

# Vibration Control of a Cantilever Beam with Time Delay State Feedback

Atef F. El-Bassiouny

Department of Mathematics, Faculty of Science, Benha University, Benha 13518, Egypt

Reprint requests to A. F. E.-B.; E-mail: elbassiouny\_af@yahoo.com

Z. Naturforsch. **61a**, 629 – 640 (2006); received June 6, 2006

The primary and subharmonic resonance of order one-third of a cantilever beam under state feedback control with a time delay are investigated. Using the method of multiple scales, we obtain two slow flow equations for the amplitude and phase. The first-order approximate solution is derived and the effect of time delay on the resonance is investigated. The concept of an equivalent damping, related to the delay feedback, is proposed and an appropriate choice of the feedback gains and the time delay is discussed from the viewpoint of vibration control. The fixed points corresponding to the periodic motion of the starting system are determined, and the frequency-response and external excitation-response curves are shown. Bifurcation analysis is conducted in order to examine the stability of the system.

*Key words:* Cantilever Beam; Time Delay; Vibration Control; Resonance; Periodic Motion; Saddle Node Bifurcation.