3D Path Planning: Pruning with Constraint Satisfaction (7A)

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1 RRT*

RRT*(Rapidly exploring Random Trees *) is an extension of RRT algorithm which converges towards optimum solution. RRT provides substantial benefits, especially for real-time applications. Like the RRT, it quickly finds a feasible motion plan. Moreover, it improves the plan toward the optimal solution in the time remaining before plan execution is complete. This refinement property is advantageous, as most robotic systems take significantly more time to execute trajectories than to plan them.
For example, robotic cars spend no more than a few seconds to plan a path before driving toward the goal, which may take several minutes. In such settings, asymptotic optimality is particularly useful, since the available computation time as the robot is moving along its trajectory can be used to improve the quality of the remaining portion of the planned path

2 Spline Fitting

The term "spline" is used to refer to a wide class of functions that are used in applications requiring data interpolation and/or smoothing. The simplest spline is a piece-wise polynomial function, with each polynomial having a single variable. The spline S takes values from an interval [a,b] and maps them to R , the set of real numbers.
$[t_i, t_{i+1}]$, $i = 0, \ldots, k-1$
$[a, b] = [t_0, t_1] \cup [t_1, t_2] \cup \cdots \cup [t_{k-2}, t_{k-1}] \cup [t_{k-1}, t_k][a, b] = [t_0, t_1] \cup [t_1, t_2] \cup \cdots \cup [t_{k-2}, t_{k-1}] \cup [t_{k-1}, t_k]$
$a = t_0 \leq t_1 \leq \cdots \leq t_{k-1} \leq t_k = ba = t_0 \leq t_1 \leq \cdots \leq t_{k-1} \leq t_k = b$
$P_i : [t_i, t_{i+1}] \to R$
$.S(t) = P_0(t)$, $t_0 \leq t < t_1$,$S(t) = P_0(t)$, $t_0 \leq t < t_1$,
$S(t) = P_1(t)$, $t_1 \leq t < t_2$,$S(t) = P_1(t)$, $t_1 \leq t < t_2$,
$\vdots\vdots S(t) = P_{k-1}(t)$, $t_{k-1} \leq t \leq t_k.S(t) = P_{k-1}(t)$, $t_{k-1} \leq t \leq t_k$.

References

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