Faculty of Mechanical Engineering
הפקולטה להנדסת מכונות
הטכניון מכון טכנולוגי לישראל
TECHNION Israel Institute of Technology

MECHANICAL ENGINEERING MSc SEMINAR (30 min.)

Monday, September 08, 2025, at 14:30-15:00, D. Dan and Betty Kahn Building, Room 217

Deformable Linear Object Surface Placement Using Elastica Planning and Local Shape Control Based on Machine Learning Method

Itay Grinberg

Adviser: Assoc. Prof. Elon Rimon

Manipulation of deformable linear objects (DLOs) in constrained environments is a challenging task. For this task with such high constraints, high-level planning is necessary to achieve successful performance. Despite the high-level planning, DLOs are difficult to model accurately. Modeling errors significantly affect DLOs manipulation in real systems which can result in task failure if the robot simply follows a DLO manipulation path in open loop manner.

This work describes a two-layered approach for placing DLOs on a flat surface using a single robot hand. The high-level layer is a novel DLO surface placement method based on Euler's Elastica solutions. During this process, one DLO endpoint is manipulated by the robot gripper while a variable interior point of the DLO serves as the start point of the portion aligned with the placement surface. The low-level layer forms a vision-based controller. The controller estimates the DLO current shape using a Residual Neural Network (ResNet) and uses low-level feedback to ensure task execution in the presence of modeling and placement errors.

The resulting DLO placement approach can recover from states where the high-level manipulation planner has failed, as required by practical robot manipulation systems. The DLO placement approach is demonstrated with simulations and experiments that use silicon mock-up objects prepared for fresh food applications.

Note: the seminar will be given in Hebrew

Seminars Coordinator: Assoc. Prof. Shmuel Gal.