CMSC427 Fall 2017

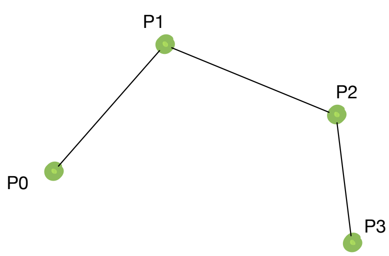
Hw 6 – Parametric meshes and curves **Due by class, Dec. 7th**

1. Given three points P0, P1, P2, calculate a quadratic form of the Hermite curve. Have the curve interpolate through P1 and P2, and use P0-P1 as the tangent for the first endpoint.

2. Given the Hermite curve we computed in class, what would be the first derivative of the curve? How could represent it as below, as the product of a vector of powers of t and a basis matrix?

$$P(t) = [t^3 \quad t^2 \quad t \quad 1]\begin{bmatrix}\boldsymbol{a}\\ \boldsymbol{b}\\ \boldsymbol{c}\\ \boldsymbol{d}\end{bmatrix} = [t^3 \quad t^2 \quad t \quad 1]\begin{bmatrix}2 & -2 & 1 & 1\\ -3 & 3 & -2 & -1\\ 0 & 0 & 1 & 0\\ 1 & 0 & 0 & 0\end{bmatrix}\begin{bmatrix}\boldsymbol{P0}\\ \boldsymbol{P1}\\ \boldsymbol{T0}\\ \boldsymbol{T1}\end{bmatrix}$$

3. This one tests only a single idea from Hermite and Bezier curves – which points are the end points, and which are used as controls to compute the tangents. Given the diagram below, draw how to fit a Hermite curve, and then how to fit a Bezier curve, to these four points.



4. At the end of the PieceWiseParametric notes (page 7) the following mapping is given between four points P0, P1, P2 and P3, and the geometry vector P0, P1, T0 and T1 used to compute a Bezier curve. Create an appropriate matrix from this mapping, and use it in the Hermite analysis to show the new basis matrix.

P0 = P0
P1 = P3
T0 = 3(P1-P0)
T1 = 3(P3-P2)

5. Compute the normal vector for a bilinear surface. For consistency, use (u,v) as the two parameters (we've used u,v as well as t,s).

6. Given two simple cubic curves

$$P1(t) = \boldsymbol{a}t^3 + \boldsymbol{b}t^2 + \boldsymbol{c}t + \boldsymbol{d}$$

and

$$P2(t) = \boldsymbol{e}t^3 + \boldsymbol{f}t^2 + \boldsymbol{g}t + \boldsymbol{h}$$

show how to blend them into a surface patch using a linear connection (eg, lerp them).