GUIMesh User's Manual

GUIMesh is a graphical user interface that allows to convert STEP geometries into GDML as tessellated solids. It is distributed with a GNU GENERAL PUBLIC LICENSE.
This manual provides simple instructions on how to run and use the program without much effort.

1. Installation

GUIMesh itself does not need to be installed since it is built on python. Its dependencies however need to be installed:
- Python2.X (www.python.org) resorting to its TKinter extension.
- FreeCAD v0.15 or v0.16 (www.freecadweb.org) – v0.17 yet to be tested
- Geant4 (version 10 or higher recommended) compiled with XERCESC libraries and GDML option "ON" (https://geant4.web.cern.ch/) – While this toolkit is not necessary to run GUIMesh, its outputs are intended to be imported in Geant4.

2. Running and Loading

If you own the compiled version of GUIMesh you can simply run the executable. Otherwise just open the ".py" file with python (python GUIMesh.py). This will open the interface shown in the figure below.
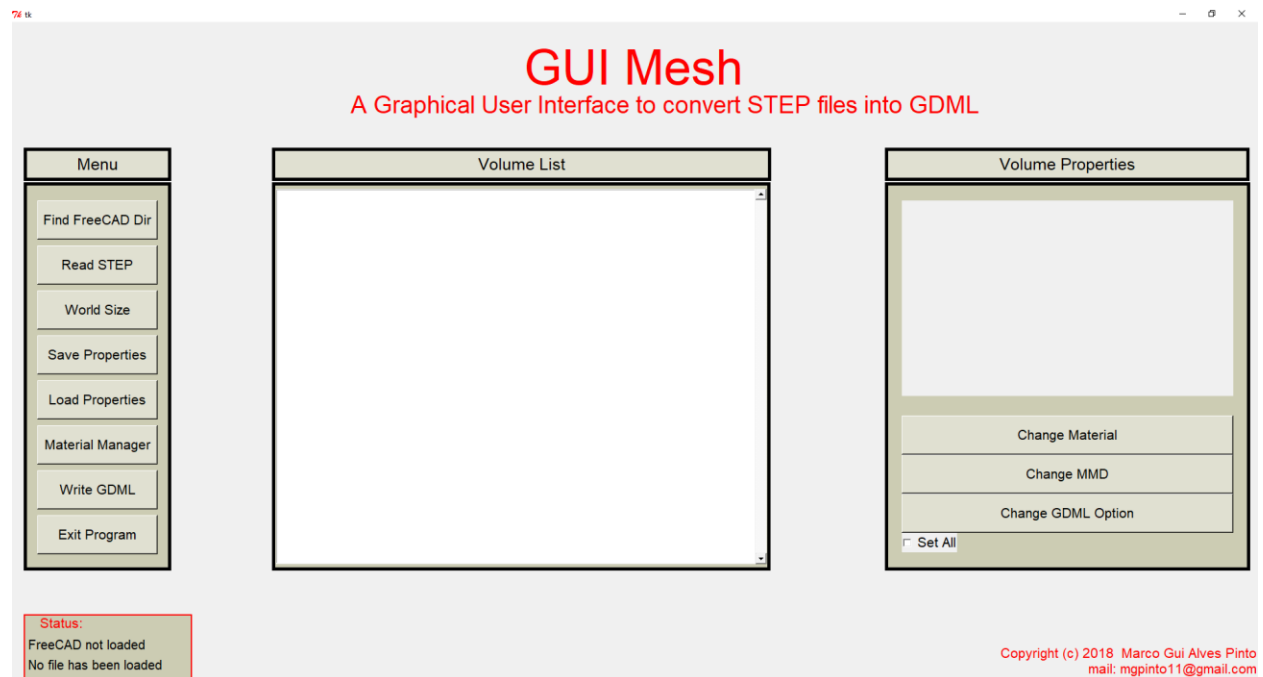

Fig. 1 Main window of GUIMesh. On the left side a menu with different functions is presented via several buttons. The middle panel displays the list of the loaded volumes. The right side is dedicated to volume editing.

3. Menu Buttons

3.1 Find FreeCAD Dir

After opening GUIMesh press the "Find FreeCAD Dir" button on the Menu. A window will pop-up to let the user search FreeCAD's main folder directory. If FreeCAD libraries are found, a popup window will display "FreeCAD loaded" and the application will be ready. No functions with STEP files are available before this is done.

3.2 Read STEP

As the name suggests this button allows the user to select a STEP file to be read by the program (FreeCAD must be loaded). Only ".STEP" files are readable. When you load a STEP file, a default material (Silicon), a MMD value (0.1 mm) and a GDML option (1 – write GDML file) are assigned to all volumes.

3.3 World Size

The user can select the world size (X, Y and Z) with this button via a small interface seen in Fig. 2. The World Volume is the top geometry in Geant4 where all other volumes are placed. Default size is 1 m * 1 m * 1 m so if the full geometry is larger this should be increased.
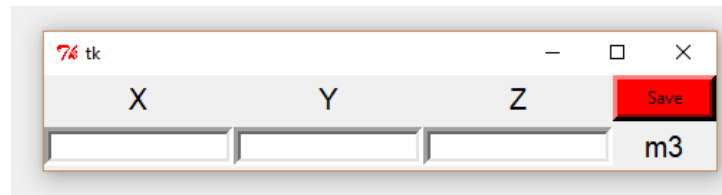

Fig. 2 Set world size interface.

3.4 Save Properties

This button writes one ".csv" file with the all volume's properties, one volume per line. This allows the user to edit the properties outside of GUIMesh, or simply to save a session and load it afterwards. The line format is the following:

Volume_Name;Volume_Material_Name;Volume_MMD;Volume_GDML_Option

3.5 Load Properties

A ".csv" file with the volume's properties can be uploaded to GUIMesh. The format should be the same as the one presented previously. Some tests are performed by the software but the user should make sure that both the format and the variables are correct.

3.6 Material Manager

This button opens the Material Manager interface. A detailed explanation can be found in Section 6 – Material Manager.

3.7 Write GDML

Prompts the user to select a folder to write the GDML files. The mother.gdml file is written in this folder and a subfolder "Volumes" is created with all the volumes GDML files. Volumes with GDML option equal to zero will not be written.

3.8 Exit

Terminates the program.

4. Volume List and Volume Properties

4.1 Volume List

Displays a name list of all the volumes found in the STEP file. Each name can be selected in order to make it the active volume displayed in the Volume Properties.

4.2 Volume Properties

When a volume name is selected in the Volume List (see 4.1), its properties are displayed in the right part of the interface: Name, Material, Volume, Mass (calculatet from the volume and material density), MMD and GDML Option (Write GDML). While the Name and Volume come from the STEP file, the Material, MMD and GDML Option are assigned in GUIMesh. These three variables can be changed with the corresponding buttons: "Change Material", "Change MMD" and "Change GDML Option". The changes can be applied to the selected volume only or to all the volumes by ticking the "Set All" option. The properties display will only be updated if the volume is re-selected. MMD values must be floats greater than zero and will affect the precision the tessellated geometry. GDML option should be either 1, write GDML, or 0, do not write. Material name must be in the session database which can be accessed and edited in the Material Manager.

5. Material Manager

The Material Manager interface (Fig. 3) is used to create, save and load materials that can be assigned during one session. An element list based on all NIST materials that are compatible with Geant4 is loaded by default and is also available.
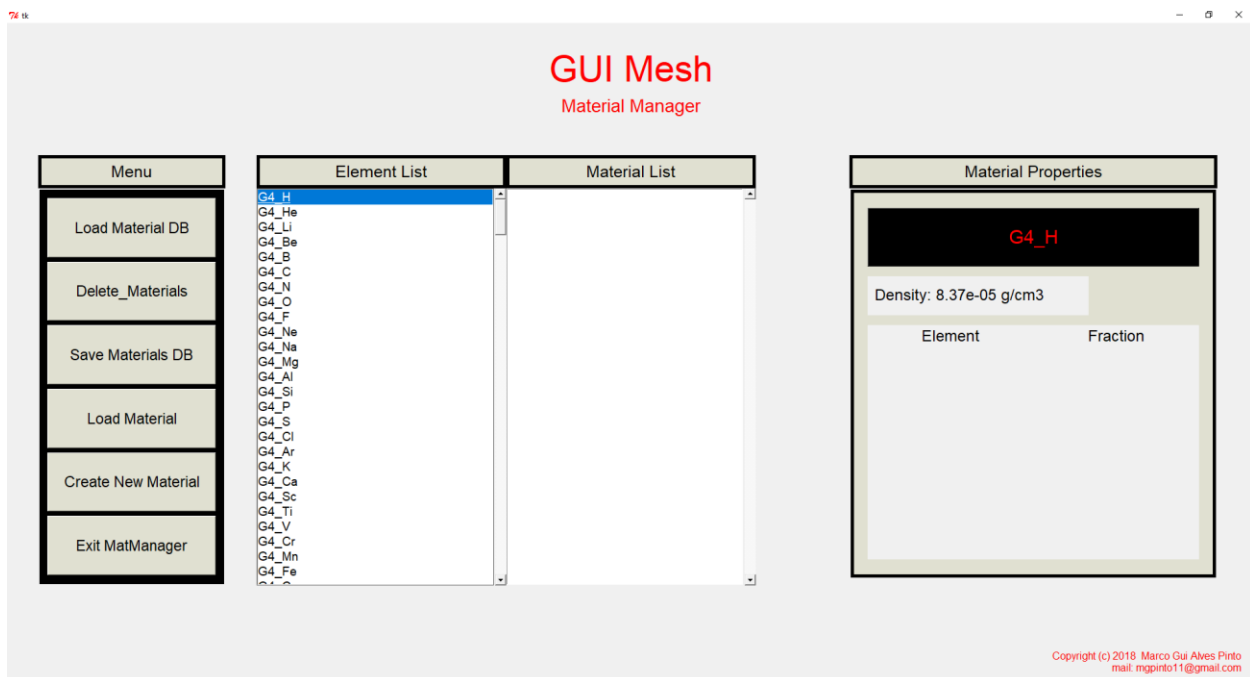

Fig. 3 Main window of the Material Manager. On the left side a menu with different functions is presented via several buttons. The middle panel displays the list of elements (left size) and materials (right). The Element List is loaded when the tool is opened. The right side displays the selected element/material properties.

5.1 Button Menu

Several options are given via buttons in this interface.

5.1.1 Load Material Database

Reads all Materials defined as text files in the "Material" folder (if in the correct format).

5.1.2 Delete Materials

Deletes all materials in the current session (elements not included).

5.1.3 Save Materials Database

Saves all Materials in the current session as text files in the "Material" folder. Will not over-write materials with the same name as others already saved.

5.1.4 Load Material

Reads a text file to add a Material to the session database (if in the correct format).

5.1.5 Create New Material

Each new material must have a name, density, number of elements and weight (fraction of these elements). When the "Create New Material" button is pressed, a small window will appear asking for the number of elements that constitute the material (must be an integer greater than zero). After this, a window such as the one in Fig. 4, will appear in order for the user to put all the material information, name, density (g/cm3), elements and weight of these elements (must add up to one). When all the parameters at put press the "Save Material" button. Note that this material is added to the session database only but not saved for future use. To save it use the "Save Materials Database" button.
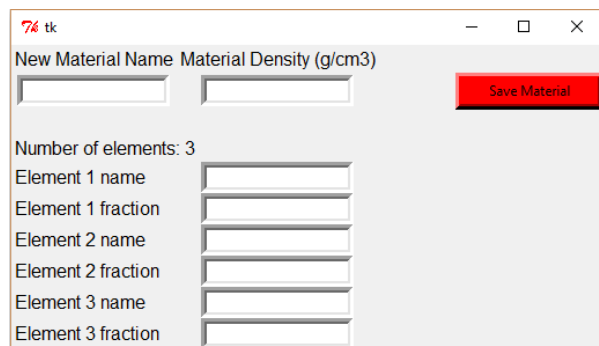

Fig. 4 Window to build new Material. As it can be seen the user should input the material name, density, elements and weight of these elements in the material. The fraction must add up to one.

5.1.5 Exit MatManager

Terminates the program.

5.2 Element and Material List and its properties

Two lists, one for elements and one for materials, are presented in the middle part of the interface. The element list does not change as it is loaded by default and no editing options are given. The material list however is empty when a session starts but can be changed by either loading, deleting or creating materials. If one of the elements of materials is selected a list of its properties is displayed in the Material Properties (right side of the interface).