

Robotic surgical tool manipulator - Recognition, control and manipulation of laparoscopic tools

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Historical Overview of Surgical robotics

Surgical Robotics Procedure

Advantages & Disadvantages of Surgical robotics

Problem statement

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Robotic arm & DH parameters

Forward Kinematics

Inverse Kinematics - Decoupling Technique

7DoF numerical solutions

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Gripper & Forward Kinematics

Gripper Inverse Kinematics

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Laparoscopic tool detection

Stereoscopic vision

Calculation of tool position and orientation

Calculation of grasping points

Trocar detection & Estimation of fulcrum point

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Path Planning - Sampling methods

Pick and place algorithm

Task space analysis

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Tool pose & the Fulcrum Effect

Circular trajectory of tool tip

Circular arc trajectory of tool tip

Line segment trajectory of tool tip

Cubic Spline trajectory of tool tip

B-Spline trajectory of tool tip

Polynomials of 5th order

Planning with velocity profiles

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Firm grasping algorithm & Force control

Position based visual servoing

Image based visual servoing

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Introduction to the ROS framework

Gazebo simulation environment

Visualization with RViz

Motion Planning with Moveit

Tools, Packages and Libraries

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Robot Planner 1: Simple MoveIt planning

Robot Planner 2: Simulation layout and reachability experiments

Robot Planner 3a: Circular and Circular arc trajectories in task space

Robot Planner 3b: Line segment trajectories in task space

Robot Planner 3c: Cubic Spline trajectories in task spac

Robot Planner 3d: B-Spline trajectories in task space

Robot Planner 3e: Polynomial trajectories in joint space

Robot Planner 3f: Trajectories in joint space with trapezoidal velocity profile

Robot Planner 3g: Trajectories in joint space with s-curve velocity profile

Robot Planner 4: Simple cube pick-and-place experiment

Robot Planner 5: Visual servoing

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Conclusions & Comparison with similar projects

Future Work