Gexcel

JRC 3D Reconstructor

MULTI RESOLUTION MESHING

AND MESH EDITING
In this tutorial you will learn how to

- Create a mesh using Uniform and Multiresolution mesh
- Merge two or more meshes
- Simplify a mesh
- Delete triangles from a mesh
- Convert a mesh into an unstructured point cloud
Important notes

Meshing is possible with Grid point clouds. If you want to generate a mesh from an Unstructured point cloud, first transform it into a Grid point cloud through the Virtual scan tool or use the “Sample” command to select the unstructured points, then the “Collect point with virtual scan inside current selection” then “New point cloud from collected points” to fix the points you want to structure. To deselect the area, press .

Before meshing you need to Preprocess the Grid
Click the button or Right-click on the “grid” item of the project tree → Meshing tool → Meshing

In the meshing window the user can select two variants of the meshing algorithm:

A) **Uniform grid triangulation:** all the 3D points are connected with triangle meshes without simplification

B) **Multiresolution grid triangulation:** simplified triangle meshes are created in “flat” areas and dense triangle meshes are created in geometrical complex areas (close to edges or curvatures)
During the meshing the software will use the Edges calculated at the pre-processing stage:

- **Angular discontinuity:** set the angle [deg], the higher the angle value, the higher the detail of the calculated edges, close to the angular discontinuity you will have more detailed triangles.
- **Depth discontinuity:** set the minimum distance [m] two points have to be considered as belonging to two separate objects → no triangles are created between two far points. The lower the distance value the more holes are filled.
Uniform grid triangulation

All the 3D points are connected with triangles meshes, without simplifications.

Set the file name and the color layer you want to map, the mesh is not simplified. The algorithm checks if 2 points are divided by a depth discontinuity, in that case no “false” triangles are created.
Multi-resolution grid triangulation

Simplified triangle meshes are created in “flat” areas and dense triangle meshes are created in geometrically complex area (close to edges or curvatures)

**Accuracy:** in [m], the higher the value, the less triangles you have

**Color mapped:** set the color layer you want to map

**Create texture from color mapped:** set to TRUE if you want the color layer not to lose resolution with the mesh simplification

**Max triangle size:** 2 [number of points], the value you can set is [number of points] you want to skip in the flat area. The higher the value, the more the mesh gets simplified.

**Min triangle aspect ratio:** 0,5 > value > 0, The lower the value, the bigger the resulting triangles

**Save as:** set the file name

**Use orientation discontinuity:** set to TRUE to have more triangles around the edges
Try to generate two multi-resolution meshes with two set of parameters

Accuracy
Max triangle size
Use orientation discontinuity: TRUE

Accuracy
Max triangle size
Use orientation discontinuity: TRUE
It is possible to **save** the meshing parameter and **load** them for other scans or projects.
Mesh viewing parameters

- **False color that you can activate with**
- **To have light effects**
- **Cull face FALSE to view mesh both sides**
- **Display mode**
  - **Vertices**
  - **Wireframe**
  - **Flat**
Meshes grouping

To group different meshes in a single mesh:

1. Create a mesh from two scans
2. Right mouse button
3. Meshing
4. Make single mesh

A single file is created divided in single sub-meshes
Mesh filtering

To further decrease the number of triangles, select a mesh then press the Edit mesh button.

- Press Decimation

- Set the decimation value: 0.1 = try to reduce the original triangles to 10% of the original

- Set the max acceptable error during the decimation
To delete some triangles:

- Select Wireframe
- Select Triangles
- Make the triangles selection in the 3D view (only rectangular selection is available)
- Then Delete triangles
Intelligent points simplification

The Surface module can be used to simplify the point cloud in an intelligent way preserving important points. The tool is useful to export points to other software (i.e. CAD, Surfer, etc.), or to navigate.

You can operate in two ways. The first one:

1. Select a Grid
2. Right-click on the “grid”
3. Filtering & Clustering
4. Simplify points

A simplified unstructured point cloud is created with a hyperlink directly connected to the full resolution Grid
The second one:

1. **Select a mesh**
2. **Right-click on the mesh**
3. **Filtering Tools**
4. **Convert to point cloud**
Mesh creation from fitting surface: plane, sphere, cylinder

Try with Sphere, Select fitting points, two possibilities:

1. Alt+Double click to select the fitting points in the Point List Window
2. to generate Sphere

1. Select the points with and 
2. Sample the data
3. Fit a Sphere
Sphere camera is created and it can be transformed in a Mesh

Property Browser:

**Sphere Camera**: Sphere camera 710

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ClipFar plane</td>
<td>24.008146</td>
</tr>
<tr>
<td>ClipNear plane</td>
<td>0.243621</td>
</tr>
<tr>
<td>Color ID</td>
<td>[150, 255]</td>
</tr>
</tbody>
</table>

Set projector image...

- Go to
- Apply projection
- Invert direction
- Copy center point
- Duplicate as...
- Registration Tools...
- Volume Calculation...
- Scan Tools...

Create triangle mesh...

Copy
- Remove
- Export XML node...
Mesh editing and manual mesh creation

You can create meshes selecting points in the Point List Windows: select a number of points, press  and select 2D projection.

If a calibrated image is available the image is automatically projected onto a mesh.
3D Volume editor

To compute a Delaunay tetrahedralization from points list (selected in the new point list window). The tool can be used to create a simplified hull model and to calculate volumes.
Mesh export

1. Select a mesh
2. Save copy as (available format: COLLADA, PLY, VRLM, 3DS)
If you need some more information, please contact our Gexcel Sales Team writing to sales@gexcel.it

Phone (+39) 030 6595001