The Response of Nonlinear Single-Degree-of-Freedom Systems to Modulated High-Frequency Input

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In this paper we study the response of single-degree-of-freedom with cubic, quartic and quintic nonlinearities to an amplitude-modulated excitation whose carrier frequency is much higher than the natural frequency of the system. The only restriction on the amplitude modulation is that it contains frequencies much lower than the carrier frequency of the excitation. The method of multiple scales is used to derive two coupled first-order ordinary differential equations that describe the evolution of the amplitude and phase with damping, nonlinearities and resonances. The evolution equations are used to determine the steady-state motions, while representative frequency-response curves are presented for each resonance. Stability analysis of the amplitude and phase modulation equations for both cases are performed. The bending of the response curves leads to multi-valued solutions and hence to jump phenomena.

Key words: Nonlinear Oscillations; Modulation Equations; Resonances; Carrier Frequency; Fixed Points; Stability.