轨迹优化-贝塞尔曲线和硬约束简介

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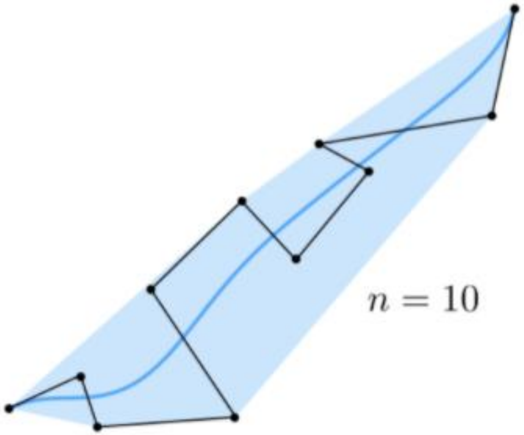
贝塞尔曲线



Bernstein form of a Bézier curve of order n:

$$\mathbf{b}^n(t) = \mathbf{b}_0^n(t) = \sum_{j=0}^{n} \mathbf{b}_j B_j^n(t)$$

Bézier curve order n
(vector polynomial of degree n)

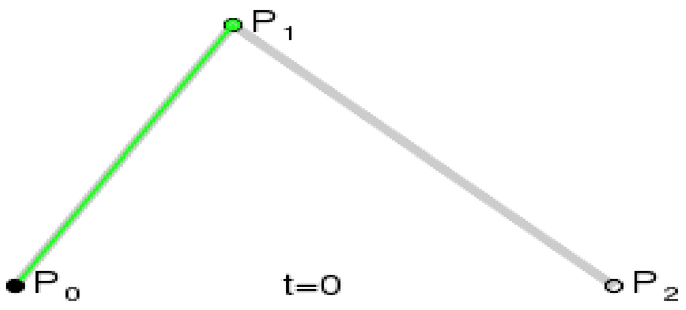
Bernstein polynomial
(scalar polynomial of degree n)

Bézier control points
(vector in R^N)

Bernstein polynomials:

$$B_i^n(t) = \binom{n}{i} t^i (1-t)^{n-i}$$

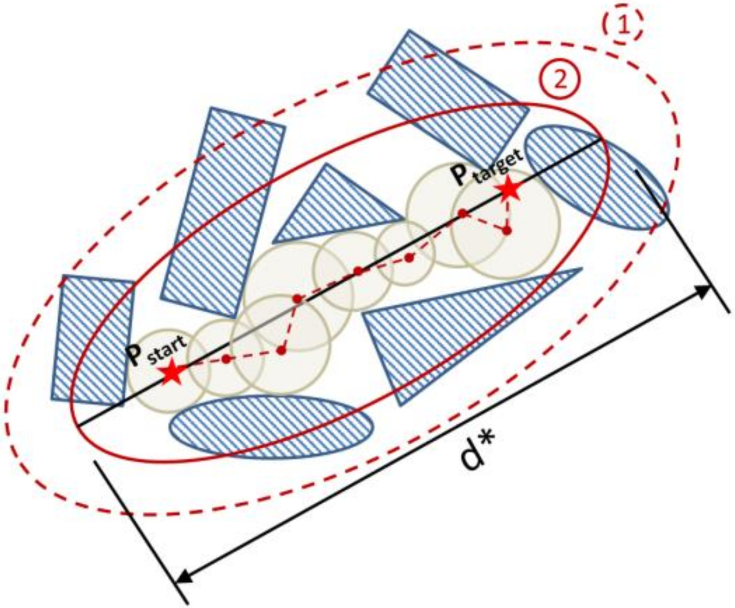
贝塞尔曲线



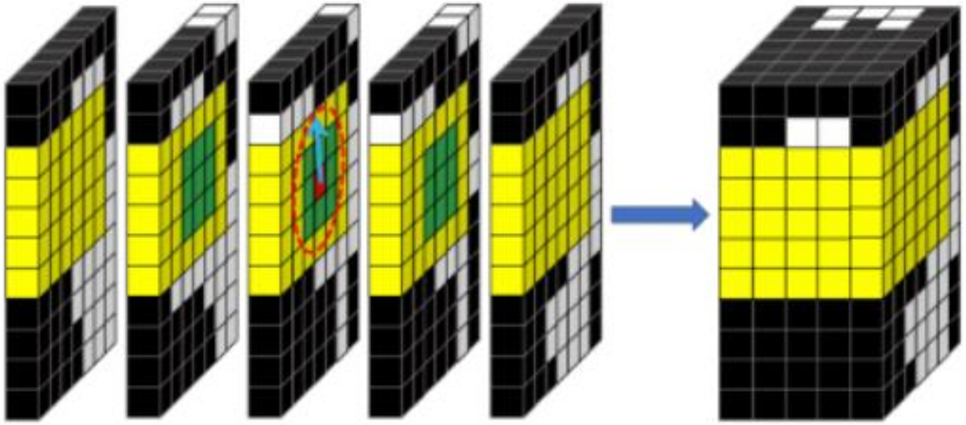
曲线转化

$$
\boldsymbol{M}=\begin{bmatrix}
1 & 0 & 0 & 0 & 0 & 0 & 0 \\
-6 & 6 & 0 & 0 & 0 & 0 & 0 \\
15 & -30 & 15 & 0 & 0 & 0 & 0 \\
-20 & 60 & -60 & 20 & 0 & 0 & 0 \\
15 & -60 & 90 & -60 & 15 & 0 & 0 \\
-6 & 30 & -60 & 60 & -30 & 6 & 0 \\
1 & -6 & 15 & -20 & 15 & -6 & 1
\end{bmatrix}
$$

飞行走廊



飞行走廊



参考

[1] Gao F , Wu W , Lin Y , et al. Online Safe Trajectory Generation for Quadrotors Using Fast Marching Method and Bernstein Basis Polynomial[C]// 2018:344-351.

[2] https://github.com/HKUST-Aerial-Robotics/Btraj

THANKS