Liu, Jing; **Du, Jianke**; **Wang, Ji**; **Yang, Jiashi**

Effects of surface impedance on current density in a piezoelectric resonator for impedance distribution sensing. (English) Zbl 1480.74152

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Summary: We study the relationship between the surface mechanical load represented by distributed acoustic impedance and the current density distribution in a shear mode piezoelectric plate acoustic wave resonator. A theoretical analysis based on the theory of piezoelectricity and trigonometric series is performed. In the specific and basic case when the surface load is due to a local mass layer, numerical results show that the current density concentrates under the mass layer and is sensitive to the physical as well as geometric parameters of the mass layer such as its location and size. This provides the theoretical foundation for predicting the surface impedance pattern from the current density distribution, which is fundamental to the relevant acoustic wave sensors.

MSC:

74J05 Linear waves in solid mechanics
74F15 Electromagnetic effects in solid mechanics
74H10 Analytic approximation of solutions (perturbation methods, asymptotic methods, series, etc.) of dynamical problems in solid mechanics
78A55 Technical applications of optics and electromagnetic theory

Keywords:

piezoelectric resonator; distributed acoustic impedance; shear mode piezoelectric plate; trigonometric series solution; current density distribution

Full Text: DOI

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