CS230 : Computer Graphics

Lecture 10: Curves and Surfaces

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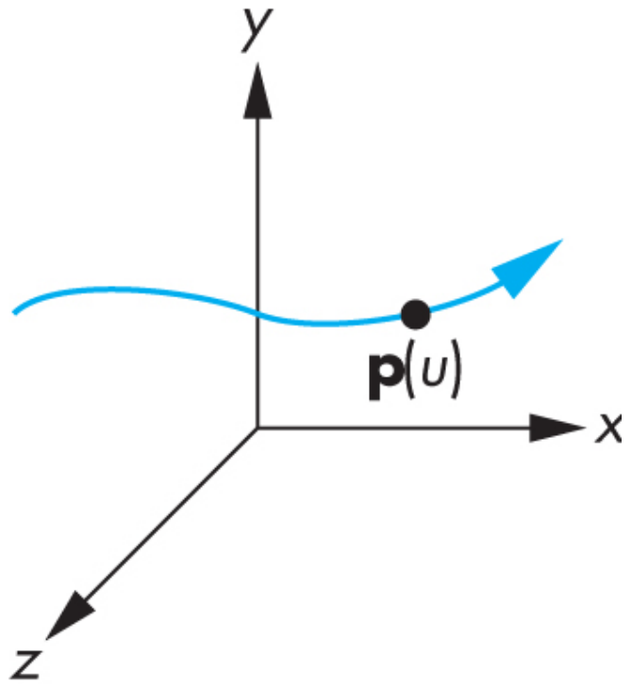
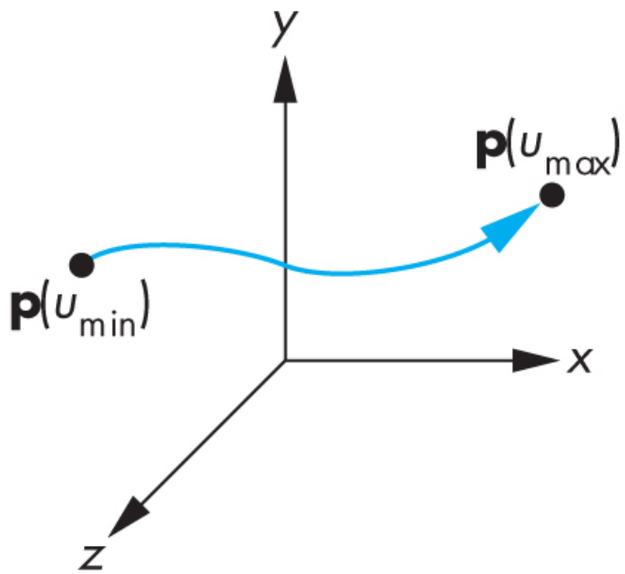
Acknowledgments

- Sources: Figures from Angel and Shreiner 6th edition, unless otherwise noted
- Some slides courtesy of V. Zordan

Parametric curve

$$x = x(u)$$
$$y = y(u)$$
$$z = z(u)$$





Curve segment

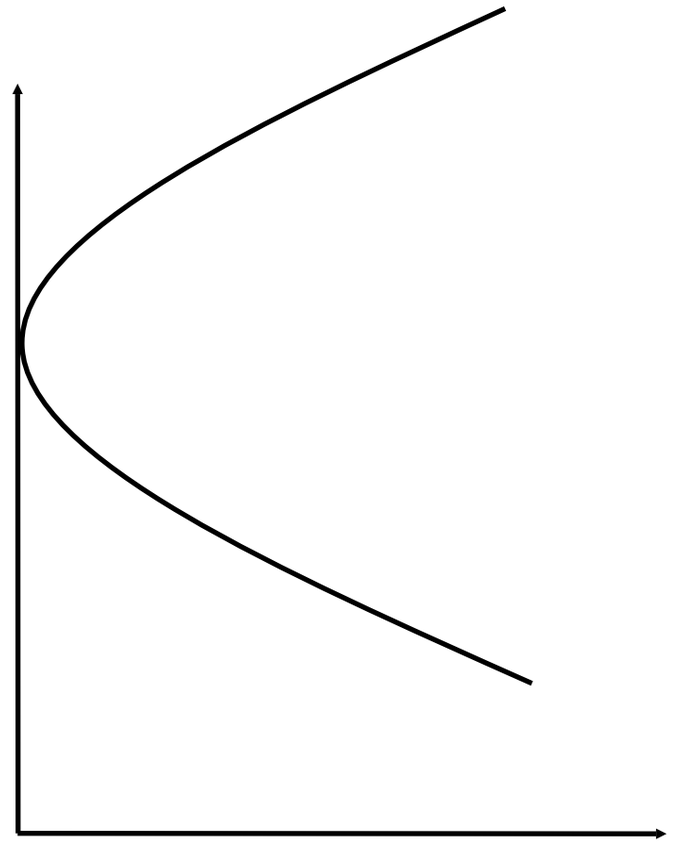
- tangent vector

Parametric curve example

$$p(u) = c_0 + c_1 u + c_2 u^2$$

$$x(u) = 3u^2$$

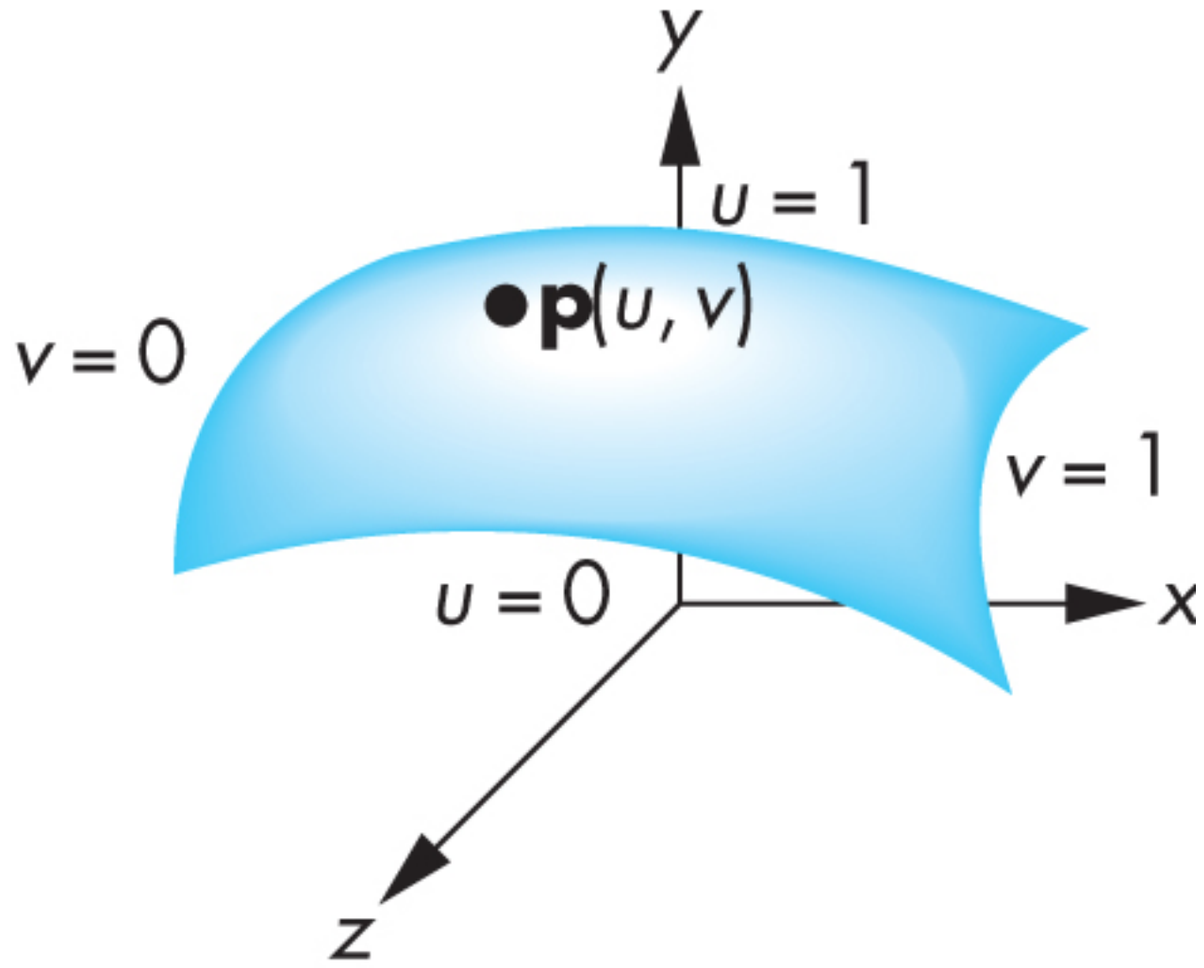
$$y(u) = 2u + 3$$

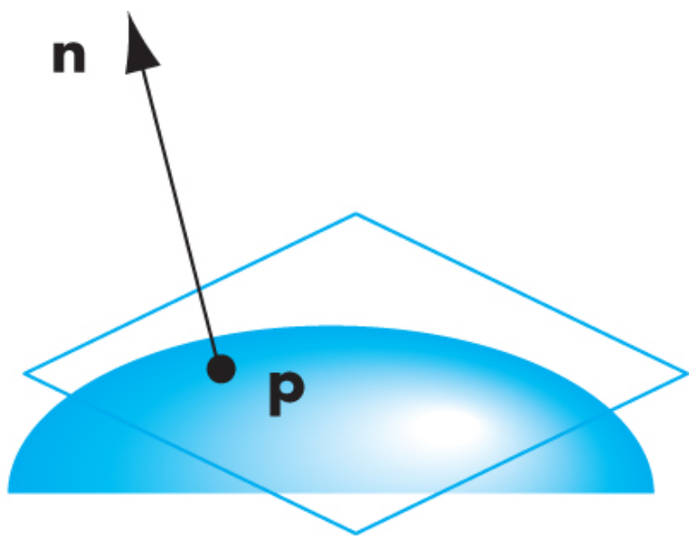


$$c_0 = ?, \quad c_1 = ?, \quad c_2 = ?$$

Parametric Surface

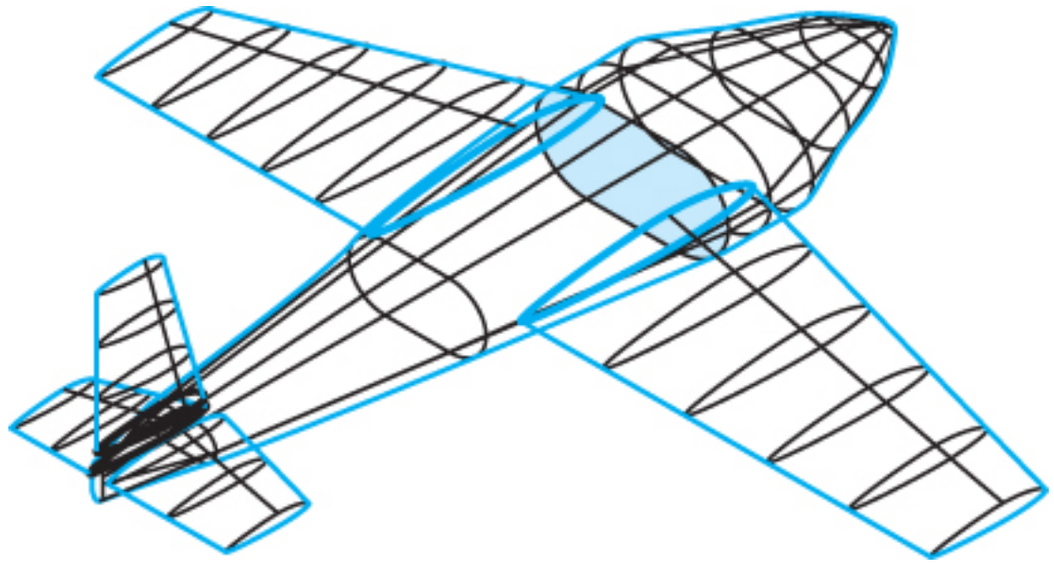
$$x = x(u, v)$$
$$y = y(u, v)$$
$$z = z(u, v)$$

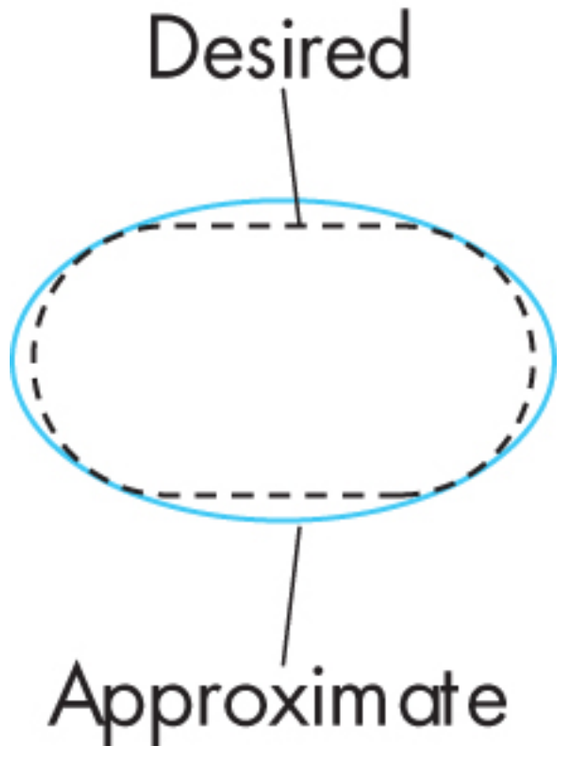




Design considerations

- local control of shape
- smoothness and continuity
- ability to evaluate derivatives
- stability
- ease of rendering





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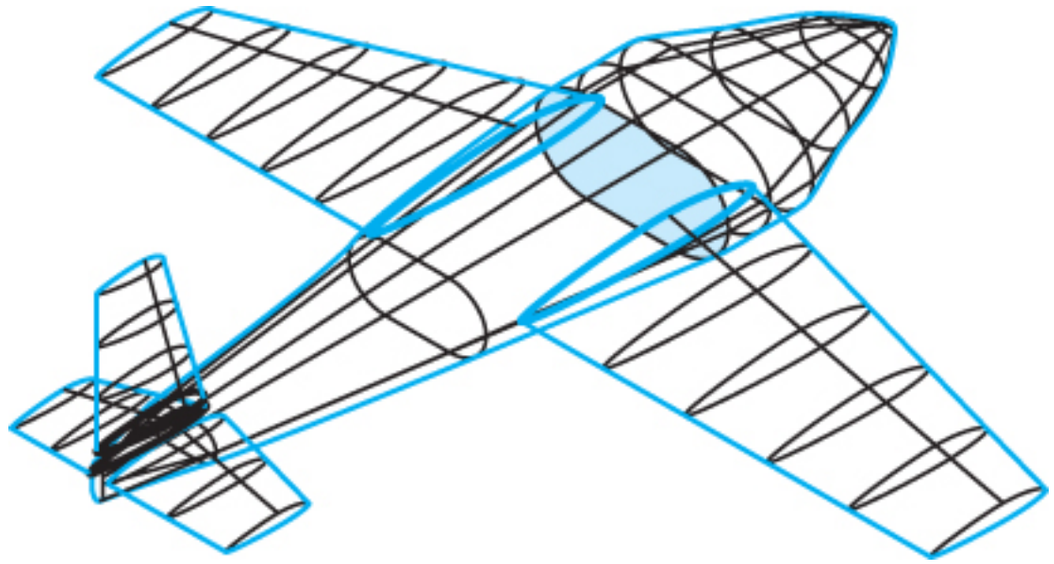
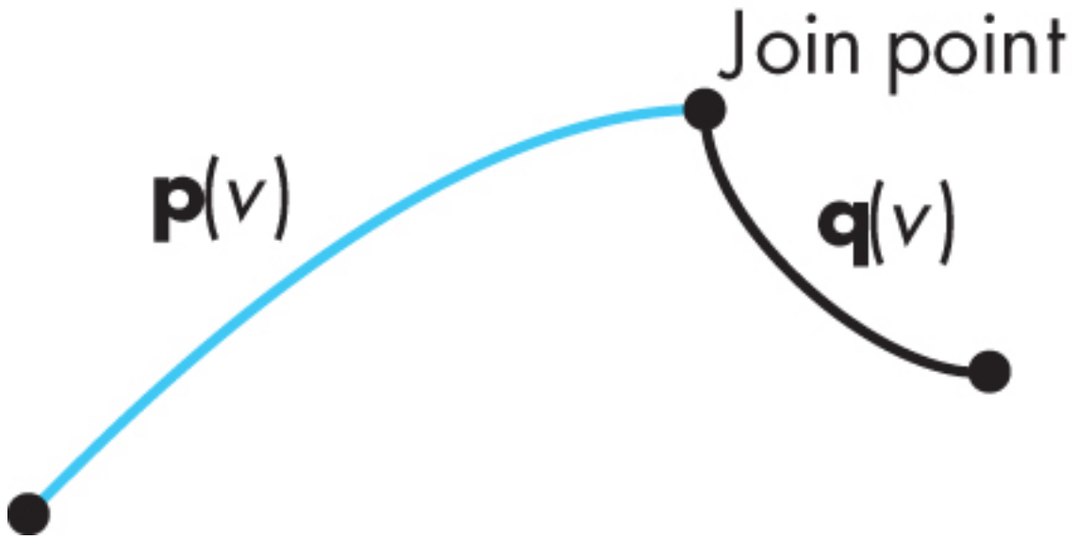
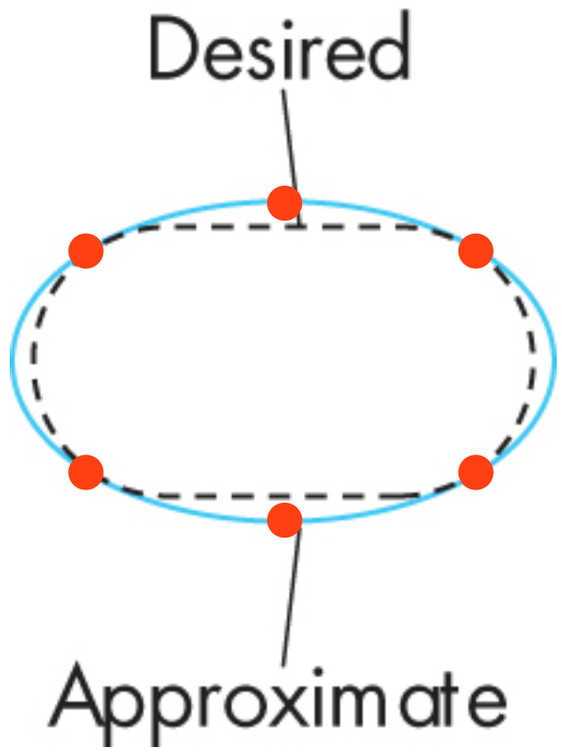




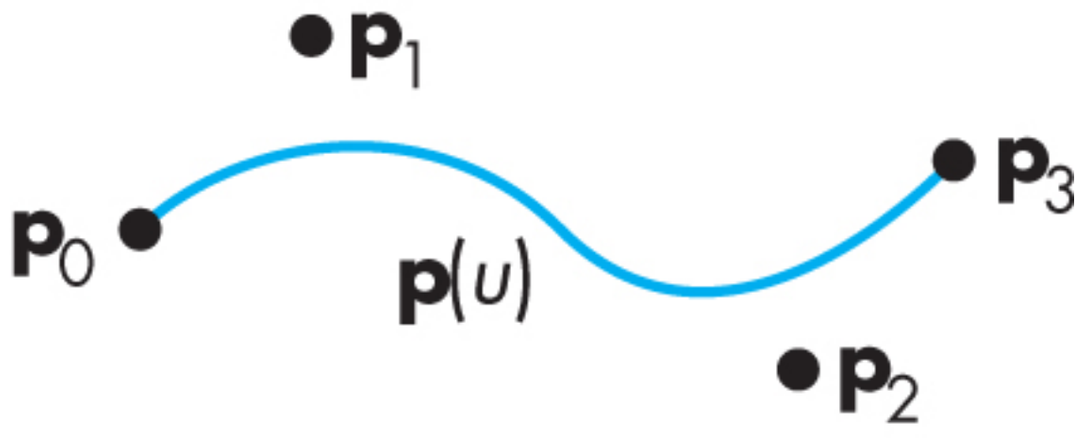


join points

- local control – design each segment independently
- stability – small change in input values leads to small change in output

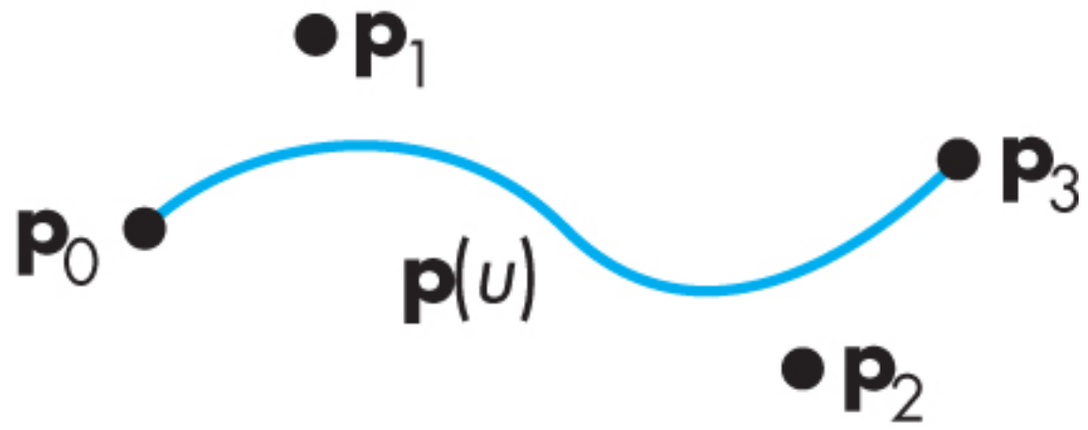
Control points

Interpolating



Non-interpolating

Algebraic and Geometric Forms



- Algebraic Form

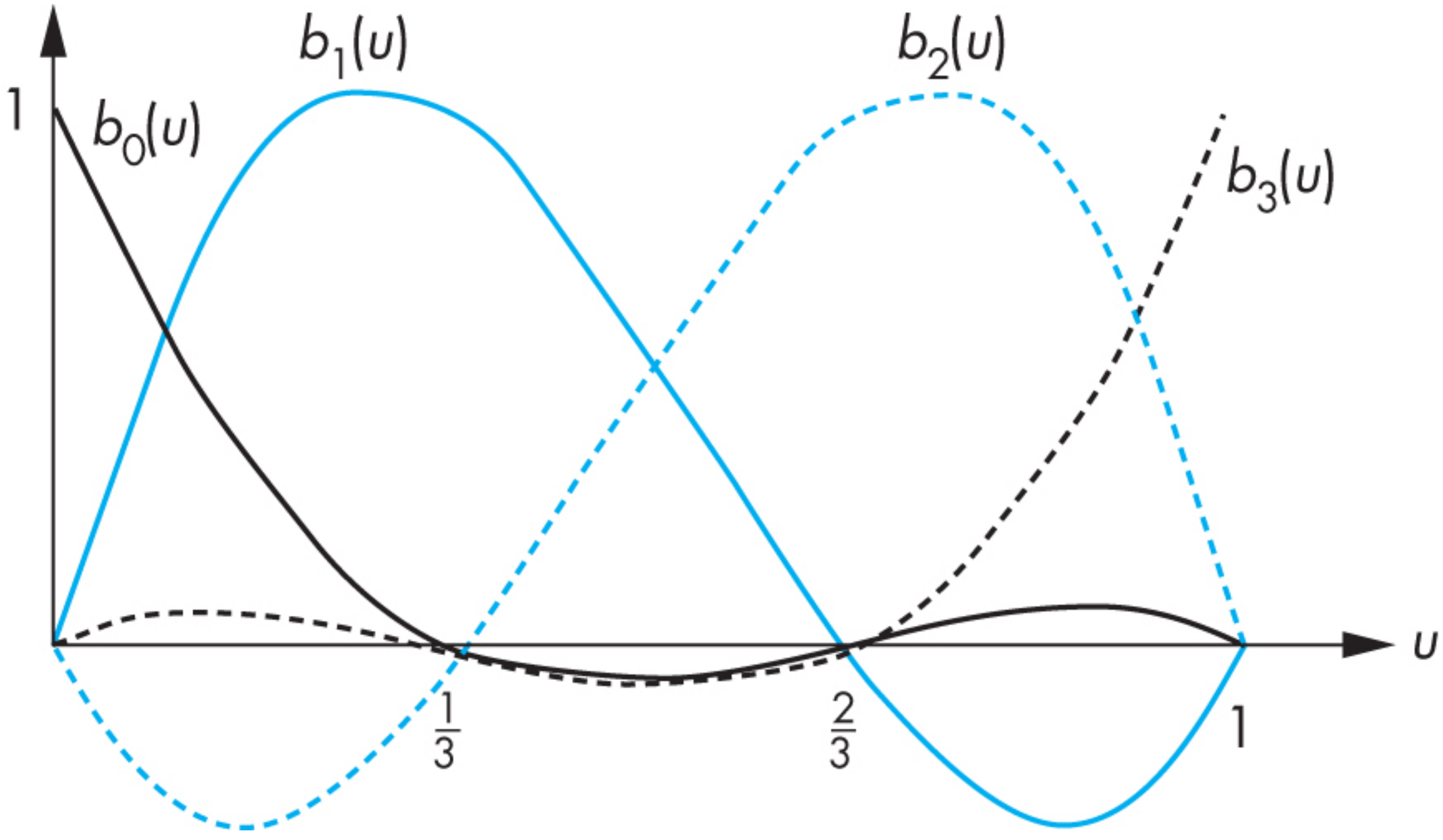
$$p(u) = c_0 + c_1 u + c_2 u^2 + c_3 u^3$$

- Geometric Form

$$p(u) = b_0(u)p_0 + b_1(u)p_1 + b_2(u)p_2 + b_3(u)p_3$$

Interpolating curves

Blending polynomials



Bicubic Surface Patch