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Increased sensitivity of MEMS sensors by integration of CMOS-compatible mechanical resonators

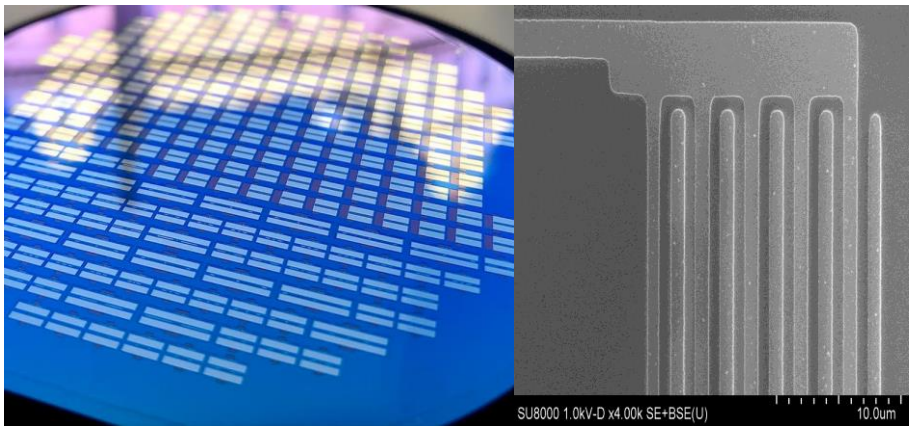
The performance of sensors based on microelectromechanical systems (MEMS) is fundamentally limited by thermal and detection noise. Methods from cavity optomechanics are implemented in MEMS sensors to overcome these limitations. Sensors are fabricated without optical components using only standard MEMS fabrication methods. The approach is applicable to a large variety of different MEMS sensor types and is suitable for the integration into mass volume MEMS sensor products which offer higher sensitivity than conventional MEMS sensors.

Background

MEMS sensors are ubiquitous in our daily lives. Despite this widespread use and a long history of development, MEMS sensors still face fundamental limitations in their noise performance. These noise limits are set by thermal fluctuations and detection noise. Recently, methods for reducing thermal and detection noise have been developed in the field of cavity optomechanics. However, these methods require the challenging integration of optical components with micromechanical sensors which prevents the use of cavity optomechanics methods in mass volume products.

Technology

MEMS technology is combined with novel concepts from cavity optomechanics to overcome limitations of conventional MEMS sensors. By integrating a mechanical high-frequency resonator instead of an optical cavity with low-frequency mechanical sensing components, cavity-assisted readout and cooling are implemented with standard CMOS-compatible MEMS fabrication methods. The mechanical high-frequency resonator is based on well-established MEMS resonator types like surface acoustic wave of bulk mode resonators.



Advantages

- Overcoming thermal and detection noise limitations of conventional MEMS sensors
- No optical components required and fabrication with well-established MEMS fabrication methods
- Technology applicable to a large variety of MEMS sensors

REFERENCE
M051/2020

POTENTIAL APPLICATIONS
Smartphones, Mobile Electronics, Automotive

KEYWORDS
Sensors, increased sensitivity, mechanical resonance, MEMS

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AT granted
US and EP pending

OPTIONS:
R&D co-operation
License contract

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