

Nanoparticle mass detection using suspended microchannel resonator with account for internal fluid flow

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Abstract: In this paper, we construct and study a mathematical model of a suspended microchannel resonator (SMR) resonator with an electrostatic principle of actuation, designed to determine the mass of nanoparticles located in the fluid flowing through the channel of the resonator. The problem of small oscillations of a resonator in the vicinity of a non-trivial equilibrium state is investigated. The dependence of the natural frequencies of the resonator on the flow rate of the liquid, the magnitude and location of the nanoparticle in the channel, the strength of the electric field is determined. The problem of elastic stability of a resonator is investigated in the presence of non-conservative forces. An algorithm is proposed for determining the mass of a nanoparticle from the recorded changes in the spectral properties of the system.

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