

Programming #3: Part III (4190.410)

Due: November 4, 2015

Design an interactive system that can control the shape of two bicubic Bézier surfaces:

$$S_1(u, v) = \sum_{i=0}^3 \sum_{j=0}^3 \mathbf{p}_{ij} B_i^3(u) B_j^3(v), \quad S_2(s, t) = \sum_{k=0}^3 \sum_{l=0}^3 \mathbf{q}_{kl} B_k^3(s) B_l^3(t), \quad 0 \leq u, v, s, t \leq 1,$$

and a line segment $L(\tau) = (1 - \tau)\mathbf{r}_0 + \tau\mathbf{r}_1$, $0 \leq \tau \leq 1$, by dragging their control points.

Part I: Implement an algorithm for approximating the surfaces using quadrangles within a given error bound.

Part II: Implement an algorithm for intersecting the surface $S_1(u, v)$ and the line segment $L(\tau)$ using the AABB tree of the surface.

Part III: Implement an algorithm for intersecting the two surfaces $S_1(u, v)$ and $S_2(s, t)$ using the AABB trees of the two surfaces, where each leaf node is an AABB of size smaller than a given error bound.