Capacitive sensor for accelerometer applications

Abarca Jiménez, G. S.[1]; Mendoza Acevedo, S.[2] y Reyes Barranca, M. A.[1]

[1] CINVESTAV-IPN, Mexico [2] UT Dallas, USA

Introduction

The presented patent refers to an electromechanic capacitive structure intended to measure inertial parameters, that can be included~~to be used~~ in MEMS like accelerometers, gyroscopes and tilt sensors.

The electromechanic device uses a novel technique to convert a mechanical stimulus into an electric signal, which can be processed easily, using only a few transistors to obtain this electric output.

To demonstrate the capabilities of this concept, ~~a~~ an accelerometer was designed and fabricated, to be compared ~~to~~ with commercially available devices.

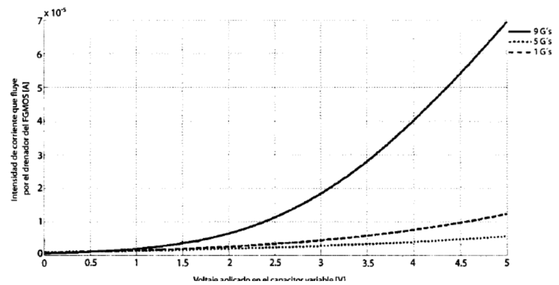
Materials and methods

The accelerometer was designed as a CMOS-MEMS device, that is, using a standard CMOS technology ~~as~~ taking into account the design restrictions ~~to~~ regarding ~~specify~~ specific materials, layers, thicknesses and in particular, the design rules pertaining that specific technology. Structural layer: Aluminum (Metal 1-Via-Metal 2 stack)

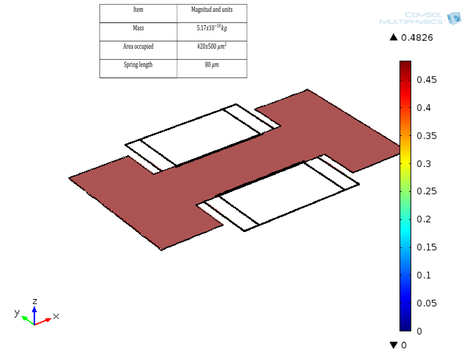
Also, the novel transducer developed requires to be fully integrated with the inertial or mechanical structure for it to work, hence this approach demands ~~that~~ the mechanical design to strictly follow~~s~~ the technology rules.

The fabrication starts at an IC foundry, then, the chip is post-processed to release the inertial structures~~.~~, after a surface etching process.

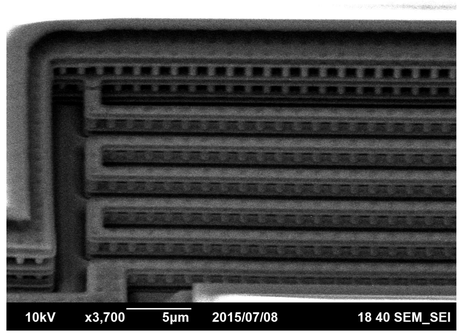
Results



Design

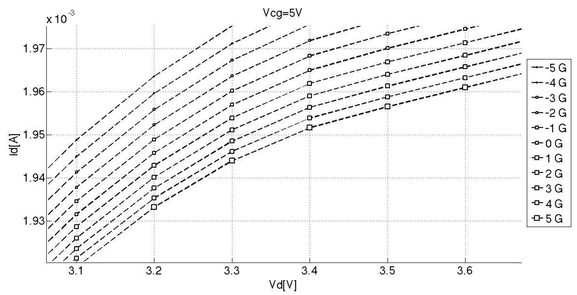


Multiphysics simulation



~~Fabrication and post-processing~~

SEM photograph of the micromechanical structure. Detail of the springs after surface micromachining.



Testing and characterization

Conclusions

This patent presents a novel microelectromechanical system, an inertial transducer based on a capacitive structure.

This transducer can be used for accelerometers, gyroscopes and tilt sensors, which are some of the most used MEMS.

The applications of the MEMS inertial sensors is a broad field, from biomedical uses in prosthesis, to consumer products like cell phones.

The development of a prototype accelerometer to demonstrate this patent shows that this transducer can be designed and fabricated in an easier way than most commercially available, using standard CMOS technology and simple surface micromachining post-process.

The characterization of the device shows that the behavior of the fabricated accelerometer is comparable to commercial devices in sensitivity.

Also, it shows that the transduction technique using only a few transistors delivers a useful output signal, reducing the silicon area and allowing to be integrated with other electronic components and systems to achieve better functionality.

The reduced electronic circuitry decreases the power consumption, making this structure very attractive for mobile applications.

Patent information

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Current assignee: Centro de Investigación y de Estudios Avanzados del IPN

Main Advantages

- **Smaller devices**
- **Reduced electronics**
- **Simpler fabrication**
- **Standard technology**

Further information

Agency for Knowledge Commercialization of the Cinvestav
América Padilla Viveros, PhD.
+(5255) 5747-4006
aviveros@cinvestav.mx

Cecilia Bañuelos Barrón, PhD.
+(5255) 5747-4007
cebanuelos@cinvestav.mx