Programming #4: Part II (4190.410)

Due: December 2, 2015

Given a polyline L interpolating $(N+1)$ points $\mathbf{p}_i$, $(i = 0, \cdots, N)$, apply the four point principle to generate an interpolating polyline $L^{(1)}$ with $(2N+1)$ points $\mathbf{p}_j^{(1)}$, $(j = 0, \cdots, 2N+1)$:

$$\begin{aligned} \mathbf{p}_{2i}^{(1)} &= \mathbf{p}_i, \\ \mathbf{p}_{2i+1}^{(1)} &= \frac{1}{16}\left[-\mathbf{p}_{i-1} + 9\mathbf{p}_i + 9\mathbf{p}_{i+1} - \mathbf{p}_{i+2}\right]. \end{aligned}$$

Repeat the subdivision step three times to generate the polyline $L^{(3)}$ with $(8N+1)$ points.

Part I: Generate a tube-like surface by sweeping a circle (approximated with a regular 32-gone) along the polyline $L^{(3)}$ and render the surface with an environment map..

Part II: Generate a smooth animation of the tube-like surface by making each point $\mathbf{p}_i$, $(i = 0, \cdots, N)$, move along a smooth curve $\mathbf{p}_i(t)$, $(0 \le t \le 1)$, that interpolates $\mathbf{p}_{i,0}$, $\mathbf{p}_{i,1}$, and $\mathbf{p}_{i,2}$ at time $t = 0, 1/2$, and 1, respectively.