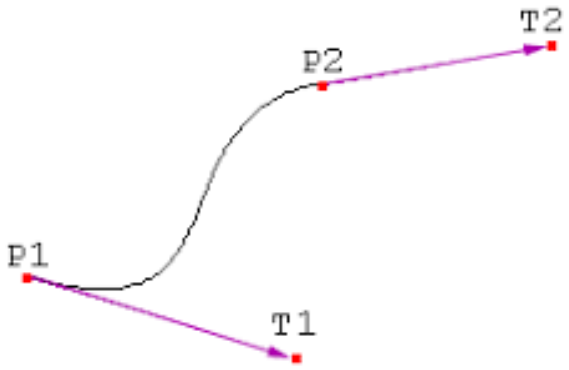
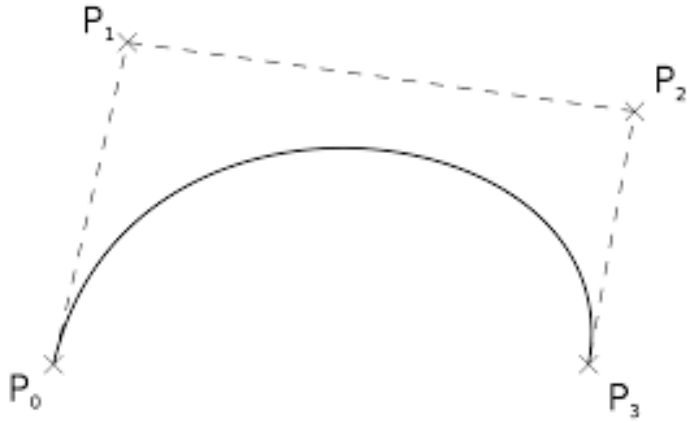
REPRESENTATION OF CURVES- HERMITE CURVE & BEZIER CURVE

Course : Computer Aided Machine Drawing

19ME304
Unit -2 Geometric Modeling
II Year / III Semester
Mechatronics and Mechanical Engineering (AM)

TOPIC OF THE DAY





GEOMETRIC MODELING

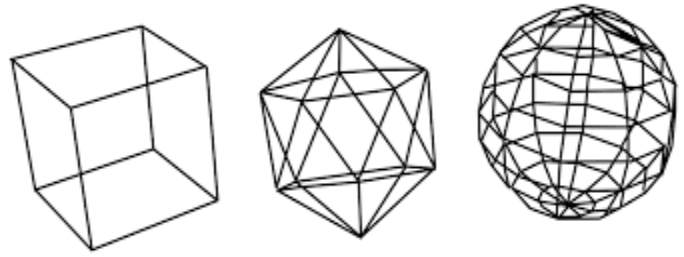
The mathematical description of the geometry of an object using software is called as geometric modelling.

There are three basic methods

1. Wire-Frame modeling
2. Surface modeling
3. Solid modeling

WIRE-FRAME MODELING

- It is one of the most common and popular method.
- In construction the edges are represented as lines.
- Represented in 2D and 3D.



COMPARISON

2D Wire Frame Model	3D Wire Frame Model
The co-ordinate system is 2D co-ordinate system i.e. *x* and *y* co-ordinates only	3D co-ordinate system is used for representing objects; *x*, *y* and *z* coordinates are used
3 Dimensional wire frame system generation is difficult	Both 2D and 3D wire frame generation is possible
Hidden lines may not complicate the figure	Difficult for the viewer to interpret the figure unless the hidden lines are removed
Curved surfaces are indicated by circles, arcs and ellipses	Curved surfaces are represented by spaced generators.

BEZIER CURVE

- This curve was developed by P. Bezier at French car company (Renault Automobiles).
- This curve is used to design the automobile bodies.
- This curve provides reasonable flexibility and avoids large number of calculations.

$$P(u) = \sum_{i=0}^{n} P_i \, B_{i,n} \, (u), 0 \leq u \leq 1$$

CONTI...

- $B_{i,n}(u)$ is the Bernstein function are given by

$$B_{i,n}(u) = C(n,i)\,u^i(1-u)^{n-i}$$

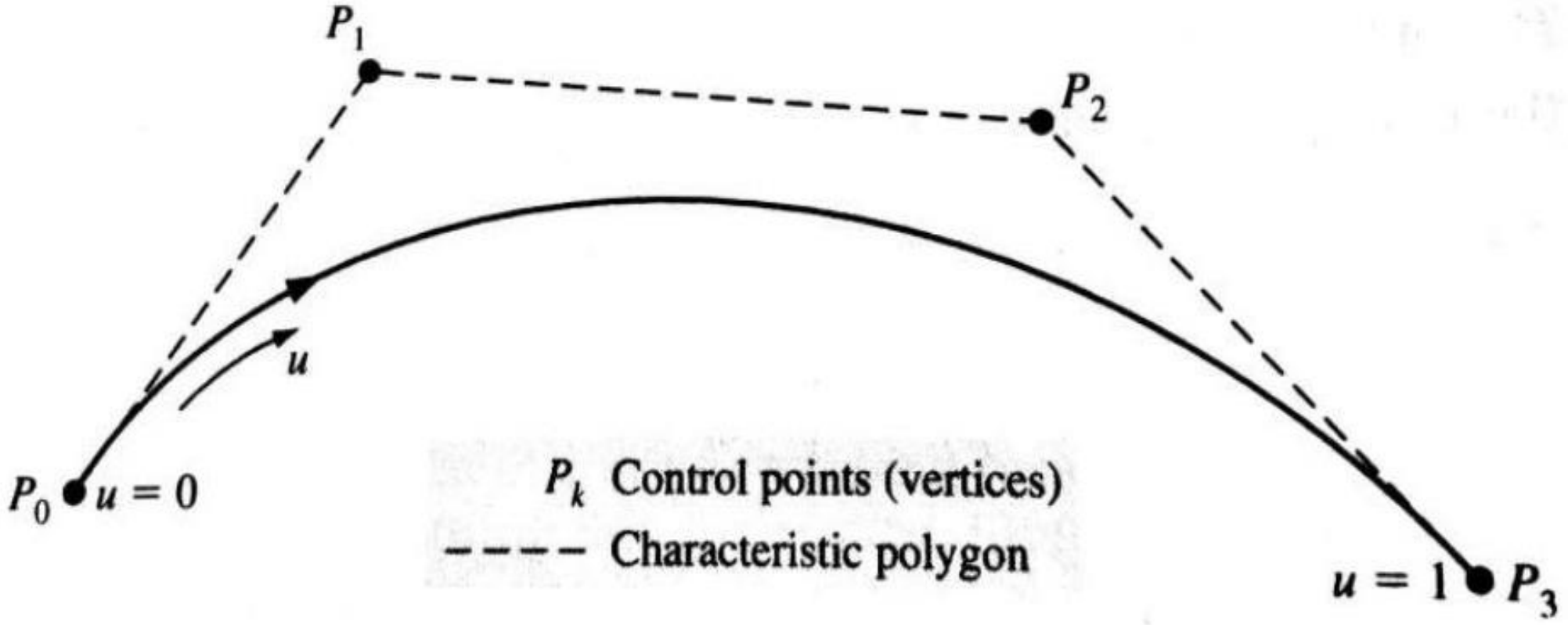
Where, $C(n,i) = \frac{n!}{i!(n-1)!}$

$$C(n,0) = C(n,n) = 1$$

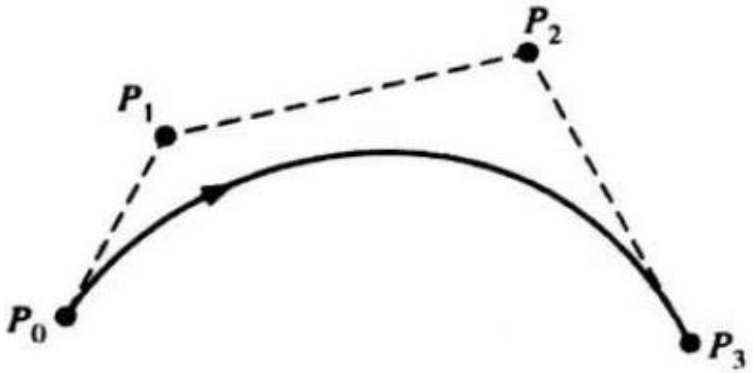
$$\mathbf{P}(u) = \mathbf{P}_0(1-u)^n + \mathbf{P}_1 C(n,1)u(1-u)^{n-1} + \mathbf{P}_2 C(n,2)u^2(1-u)^{n-2}$$

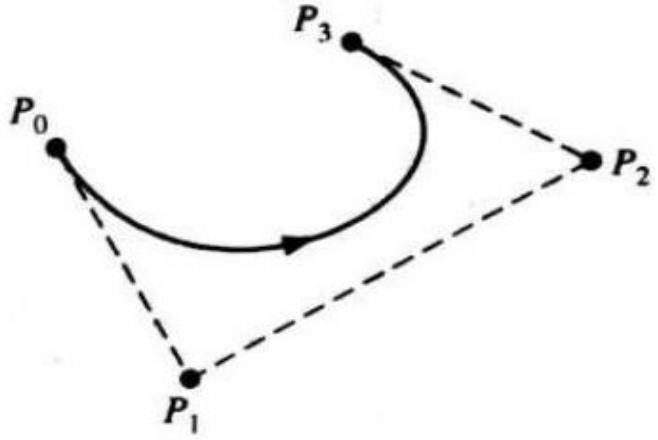
$$+ \cdots + \mathbf{P}_{n-1} C(n,n-1)u^{n-1}(1-u) + \mathbf{P}_n u^n, \qquad 0 \le u \le 1$$

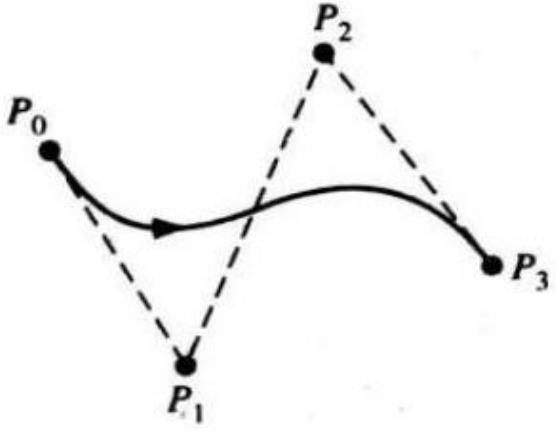
CONTI...

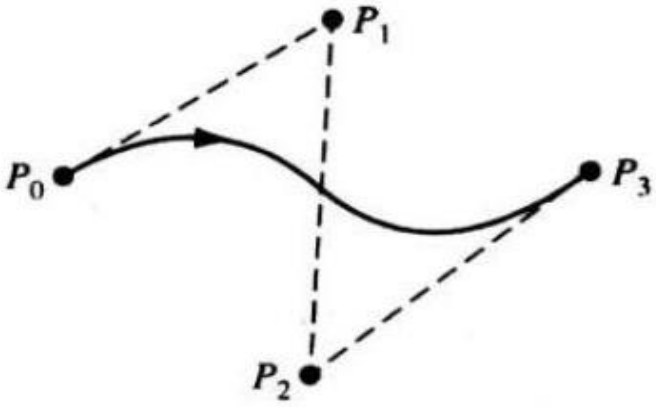

P_1
P_2
u
P_0 $u = 0$
P_k Control points (vertices)
Characteristic polygon
$u = 1$ P_3

BEZIER CURVE WITH VARIOUS CONTROL POINTS

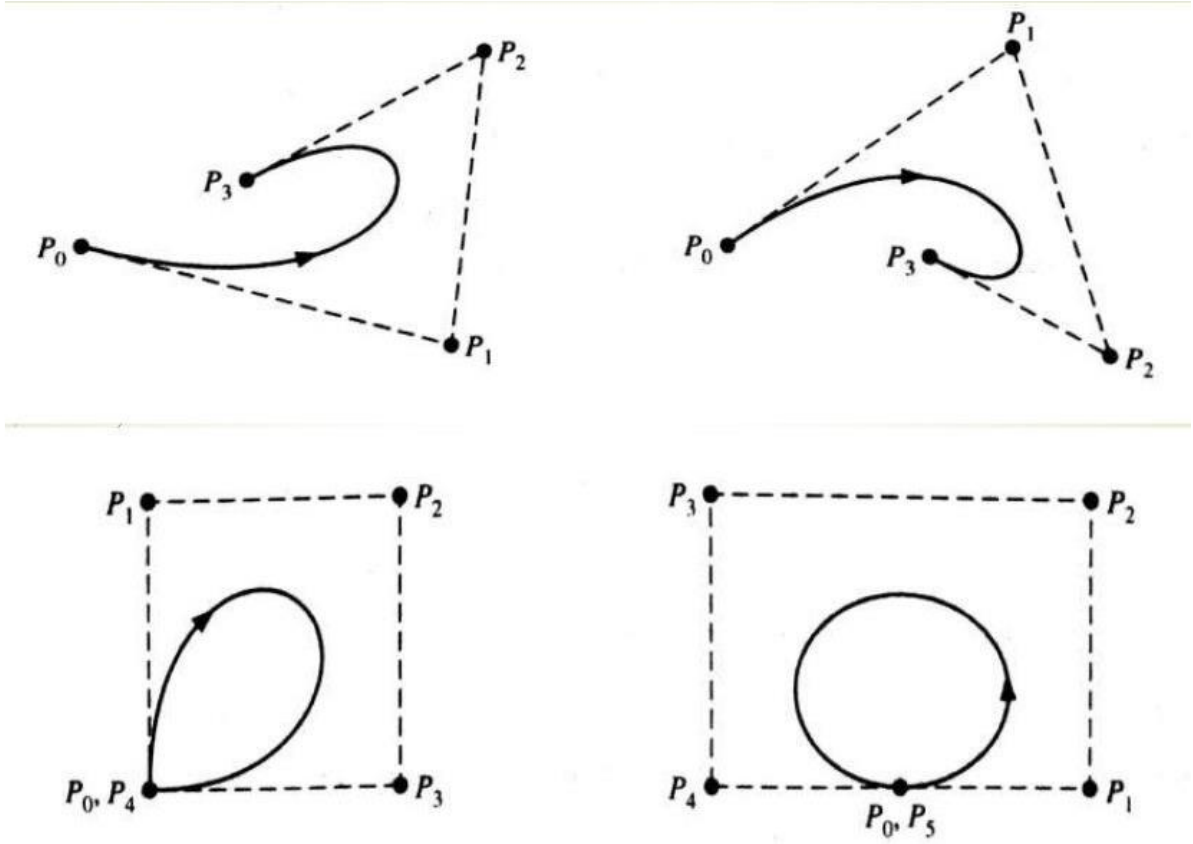








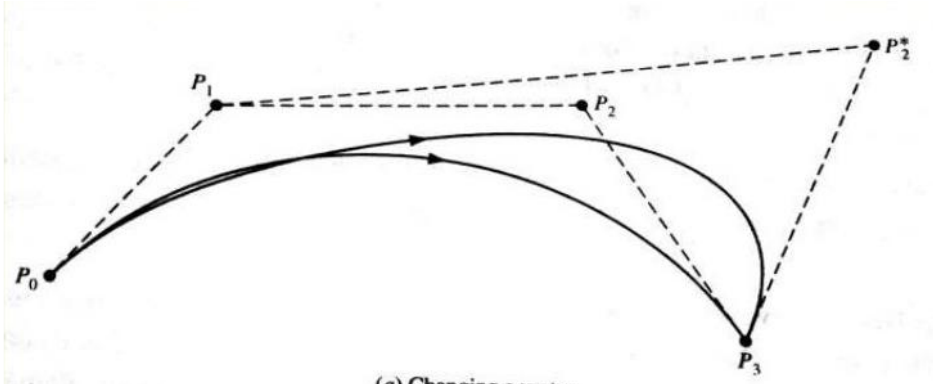
CONTI...



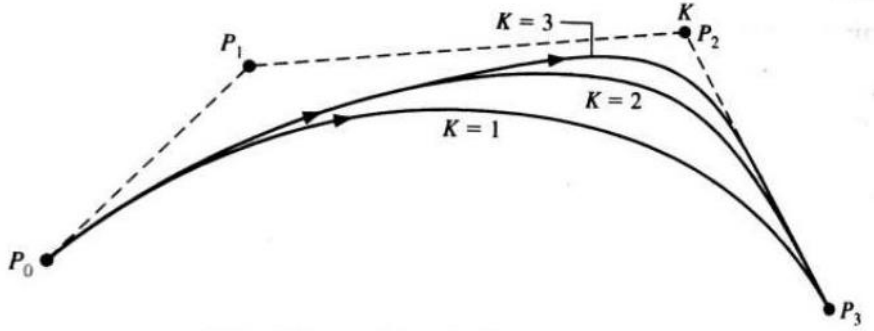
CHARACTERISTICS OF BEZIER CURVE

- This is defined on n+1 points $P_0,\ldots,P_n$ and is represented as a parametric polynomial curve of degree n.
- It always passes through first and last control points.
- This curve is tangent to first and last segments of the characteristics polygon.
- This curve generally follows the shape of the characteristics polygon.
- The degree of polynomial defining the curve segments in one less that the number defines the polygon points.
- It exhibits the symmetrical property.
- Each control point is weighted by its blending function of u value.
- This curve is entirely lies with in the convex hull formed four control points.

CONTI...



(*a*) Changing a vertex



(*b*) Specifying multiple coincident points at a vertex

REFERENCES

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