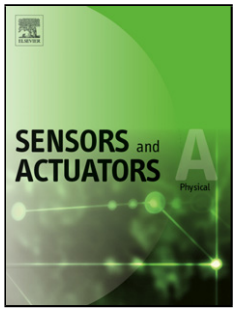

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A MEMS resonant accelerometer for low-frequency vibration detection

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Abstract

According to their inherent characteristics, MEMS resonant accelerometers are suitable for low-frequency, low-g acceleration measurement. In this paper, we report a MEMS accelerometer based on double-ended-tunning fork resonators. The scale factor of our sensor is 1153.3 Hz/g and the bias stability of the oscillator is 58 ppb (parts per billion) for an averaging time of 1s. The static test showed that the resolution of our sensor was 13.8μg. The dynamic performance was demonstrated by single-frequency and hybrid-frequency vibration tests, and the results showed that our device is suitable for detecting low-frequency vibration (0.5$\sim$5 Hz). The cross-axis sensitivity is 1.33%. Compared with a standard charge accelerometer, our device showed its superiority in mixed acceleration measurement, which makes it a potentially attractive option for geophone or seismometer applications.

Keywords: MEMS resonant accelerometer, oscillator, dynamic test, low-frequency

1. Introduction

In the past few decades, high-precision acceleration measurement has become an important issue of concern due to its broad uses in various industries, such as spacecraft guidance, inertial navigation, and seismic detection. As the silicon-on-insulator (SOI) technology developed, MEMS accelerometers drew more attention because they are small in size and easy to be integrated. Among the all, MEMS resonant accelerometers have been considered more attractive due to their high sensitivity, wide dynamic range [1], and quasi-digital output [2].

In 1997, Trey A. Roessig proposed the first surface-micromachined resonant accelerometer based on double-ended-tuning fork (DETF) [3]. Ashwin A. Seshia introduced a vacuum packaged

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