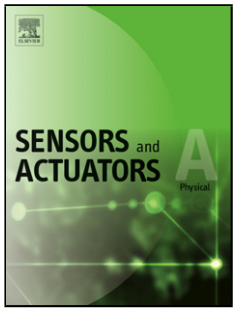

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A MASS SENSOR BASED ON 3-DOF MODE LOCALIZED COUPLED RESONATOR UNDER ATMOSPHERIC PRESSURE

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Research highlights

- For the first time, the mass sensitivity of a 3-DoF mode localized electrostatic coupled resonator is characterized under atmospheric pressure.
- The reusability of MEMS coupled resonator sensor after mass sensing operations is clearly proved. Nanoparticles as mass perturbation to characterize MEMS mass sensors is a validated and cost-effective technique, accordingly, it can contribute to the researches in any MEMS mass sensor developments.
- The results demonstrate that the change of the resonance amplitude ratio as output metric yields higher sensitivity in comparison with amplitude change and frequency shift.

Abstract:

In this paper, for the first time, the mass sensitivity of a 3-DoF mode localized electrostatically coupled resonator is investigated and characterized under atmospheric pressure. A reversible method is used in which nanoparticles are added on and removed from one resonator of the 3-DOF coupled resonator system. Furthermore, a comparison of three mass sensitivity characterization methods was carried out: resonance frequency shift, resonance vibration amplitude change and resonance vibration amplitude ratio. MATLAB/SIMULINK and COMSOL Multiphysics models for the 3-DoF coupled resonator system are presented. The simulation results and theoretical calculations are in good agreement with the experimental data. The results show that a 3-DOF mode localized coupled resonator has potential to be employed for biosensing applications.