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P2FP-48

Experimental and Theoretical Study on Snap-through of Micro Arch-shaped Structures

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Arch-shaped structures are widely employed in micro-electro-mechanical systems (MEMS) devices, such as mechanical memories, micro-relays, micro-valves, optical switches and digital micro-mirrors. A bistable structure, such as an arch, is characterized by a multivalued load deflection curve. Here we study the snap-through instability of bistable arch-shaped MEMS under Lorentz force, as shown in Fig. 1.

In our research, the nonlinear partial differential equation governing deformations of the arch is analytically solved; we have demonstrated the results from analytical results in the form of graph in Fig. 2, 3, and 4. For the static problem, the curve of the arch's displacement versus a load parameter is obtained. It can be observed from the numerical results that there is no snap-through buckling when the spring is harder, but increase in the applied load results in increase in deflection of an arch rapidly. For further validation of the deformation of an arch, microfabricated arch and arch with spring structures are tested to prove the validity of our derived analytical solution. We compare results from the present analytical model with results of experiments and other models available in the literature.

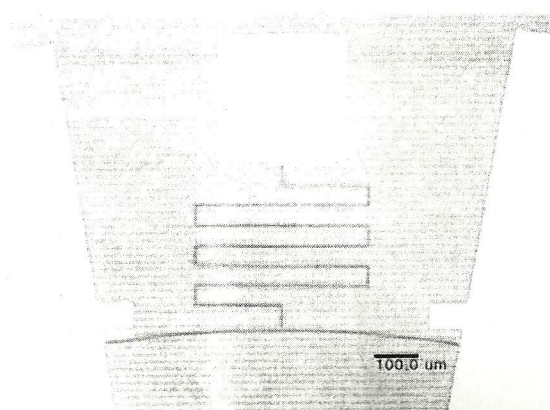


Fig. 1 Micro arch with spring structure