

Estimation of the domain of attraction for a nonlinear mechanical system with three degrees of freedom

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Abstract: The paper deals with the problem of obtaining estimates of the domains of attraction (DA) and stability for a nonlinear mechanical system with three degrees of freedom and uncertain parameters. The system under consideration consists of two coupled linear oscillators, to one of which a dynamic absorber with damping and nonlinear stiffness is connected. Two models are studied: a) the linear component of the stiffness of the absorber is positive; b) a case of a bistable absorber, i.e. the stiffness of the absorber is characterized by negative linear and positive nonlinear (cubic) spring coefficients. The Lyapunov functions (LF) are used to obtain the approximations for regions of attraction/stability. Various methods of LF construction are discussed: the representation of the equations of motion in different coordinates (Cartesian and polar), the use of polynomial and rational functions, etc. The results of numerical simulations are presented. The influence of absorber's parameters (mass ratio and dimensionless damping and stiffness coefficients) onto shape and size of the DA is discussed.

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