World Academy of Science, Engineering and Technology
International Journal of Mathematical and Computational Sciences
Vol:8, No:02, 2014

Numerical and Experimental Investigation of a Mechanical System with a Pendulum

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Abstract : This paper presents a numerical and experimental research of a nonlinear two degrees of freedom system. The tested system consists of a mechanical oscillator (the primary subsystem) with the attached pendulum (the secondary subsystem). The oscillator is suspended on a linear (or nonlinear) coil spring and a nonlinear magnetorheorogical damper and it is excited kinematically. Added pendulum can be used to reduce vibration of a primary subsystem or to energy harvesting. The numerical and experimental investigations showed that the pendulum can perform several types of motion, for example: chaotic motion, constant position in lower or upper (stable inverted pendulum), rotation, symmetrical or asymmetrical swinging vibrations. The main objective of this study is to determine an influence of system parameters for increasing the zone when the pendulum rotates. As a final effect a semi-active control method to change the pendulum solution on the rotation is proposed. To the implementation of this method the magnetorheorogical damper is applied. Continuous rotation of the pendulum is desirable for recovery of energy. The work is financed by Grant no. 0234/IP2/2011/71 from the Polish Ministry of Science and Higher Education in years 2012-2014.

Keywords : autoparametric vibrations, chaos and rotation control, magnetorheological damper
Conference Title : ICMCM 2014 : International Conference on Mathematics and Computational Mechanics
Conference Location : Barcelona, Spain
Conference Dates : February 27-28, 2014