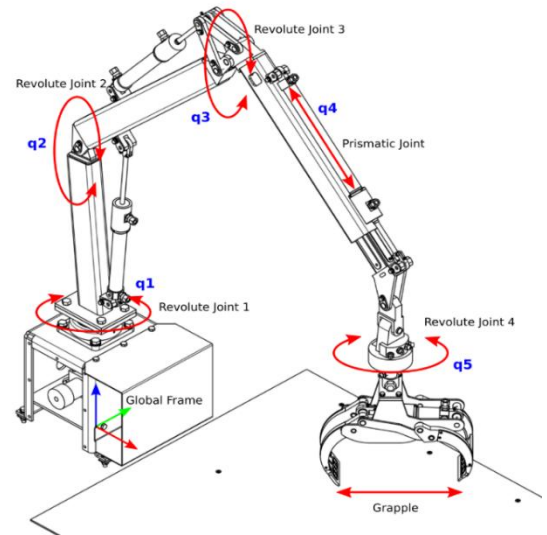


Masterarbeit

Optimal Trajectory Planning and Motion Control of a Hydraulic Manipulator

Hydraulic manipulators play an integral role in various industries, including construction and forestry, due to their robustness and high load capacity, making them indispensable for heavy-duty tasks. However, overcoming the existing challenges associated with these manipulators, such as nonlinear dynamics and uncertainties, is critical to realize their potential and optimize control performance.

This study is motivated by the pressing need to optimize trajectory planning and motion control in hydraulic manipulators. The goal is to improve productivity, precision, and automation level for mobile machines. To achieve this, the study will consider the multi-DOF kinematics of the manipulator for optimal trajectory planning and model the dynamics of the hydraulic system for high-precision controller design. In addition, special attention will be given to the design of the control frame to reduce the complexity of the controller design while maintaining high control performance. The proposed control strategy will be verified in simulation and supported by a fundamental study from a previous MA at Mobima.



The following steps are planned for the thesis:

- Research and survey on the topic.
 - Kinematic and dynamic modeling of a multi-DOF hydraulic manipulator.
 - Model-based controller design, including trajectory planning and motion tracking.
 - Simulation of the system.
 - Documentation & presentation of results.
- If you are interested in this project, please feel free to send your application documents (i.e., a **brief cover letter, CV, and transcript**) to the email address below. Further discussions on the extension of the topic would be welcome.

Type of work:

- Main emphasis: control of a hydraulic manipulator
- Areas: robotics, control, simulation

Start and duration:

From: January, 2025 or upon agreement
Duration: 6 months

Requirements:

- Interests in control, robotics, and electro-hydraulic systems.
- A high degree of independence and motivation.
- Good academic performance and knowledge of German and English.
- Previous knowledge in robotics (i.e., kinematic and dynamic modeling of a multi-DOF manipulator), control, and simulation software for robot control (e.g., Matlab Simulink, Simscape, or others).

Contact: Bobo Helian | Publications: GoogleScholar Bobo Helian

☎ +49 721 608-41898, ✉ bobo.helian@kit.edu

[Picture source] Autonomous Control of Redundant Hydraulic Manipulator Using Reinforcement Learning with Action Feedback