Programming #1: Part IV (4190.562)

Due: April 6, 2016

A cubic Bézier curve $C(t) = \sum_{l=0}^{3} \mathbf{b}_l B_l^3(t) = \sum_{l=0}^{3} (x_l, y_l) B_l^3(t) = (x(t), y(t))$, $0 \leq t \leq 1$, can be used for the deformation of a planar shape given as a point cloud: $\{\mathbf{p}_k \mid k = 1, \cdots, N\}$.

Part I: For each point $\mathbf{p}_k$, compute the closest point $C(t_k)$ and bind $\mathbf{p}_k$ to the local frame at $C(t_k)$ (determined by the tangent and normal directions). When we edit the cubic Bézier curve $C(t)$, each point $\mathbf{p}_k$ should move to the corresponding position in the new local frame at $C(t_k)$ under the shape deformation of $C(t)$.

Part II: Given two planar shapes, each controlled by a cubic Bézier curve, compute the intersection points between the two shapes and the self-intersection points of each shape.

Part III: Construct an AABB tree for each planar shape in a bottom-up way.

Part IV: Construct an LSS tree for each planar shape in a bottom-up way, and compute the intersection points between two shapes and their self-intersection points using the LSS trees of the two shapes.