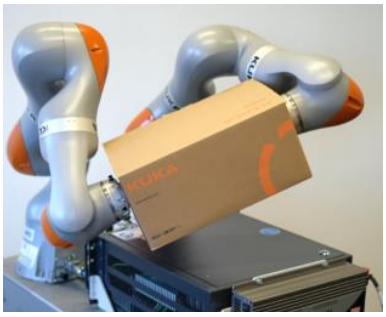
Lehrstuhl für Regelungstechnik

FAU

Announcement for research-project/ master's thesis

Projected Inverse Dynamics Control for cooperative dual-arm robots

Motivation



The control of mechanically coupled cooperative multi-arm robots has many challenges. Due to the kinematic coupling of the manipulators, the joints can no longer be controlled independently to follow a desired trajectory of the end-effector or the grasped object [3]. A possible solution to the control problem is proposed by the projected inverse dynamics control (PIDC) [1, 2]. Here, the constrained dynamics are projected onto a constrained and a free subspace, which are orthogonal to each other. This formulation allows to use standard controller formulations as for example, feedforward control using inverse dynamics. However, the projection step has to be repeated in each time step, which can make this control strategy computationally challenging.

Task

First, literature on the control of coupled dual-arm robots must be reviewed to gain a good understanding of the problem. The main objective of this thesis is to develop and implement a suitable control architecture for the Projected Inverse Dynamics Control. It will be tested in simulation and on the experimental platform for cooperative dual-arm manipulation. A performance analysis of the controller and its computational efficiency is to be carried out and compared to other control methods for cooperative dual-arm manipulation.

Requirements

Fundamental knowledge of robotics (Robotics 1 + 2). Knowledge of Matlab and C++, experience with ROS2 is advantageous.

Contact

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References

[1] Dehio, N., Smith, J., Wigand, D. L., Xin, G., Lin, H. C., Steil, J. J., & Mistry, M. (2018). Modelling and Control of Multi-Arm and Multi-Leg Robots: Compensating for Object Dynamics during Grasping. Proceedings - IEEE International Conference on Robotics and Automation, p. 294–301.

[2] Lin, H. C., Smith, J., Babarahmati, K. K., Dehio, N., & Mistry, M. (2018). A projected inverse dynamics approach for multi-arm cartesian impedance control. Proceedings - IEEE International Conference on Robotics and Automation, p. 5421–5428.

[3] Caccavale, F., & Uchiyama, M. (2016). Cooperative manipulation. In Springer Handbook of Robotics (pp. 989–1006).