Remote Center of Motion Constrained Planning for a 7DOF Robotic Arm

A Project Report

submitted by

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THESIS CERTIFICATE

This is to certify that the thesis titled **Remote Center of Motion Constrained Planning for a 7DOF Robotic Arm**, submitted by **Suraj Rathi**, to the Indian Institute of Technology, Madras, for the award of the degree of **B.Tech**, is a bona fide record of the research work done by him under my supervision. The contents of this thesis, in full or in parts, have not been submitted to any other Institute or University for the award of any degree or diploma.

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ABSTRACT

KEYWORDS: abc; ahds; hags.

In this project we attempt to build a realtime path planner satisfying a remote center of motion constraint. After ensuring the method will converge to a solution, the optimization objective is to minimize the total joint motion and to enforce motion limits on each joint. We set up a simulation using Open Robotics' Gazebo to conduct our experiments in conjunction with the ROS platform. We worked to identify the challenges faced by planning in task space using Inverse-Kinematics. Sampling based methods were then used to improve the performance. Our work demonstrates the effectiveness of task space Inverse-Kinematics based methods.

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ABBREVIATIONS

RCM	Remote Center of Motion
DOF	Degrees of Freedom

NOTATIONS

F	Force (N)
δ	Displacement (m)

CHAPTER 1

INTRODUCTION

1.1 Motivation

Laparoscopic surgery, commonly know as 'keyhole' surgery, is a procedure where a surgeon accesses the inside of the abdomen and pelvis without having to make a large incision. We were attempting to use a seven DOF KUKA iiwa LBR arm

Abdominal surgery is often done through making small 'keyhole' incisions and and manipulating surgical tools through it. We must ensure that the robot's end-effector never passes outside of this region. This is called the restricted center of motion (RCM) constraint.

Path Planning refers to calculating the set of joint motions that will move the end-effector from one position to another in task space. This refers to the coordinate system specifying the robot's position in terms of the pose of the end effector. Configuration space refers to the coordinate system specifying the robot's position by the angle of each of its joints. Traditionally, path planning is done by computing the path through the second of these. This is generally faster as it avoids solving complicated inverse kinematics (IK) problems and robot singularities.

Through preliminary experiments in the simulation, we found that in practice, computing differential IK solutions is extremely fast. This eliminates the computational gap between the two methods/

1.2 C-Space and T-Space Planning

1.3 Objectives

CHAPTER 2

METHODOLGY

APPENDIX A

MATLAB code for polymer network creation

Just put in text as you would into any chapter with sections and whatnot. Thats the end of it.