

Doc No.: AN-207

Version: 1.0

Date: 19 May 2008

Subject: Using NURBS to generate complex surfaces

APPLICATION NOTE

1. B_SPLINE NURBS mode

1.1. Type: Command

1.2. Syntax:

B_SPLINE(type, dimen, Curve_type, weight_op, points, knots, expansion, in_data, out_data)

1.3. Description:

Non Uniform Rational B-Splines, commonly referred to as NURBS, have become the industry standard way of representing geometric surface information designed by a CAD system. NURBS is the basis behind many 3D files such as IGES, STEP and PHIGS.

NURBS provide a unified mathematical basis for representing analytic shapes such as conic sections and quadratic surfaces, as well as free form entities, such as car bodies and ship hulls. NURBS are small for data portability and can be scaled to increase the number of target points along a curve, increasing accuracy. A series of NURBS are used to describe a complex shape or surface.

NURBS are represented as a series of XYZ points with knots + weightings of the knots

This application note covers the B_SPLINE command type 2 only.

1.4. Parameters:

type	1. Standard B-Spline (See standard B-Spline command) 2. Non Uniform Rational B-Spline
Dimen	Defines the number of axes. Reserved for future use must be 3.
Curve_type	Classification of the type of NURBS curve Reserved for future use must be 3.
Weight_op	Sets the weighting of the knots 0=All weighting set to 1.
points	Number of data points
knots	Number of knots defined
expansion	Defines the number of points the expanded curve will have in the table. Total output points = Number of points * expansion. Minimum value = 3
in_data	Location of input data Data is stored with X0,Y0,Z0,X1,Y1,Z1...,followed by knots data N0, N1, N2 ...
Out_data	Table start location for output points stored X0, Y0, Z0 etc.

1.5. Example:

```

type=2                '2 for NURBS
dimen=3               'must be 3 at present (X Y Z)
curve_type=3         'XYZ axes
weight_op=0          '0 sets all weights to 1.0
points=9              'number of data points
knots=13              'number of knots
expansion=5           'Expansion factor
in_data=100           'data points
out_data=1000         'table location to construct output

' Data Points:
TABLE (100,150.709,353.8857,0)
TABLE (103,104.5196,337.7142,0)
TABLE (106,320.1131,499.4647,0)
TABLE (109,449.4824,396.4945,0)
TABLE (112,595.3350,136.4910,0)
TABLE (115,156.816,96.3351,0)
TABLE (118,429.4556,313.7982,0)
TABLE (121,213.3019,375.8004,0)
TABLE (124,150.709,353.8857,0)

' Knots:
TABLE (127,0,0,0,0,146.8154,325.6644,536.0555,763.4151)
TABLE (135,910.13,38,1109.0886,1109.0886,1109.0886,1109.0886)

'Expand the curve, generate 5*9=45 XYZ points or 137 table
locations
B_SPLINE (type,dimen,curve_type,weight_op,points,knots,
          expansion,in_data,out_data)

```