Master Graduation Project

Data-Driven Stability Analysis of Legged Locomotion with Applications to Rehabilitation

Project Description

The analysis of legged locomotion is essential in various applications such as the development of legged robots, exoskeletons, and human walking rehabilitation technologies. Particularly, for rehabilitation, quantitative biomarkers are important to measure the stability of human walking and to understand how human gait changes during the rehabilitation process. However, developing such biomarkers remains an open research problem. Especially, due to the variability of the gait patterns among different people and the complexity of physical modeling of human walking movements, standard model-based approaches in systems and control can be hard to apply. To overcome these challenges, one promising avenue is to exploit collected data to construct data-driven biomarkers.

Figure 1 MIT Cheetah 3.

Figure 2 Exoskeleton developed by Stanford University.

In this graduation project, the goal is to develop data-driven approaches to analyze and quantify the stability of legged locomotion, by combining learning-based methods and system-theoretical analysis. The developed approaches will be validated by data sets in the domain of walking rehabilitation and exoskeletons.

Project Application

Experience in the following aspects are preferred but not strictly required:

1. Systems and control: Hybrid systems and nonlinear systems
2. Data analysis, machine learning, or system identification

This project is a collaboration with **Stanford University** and will be hosted in the group of Prof. Bart De Schutter at TU Delft. If you are interested in this project, please contact me via the following email: Dr. ir. Shengling Shi, s.shi-3@tudelft.nl