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Structure Design of Micromechanical Silicon Resonant Accelerometer

Libin Huang*, Weiwei Chen, Yunfang Ni, Yang Gao and Liye Zhao

School of Instrument Science and Engineering, Southeast University, Nanjing 210096, China
Key Laboratory of Micro-Inertial Instrument and Advanced Navigation Technology, Ministry of Education

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The micromechanical silicon resonant accelerometer is one of the development directions toward high-performance micromechanical accelerometers. We designed a differential micromechanical silicon resonant accelerometer based on double-ended tuning fork (DETF) resonators and single-stage microleverage mechanisms. The effect of the gap on the resonance characteristic of the resonant beams in the DETF structure was investigated through modal analysis and harmonic response analysis. An improved microleverage mechanism was designed. Compared with the conventional mechanism, this microleverage mechanism can markedly improve the sensitivity of the accelerometer. The overall structure of the accelerometer was designed in combination with the present microfabrication technology. The simulation of the overall structure was carried out using ANSYS software. Then the accelerometer was fabricated through the silicon on glass (SOG) process and packaged in a ceramic shell. Test results show that the unloaded resonant frequencies of the packaged accelerometer resonators are 30.519 and 30.448 kHz. The quality factor is 335 and the scale factor is 84.52 Hz/g. The test results prove the feasibility of the accelerometer design. This study lays a good foundation for subsequent development work.

*Corresponding author: e-mail: huanglibin@seu.edu.cn