CP10683

The Feature of Making Dream

Matteo Crocetti
Technical Sales Autodesk EMEA

Bertrand Masure
Technical Sales Autodesk EMEA

Learning Objectives

1. Discover golden rules for Freeform modeling (T-Spline environment)
2. Discover the complete hybrid modeling process ON Fusion 360 (solid and surface)
3. Discover consumer goods production workflow (modeling, rendering, prototyping and CAM)
4. Discover Fusion 360 and take a global picture of this new disruptive technology

Description

This class will cover a complete design process inside Fusion 360 software using different modeling tools and discovering tip and tricks for using the Freeform commands in a better way.

As you know, there are many differences between classic NURBS modeling and T-spline. Especially for consumer goods parts, it is important to integrate the process with solid modeling features like shell, ribs, and bosses.

During the lesson we will cover 10 golden rules for speeding up and increasing the quality of Freeform modeling and creating a good integration with solid modeling stuff. All the processes are going to use Fusion 360. In the last part of the class we will show the workflow from the model to the first prototyping product and to the integrated computer-aided manufacturing (CAM) for mold making.

About the speakers

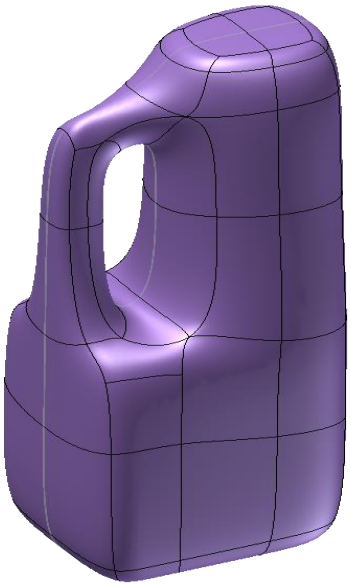
Matteo Crocetti *started his work path 17 year ago from Cimatron Ltd (CAD\CAM software) as Application engineer. He also worked for Think3 (thinkdesign CAD) and move his knowledge across several reseller of SolidEdge, PTC and Solidthinking. 2 years ago he joined Autodesk as Technical Sales EMEA focused on Data Management and Digital Prototyping products.*

After several years' experience with SolidWorks reseller mainly based on Data Management and CAD Methodology, ***Bertrand Masure*** *joined the Autodesk MFG South Europe Team 3 years ago with a focus on supporting internal and channel sales activities regarding the MFG portfolio, mainly in France.*

Freeform technology

History

Freeform tool are recently introduced from Autodesk in some manufacturing product for better perform the design process, especially for easily solve complex shape modeling. The technology is based on a product called T-Spline, acquired by Autodesk a couple of years ago. T-Splines helps to quickly create and edit organic models and originally it was born like a plug in for Rhino 3D and Solidworks.



Actually this technology is present inside Inventor, Fusion360 and Speedform in the MFG Autodesk Portfolio.

Design

With the Freeform technology users can easily sculpt smooth curvature continuous forms without require special knowledge skills. The shape could be very precise as watertight object and can be integrated on Solid modeling preventing conversion to CAD software

Other surface Modeling Technology

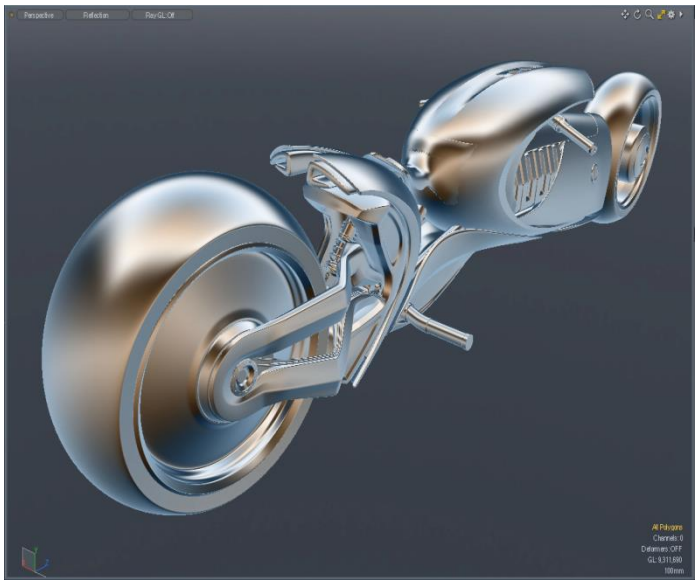
Nurbs

NURBS, Non-Uniform Rational B-Splines, are mathematical representations of 3-D geometry that can accurately describe any shape from a simple 2-D line, circle, arc, or curve to the most complex 3-D organic free-form surface or solid.

However they require a lot of control points to create shapes, the models are not watertight by default, and they need to be stitched prior to converting to a solid.

Autodesk Alias and McNeel Rhino3D are the two most popular NURBS modeling applications for design

Subdivision Surface



Subdivision surfaces get their name from their characteristic “dividing into regions of greater detail”. Like NURBS surfaces, subdivision surfaces are capable of producing smooth organic forms and can be shaped using relatively few control vertices. Like polygon surfaces, subdivision surfaces allow you to extrude specific areas and create detail in your surfaces when it is required.

Unlike NURBS – SubD surfaces don’t need to be stitched to make them watertight. SubD are compatible with NURBS but create an infinite number of patches.

Subdivision surface modeling can be found in: Catia—Imagine and Shape, PTC Creo Freeform, PowerNURBS for SolidWorks and Maya, 3DSMAX, Modo, etc.

What makes T-Splines unique

T-plines, unlike NURBS, can have partial rows of control points. These terminate in T-points, hence the name T-splines.

T-points allow you to terminate the areas of greater detail. Line work does not have be carried throughout the model.

T-points can be created by many commands, such as *insert edge*, *insert point*, *subdivide face*, *merging*, and *welding.*

In general T-splines require less control point for describing the shape instead the other technology. Minimizing control points makes it easier to create models, control surface smoothness, decrease file size, and speed up editing time.

A limitation of NURBS is that refinement requires the insertion of an entire row of control points, increasing the density of the mesh across the entire surface.

T-Points enable T-Splines to be locally refined.

Support for local detail in a single surface makes it easier to model complex shapes and create smooth watertight models.

With T-Splines non-rectangular surfaces can be constructed using star points. NURBS requires many individual rectangular patches to create complex shapes with varying detail, curvature or smoothness. Star Points are available in SubD modeling.

Creating the watering can model above (left) required many NURBS patches. This same model in T-Splines (right) is a single watertight surface.

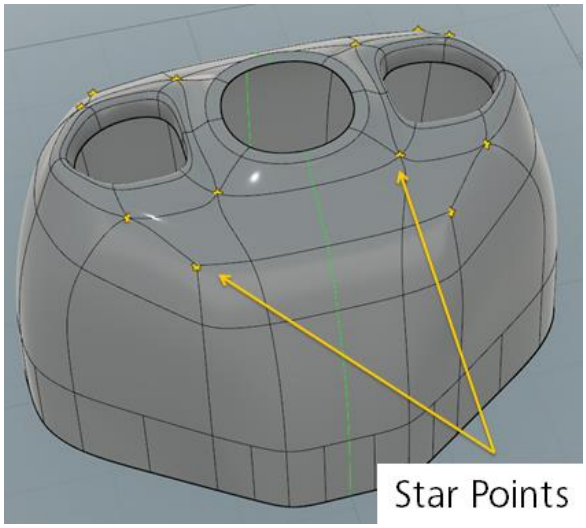
STAR POINT

Star points allow a T-spline to be non-rectangular.

Star points can be generated by commands such as ***extrude***, ***delete face***, **and** ***merge***.

It is more difficult to control the shape of a T-spline at star points, so they should only be used where necessary. Star points also determine how a T-spline will be converted to NURBS. When a T-spline is converted to NURBS, it will split into separate surfaces at each star point.

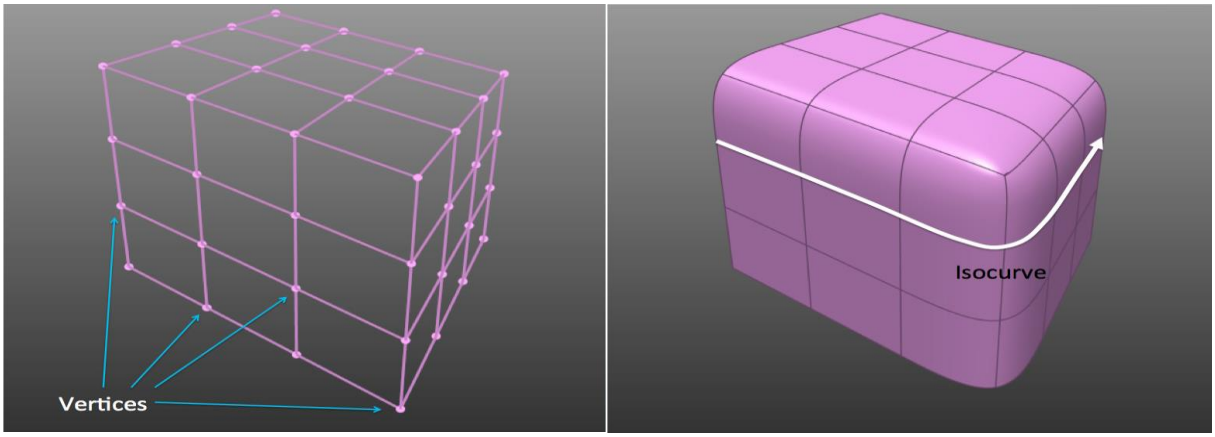
All T-Splines surfaces are 100% compatible with NURBS and create gap-free, smooth and manufacturable surfaces. T-Splines surfaces can be converted to untrimmed NURBS surfaces, and vice-versa, without any loss or change to the surface shape.



The Technology

Every T-Spline has a control cage. The control cage is what the user is editing when they model a T-Spline and it's displayed when you „Toggle Smooth" the model visualizzation.

The user can push and pull on the control cage's vertices to change the shape of the surface. No matter how much you move the vertices, the T-Spline always remains smooth.



On the T-Spline surface, a chain of edges create an isocurve, and between the edges there are T-Spline faces.

The surface itself is made up of all these faces, joined together by edges and vertices.

Freeform Approach

T-spline technology offer a very Quick and easy-to-use tool for creation of complex organic forms. The output surfaces are smooth (G2 continuity), watertight and geometrically accurate, and can be combined with powerful hybrid modelling workflows (es. Solid modelling)

Modelling a freeform object is like modelling a piece of clay, it's very nature! The key success for a quality results is the definitively different approach instead "classic Nurbs" modelling.

Some rules for better understand the topic are:

- Everybody will approach a Freeform model differently, no only one way to obtain the same shape.
- There is no 'right or wrong' way to design a freeform model
- It requires trial-and-error to understand and find the form
- Undo to revert back if needed