Piezoelectrically actuated microscale resonators [1] are attractive for communication and signal processing applications. An example of a typical resonator studied in this work is shown in Figure 1. As pointed out in recent work [2]-[4], these resonators exhibit nonlinear characteristics, some of which may possibly be explained as oscillations about a non-flat equilibrium position that is caused due to buckling. The intent of the present work is to develop a model for this resonator from an experimental standpoint. To this end, the Duffing oscillator model is picked as a first prototype and parameters in this model are identified for various microscale oscillators. The basis for the parametric identification scheme is obtained from the work of Nayfeh and Balachandran [5].

A representative result obtained in this work is shown in Figure 2, where experimental data is compared to a nonlinear oscillator model obtained through the developed parametric identification scheme. This scheme will be discussed in the talk, and the sensitivity of the various system parameters such as the damping coefficient, the linear stiffness coefficient, and the nonlinear stiffness coefficient to the DC offset in the input signal will also be presented.

Figure 1. Piezoelectric resonator and a sketch map of the resonator at the input port.
Figure 2. Duffing oscillator curve fit to resonator data.

References


