Programming #2-4 (4190.667)

Due: June 3, 2015

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

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

by dragging their control points.

Part I: Using the subdivision algorithm discussed in the textbook and the AABB tree, implement an algorithm for computing the intersection curve between the two surfaces and the self-intersection curve of each surface.

Part II: Using the Bézier basis functions pre-evaluated and the Filip condition for surfaces, implement an algorithm for computing the intersection curve between the two surfaces and the self-intersection curve of each surface.

Part III: Given a point $\mathbf{p}$ and a bicubic Bézier suface $S_1(u,v)$, implement an algorithm for computing the shortest distance from $\mathbf{p}$ to the surface $S_1(u,v)$.

Part IV: Given two bicubic Bézier sufaces $S_1(u,v)$ and $S_2(s,t)$, implement an algorithm for computing the minimum distance between the two surfaces $S_1(u,v)$ and $S_2(s,t)$.