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Viscous damping of a periodic perforated microstructure DOREL HOMENTCOVSCHI, BRUCE MURRAY, RON MILES, Mech. Eng. SUNY Binghamton — The study of a thin air layer squeezed between a moving plate and a rigid plate is important in many microelectromechanical systems such as microphones, microaccelerometers and resonators as some examples. The horizontal motion of the thin air gap in a planar microstructure yields squeeze-film damping that can adversely affect the dynamic response of the device. The backplate often contains a regular array of perforations in order to reduce the time required for fabrication. In order to analyze the viscous damping in some cases, it is possible to take advantage of the regular hole pattern by assuming periodicity. Here a method is developed to calculate the damping coefficient in microstructures with periodic perforations. An approximate analytic solution as well as numerical solutions to the incompressible Stokes equations are obtained. The results can be used to minimize squeeze film damping. In addition, since micromachined devices have finite dimensions, the periodic model for the perforated microstructure requires the calculation of some frame (edge) corrections. Analysis of the edge corrections has also been performed. Results from analytical formulas and numerical simulations match very well with published measured data.

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