

Vibration of nonlinear lumped systems with serially connected elastic elements

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Abstract: The mechanical systems with the nonlinear springs connected in series are considered in the paper. The mathematical model of that kind of systems consists of the differential and algebraic equations (DAEs). Adequately modified multiple scales method (MSM) in time domain have been applied to solve effectively the problem of harmonically forced vibration governed by DAEs. The obtained approximate solution in the analytical form allows for qualitative study of the considered systems, among others for identification of the resonance conditions. The selected cases of the main and internal resonances are analysed in details. The modulation equations of the amplitudes and phases which are the integral part of the MSM solution allow one to study both steady and unsteady resonant motion. The stability of the resonant curves concerning the steady states has been tested and verified by comparison with the numerically obtained solutions.

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