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Nonlinear Dynamics of Parametrical Excited Two-Degrees-of-Freedom Flexible Pendulum

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The motion of a flexible pendulum subjected to a harmonic vertical motion of pivot is studied in this paper. Rotational displacement of mass is associated with radial displacement due to existence of a linear, weakly nonlinear or strongly nonlinear spring. These two degrees of freedom, rotational and longitudinal, are coupled nonlinearly and parametrical excitation of the system makes it a non-autonomous nonlinear system. Bifurcation theory is used to study dynamics of the system. It has been shown that it is possible for system to become chaotic. Routes to chaos are studied through construction of the phase portraits and Poincaré maps and computation of Lyapunov exponents. The linear, weakly nonlinear and strongly nonlinear springs are studied respectively and dynamical alternation of system in each case is studied separately. Amplitude of pivot vertical harmonic displacement is chosen as control parameter.

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