

Development of Flexible Link-Module Kinematics for Modular Robots

Thesis proposal

Background

Modular industrial hardware provides flexibility for manufacturing. The advantages of modular industrial robots in this context are elaborated in [1] and [2]. The research-transfer project “proModular” is investigating applications for modular robotic arms both in simulation and in hardware. This thesis is offered in cooperation with the start-up Kea Robotics GmbH.

Description

In this thesis, the accuracy of the modular robot of the chair is to be investigated and improved by incorporating flexible link modules into the virtual robot model and taking them into account in the robot’s kinematics calculations. Therefore, the thesis consists of four parts: (1) implementing a mechanical absolute calibration procedure, (2) finding measurement routines for evaluating accuracy, (3) measuring the mechanical stiffness of the robot’s link-modules, (4) incorporating link-module stiffness into the robot’s model and evaluating the impact on accuracy.

Tasks:

- Literature review on considering flexible link-modules in robotics,
- Identifying key stiffness parameters of link-modules and identifying them on the chair’s testbench,
- Implementing a robot calibration procedure,
- Integrating flexible link-modules in the robot’s kinematic model,
- Verifying potential improvements in accuracy by measuring.
- Give recommendations for future work,
- Optional: Incorporate stiffness into dynamical robot model to improve control performance.

References

- [1] Althoff, M., Giusti, A., Liu, S. B., and Pereira, A., 2019. Effortless creation of safe robots from modules through self-programming and self-verification. *Science Robotics*, 4(31), eaaw1924.
- [2] Liu, S.B. and Althoff, M., 2020. Optimizing performance in automation through modular robots. In *IEEE International Conference on Robotics and Automation*.



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Research project:

proModular

Type:

Master’s thesis

Research area:

Modular robots

Programming languages:

Matlab or C/C++

Required skills:

Research, Mechanics,
Programming

Language:

English

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