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Analytical modeling of thermoelastic damping in bilayered microplate resonators

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Abstract: Accurate determination of thermoelastic damping (TED) is very challenging in the design of microresonators with composite structures. This paper investigates TED in the bilayered microplate. The temperature field in the bilayered microplate with a thermally perfect interface subjected to a time-harmonic excitation is presented. The total damping is obtained by computing the energy dissipated in each layer. An analytical model in the form of an infinite series for TED in the bilayered fully clamped rectangular and circular microplates is developed, and the convergence rate of the present model is studied. For TED in the bilayered cantilever and fixed-fixed microplates oscillating at the first natural frequency, an approximate analytical model is also presented based on Rayleigh's method. TED calculated by the present model agrees well with that obtained by the finite element method (FEM). Present results show that the effects of the thickness and the property of the metallic layer on the peak damping are significantly. The present model can be used to optimize the design of the high-*Q* bilayered microplate resonators

Keywords: MEMS, bilayered microplate, thermoelastic damping, quality factor

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