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Analytical approximation of a parametrically excited experimental two-degree-of-freedom system

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Abstract: We analyze a model of an electromechanical system with a nonlinear parametrically excited cantilever beam with nonlinear stiffness. The analysis is inspired by an existing experimental test rig. General condition for full vibration suppression near parametric resonance frequency is derived analytically using the Method of Averaging. The insufficiency of the firs order approximation is discussed and results are derived with approximations up to second order. We include damping and nonlinear coupling in the equations and extend the area of validity by dropping various assumptions made in previous studies. Condition for existence of stable limit cycle, only dependent on system parameters is derived. We further try to predict maximum response near the parametric resonance frequency and motivate their use in accurate design of such systems.

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