Public Abstract
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The current MEMS (Micro-Electro-Mechanical System) gyroscopes which normally use the electro static force to excite the comb drive are faced with the limitations such as low precision, coupling problem, and poor robustness. We propose to use parametric excitation to solve those problems. The advantage of the parametric excitation is that it can be externalized, thus, the fabrication process can also be simplified.
A feasibility study of the parametric excitation using a two-pendulum model is presented. Governing equations are derived by Lagrange equation, and the results are simulated using MATLAB program. Two swing patterns, symmetric and anti-symmetric motion, are illustrated and investigated with different initial conditions. An experimental study of a tuning fork beam is presented. For non-contact motion analysis, an Eagle 3-D motion analysis digital camera system is employed. We discuss the practical problems such as limited shaker power, which is caused by open-loop excitation method. A governing equation including the damping effect by the lateral vibration of the tines is presented, and its analytical solution is compared with the experimental results. A good qualitative agreement is obtained. To clarify the softening nonlinearity of the tuning fork beam, the gravity effect is described for both vertical and inverted pendulum cases.