

Motion Planning for Multiple Robots of a Object Handling System Considering Fast Stable State Transition

Fast transition from a stable initial state to a stable handling state is important when multiple mobile robots grasp and transport a bulky and heavy object. We focus on the problem of fast transition from a stable initial state to a stable handling state and propose a strategy for two mobile robots to grasp and lift an object in a minimal amount of time.

In order to realize the transition from a stable initial state to a stable handling state, a object handling system consisting of a gripper robot and a lifter robot was designed. A gripper robot moves to the grasping position and grasps an object. Then a gripper robot lifts one side of the object and transmits grasping finished message to the lifter robot. This provides space between the object and ground which can be used by the lifter robot. The lifter robot moves to the lifting position and inserts the lifter into the space under the object after receiving message from the gripper robot, then lifts the other side of object and transmits the lifting finish message to the gripper robot. Finally, two mobile robots perform circular motion at same time, so the stable handling state can be realized by using the object handling system designed.

Trajectory generation of two robots to minimize the transition time from a stable initial state to a stable handling state can be formulated as an optimization problem. The goal is to acquire the velocity of left/right wheel of the gripper robot and the lifter robot to realize fast transition from the stable initial state to the stable handling state. The penalty method and multi-start local search method were chosen to acquire the optimization solution.

The experiments were conducted with two real robots and the objects which are used in daily life. Two robots can realize fast stable state transition cooperatively.

Keywords: Motion planning, a object handling system, fast stable state transition

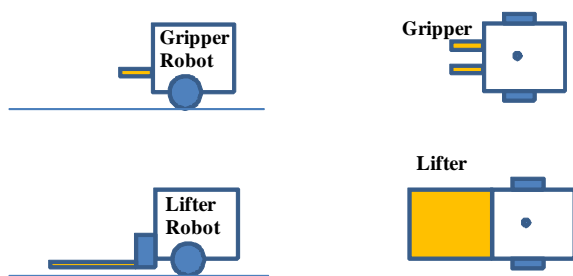


Fig. 1 A object handling system

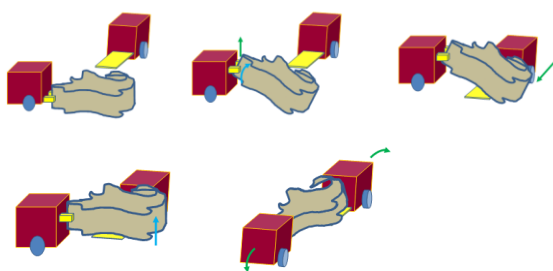


Fig. 2 Fast stable state transition using a object handling system

Reference

- 1) Z.J. Liu, H. Kamogawa and J. Ota, Manipulation of an Irregularly Shaped Object by Two Mobile Robots, Proc. 2010 IEEE/SICE Int. Symp. System Integration, 228-223 (2010).

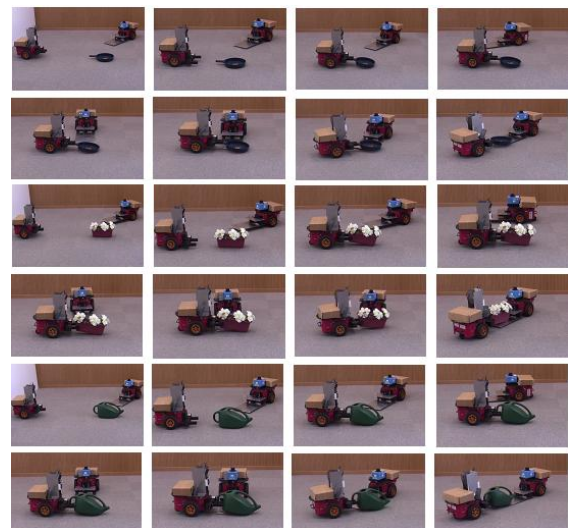


Fig. 3 Experiments of fast stable state transition.