Efficient Grasp Planning and Execution with Multi-Fingered Hands by Surface Fitting

Welcome to this page. This page supplements our RA-L submission with IROS2019 option, in which we present an approach to plan and execute grasps with multi-fingered hand by surface fitting.

Grasp planning for multi-fingered hands is challenging due to the high-dimensionality, collision and sensing/actuation uncertainties.

We propose a method called multi-dimensional iterative surface fitting (MDISF) to plan grasps for multi-fingered hands. The trajectories to reach these desired grasps are further generated by the proposed grasp trajectory optimization (GTO) module.

The MDISF algorithm searches for optimal contact regions and hand configurations by minimizing the collision and surface fitting error, and the GTO algorithm generates optimal finger trajectories to reach the highly ranked grasp configurations and avoid collision with the environment.

The proposed grasp planning and execution framework considers the collision avoidance and the kinematics of the hand-robot system, and is able to plan grasps and trajectories of different categories efficiently with gradient-based methods using the captured point cloud. The found grasps and trajectories are robust to sensing noises and underlying uncertainties.

Video included:

1. Surface fitting demo. (Done).
2. Precision grasp and power grasp comparison.
3. GTO demo. Use bunny object, explain the three cases.
4. Experiment Results.
5. Summarize the points.