

MECHANICAL ENGINEERING STUDENT SEMINAR

Tuesday, August 27th 2024, at 14:00, D. Dan and Betty Kahn Building, Room 217.

Online: <https://technion.zoom.us/j/91789830224>

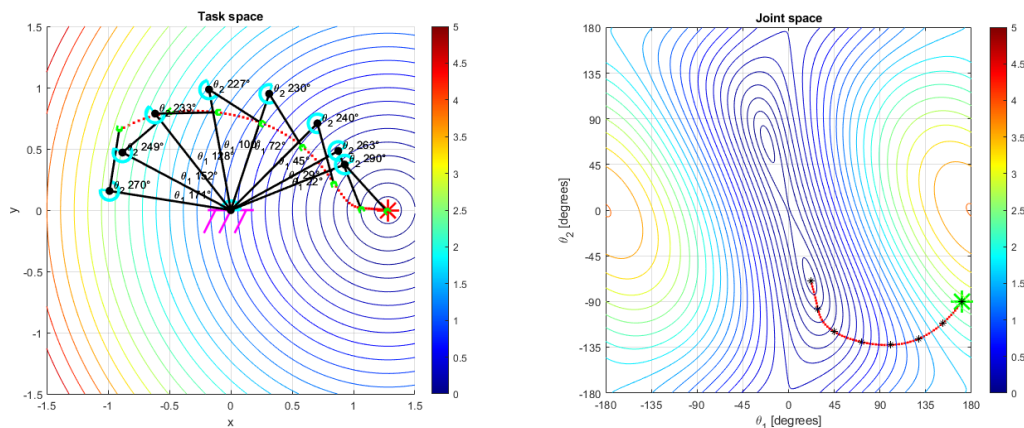
Potential Function Based Inverse Kinematics of Robotic Manipulators

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The inverse kinematics (IK) of redundant robotic manipulators can be particularly challenging to solve algebraically, especially when dealing with uncertain information about the manipulator link lengths or target location. Potential functions offer a method to obtain numerical solutions for various problems by leveraging well-known optimization algorithms. However, their construction requires careful attention to avoid the creation of parasitic local minima. In this seminar, we will introduce potential functions designed specifically to solve the inverse kinematics problem for planar redundant manipulators. Additionally, we will present a novel proof of convergence for the method, which has significant implications for other IK algorithms, particularly Jacobian or gradient-based methods. We will highlight several important properties of these potential functions, which enable their application even when given uncertain data.

Time permitting, we will discuss three extensions to this approach. First, we will explore extending potential functions to sensor-based applications, along with an analysis of performance. Second, we will discuss the addition of an orientation component to the IK potential function, enabling the computation of IK solutions for both position and orientation within a single algorithm. Third, we will examine how these potential functions can be applied to 180°-type joint limits, which arise from physical constraints of the robot arms, preventing damage to wires or air-hoses connected between the links. Finally, we will discuss two open problems: applications for general joint limits and the general torus-torus intersection problem.



Note: the seminar will be given in English