Semester/Master Thesis

# Data-Driven Identification and Model Reduction of Dynamic Model

## Background

The operation of a mobile crane involves movements of a long, slender boom structure, which exhibits significant nonlinear dynamic behaviour. The dynamic model for such long, slender boom is a classic example of a **nonlinear multi-body dynamic** model. The large-scale nonlinear model demands significant computational effort to solve, making it unsuitable for control design purposes. Recently, **data-driven** modelling emerges as an option to simplify the original model[1]. The high-dimensional data generated by the original dynamic model can be utilized to identify a lower-dimensional coordinate system. The model reduction can be achieved while maintaining the fundamental properties of the original dynamic system through **learning** techniques like auto-encoders[2].

## Your Tasks

In this thesis, your tasks will be learning the techniques of data-driven modelling using machine learning to reduce the dynamic model. To be specific;

1. Investigate the latest research works;
2. Select proper learning model;
3. Establish and train a suitable learning model with the generated data;
4. Implement the reduced model with optimal control technique (optional).

## Requirement

- High self-motivation, co-working spirit
- Experiences of knowledge from related courses
- Programming experiences

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[1] Peng, Song and Kan, 'Data-driven model order reduction with proper symplectic decomposition for flexible multibody system'.
[2] Yildiz et al., *Data-Driven Identification of Quadratic Symplectic Representations of Nonlinear Hamiltonian Systems*.