Progress Report

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1 DLO Dataset Tests

- Clamped end low, DLO on table and flat, change gripper pose, no twist on DLO: omega shape, s shape, u shape, circle shape, ellipse shape, spiral.
- Clamped end low, DLO on table and 3D, with twist: same shapes.
- Clamped end low, DLO angles at 30 degrees and 3D, without twist.
- Clamped end low, DLO angles at 45 degrees and 3D, without twist.
- Clamped end low, DLO angles at 60 degrees and 3D, without twist.
- Clamped end low, DLO angles at 75 degrees and 3D, without twist.
- Clamped end low, DLO angles at 90 degrees and 3D, without twist.
- Clamped end low, DLO angles at 30 degrees and 3D, with twist.
- Clamped end low, DLO angles at 45 degrees and 3D, with twist.
- Clamped end low, DLO angles at 60 degrees and 3D, with twist.
- Clamped end low, DLO angles at 75 degrees and 3D, with twist.
- Clamped end low, DLO angles at 90 degrees and 3D, with twist.

2 Progress

The following items are listed in the order of priority:

- DoD SMART (Dec 1st.): Submitted.

- Photogrammertry Scanner: I developed a camera calibration module but my initial system didnot work based on SfM code. I wanted this to work as a pose estimation methods for DLO dataset, but it seem to complex and expensive at this point. After discussing it with Dr. Gans and looking deeper into what it takes to build one, we decided to use a Intel depth camera for now. I collected data with two different cables to check image quality and the retrievable DLO configuration.

- DLO Dataset (Dec 1st.): This week, I worked the BOM for UR5 work cell, the final version is attached. Moreover, Maicol and I worked on UR5 setup and we collected a test-run recording. One of the RealSense L515 cameras doesnot work properly. We looked the issue, they recommended returning it. Moreover, we printed the DLO mounting piece with Jerry's guidance. I am figuring out how to work with the collected dataset at the moment. Maicol and I are reviewing ROS and UR5 tutorials as well.

- DLO Manipulation (IROS): [1].

- Maicol (REU): I checked with Maicol on his reports, he miss his last report due to finals, but is up to date now. I gave additional details regarding our work to help him with his writing.

- XEst (RAL —): No update.

References

[1] I. Abraham, G. De La Torre, and T. D. Murphey, "Model-based control using koopman operators," *arXiv preprint arXiv:1709.01568*, 2017.

3 Research Plan - Out of date

This section outlines my current research plan where the main ideas, target conference/journal, and expected date of completion for each paper are provided. Target conferences: ICRA, IROS (March), CASE (Late Feb.), NIPS. Target Journals: RAL, CVPR, CORAL.

- Koopman-01 (IROS - Dec. 1st - active): Koopman-based MPC control of VTOL-DIP and VTOL-TIP in simulation, DLO pose estimation in simulation, experiments on choice of basis function and lifting dimensions, and performance comparison with optimal, robust, and/or adaptive control schemes.
- Koopman-02 (ACC - Sep 30th - active): A review on Koopman-based control schemes. Not enough, make it part of another paper. Read papers and write literature reviews.
- Koopman-03 (RAL - Mar. 1st - status): Extension to Koopman-01, Koopman-based dynamic estimation of DLO, collect dynamic DLO dataset, prediction of DLO configuration.
- Quest-01 (IROS - Mar. 1st - next): Optimal transform solution for QuEst based on dominant mode decomposition (DMD).