stlutils

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CMUTILS

1.1 stlutils module

1.1.1 STL file generation

This is a simple "brute force" conversion resulting in large files. Each rectangle in the rastered data is simply converted to two triangles.

The resulting stl file therefore includes: - vertices: x-,y- and z-coordinates of all points in the original surface - faces: triangles represented by the indices of their corner points - vectors: normals of triangle faces

You can reduce the size of the file afterwards in MeshLab using "Filters -> Simplification: Quadratic Edge Collapse Decimation", where "Percentage reduction" is the target mesh size relative to original.

`stlutils.`**`add_border`**(*array*, *border*, *flip*)

add border around 2D height array assuming uniform lattice spacing.

Parameters

- **array** (*np.ndarray*) – array of shape (nx,ny) containing z coordinates.
- **border** (*int*) – width of the border in 'pixels'.
- **flip** (*bool*) – whether or not to flip the topography upside-down.

Returns updated 2D array of shape (nx+2*border, ny+2*border).

Return type np.ndarray

`stlutils.`**`add_foundation`**(*vertex_list*)

add to vertex list the vertices representing the bottom foundation of the 3D model.

Parameters **vertex_list** (*np.ndarray*) – array of shape (nx*ny, 3).

Returns updated vertex list of shape ((nx+2)*(ny+2), 3).

Return type np.ndarray

`stlutils.`**`convertArray`**(*array*, *outpath*, *Lx=1*, *Ly=0*, *norm=1*, *flip=False*, *foundation=True*, *border=0*)

create stl file from 2D numpy array

Parameters

- **array** (*np.ndarray*) – array of shape (nx,ny) containing z coordinates.
- **outpath** (*str*) – filepath to the stl output file.
- **Lx** (*float*) – physical dimension of the topography in x direction.
- **Ly** (*float*) – physical dimension of the topography in y direction.

- **norm** (*float*) – factor, by which to multiply z coordinates.
- **flip** (*bool*) – whether or not to flip the topography upside-down.
- **foundation** (*bool*) – whether or not to add 2 triangles representing the bottom of the 3D model
- **border** (*int*) – width of the border in 'pixels'.

stlutils.**convertFile**(*inpath*, *outpath=''*, *norm=1*, *flip=True*, *foundation=True*)
create stl file from config file

Parameters

- **inpath** (*str*) – filepath to a contMech config file containing nx*ny points.
- **outpath** (*str*) – filepath to the stl output file.
- **norm** (*float*) – factor, by which to multiply z coordinates.
- **flip** (*bool*) – whether or not to flip the topography upside-down.
- **foundation** (*bool*) – whether or not to add 2 triangles representing the bottom of the 3D model

stlutils.**create_faces**(*foundation=True*)
calculate the 2*(nx-1)*(ny-1) triangles contained in a nx*ny surface

Parameters **foundation** (*bool*) – whether or not to add 2 triangles representing the bottom of the 3D model

Returns array of shape (2*(nx-1)*(ny-1) + foundation*2, 3) containing the indices of the 3 vertices of each triangle.

Return type np.ndarray

stlutils.**from_array**(*array*, *Lx=1*, *Ly=1*, *norm=1*, *flip=False*)
convert 2D height topography to a 3D vertex list assuming uniform lattice spacing.

Parameters

- **array** (*np.ndarray*) – array of shape (nx,ny) containing z coordinates.
- **Lx** (*float*) – physical dimension of the topography in x direction.
- **Ly** (*float*) – physical dimension of the topography in y direction.
- **flip** (*bool*) – whether or not to flip the topography upside-down.

Returns 3D vertex positions as an array of shape (nx*ny, 3).

Return type np.ndarray

stlutils.**from_file**(*inpath*, *norm=1*, *flip=True*)
convert 2D height topography to a 3D vertex list assuming uniform lattice spacing.

Parameters

- **inpath** (*str*) – filepath to a contMech config file containing nx*ny points.
- **norm** (*float*) – factor, by which to multiply z coordinates.
- **flip** (*bool*) – whether or not to flip the topography upside-down.

Returns 3D vertex positions as an array of shape (nx*ny, 3).

Return type np.ndarray

> **Warning:** These files assume that the surface is periodically repeatable!

> **Warning:** flip=True is default since these files store the surface upside down!

stlutils.**save_mesh**(*vertex_list*, *faces_list*, *outpath*)
create mesh from vertices and faces and save it to an stl file

Parameters

- **vertex_list** (*np.ndarray*) – array of shape (nx*ny, 3).
- **faces_list** (*np.ndarray*) – array of 3-tuples of indices, where each of those 3-tuples forms a triangle in vertex_list.
- **outpath** (*str*) – filepath to the stl output file.

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