TECHNISCHE UNIVERSITÄT MÜNCHEN
Human-centered Assistive Robotics
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July 13, 2021

MASTER'S THESIS

Kinesthetic force reshaping in robotic surface processing tasks

Problem description:

Surface processing tasks such as grinding or deburring are often manually crafted. However, the workers are exposed to hazardous grinding dust and subject to a physically demanding work. These issues suggest to use robots to relief the workers from a possible health risk.
In our scenario, a robot shall learn a force-based task from the human worker. Whenever a correction is required during execution, the human shall be able to correct the robot's motion and forces by kinesthetic teaching.
State of the art has shown that the robot's motions can be reshaped by physical interaction [2] and that task contact and human interaction forces can be distinguished [1]. By now, there has been put only minor attention on altering a force profile by kinesthetic teaching while the robot is in task contact.
We want to develop a technique that allows the worker to reshape the robot's actions such that the robot performs as desired. Hereby, two approaches shall be investigated in more detail, which are described in the following.

Tasks:

- Literature survey on motion and force profile reshaping techniques
- Development of a manual force parameterization (MFP) technique (offline)
- Development of a kinesthetic force reshaping (KFR) technique applicable during robot execution (online)
- Robotic experiments on a surface processing task
- Experimental evaluation and comparison of both techniques (MFP, KFR)
- Documentation and discussion of the experimental results in comparison to existing works

Bibliography:

[1] Felix Franzel, Thomas Eiband, and Dongheui Lee. Detection of collaboration and collision events during contact task execution. In *Humanoid Robots (Humanoids), IEEE-RAS 20th International Conference on*. IEEE.
[2] Dongheui Lee and Christian Ott. Incremental motion primitive learning by physical coaching using impedance control. In *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, pages 4133–4140. IEEE, 2010.

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Start:	XX.XX.XXXX
Intermediate Report:	XX.XX.XXXX
Delivery:	XX.XX.XXXX

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