

Analysis of the oscillation of a self-excited pendulum due to varying length

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ABSTRACT

This paper presents the study of a system composed by a simple pendulum with distributed mass carrying a control device that is able to adjust its length. This will result in an extra injection (or loss) of energy in the system, according to the control strategy. The system is modeled as a body with variable inertia, and for computations, Simulink software, from MatLab, is used. Instantaneous change will be compared to continuous variation in length. In a second phase, friction is added to the system, and a way to compensate this friction using the change of the length is proposed. To view more clearly this problem, it is possible to make an analogy with a person sitting on a swing. The person can move his legs in order to leave them in two ways: straight or bent. This way, the system swing-person may be seen as an auto parametrically excited system, due to the variation in the position of the center of mass. This article focuses on a broader topic when control is used to alter the distribution of mass of a mechanical system. The objective of this work is to develop a control technique to make the pendulum do a complete revolution only by varying its length. Properties of the swing up control technique of inverted pendulum models are compared with this model and the energy efficiency is discussed.

Keywords: pendulum, variable length, swing up, Simulink.

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