Task Allocation and Dead-Lock-Free Trajectory Planning for Collaborative Multi-Robot System

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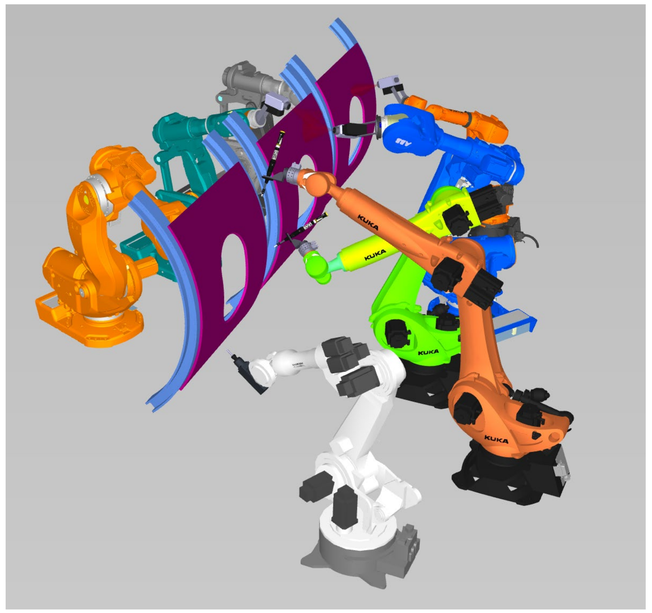
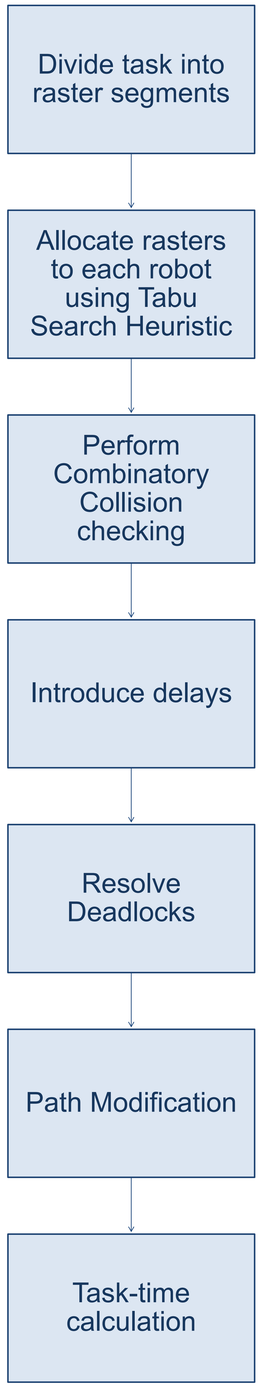
Research Objective: To develop offline-coordination planning techniques for multi-robot systems with partially shared workspaces that enables them to allocate and perform manufacturing tasks in a time-effective and computationally efficient manner.

Collaborative robots performing a manufacturing task

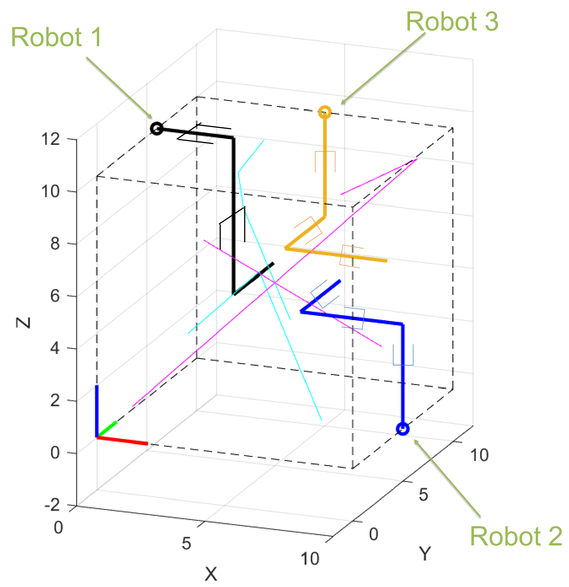


Applications

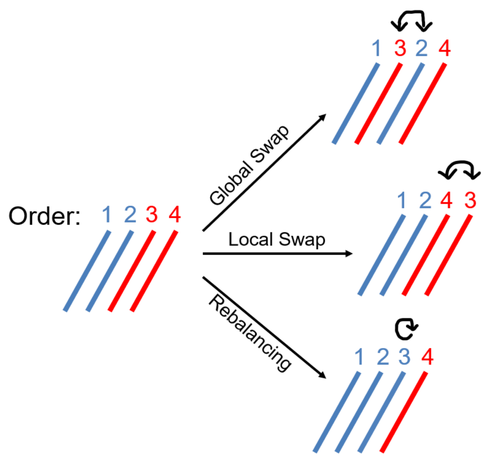
- Spray Painting
- 3D Printing (Additive Manufacturing)
- Pressure Washing
- Loading Docks (Object manipulation)



Modeling of three 3P robots in MATLAB



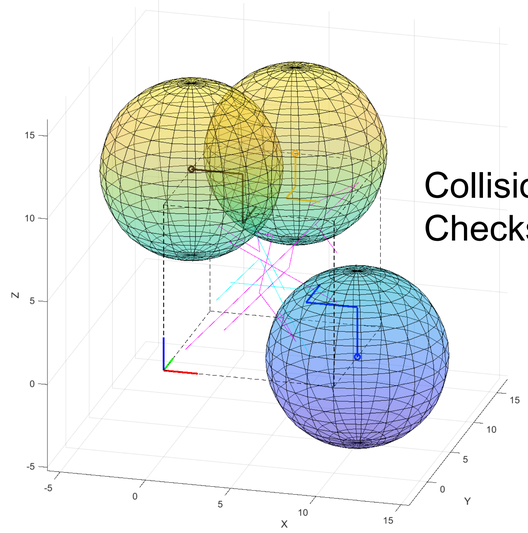
Tabu Search Heuristic



Tabu Search Heuristic is employed for task allocation and to find the local optimal path with minimum timespan.

Combinatory Collision Checking

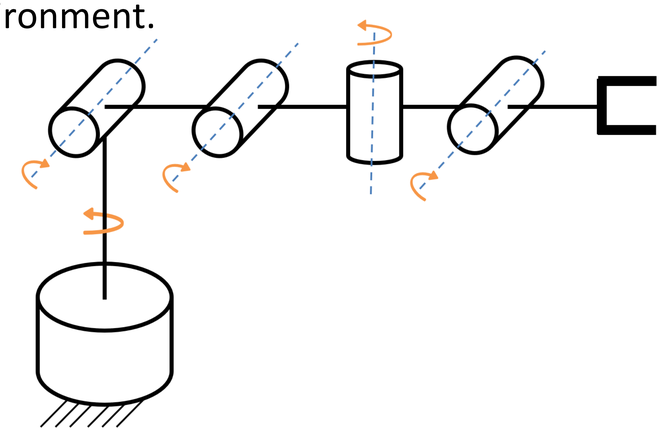
Generally, for m robots, each with n links:



$$\text{Collision Checks} = \binom{m}{2} * n^2$$

Future Work

The coordination planning techniques now need to be implemented on a 5/6 DOF multi-robot systems for manufacturing environment.



Reference:
https://www.therobotreport.com/top-5-countries-using-industrial-robots-2018/