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New vertically planed pendulum motion. (English) [Zbl 1459.70017]

Summary: This article is concerned about the planed rigid body pendulum motion suspended with a spring which is suspended to move on a vertical plane moving uniformly about a horizontal X-axis. This model depends on a system containing three generalized coordinates. The three nonlinear differential equations of motion of the second order are obtained to the elastic string length and the oscillation angles \( \varphi_1 \) and \( \varphi_2 \) which represent the freedom degrees for the pendulum motions. It is assumed that the body moves in a rotating vertical plane uniformly with an arbitrary angular velocity \( \omega \). The relative periodic motions of this model are considered. The governing equations of motion are obtained using Lagrange's equations and represent a nonlinear system of second-order differential equations that can be solved in terms of generalized coordinates. The numerical solutions are investigated using the approximated fourth-order Runge-Kutta method through programming packages. These solutions are represented graphically to describe and discuss the behavior of the body at any instant for different values of the different physical parameters of the body. The obtained results have been discussed and compared with some previously published works. Some concluding remarks have been presented at the end of this work. The value of this study comes from its wide applications in both civil and military life. The main findings and objectives of the current study are obtaining periodic solutions for the problem and satisfying their accuracy and stabilities through the numerical procedure.

MSC:

70E17 Motion of a rigid body with a fixed point
70K25 Free motions for nonlinear problems in mechanics

Full Text: DOI

References:


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