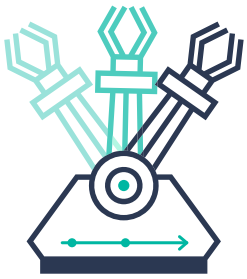
PICKNIK

TrackJoint Technical Spec



Position Interpolation Library

picknik.ai/products

TrackJoint is targeted at robot arm manufacturers or others who need to send smooth, low-level motion commands to each joint. TrackJoint provides smooth motion commands for any number of robot actuators. The smoothing can increase actuator longevity by a factor of two or more. Jerk, acceleration, and velocity constraints are enforced and discontinuities in acceleration and velocity are eliminated.

Algorithm Overview

Input

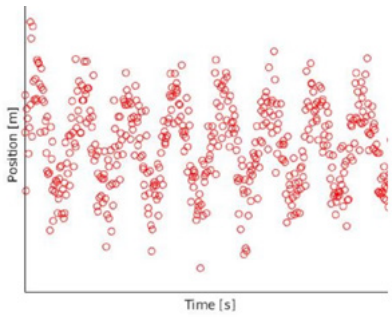
- The current state (current position, velocity, and acceleration of the joints)
- The target state (desired position, velocity, and acceleration of the joints)
- The desired time to reach the target state
- The maximum acceptable time to reach the target state [1]
- The maximum velocity, acceleration, and jerk for each joint
- The period of the robot controller

Output

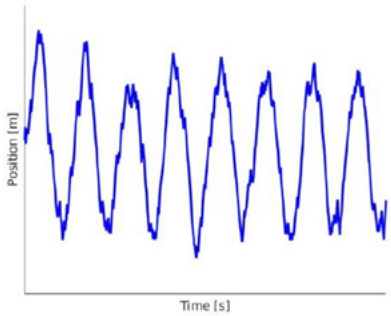
- A smooth, jerk-limited trajectory per-joint
- Waypoints spaced at the desired control frequency
- The calculated time to reach the target state [1]

[1] If a trajectory obeying maximum limits exists, the returned trajectory's time will equal desired time

Non-Jerk Limited Trajectory Generation



TrackJoint Smoothed Trajectory



Smoothed trajectory reduces hardware oscillation & wear

Performance

Algorithm runtime [2]	less than 1 ms
Algorithm completeness	If a solution exists for the provided input a solution is returned
Algorithm optimality [3]	Within 10% of optimal
Trajectory density	1 waypoint per controller timestep
End effector jerk	Does not exceed joint's limit
End effector acceleration	Does not exceed joint's limit, is continuous
End effector velocity	Does not exceed joint's limit, is continuous

[2] See case studies below for details

[3] If desired time is not possible and is increased

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Algorithm Integration

Recommended robot controller rate	1000 Hz
Licensing	Per robot perpetual license
Distribution format	.so .dll [4]
Integration support	Available [5]

[4] Contact for dll library details [5] Additional costs apply

Technical Scenario 1 - Planning a Small Motion at High Control Rate

In this case study, TrackJoint rapidly brings three joints to a halt at the desired position.

Input

Current state	Joint Positions (0.01, -0.6, -0.1) rad Joint Velocities (-0.18, 0.2, 0.13) rad/s Joint Accelerations (-3.06, 2.39, 0.2) rad/s²
Target state	Joint Positions (0, -0.57, 0) rad Joint Velocities (0, 0, 0) rad/s Joint Accelerations (0, 0, 0) rad/s²
Desired duration	28 ms
Constraints	Max join vel = 3.2 rad/s Max joint accel = 5 rad/s² Max joint jerk = 1000 rad/s³
Robot controller period	1 ms (1000 Hz)

System Configuration

CPU Specs	Intel i7-7700HQ, 2.8GHz, non-realtime kernel

TrackJoint Performance

TrackJoint planning time	0.9 ms
Calculated duration	332 ms
Number of waypoints	333

Technical Case Study 2 - Planning a Large Motion

In this case study, TrackJoint plans large motions for three joints, starting and ending with non-zero velocities and accelerations.

Input

Current state	Joint Positions (0.74, -0.59, -1.1) rad Joint Velocities (0.33, 0.2, 1.13) rad/s Joint Accelerations (0.2, -0.12, 0.9) rad/s²
Target state	Joint Positions (0.93, -0.86, -0.42) rad Joint Velocities (0.1, 0.05, 0.59) rad/s Joint Accelerations (-0.2, -0.12, -0.23) rad/s²
Desired duration	1 s
Constraints	Max joint vel = 3.2 rad/s Max joint accel = 5 rad/s² Max joint jerk = 1000 rad/s³
Robot controller period	1 ms (1000 Hz)

System Configuration

CPU Specs	Intel i7-7700HQ, 2.8GHz, non-realtime kernel

TrackJoint Performance

TrackPose planning time	1.00 ms
Calculated duration	1.01 s
Number of waypoints	1014