

Research project / Student thesis

Robotic manipulation of deformable objects

Motivation

Typical examples of deformable objects are cables, ropes, paper, cloths, or many food products. Since these objects are not single rigid bodies, they cannot be described by position and orientation alone. Examples of manipulation tasks are knot tying, cable wiring, or folding laundry. Robotic automation of such tasks offers high potential, but is still a complicated and partially open field of research.

Task description

First, a suitable example task shall be selected. For example, the threading of belts on the NIST board #2. After a literature survey, a simulation environment shall be developed for this task. Then, a manipulation and control approach shall be implemented, tested in simulation, and if possible, validated with an experimental setup. The last step also requires to implement vision-based sensing of the object state.

Requirements

Basic knowledge of control theory and robotics as well as programming experience in MATLAB and / or C++ are of advantage.

References

- [1] Sanchez, Jose, et al. "Robotic manipulation and sensing of deformable objects in domestic and industrial applications: a survey." *The International Journal of Robotics Research* 37.7 (2018): 688-716.
- [2] <https://www.nist.gov/el/intelligent-systems-division-73500/robotic-grasping-and-manipulation-assembly/assembly>

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NIST task boards #2 and #3 (image from [2])