

Foundations of Robotics

Homework 7

1. (Exercise 9.2) Please solve the exercise introduced as follows.

Exercise 9.2 A cylindrical path in $X = (x, y, z)$ is given by $x = \cos 2\pi s$, $y = \sin 2\pi s$, $z = 2s$, $s \in [0, 1]$, and its time scaling is $s(t) = \frac{1}{4}t + \frac{1}{8}t^2$, $t \in [0, 2]$. Write down \dot{X} and \ddot{X} .

2. (Exercise 9.5) Please solve the exercise introduced as follows.

Exercise 9.5 Find the fifth-order polynomial time scaling that satisfies $s(T) = 1$ and $s(0) = \dot{s}(0) = \ddot{s}(0) = \dot{s}(T) = \ddot{s}(T) = 0$.

3. (Exercise 9.7) Please solve the exercise introduced as follows.

Exercise 9.7 If you want to use a polynomial time scaling for point-to-point motion with zero initial and final velocities, accelerations, and jerks, what would be the minimum order of the polynomial?