Introduction to Computer Graphics
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Lecture - 15
Curves (Contd….)

We have been talking about B-Spline curves. Here is a recapitulation of some aspects of B-Splines. What we observed in the case of B-Splines is that B-Splines enable us to define an associated unique basis function for each control point.

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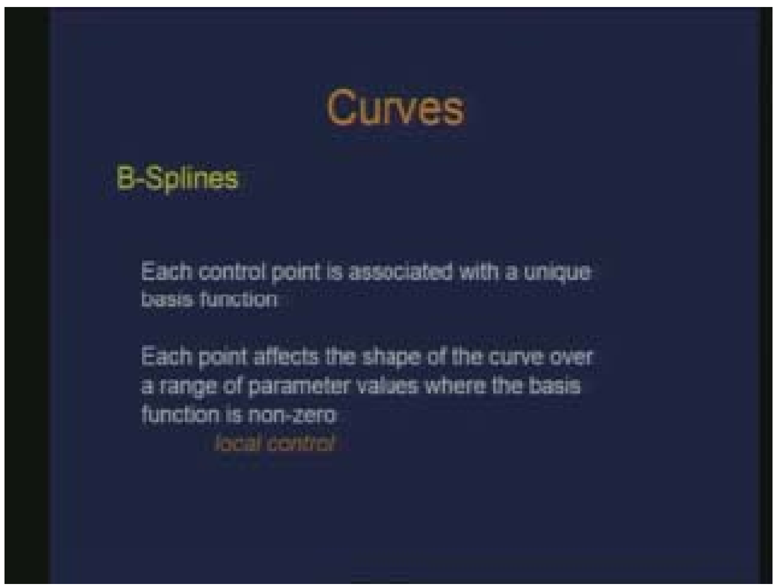

In turn what happens is that the influence, the way, the point on the control polygon affects the shape of the curve. It is actually in a range of the parameter values, it is not the entire range of the parameter values but it is a sub range of the parameter values. And in turn we get the local control which is not the case in the case of Bezier curves. Also, we observed that these B-Splines help us decoupling the order of the curve or the degree of the curve and the number of control points you specify for the B-Spline polygon. So the polynomial spline function which is used as the basis for B-Splines is basically defined as these $N_{i,k}$'s where k is the order of the curve.

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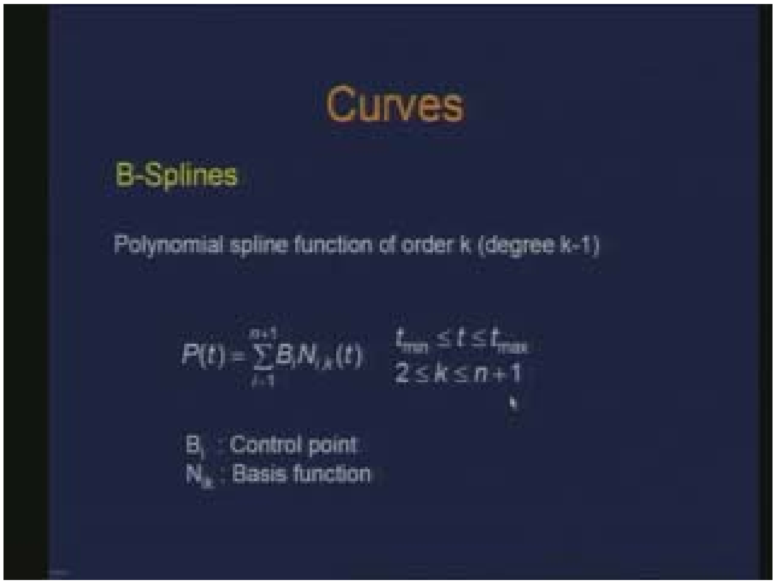

Therefore it ranges from 2 to n plus 1 where n plus 1 is the number of control points you specify. So the maximum order of the curve which you can obtain is n plus 1 and the parameter t ranges from some t minimum to t maximum and these B_{is} are nothing but the control points. This is a very standard way of defining the parametric curves as some sort of a blending of the geometric information specified through the control points. And if we see how these $N_{i,k}$'s are computed they are computed in a recursive manner where the base cases for $N_{i,1}$s which is nothing but some sort of a step function which you find as 1 or 0. So it is 1 when the parameter t is in the knot values x_i to x_i plus 1. So there is also a notion of knot vector which is in some way the junction points for the parameter domain for the curves which are defined. So x_i and x_i plus 1 are nothing but the pair of knots.

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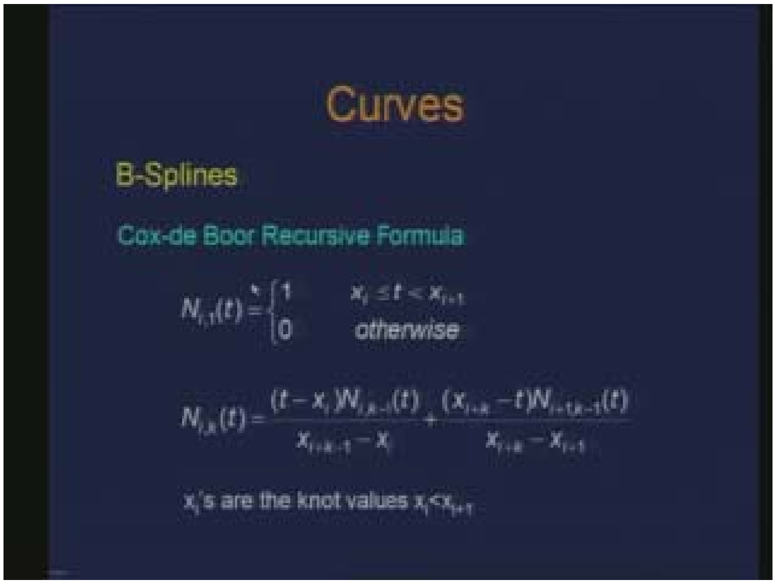

Then the $N_{i,k}$ is just defined in a recursive way using the $N_{i,k \text{ plus } 1}$ and $N_{i,k \text{ minus } 1}$. These are some combination of these. And the xi is the knot values and there is a property to these knot values that they are monotonically increasing. In particular we observed that there could be a number of ways in which we can define or give the x values or the knot vector x.

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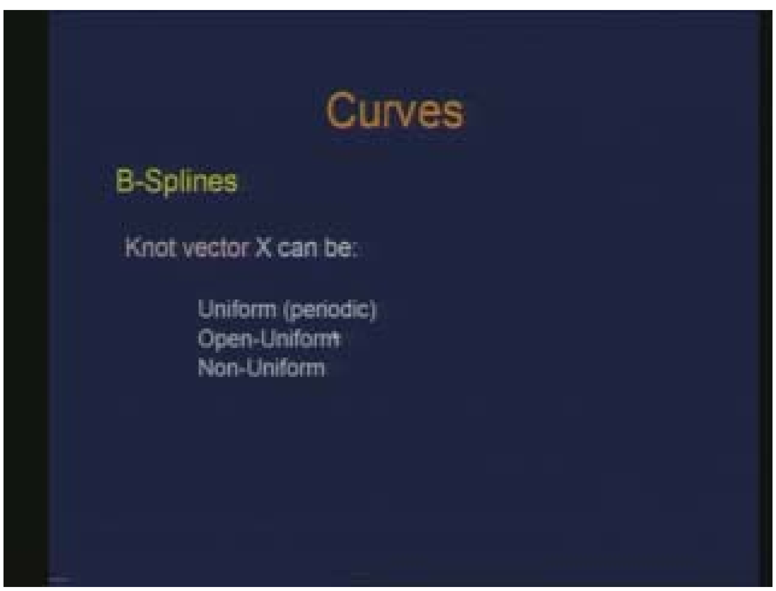

So there could be uniform x or uniform knot vector or periodic knot vector. It is periodic because the $N_{i,k}$s which are computed using these knots turn out to be periodic in nature.

Or it could be open uniform so there we have the multiplicity of the knots at the two ends. So the knot is repeated k times that both the…….