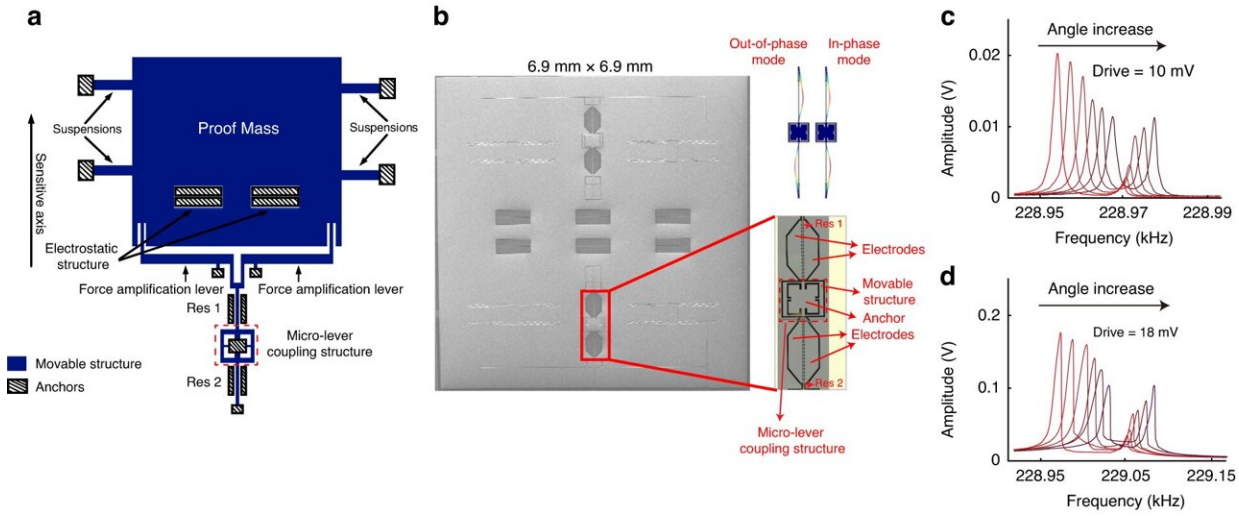
New noise analysis model targets resolution

February 2 2024, by Liu Jia



Device structure and characterization. Credit: *Microsystems & Nanoengineering* (2023). DOI: 10.1038/s41378-023-00614-z

In recent years, there has been a growing interest in developing mode-localized sensors that focus on the strength of their signals for better sensitivity.

A research team led by Prof. Zou Xudong from the Aerospace Information Research Institute (AIR) of the Chinese Academy of Sciences (CAS) introduced a decouple-decomposition (DD) noise analysis model which was employed to achieve high-resolution in mode-localized tilt sensor featuring closed-loop circuit. The study was published in *Microsystems & Nanoengineering*.

The DD noise model is like a detective for the sensors, uncovering the noise mysteries inside. It explores various parts of the sensor's internal circuit, revealing how noise affects the performance of the mode-localized sensors.

To make sense of this noise, the model used a decoupling method, considering how the sensor's parts interact. It broke down the sensor's closed-loop circuit, the inner workings of its weakly coupled resonators, into different paths. This allowed it to study the noise related to the signal's strength (amplitude) and timing (phase).

The result provided a clearer picture of how noise behaves in the sensor's system. A computer program called MATLAB/Simulink, which acts like a virtual lab, was used to prove the accuracy of the detective work. The simulations confirmed that the model is spot-on when compared to the theoretical analysis—making sure the detective's findings are correct by double-checking the clues.

This DD model is not limited to tilt sensors and is applicable to a range of mode-localized sensors.

More information: Kunfeng Wang et al, A decouple-decomposition noise analysis model for closed-loop mode-localized tilt sensors, *Microsystems & Nanoengineering* (2023). DOI: 10.1038/s41378-023-00614-z

Provided by Chinese Academy of Sciences