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Novel motion nanosensor based on mechanical amplification

In the past years there is an increasing interest to incorporate in any electronic device a motion sensor to provide interaction: measuring our reactions, position or motion. Therefore, the motion sensors should be low-cost but more precise. A nanosensor based on a motion amplifier mechanism is presented. The design can amplify extremely small displacements (nanometers) up to 200 times. Partners to further develop the system and/or to establish commercial agreements along with technical cooperation are sought.

The Challenge

The past two decades have witnessed the evolution of Microelectromechanical devices (MEMS) from a laboratory curiosity to a solid and mature technology. Besides the obvious advantage in space reduction, the scaling laws are such that miniaturization results in reduced power consumption, lower thermal mass, higher operational frequencies, lower noise and vastly improved sensitivities.
But it remains a high technological challenge the possibility to produce nano motionsensors that can sense nanodisplacement and can be mass produced. To help address these challenges, we proposed to develop a single mask design MEMS-based ultra-sensitive motion sensor (load cell) based on a novel motion amplifier mechanism.

The Technology

A MEMS (microelectromechanical systems) nano motion sensor has been developed to detect extremely small displacement. The design uses a capacitive read-out scheme to monitor the lateral displacement of a slender beam in response to the axially applied force. To greatly amplify the lateral displacement (and hence the sensitivity), the beam is designed with an initial (small) curvature. The amplification factor is controlled by the geometry of the beam. The mid-point of the beam is connected on each side to one electrode of a charged capacitor, with the other electrode held stationary. Small capacitance changes can be measured very accurately with inexpensive commercially available detectors thus providing a very sensitive measurement of the applied axial load. The design can be manufactured in any single mask microfabrication process.

Innovative advantages

- Single mask lithography process and CMOS Compatibility
- Highly sensitive measurements
- Low-cost
- Robust economical device
- Easy packaging

Current stage of development

The system has been successfully tested in a laboratory prototype. In general, this motion sensor provides exceptional resolution, but the range has to be tuned according to the application. The designs tested predict a wider range of acceleration forces, tens of microNewtons, with higher resolutions, and below the picoNewton in vacuum.

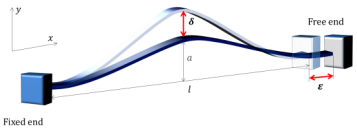
Applications and Target Market

The motion amplifier mechanism can be integrated in different topologies of motion sensors: accelerometer or angular accelerometer, threshold accelerometers and switches. Since it can be fabricated in any single mask fabrication process resulting in a robust economical device the target market is mass production products such as: mobile hand sets.

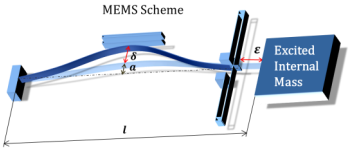
Reference number

MKT2012/0124_I

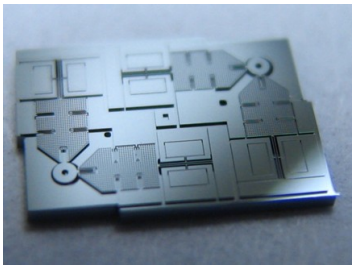
Highly sensitive and low-cost MEMS nano motion sensor



Basic scheme of the motion amplifier



Accelerometer based on the amplifier mechanism



Picture of a sensor using a SOI wafer

Business Opportunity
Technology available for licensing with technical cooperation

Patent Status
Priority application

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