

B-SPLINE CURVES & RATIONAL CURVES

Course : Computer Aided Machine Drawing

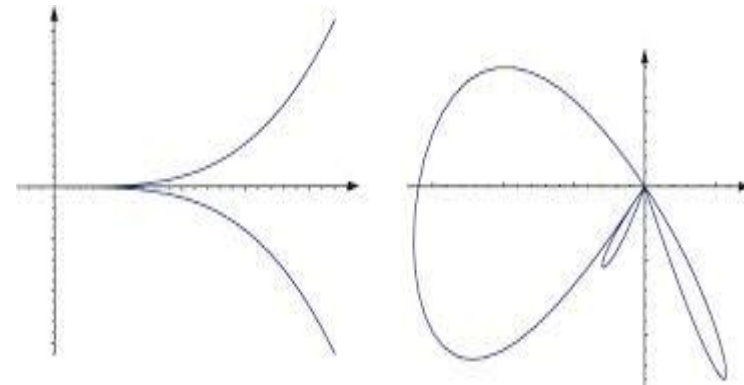
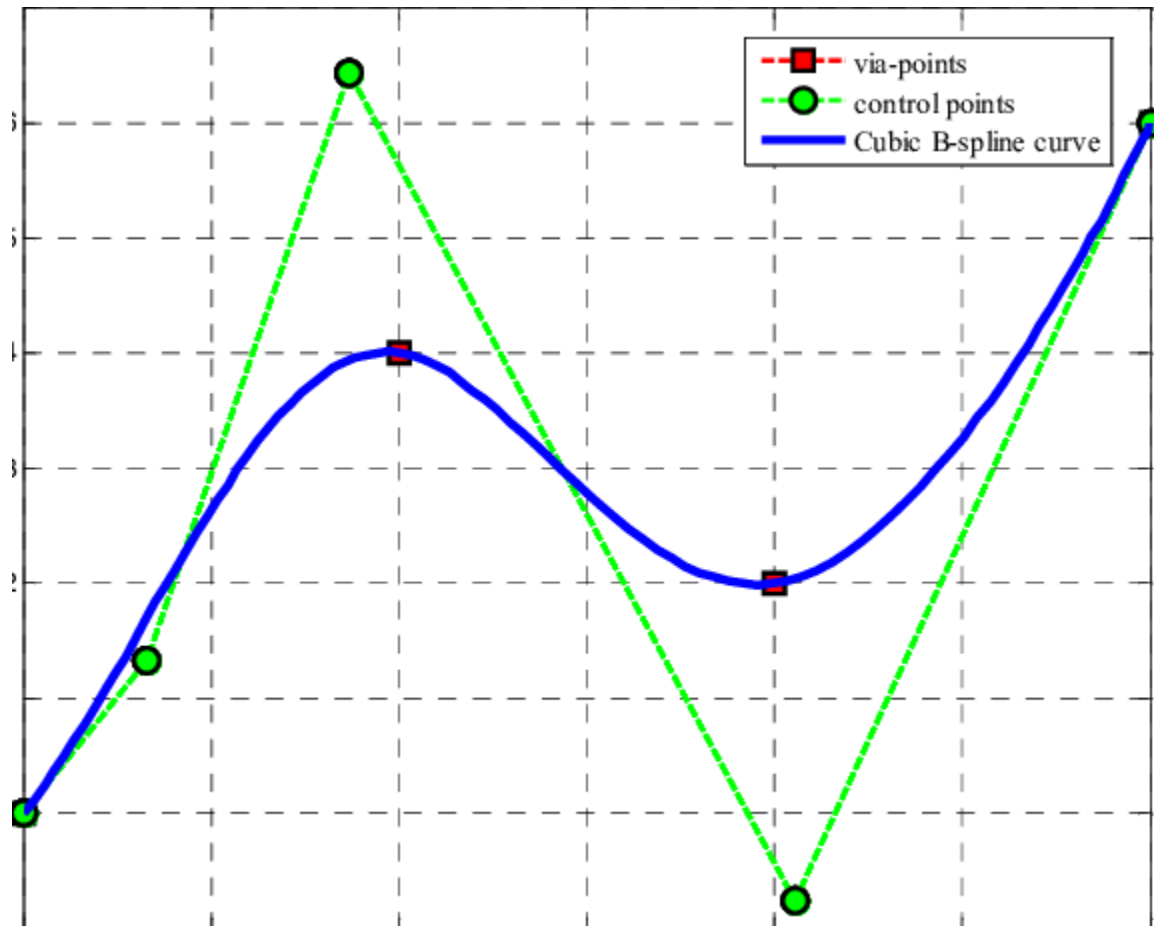
19ME304

Unit -2 Geometric Modeling

II Year / III Semester

**Mechatronics and Mechanical
Engineering (AM)**

TOPIC OF THE DAY



B-SPLINE CURVE

- It provides another effective method of generating curve defined polygons.
- These curves are widely used for approximation splines.

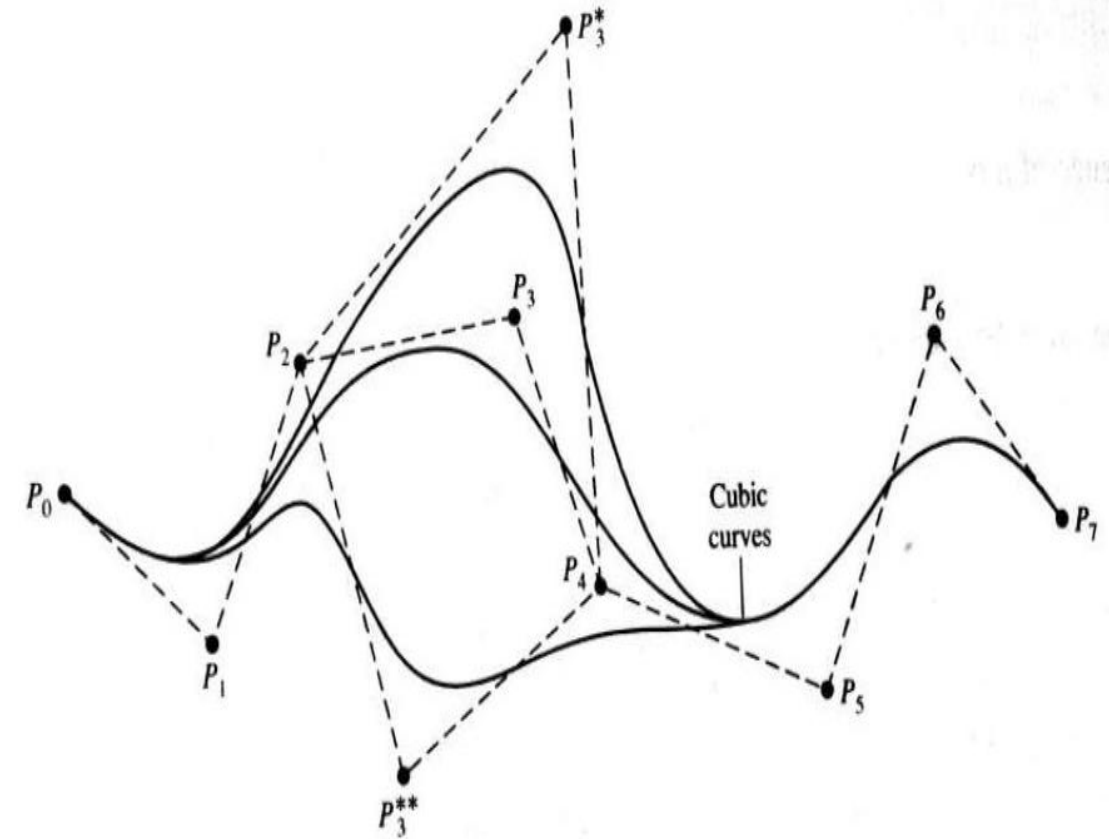
$$P(u) = \sum_{i=0}^n P_i B_{i,k}(u), 0 \leq u \leq u_{max}$$

$$B_{i,k}(u) = \frac{u - u_i}{u_{i+k-1} - u_i} B_{i,k-1}(u) + \frac{u_{i+k} - u}{u_{i+k} - u_{i+1}} B_{i+1,k-1}(u)$$

$$\text{where } B_{i,1}(u) = \begin{cases} 1, & \text{if } u_i \leq u \leq u_{i+1} \\ 0, & \text{otherwise} \end{cases}$$

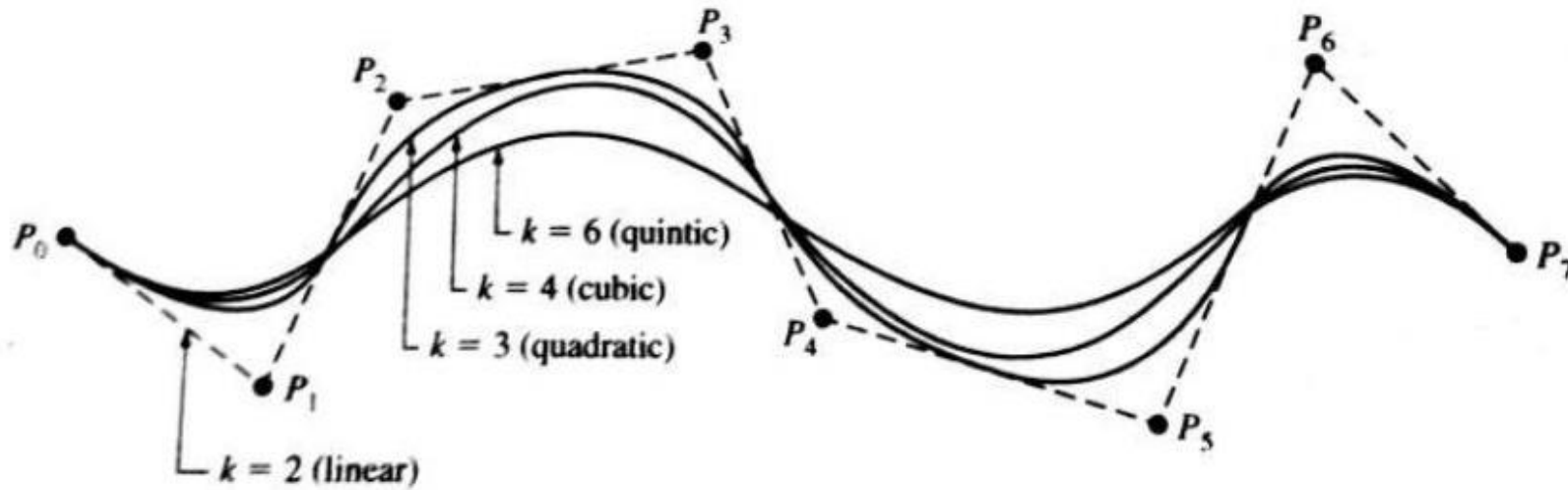
CHARACTERISTICS OF B-SPLINE CURVE

- The local control of the curve can be obtained by chaining the position of the control points or using multiple control points by placing several points at same location.
- A non-periodic B-spline curve passes through the first and last control points and its tangent to the first and last segment of the control polygon.
- It allows us to vary the number of control points used to design a curve without changing the polynomial.

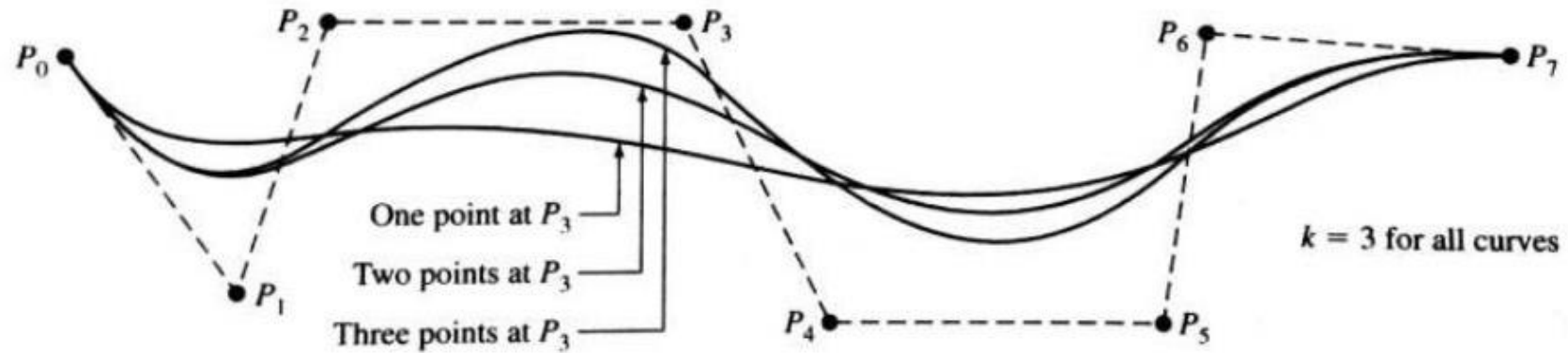


EFFECT OF THE DEGREE OF B-SPLINE CURVE ON ITS SHAPE

If the degree of the curve increases, it is more difficult to control and calculate accurately.



EFFECT OF POINT MULTIPLICITY OF B-SPLINE CURVE ON ITS SHAPE



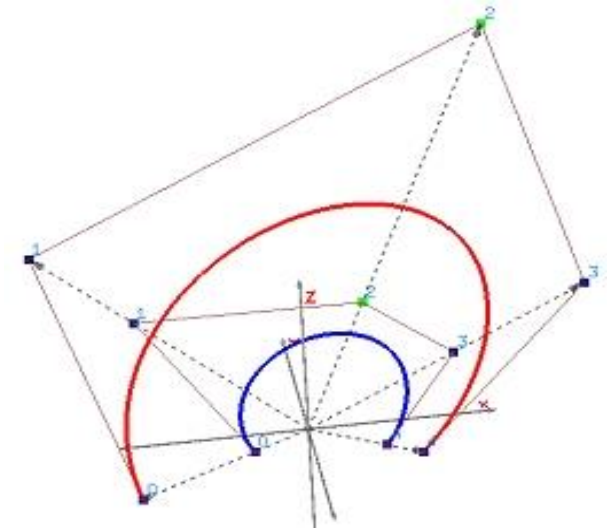
RATIONAL CURVES

- The rational curve is defined by the algebraic ratio of two polynomials where as non-rational curve is defined by one polynomial.
- The most widely used curve is Non-Uniform Rational B-Splines (NURBS).
- A rational B-spline is defined by

$$P(u) = \sum_{i=0}^n P_i B_{i,k}(u), 0 \leq u \leq u_{max}$$

- $B_{i,k}(u)$ are the rational B-spline basis function are given by

$$B_{i,k}(u) = \frac{w_i R_{i,k}(u)}{\sum_{i=0}^n w_i R_{i,k}(u)}$$





REFERENCES

1. Ibrahim Zeid “Mastering CAD CAM” Tata McGraw-Hill Publishing Co.2007.
2. Radhakrishnan P, Subramanyan S. and Raju V., “CAD/CAM/CIM”, 2nd Edition, New Age International (P) Ltd, New Delhi, 2000.

