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Dynamics of Nonlinearly Damped Duffing-Van Der Pol Oscillator Driven by Frequency Modulated Signal

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Abstract: The dynamics of a nonlinearly damped Duffing-Van der Pol (DVP) oscillator driven by a frequency modulated (FM) signal is numerically investigated as a function of the amplitude (g) and frequency (Ω) of the high-frequency signal and damping exponent (P). FM signals are basically classified into two types, namely, Narrow-Band FM (NBFM) and Wide-Band FM (WBFM). We considered both signals to study the dynamics of the system. As the amplitude g and frequency Ω of the high-frequency signal are varied, with other parameters at a constant value, a variety of features such as different routes to chaos, periodic windows, period-doubling and reverse period-doubling bifurcations, periodic bubbles, hysteresis and vibrational resonance are found to occur due to the signals. Our results show many striking departures from the behaviour of a linearly damped system with the FM signal. A bifurcation diagram, phase portrait, Poincaré map, resonance plot are also plotted to show the manifestation of periodic and chaotic orbits and resonance phenomenon.

Keywords: *DVP oscillator; nonlinear damping; FM signal; hysteresis; chaos; vibrational resonance.*

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