

Mixed Frequency Excitation of an Electrostatically Actuated Resonator

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Abstract : We investigate experimentally and theoretically the dynamics of a capacitive resonator under mixed frequency excitation of two AC harmonic signals. The resonator is composed of a proof mass suspended by two cantilever beams. Experimental measurements are conducted using a laser Doppler Vibrometer to reveal the interesting dynamics of the system when subjected to two-source excitation. A nonlinear single-degree-of-freedom model is used for the theoretical investigation. The results reveal combination resonances of additive and subtractive type, which are shown to be promising to increase the bandwidth of the resonator near primary resonance frequency. Our results also demonstrate the ability to shift the combination resonances to much lower or much higher frequency ranges. We also demonstrate the dynamic pull-in instability under mixed frequency excitation.

Keywords : electrostatically actuated resonator, multi-frequency excitation, nonlinear dynamics, AC harmonic signals

Conference Title : ICSDEE 2015 : International Conference on Structural Dynamics and Earthquake Engineering

Conference Location : New York, United States

Conference Dates : June 04-05, 2015