Programming #2: Part II (4190.562)

Due: May 2, 2016

A bicubic Bézier surface

$$S(u,v) = \sum_{i=0}^{3}\sum_{j=0}^{3}\mathbf{b}_{ij}B_i^3(u)B_j^3(v) = \sum_{i=0}^{3}\sum_{j=0}^{3}(x_{ij}, y_{ij}, z_{ij})B_i^3(u)B_j^3(v),$$

for $0 \le u, v \le 1$, can be used for the deformation of a 3D 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 $S(u_k, v_k)$ and bind $\mathbf{p}_k$ to the local frame at $S(u_k, v_k)$ (determined by the tangent and normal directions). When we edit the bicubic Bézier surface $S(u, v)$, each point $\mathbf{p}_k$ should move to the corresponding position in the new local frame at $S(u_k, v_k)$ under the shape deformation of $S(u, v)$.

Part II: Construct the BVHs for two 3D shapes (under deformation) using the PQP library, and compute the intersection of two shapes and each of their self-intersections.