Notice of dissertation defense 26.02.2018

How to coordinate and control two different robots for cooperative manipulation tasks?

Title
Decentralized Grasp Coordination and Kinematic Control for Cooperative Manipulation

Content
Multi-robot systems have shown potential over single robot systems in handling long, large and heavy objects. Manipulation with multiple robots increases task precision and decreases required load capabilities of individual robots while saving cost and space. However, the limitations of multi-robot systems in communication, sensing and knowledge sharing pose challenges for coordination and control. These challenges are emphasized in cases with heterogeneous robots, that is, where the robots' physical embodiments differ.

This dissertation explores approaches for multi-robot grasp planning in heterogeneous and decentralized settings and develops a control strategy to ensure safety in collaborative manipulation under joint limit constraints.

Grasp coordination results confirmed that with sufficiently similar robots the projection of a robot's own model can be used to model another robot in order to enable effective collaboration. Moreover, the applicability of decentralized approaches are not only for complex hands but also if the robots have simple grippers of different brands and have limitations in centralized planning.

The kinematic controller behavior and performance in heterogeneous dual-arm system were studied and it was observed that the lower performance robot set the performance limit for the entire system. The control strategy is immediately applicable in an industrial setting.

Overall, the dissertation addresses important aspects of multi-robot manipulation and develops technologies related to grasp coordination and collaborative control.

Field of research
Automation, Systems and Control Engineering, Specializing in Robotics

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The dissertation is publicly available on the notice board of the Aalto University Learning Hub Atrium, Maarintie 8.