Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Softening and Hardening of a Micro-electro-mechanical systems (MEMS) Oscillator in a Nonlinear Regime SARAH JOHNSON, Hillsdale College, TERRENCE EDMONDS, University of Florida — Micro-electro-mechanical systems or MEMS are used in a variety of today's technology and can be modeled using equations for nonlinear damped harmonic oscillators. Mathematical expressions have been formulated to determine resonance frequency shifts as a result of hardening and softening effects in MEMS devices. In this work we experimentally test the previous theoretical analysis of MEMS resonance frequency shifts in the nonlinear regime. Devices were put under low pressure at room temperature and swept through a range of frequencies with varying AC and DC excitation voltages to detect shifts in the resonant frequency. The MEMS device studied in this work exhibits a dominating spring softening effect due to the device's physical make-up. The softening effect becomes very dominant as the AC excitation is increased and the frequency shift of the resonance peak becomes quite significant at these larger excitations. Hardening effects are heavily dependent on mechanical factors that make up the MEMS devices. But they are not present in these MEMS devices. I will present our results along with the theoretical analysis of the Duffing oscillator model. This work was supported by NSF grant DMR-1461019 (REU) and DMR-1205891 (YL).

Sarah Johnson
Hillsdale College

Date submitted: 04 Nov 2015 Electronic form version 1.4