



Project Type

- Master Thesis
- Bachelor Thesis
- Research Project

Supervisors

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Difficulty

Algorithmic



Math



Application



Benchmarking Model-based Controllers for Franka Emika Robot

Description

Motion control is an important topic in robotics. For the design and implementation of motion controllers, robot models play an essential part. The robot models used in controller design are often divided into kinematic and dynamic models. Kinematic models describe the geometric relationship between robot components and are often used to design operational space controllers. Dynamic models describe the relationship between joint torques, loads, and robot motion and are often used to design feed-forward controllers. Model-based controllers are widely used in scenarios that require both high accuracy and flexibility, e.g., object manipulation and Human-Robot Interaction (HRI).



Figure 1: Franka Emika Panda Robots

In this thesis, we want to benchmark and evaluate open-source robot motion control libraries[1, 2] for the Franka Emika Panda robot. The main goal is to test and evaluate the performance of those controllers both in simulation and on real robots. **Both the simulation framework and real hardware are provided, along with some pre-implemented motion controllers.**

Tasks

The tasks in this project will involve:

- Literature research: The student should search for open-source motion control libraries and learn more about the available model-based motion controllers.
- Benchmark in Simulation: Get familiar with the simulation framework, design and implement new experiments to benchmark controllers.
- Benchmark on Real Hardware: Benchmark motion controllers on a real Franka Emika Panda robot.
- Performance Evaluation: The results of both simulation and hardware experiments should be analyzed to gain new insights on how to choose or design motion controllers for future applications.

References

- [1] Lars Berscheid, Nicolai Anton Lynnerup, Lukas Hermann, and Tony Fang. Frankx: High-level motion library for the franka emika robot. <https://github.com/pantor/frankx>, 2022.
- [2] Justin Carpentier, Florian Valenza, Nicolas Mansard, et al. Pinocchio: fast forward and inverse dynamics for poly-articulated systems. <https://stack-of-tasks.github.io/pinocchio>, 2015–2021.