Repurposing a Sampling-Based Planner for a Six-Degree-of-Freedom Manipulator to Avoid Synthetic Moving Obstacles

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Abstract

This paper presents the use of a sampling-based planner as a local planning scheme to avoid obstacle between a robotic arm and a moving obstacle. Based on a planner benchmark on a obstacle-ridden environment, rapidly-exploring random tree (RRT) planner are used to populate the trajectories of the task space and map them into a configuration space using Newton-Raphson-based inverse kinematic solver. Three robot poses are defined in a cycle of back-and-forth motion; the starting, the midpoint, and the end pose. The starting pose and the end pose are equal. The robot repeatedly moves from the starting pose to the end pose via the midpoint pose. Poses between the three are a subset of a trajectory populated by the sampling-based planner. Each set of trajectory is unique. We impose periodically occuring synthetic obstacle that moves in and out of the robot arm workspace defined in a simulated environment. Within the robot's workspace, the obstacle moves and cuts through the cyclical space to emulate a dynamic environment. Based on the performance of the local planning strategy, the robot has a higher success in avoiding the obstacles when the planning query starts during the presence of the obstacles in the cyclical space. However, a higher chance of collision occurs when the planning query is invoked when the obstacle nearly approaches the cyclical space.

Keywords— mechatronics, robotics, planner, path-planning, sampling-based planner, robotic arm, manipulator, dynamic environment, moving obstacles, ROS, MoveIt

1 Introduction

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References

[1] M. Hägele, K. Nilsson, J. N. Pires, and R. Bischoff, "Industrial robotics," in *Springer Handbook of Robotics*, Springer International Publishing, Jan. 2016, pp. 1385–1421, ISBN: 9783319325521. DOI: 10.1007/978-3-319-32552-1_54. [Online]. Available: https://link.springer.com/chapter/10.1007/978-3-319-32552-1_54.