# סמינריון

הנך מוזמן/ת להרצאה סמינריונית של הפקולטה להנדסת מכונות שתתקיים ביום ה' 24.12.2020

(ט' בטבת, תשפ"א), בשעה 10:00 באמצעות הזום :

https://technion.zoom.us/j/95639648328

**מרצה** : עמית רוס

**מנחים** : פרופ'/ח אמיר דגני ופרופ'/ח יזהר אור

**על הנושא:**

## Obstacle-Aided Locomotion of a Robot Manipulator: Modeling, Path Planning, Simulation, and Experiments

The seminar will be given in Hebrew

**תקציר ההרצאה :**

Performing a "surgical" manipulation task in an obstacle-rich environment is a widespread engineering challenge. One method to tackle this problem is to use robotic manipulators with many joints, i.e., hyper-redundant manipulators, to increase flexibility. However, the hyper-redundancy of joints increases the complexity while compromising the stiffness, load capacity, and precision. Previous studies of manipulators in the presence of obstacles have mostly focused on **obstacle avoidance**. Here, we design a manipulator that **utilizes** contact with **obstacles** in order to relieve the load on the joints due to self-weight.This study comprises modelling, path planning, simulations and experiments of obstacle-aided locomotion of a hyper-redundant manipulator. The planar manipulator includes five revolute joints, with its base on a prismatic joint. Free-rolling wheels on each of the joints and at the manipulator's distal tip allow frictionless contact.The planning algorithm spans a configuration space adapted to the environment that includes the contact configurations with the environment. The algorithm minimizes the norm of joint torques by finding the optimal configuration and the optimal contact forces under constraints. Furthermore, we developed a dynamic simulation (Mathworks - Simscape Multibody) including contact forces. The simulation enabled us to explore a hybrid control law that switches between a position loop and torque loop, which subsequently controls the contact forces. Using the dynamic simulation, we examined various scenarios of different difficulties. Statistical comparison of scenarios showed increased efficiency of the algorithm for high-difficulty scenarios. Finally, we experimentally tested three different scenarios, showing a good fit between experimental results, algorithm results, and simulations. Experimental results demonstrate the importance ofobstacle-aided kinematic path planning.

בברכה,

פרופ"ח מתני סאס
מרכז הסמינרים