

Project Work, Laboratory Work

Modelling and Control of a Chain Pendulum

Content of the proposed project/laboratory work:

The chain pendulum shown in Fig. 1 consists of a cart on a one-dimensional track with a chain carriage. A DC motor which is connected to a belt, drives the cart. The measurable outputs via encoder sensors are the position of the cart and the angle between the chain and its vertical position at the connection point. Hence, the chain pendulum system is a single-input and multi-output system where the DC motor control voltage is the input and the cart position and the angle of the chain are the outputs of the system.

The chain pendulum laboratory experiment aims to stabilize the cart position and chain oscillations by controlling DC motor voltage. It is a compelling problem from the dynamics and control theory perspective due to the chain attached to the cart. Distinctively from the classical pendulum setup, it is challenging to describe the motion of the pendulum and develop a control strategy based on the equations of motion. Therefore, this setup can be used as a benchmark for testing control strategies.

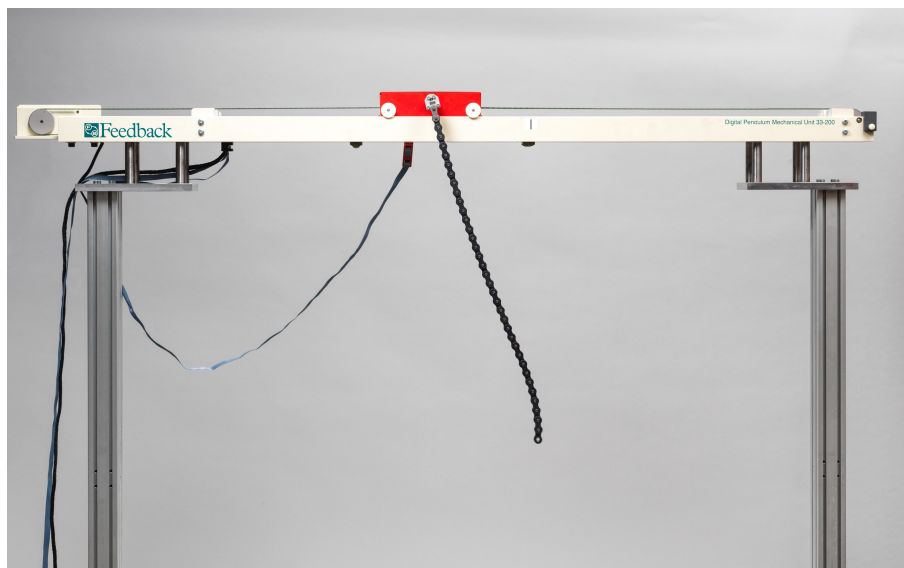


Figure 1: The chain pendulum system

The topics that have to/could be handled within the context of this problem include nonlinear complex dynamic system modeling, observer design, model-based control, disturbance rejection control, etc. Thus, working on the chain pendulum laboratory experiment will help one gain skills and knowledge of modeling, optimisation and control of the dynamic behaviour of a mechatronic system.



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What you will do:

- Validate the chain pendulum dynamic equations and create a model in MATLAB & Simulink
- Design model-based control strategies for the chain pendulum
- Simulate the model with the designed controllers
- Test the developed controllers at a chain pendulum (available at E325-04)

What we are looking for:

- Having basic dynamics and control theory knowledge
- Knowledge of MATLAB and programming skills
- Being passionate about problem-solving
- Being eager to learn, especially deepen control theory and MATLAB & Simulink knowledge

If you are interested in working out a project or laboratory work, please do not hesitate to contact.
See contact below.

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