

Optimal Robot Path Planning Using the Minimum-Time Criterion

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Problem statement:

3 Degree of Freedom robots are often used in industrial environments for object manipulation purposes. However, it is not possible to directly calculate the shape of the path that minimizes the travel time between two points, especially if obstacles are considered.

Optimization problem:

Find the path which minimizes the total traversal time. The variables are the motor torques in each joint. This is subject to several constraints: the equations of motion of the robot must be satisfied, and a set minimum distance between the robot and any obstacle must be kept. Also, there are bounds on the joint torques and physical limits on the joint displacements based on the construction of the robot. A general-purpose optimization program was used.

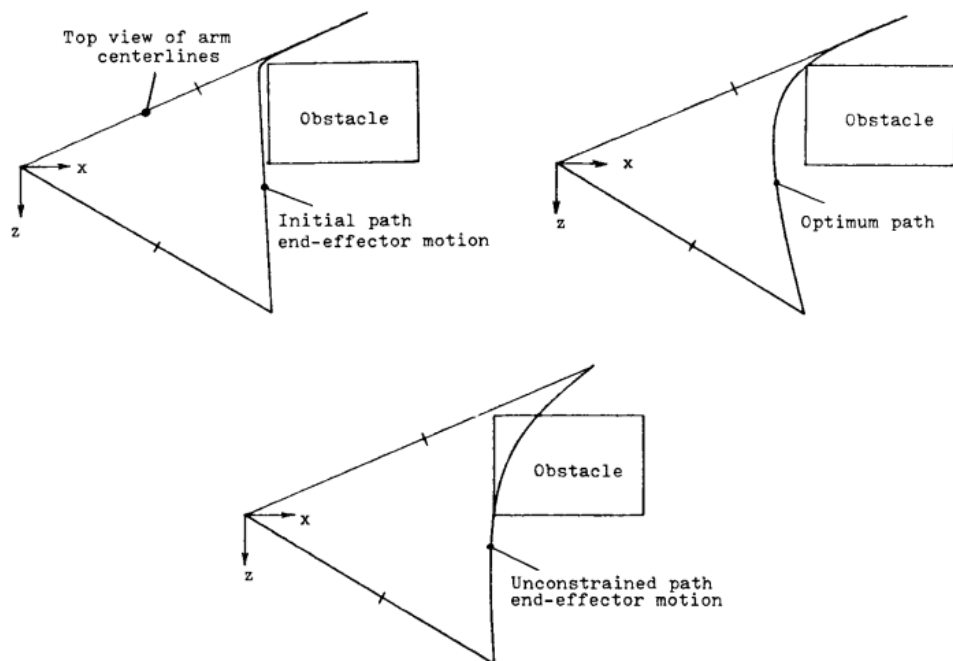


Fig. 6. Top view of three different three-dimensional motions between fixed endpoints. The traversal time for the initial path was 0.375 s, the optimal path was 0.308 s, and the unconstrained path was 0.27 s.