

DSM Export Plugin for CamBam

[Version 1.1.0]

Purpose

DesignSpark Mechanical (DSM) is a 3D modelling package that provides a wide range of capabilities to construct and visualise 3D models. It might be of interest to CamBam users as there is a free version which, while limiting some capabilities, can be useful to complete 3D designs. While DSM provides all the necessary tools for 3D modelling, it is sometimes useful to begin a design using a CAD drawing from another package. This CAD drawing might define some key geometric elements (points, lines, edges) which form the basis for constructing the required 3D model.

Up until V5 of DSM, the free version was able to import STEP files, and these can be generated a number of ways, including from FreeCAD. Now, and with the introduction of V6, this capability has been removed from DSM (although the capabilities to import a wide variety of file formats can be purchased for a monthly fee).

This plugin is aimed at CamBam users who are able to use CamBam to create (or import from a DXF, or some other, file) the required basic geometry that might be used to build a 3D model in DSM. From a CamBam model this plugin allows the selected geometry elements to be exported to a "Point-Curve-Text" file that is supported by the free version of DSM. This file is a simple text representation of points, lines and shapes that can be imported into DSM to create a range of simple drawing shapes, that in turn can be used to define the geometry for building complex 3D models. The resulting models can be exported from DSM to STL files that can be used in CamBam, or other modelling tools. They can also be used in 3D slicing software for 3D printing.

Version 1.1 changes the way Polylines and handled in Spline mode.

Installation

The DSMExport.dll file must be placed inside the CamBam plugins folder, and CamBam restarted. The DSMExport option will then appear in the Plugins toolbar.

Operation

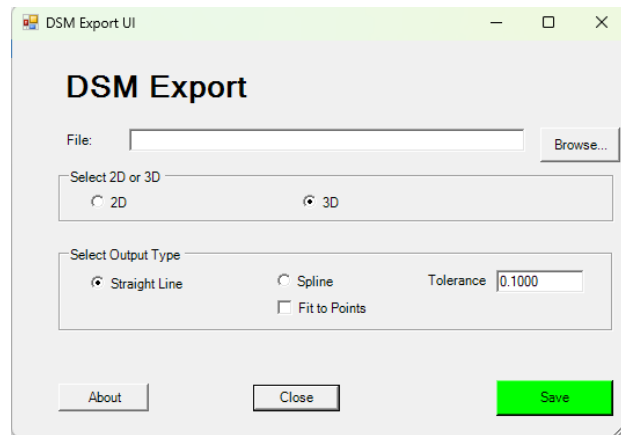
The shapes of interest are first created in CamBam, or imported into CamBam. They will generally be 2D shapes orientated on the X,Y plane at Z=0, but can also be 3D shapes.

The shapes can be:

- PointList: one or more points
- Lines: a single line
- PolyRectangle: a single rectangle
- Polyline: open or closed
- Arc
- Circle
- Spline: open or closed

Any shapes that have CamBam transformations should have them applied before exporting them.

With the required objects selected, launching the plugin will give this dialog:



The fields are:

- **File** field: the name of the file where the “Point-Curve-Text” file will be saved. This file should have a “.txt” extension.
- **Browse** button: Launches a file selector dialog to select/name this file and its location.
- **2D** and **3D**: radio buttons:
 - If **3D** is selected (default), then the 3D coordinates of the vertices (or control points) of the selected shapes are exported.
 - If **2D** is selected, then the coordinates are reduced to 2D by setting the Z value to 0 in each case.
 - The reason for this is not clear, other than ensuring that shapes are set exactly on the Z=0 plane when imported into DSM – this may make it easier to then perform further operations with those points.
- **Straight Line** and **Spline** radio buttons:
 - These options determine if the shapes to be exported have straight line edges or spline edges (splines can still be straight lines).
 - DSM likes to have splines for model building.
 - Points are exported as points, and become points in DSM.
 - If **Straight Line** is selected, then it is assumed that all the lines between the imported points are straight lines.
 - Arc, Circles and Splines are first converted to Polylines then the arcs are removed using the stated **Tolerance**. This may result in large numbers of edges for curved shapes when they are imported into DSM.
 - This option seems to have some difficulties for DSM. If the number of line segments created in the conversion to Polylines is greater than some number (~16), DSM fails to create surfaces from that shape (to create a solid), though the shape can be extruded into a surface.
 - If **Spline** is selected (default), then all shapes are taken to be splines and the exported points are the control points for the spline to be built by DSM.
 - Lines and PolyRectangles are exported as sets of Lines (between pairs of points). When imported into DSM these become sets of straight-line splines.
 - Polylines are exported as a spline with the verices defining the control points for the spline. This may mean that the exact curve is not reproduced in DSM, but by adding more points in the Polyline, the result will be close. That is, it is assumed that the Polyline is meant to be curved. If this is not

the case, then use Line mode or explode the Polyline into separate line segments.

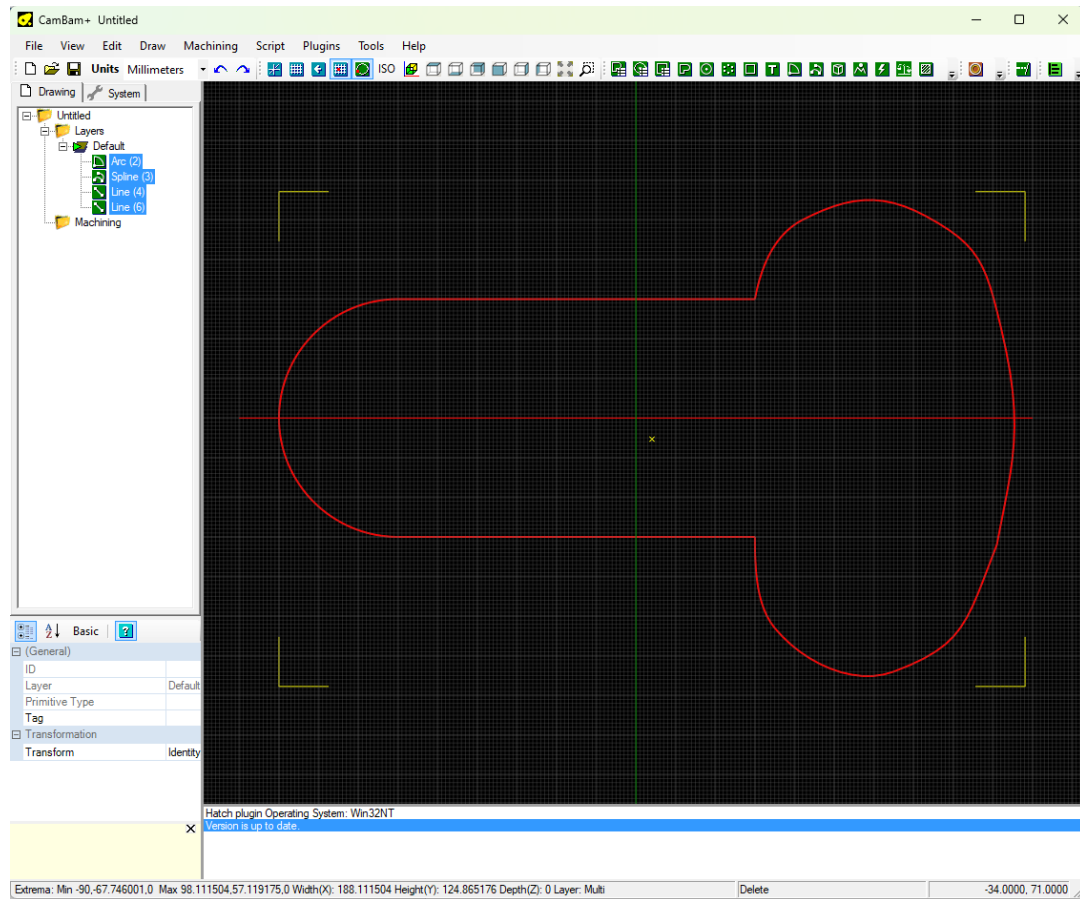
- Arcs and Circles are first converted to Polylines and then the bulges (arcs) are removed with a tolerance of *10 times* the set **Tolerance**. The number 10 is a bit arbitrary, but it is a guess at defining a reasonable number of control points while still reasonably representing the original shape. The result of this is to provide a set of points that approximates the original shape (Arc or Circle) but are then taken as control points in DSM to build a spline that closely (but not exactly) matches the original shape. As a result, the shape in DSM can then be manipulated/extruded as a smooth surface and not as large number of flat facets (as might happen if the Straight-line option is used).
- Splines are exported as the set of defined control points for the spline.
- This seems to be the most useful export option.
- While the result for **Straight Lines** is predictable (the shapes in DSM may have many facets), if the **Spline** option is used the result may not be exact, but probably close enough to be acceptable.
- **Fit to Points** checkbox: For the case of Splines (only) if this is checked then the spline fitted in DSM is approximated/smoothed to the control points within a set **Tolerance**. If not checked, then the spline in DSM fits all the control points exactly. The effect of this needs to be closely reviewed to see if the resulting spline is more-or-less what is required.
- **Save** button: creates and saves the data in the named file.
- **Close** button: Closes the plugin.

Notes

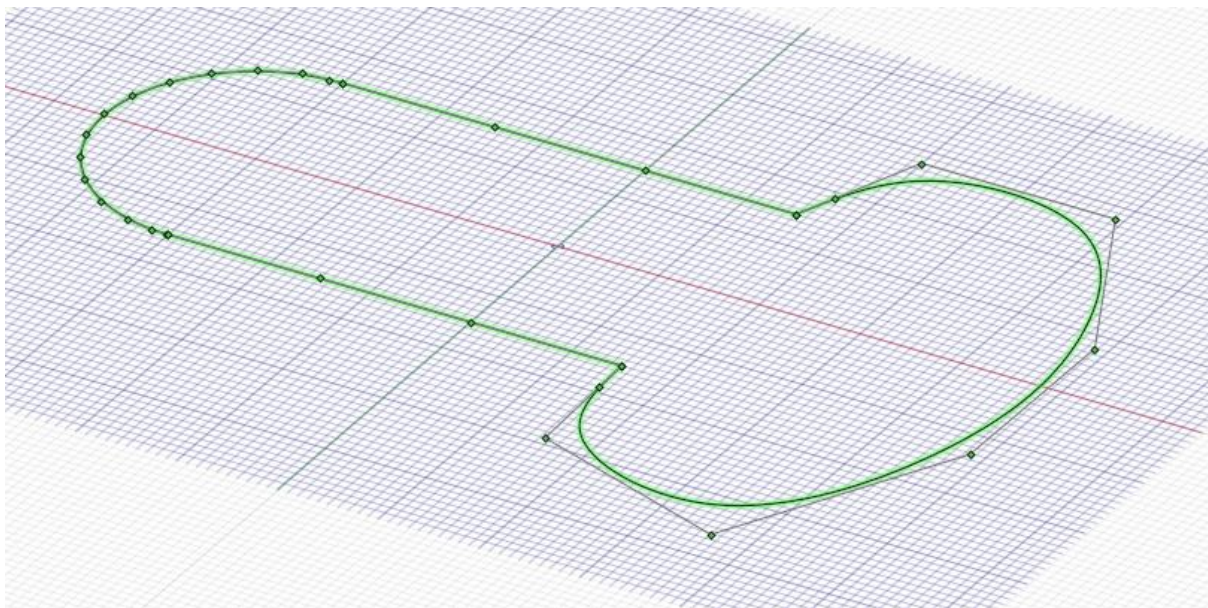
1. It would seem that the settings (Straight Lines/Splines and 2D/3D) can only be set once in the exported file (in the first few lines of the file) and so they apply to all points in the file. If you need to apply different conditions to different shapes, then those shapes will need to be exported into separate files.
2. For complex shapes (say, constructed from a set of Lines, Polylines, Arcs and Splines) then these component shapes should not be joined (to form a single Polyline) before exporting with the Splines option.
3. For closed shapes with the straight lines option (PolyRectangles, closed Polygons and Circles) the exported points for that shape includes an additional point to define the closure explicitly.
4. When a closed shape (e.g. PolyRectangle, closed Polyline, Circle or closed Spline) is first imported into DSM, it will appear as a boundary shape (composed of one or more curves), and not as a surface (in DSM terminology). To create a surface, select the shape boundary and then use the DSM **Fill** tool to create a surface. This surface can then be extruded into a solid.
5. In the output file the point coordinates are ordered (Z,X,Y) in each line. A blank line terminates a shape.
6. Any shapes that have been transformed in CamBam must have these transformations applied before exporting. This is not done automatically in the plugin. Note that PolyRectangles are converted to Lines when a transformation is applied.

Example

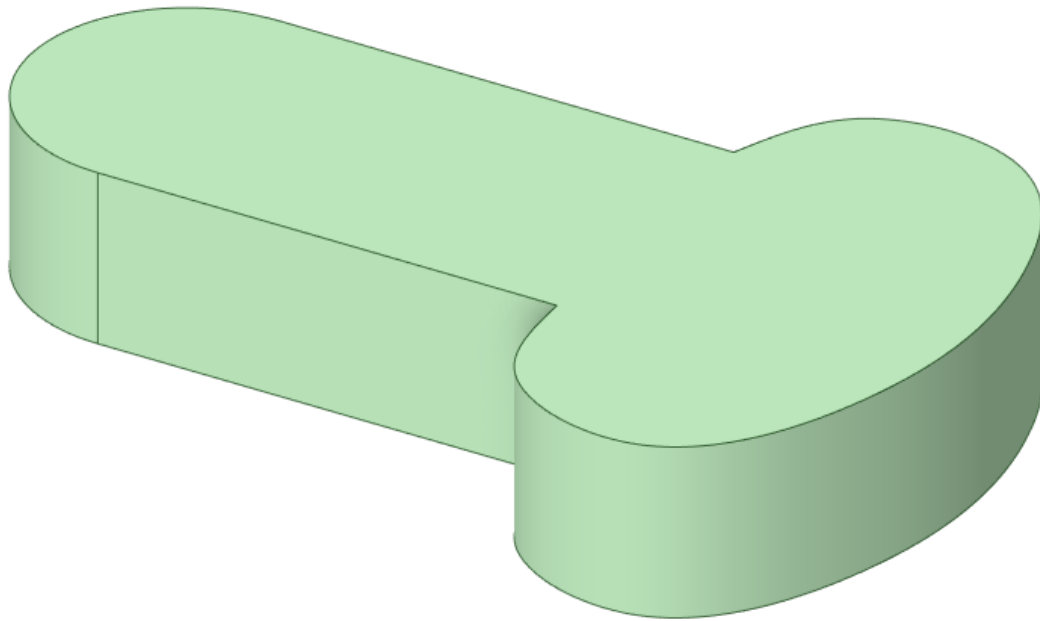
Here is a simple example shape: composed of two Lines, and Arc and a Spline (and not joined together to make a Polyline) in CamBam:



If these shapes are exported from CamBam as a **Spline**, then imported into DSM we get:



Note that DSM has added some extra points. If this shape is **Filled** to create a surface, then it can be extruded (in the Z direction) to create a solid with smooth curved surfaces like this.



This model could be further manipulated in DSM and then exported as an STL file for CNC machining or 3D printing.

DSMExport Plugin Versions

Version	Date	Notes
1.0.0	5/5/2023	First version for feedback
1.1	16/9/2023	Changed behaviour of polylines in spline mode.