

Announcement for Research Project / Master's Thesis

## Robotic Catching of Suspended Heavy Building Components with Memory-based Reinforcement Learning

The automatic assembly of timber structures using robotic systems can increase productivity and quality on construction sites and benefit health and safety. However, the manipulation of heavy building components lifted by cranes presents unique challenges. Specifically, suspended components exhibit dynamic swinging motions. Moreover, due to the large mass and momentum of these components relative to the robot, an effective catching strategy must be developed that accounts for impact forces to minimize potential damage to the robotic system.

### 1 Task Definition

The aim of the project is to implement a memory-based deep reinforcement learning algorithm for dynamic catching of suspended heavy building components with a Franka Research 3 robot.

- MuJoCo simulation for the catching task.
- Implementation of algorithms including impedance control, Proximal Policy Optimization (PPO), Deep Deterministic Policy Gradient (DDPG) and Recurrent Deterministic Policy Gradient (RDPG).
- Domain randomization for sim2real: geometry, mass, friction, ...
- Validation of the algorithm on a real Franka Research 3 robot.

### 2 Requirements

- Strong self-motivation and willingness to familiarize yourself with new topics
- Basic knowledge/interest in RL, practical work in the lab

### 3 Additional Information

- Start: from now on
- Language: German or English
- The topic can be individually extended or restricted depending on interest and qualifications.

### 4 Contact

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