Robotics Tutorial 3: Trajectory Planning

Exercise 1:

Compute the joint trajectory from $q(0) = 1$ to $q(2) = 4$ knowing that initial and final velocities and accelerations are null.

Propose a script MatLab or Scilab to display trajectories $q(t), \dot{q}(t)$ and $q\ddot{(t)}$ for $0 \leq t \leq 2$.

Exercise 2:

Compute the timing law $q(t)$ for a joint trajectory with velocity profile of the type $\dot{q}(t) = k(1 - \cos(at))$ from $q(0) = 0$ to $q(2) = 3$ knowing that final velocity $(\dot{q}(2))$ is null.

Propose a script MatLab or Scilab to display trajectories $q(t), \dot{q}(t)$ and $\ddot{q}(t)$ for $0 \leq t \leq 2$.

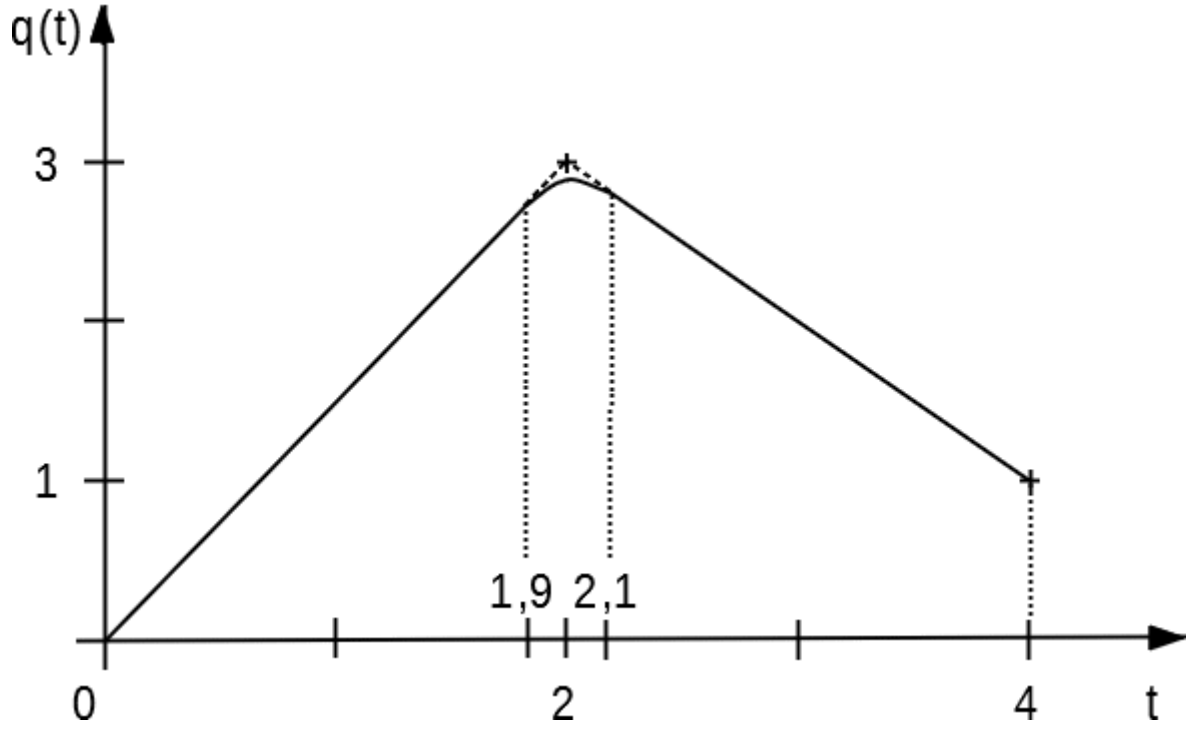
Exercise 3:

Given the values for the joint variable : $q(0) = 0, q(2) = 2$ and $q(4) = 3$, compute the two fifth-order interpolating polynomials (the first one for points defined between times 0 and 2, the second one for points defined between times 2 and 4) with continuous velocities and accelerations knowing that initial and final velocities $(\dot{q}(0), \dot{q}(4))$ and accelerations $(\ddot{q}(0), \ddot{q}(4))$ are null. Velocity at time 2 $\left(\dot{q}(2)\right)$ is equal to the mean velocities in the intervals [0,2] and [2,4]. Likewise, acceleration at time 2 $\left(\ddot{q}(2)\right)$ is equal to the mean accelerations in the intervals [0,2] and [2,4].

Propose a script MatLab or Scilab to display trajectories $q(t), \dot{q}(t)$ and $q\ddot{(t)}$ for $0 \leq t \leq 4$.

Exercise 4:

Given the values for the joint variable: $q(0) = 0, q(2) = 2$ and $q(4) = 1$, find the interpolating polynomial with 2 linear segments and 1 parabolic described below.



Propose a script MatLab or Scilab to display trajectories $q(t), \dot{q}(t)$ and $q\ddot{(t)}$ for $0 \leq t \leq 4$.