

# Manipulator System Selection Based on Evaluation of Task Completion Time and Cost

Task completion time and cost are two significant criteria for the selection of manipulator system. For a given task, several Pareto solutions of manipulator systems should be derived based on evaluation of these two criteria. However, a large calculation time is required to evaluate these two criteria for all candidate manipulator systems.

In this study, we propose a method (Fig. 1) that can select Pareto solutions of manipulator systems by evaluating task completion time and cost within the desired calculation time. Selection of manipulator is taken into account in manipulator system selection since task completion time and cost are affected greatly by the selected manipulator. Each candidate manipulator system consists of a 6-DOF robot arm and a 1-DOF positioning table (Fig. 2). In the proposed method, multiple objective particle swarm optimization (MOPSO) is employed to search for appropriate manipulator systems from a set of candidate systems. Location optimization and motion coordination are integrated to derive the task completion time. We employ particle swarm optimization (PSO) for location optimization and use nearest-neighborhood algorithm (NNA) for motion coordination. The proposed method is proved to be effective through a simulation under 3 types of tasks. The proposed method is compared to a comparative method which evaluates all candidate systems. The calculation time for these two methods is shown in Fig. 3 and the derived Pareto solutions are shown in Fig. 4.

**Key words:** Manipulator system selection, MOPSO, task completion time, location optimization

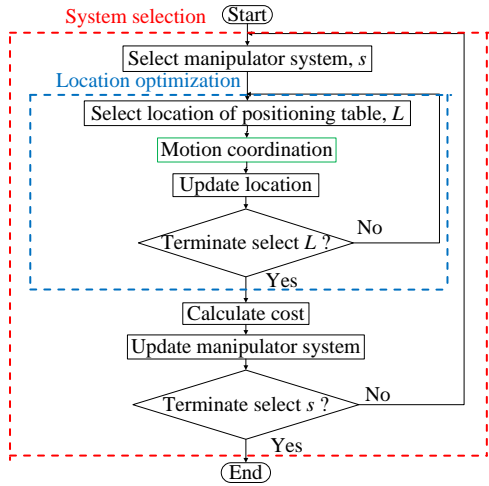


Fig. 1 Proposed method

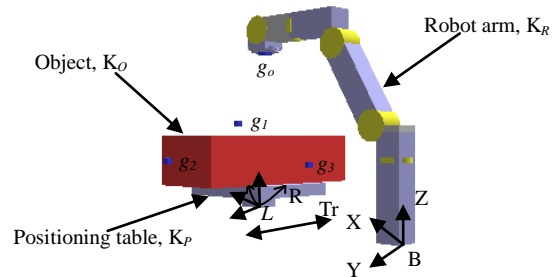


Fig. 2 A system with a robot arm and a positioning table

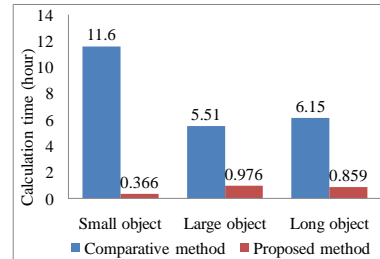


Fig. 3 Calculation time

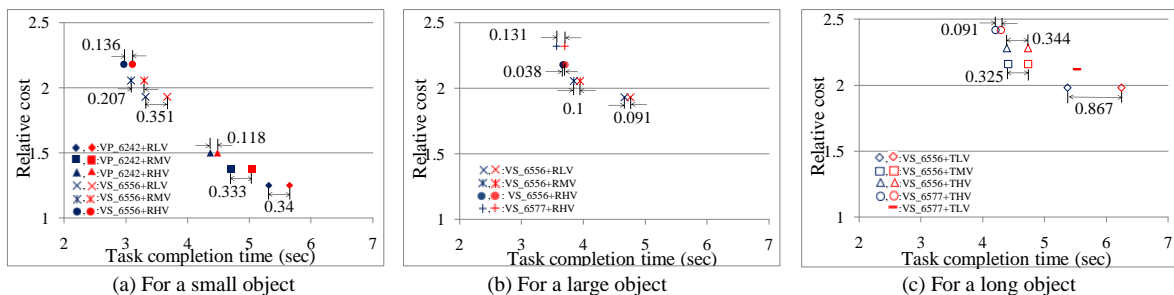


Fig. 4 Derived Pareto solutions of manipulator systems by using proposed method and comparative method. The red symbols are the systems derived by using proposed method, the blue symbols are the systems derived by comparative method.