

Computer graphics

Lesson 6

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Coons bilinear surface

- interpolates 4 given boundaries with endpoints at the corners of the patch
- given boundaries $P_0(u)$, $P_1(u)$, $P_0(v)$, $P_1(v)$ with common points at corners $P_{0,0}$, $P_{0,1}$, $P_{1,0}$, $P_{1,1}$, vector equation of surface is:

$$\mathbf{P}(u, v) = (1 - u, 1, u) \cdot \begin{pmatrix} -\mathbf{P}_{0,0} & \mathbf{P}_0(v) & -\mathbf{P}_{0,1} \\ \mathbf{P}_0(u) & \mathbf{0} & \mathbf{P}_1(u) \\ -\mathbf{P}_{1,0} & \mathbf{P}_1(v) & -\mathbf{P}_{1,1} \end{pmatrix} \cdot \begin{pmatrix} 1 - v \\ 1 \\ v \end{pmatrix}, \quad (u, v) \in [0, 1]^2$$

- **Example 3.5**

Coons bilinear surface

- **properties:**
 - interpolates all boundaries
 - interpolates all corners
 - ruled surface (u/v) is identical with CBS given by two boundaries as straight line segments (v/u direction)
 - HP is identical with CBS given by straight line segments as all boundaries
- derivation of vector equation of CBS – see page 98
→ another form of vector equation:

$$\mathbf{P}(u, v) = \mathbf{S}(u, v) + \mathbf{T}(u, v) - \mathbf{R}(u, v), \quad (u, v) \in [0, 1]^2$$

Ruled surface given by
boundaries in u -direction

Ruled surface given by
boundaries in v -direction

Surface of hyperbolic paraboloid given
by corners of CBS

Coons bilinear surface

- important in technical practice
- patching – it allows only C^0 continuity
- **Exercise 3.5**