International Journal of Modelling and Simulation

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/tjms20

Modeling, simulation and control of a ball on a T-shaped inverted pendulum: a conservative unstable mechanism

Yousef Sweiti & Jasem Tamimi

To cite this article: Yousef Sweiti & Jasem Tamimi (2022): Modeling, simulation and control of a ball on a T-shaped inverted pendulum: a conservative unstable mechanism, International Journal of Modelling and Simulation, DOI: 10.1080/02286203.2022.2065162

To link to this article: https://doi.org/10.1080/02286203.2022.2065162

Published online: 04 May 2022.

International Journal of Modelling and Simulation ›
Latest Articles

Research Article

Modeling, simulation and control of a ball on a T-shaped inverted pendulum: a conservative unstable mechanism

Yousef Sweiti & Jasem Tamimi

Received 06 Dec 2021, Accepted 08 Apr 2022, Published online: 04 May 2022

Download citation https://doi.org/10.1080/02286203.2022.2065162 Check for updates

ABSTRACT

This paper presents modeling, simulation and control of a novel and a highly nonlinear dynamic mechanism. It consists of a ball on a beam that is mounted on an inverted pendulum on a moving cart. The mathematical model will be derived using Eular–Lagrange approach. The resulted mathematical model has six ordinary differential equations with six states, namely, the cart position and velocity, the angle and the angular velocity of the inverted pendulum as well as the position and the velocity of the ball on the inverted T-shaped pendulum where the system is only controlled by the force that is applied to the cart. Moreover, the control will be done using state feedback using pole placement as well as linear quadratic regulator (LQR), and then the system model and control with an arbitrary case study are simulated using Matlab environment showing successful results. Successful control laws obtained by simulation results in both cases, that is, the applied force to the cart can bring the inverted pendulum angle as well as the ball position to the equilibrium states in approximately five and eight seconds using state feedback using pole placement and LQR controllers, respectively.

KEYWORDS: Ball and beam inverted pendulum Lagrange equation nonlinear dynamics and control

‹ **Previous** article **View** latest articles **Next** article ›