping ability to design high-order sigma-delta closed-loop, especially with the high-Q acceleration sensors. In this paper, a pseudo electrostatic spring constant is proposed based on the electrostatic force-feedback sigma-delta closed-loop accelerometer. It uses to adjust the resonant frequency of the system transfer function to achieve a lower noise level in the signal band, and this adjustment is outside the closed-loop without influence on the stability of the closed-loop system. The concept of the pseudo electrostatic spring constant, the system analysis and simulation are presented. The integrated measurement system is implemented on the PCB. The system noise floor can achieve about 160ng/√Hz after the adjustment by using the optimal pseudo electrostatic spring constant. The experimental results confirm the theoretical analysis and simulation results.