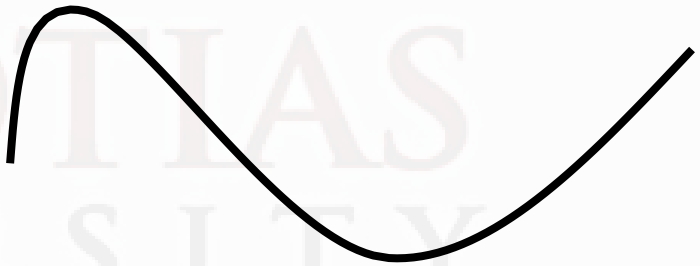
UNIT 4

Spline: Interpolation and approximation spline

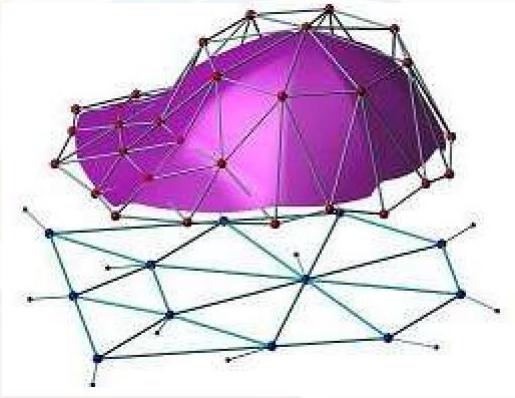
Spline

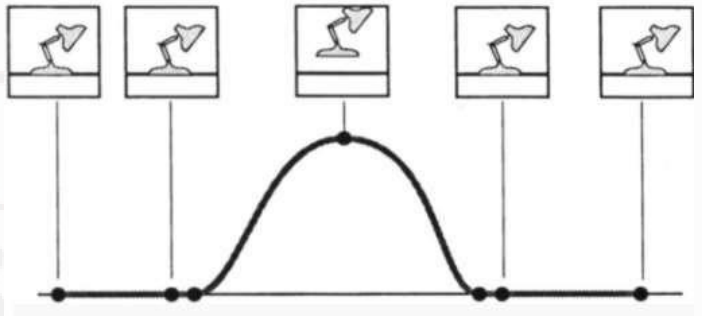
- Drafting terminology
  - Spline is a flexible strip that is easily flexed to pass through a series of design points (control points) to produce a smooth curve.
- Spline curve – a piecewise polynomial (cubic) curve whose first and second derivatives are continuous across the various curve sections.



Spline Representations

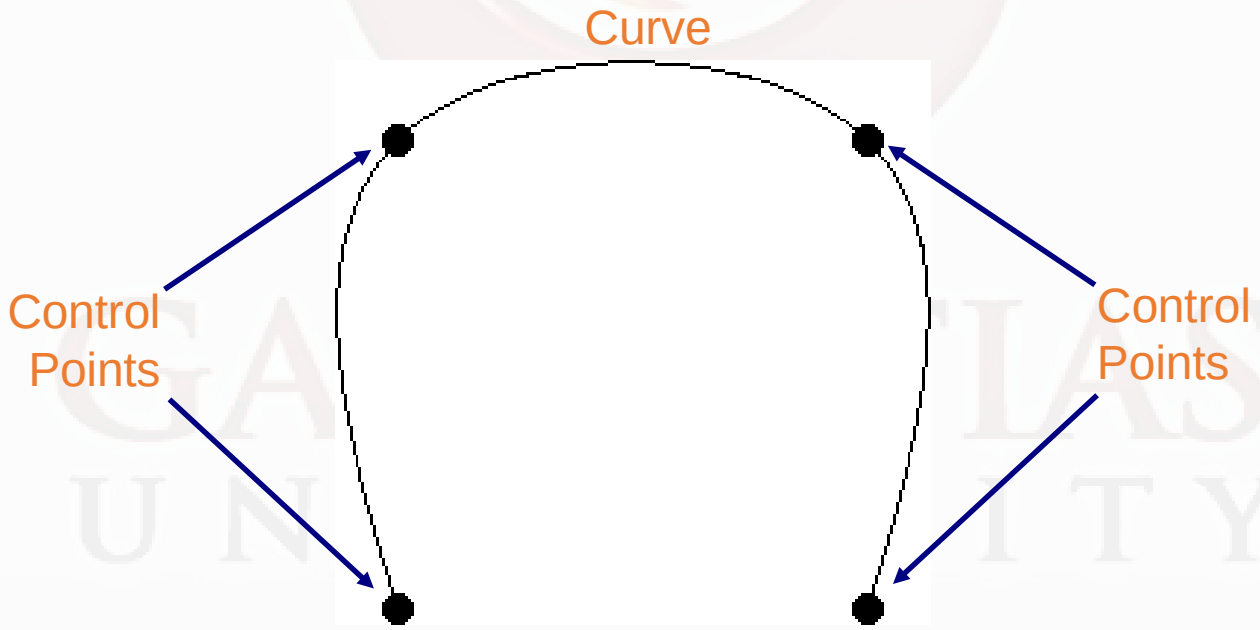
- Spline Representations defined mathematically using a set of constraints
- Splines have many uses:
  - 2D illustration
  - Fonts
  - 3D Modelling
  - Animation





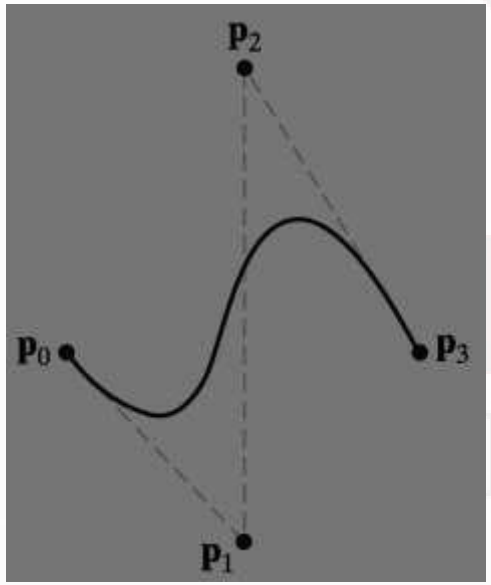
Big Idea

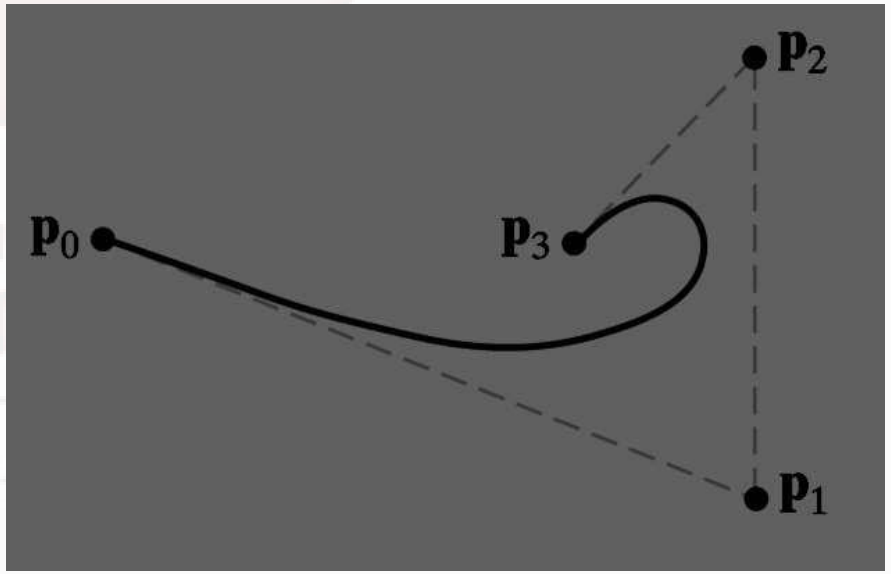
- User specifies control points
- Defines a smooth curveThe boundary formed by the set of control points for a spline is known as a **convex hull**
- Think of an elastic band stretched around the control points



Control Graphs

- A polyline connecting the control points in order is known as a
- **control graph**
- Usually displayed to help designers keep track of their splines





Types of Curves

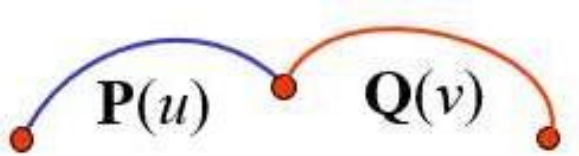
- A curve is an infinitely large set of points. Each point has two neighbors except endpoints. Curves can be broadly classified into three categories −
- **explicit, implicit,** and **parametric curves**.
- Implicit Curves

Implicit Curves

- Implicit curve representations define the set of points on a curve by employing a procedure that can test to see if a point in on the curve.
- Usually, an implicit curve is defined by an implicit function of the form –
- $f(x, y) = 0$
- Eg. A common example is the circle, whose implicit representation is
- $\mathbf{x^2 + y^2 - R^2 = 0}$

Parametric curve

- The explicit and implicit curve representations can be used only when the function is known.
- Curves having parametric form are called parametric curves.
- In practice the parametric curves are used.



- Every point on the curve is having two neighbors (other than the end points). A two-dimensional parametric curve has the following form –
- P(t) = f(t), g(t) or P(t) = x(t), y(t)
- The functions f and g become the (x, y) coordinates of any point on the curve, **and the points are obtained when the parameter t (or u)** is varied over a certain interval [a, b], normally [0, 1].

Reference

Demo animation of metaballs
http://www.youtube.com/watch?v=UWvGyKolkho&feature=related
http://www.youtube.com/watch?v=Nf_OlfWMRaA&NR=1

http://www.nbb.cornell.edu/neurobio/land/OldStudentProjects/cs490-96to97/anson/BezierPatchApplet/

Thank You