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F O R S C H U N G S P R A X I S
for
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Real-Time Motion Planning for Human Safety Optimization

Problem description:

Recently, the number of robotic applications requiring safe human-robot collaboration have increased significantly. Many efforts have been made to ensure human safety around robots, such as workspace separation, compliant mechanical design and applying interactive control schemes. However, a new paradigm involves quantifying human injuries in pHRI (physical Human-Robot Interaction) and embedding it into robot control. This research work aims to contribute to the field of safe pHRI through extending and implementing a safety/injury knowledge-based multi-priority control scheme. The control method aims to dynamically optimize the robot trajectory with respect to task completion time and human safety criteria.

Work schedule:

- Literature review of the state of the art
- Formulation and implementation of a multi-priority controller for handling manipulation tasks, constraints and additional optimization tasks.
- Implementation of the control scheme and verification via simulation Experimental evaluation

Bibliography:

[1] Haddadin, Sami, et al. *On making robots understand safety: Embedding injury knowledge into control.* The International Journal of Robotics Research 31.13 (2012): 1578-1602.
[2] Khatib, Oussama. *A unified approach for motion and force control of robot manipulators: The operational space formulation.* Robotics and Automation, IEEE Journal of 3.1 (1987): 43-53.
[3] Albu-Schffer, Alin, Christian Ott, and Gerd Hirzinger. *A unified passivity-based control framework for position, torque and impedance control of flexible joint robots.* The International Journal of Robotics Research 26.1 (2007): 23-39.
[4] Dietrich, Alexander, Thomas Wimbck, and Alin Albu-Schffer. *Dynamic whole-body mobile manipulation with a torque controlled humanoid robot via impedance control laws.* Intelligent Robots and Systems (IROS), 2011 IEEE/RSJ International Conference on. IEEE, 2011.

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