Georgiou, Ioannis T.

On the global geometric structure of the dynamics of the elastic pendulum. (English)

Zbl 0963.70013
Nonlinear Dyn. 18, No. 1, 51-68 (1999).

The authors studies the dynamics of planar elastic pendulum by considering it as a singular perturbation of uncoupled pendulum. The equations of motion are $\ddot{\theta} + \frac{2\dot{\theta}\dot{R}}{1+R} + \frac{\sin\theta}{1+R} = 0$ and $\ddot{R} + (\frac{\omega_s}{\omega_p})^2 R - (1 + R)\dot{\theta}^2 + 1 - \cos\theta = 0$, where ω_p and ω_s denote respectively natural frequencies of the pendulum and radial oscillator. The author determines the global geometric structure of the dynamics in terms of two-dimensional invariant manifolds of motion. A general analytic study is carried out and confirmed by numerical experiments.

Reviewer: S.Nocilla (Torino)

MSC:

70K05 Phase plane analysis, limit cycles for nonlinear problems in mechanics
70K20 Stability for nonlinear problems in mechanics
70K50 Bifurcations and instability for nonlinear problems in mechanics
70K60 General perturbation schemes for nonlinear problems in mechanics

Keywords:

planar elastic pendulum; singular perturbation; global geometric structure; two-dimensional invariant manifolds of motion

Full Text: DOI