WIPL-D Pro CAD: What is New in 2024 Release?

This 2024 release brings significant enhancement in software stability, new useful features and many improvements such as:

1. **Increased stability - Import of CAD projects, import from Library, import of WIPL-D Pro projects, import of geometry files, import of multilayer AutoCAD files, attributes propagation and handling on Booleans, splitting wires by bodies, copy layer, working with assemblies, validate model for irregularities, material i.e. domain assignment, sweep, crop, blending, project tree and subtree, microstrip ports with common ground, GUI features, frequency and sweep parallel runs on CPU/GPU...**

2. **WIPL-D scripting in Python:**
   a. **Open and run WIPL-D suites**
   b. **Access and modify symbols lists**
   c. **Obtain simulation results**

3. **Expanded Domains in Project tree - All operations with body regions listed along with their materials i.e. domains are enabled from main Project tree**

4. **Repair tools - Remove redundant vertices**

5. *Sweep* **is enhanced and accelerated for complex paths, using multiple tolerance.**

6. *Wrap* **is enhanced - allows the use of general sheets and deleting wrapped objects' surrounding faces**

7. *Crop* **is enhanced - smart crop with attribute transfer, keeping the structure parts in the crop plane**

8. **Recover body regions on geometry import**

9. **Drag and drop to assembly in Project tree**

10. **Other options/improvements:**
    a. **WIPL-D Pro projects import improved**
    b. **CAD projects import: transformation to currently set local coordinate system, accelerated import for projects with large number of symbols**
    c. **Symbol list can take an alternative shape of an editable text box so that symbols can be modified double and long-double click**

d. **Set simulation frequencies by step size**
e. **Plate domain integrity check on Create Mesh/Run**
f. **Set as Unused option includes structures with excitations**
g. **Copy Layer is more robust for general bodies, automatic unification of faces' normal where possible**
h. **Command 'Save as' available via command line**

1. Increased Stability

This release brings more stable software suite as we put a great effort on potential issues and improvements suggested by our customers.

This includes updates of many code parts like: geometry creation i.e. imports of native projects, AutoCAD projects, geometry from popular CAD formats, Booleans, cropping, wrapping, blending, then assigning the attributes to geometry e.g. surface and concentrated loads, reference frequency, local mesh settings, also assigning general settings i.e. materials, excitations, frequency, interface or preview enhancements, project tree enhancements, CPU/GPU parallel runs, etc.

2. WIPL-D scripting in Python

We are excited to announce the introduction of Python scripting in WIPL-D Pro CAD. We prepared powerful, comprehensive, and easy-to-use scripting libraries that allow automation of various tasks. These libraries allow users to open and run WIPL-D suites, to access and modify symbols lists and to obtain simulation results.

The scripting language that has been used is Python 3.10. WIPL-D Python library is distributed as a wheel (.whl) file. It is a standard format installation of Python distributions and contains all the files and metadata required for the installation.
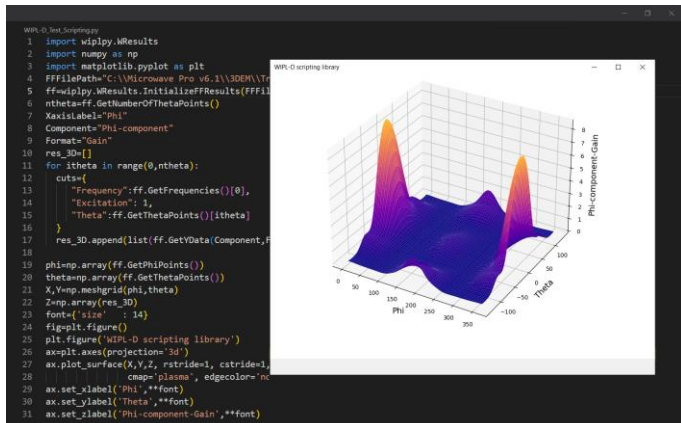
Fig. 1. WIPL-D Scripting in Python.

The WIPL-D scripting package provides three different modules: interface, symbols, and results.

a) Open and run WIPL-D suites

Simple operations such as opening and running the WIPL-D Pro CAD (or alternatively WIPL-D Pro) projects are accessible via interface module. In addition, this module provides access to project symbols.

The next script shows how to open WIPL-D Pro CAD suite and run the model of patch antenna from the installation directory.

```
import wiplpy.WiplInterface
WIPLDInstallDirectory="C:\Microwave Pro v6.2"
PathToProject="C:\\Microwave Pro
v6.2\\3DEM\WCAD\\Examples\\Quick Tour\\patch_antenna"
CAD=wiplpy.WiplInterface.InitializeWIPLDSuite(WIPLDIns
tallDirectory)
CAD.Run(PathToProject)
```

b) Access and modify symbols lists

While the interface module itself has a built-in functionality of accessing and modifying the symbols list, the project symbols are also manageable via independent *symbols module*. Accessing the symbols via symbols module increases user's comfort since it does not require running instance of WIPL-D suite.

The following piece of code shows how to access the symbol named "A", print its current value, then change its value to 100, and print the new symbol value.

```
import wiplpy.WSymbols
PathToSMB="C:\\Microwave Pro
v6.2\\3DEM\\Training\\Models\\Intro
Task2\\Intro_Task2.smb"
SymbolsList=wiplpy.WSymbols.GetSymbols(PathToSMB)
```

```
Symb1=SymbolsList.GetSymbolByName("A")
print("The value of symbol A: ",Symb1)
SymbolsList.SetSymbolByName("A",100.0)
Symb1=SymbolsList.GetSymbolByName("A")
print("The new value of symbol A: ",Symb1)
```

c) Obtain simulation results

The result module enables access to WIPL-D output results. It allows one-dimensional access to results. Starting from one-dimensional results, obtaining two-dimensional results is just a step away, as it is supported by loops. No running instance of WIPL-D Suite is required for simulation results access.

The next script returns s11 parameters in dB at different frequency points, prints X-axis and Y-axis units and values.

```
import wiplpy.WResults
YZSFilePath="C:\\Microwave Pro
v6.2\\3DEM\\Training\\Models\\Eval Task6\\Slot-
Fed_Microstrip_Patch"
yzs=wiplpy.WResults.InitializeYZSResults(YZSFilePath)
cuts={"i":1,
      "j":1,
}
XaxisLabel="Frequency"
Component="Sparameter"
Format="MagdB"
resx=yzs.GetXData(XaxisLabel)
res=yzs.GetYData(Component,Format,XaxisLabel,cuts)
print("X-axis in: "+yzs.GetXUnit())
print(resx)
print("Y-axis in: "+yzs.GetYUnit())
print(res)
```

3. Expanded Domains in Project Tree

Regions of the bodies are available in the Domains of the Project Tree.

Card "Domains" from main tree that lists all the defined materials now includes all regions of bodies from the project, arranged according to their assigned domains. Therefore, all operations intended for bodies' regions are now available from tree. This also provides information about the region of the domains which makes it easier to see the model structure and make changes regarding the domain and region definition.

The following figure shows two patch antennas fed by coaxial line and corresponding project tree with visible "Domains" card.
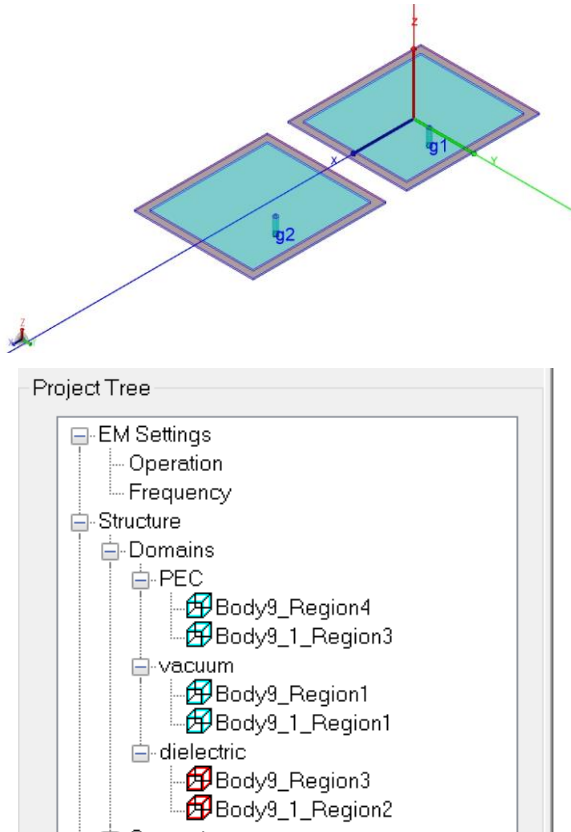

Fig. 2. Patch antennas fed with coaxial line and how their materials and regions appear in the project tree.
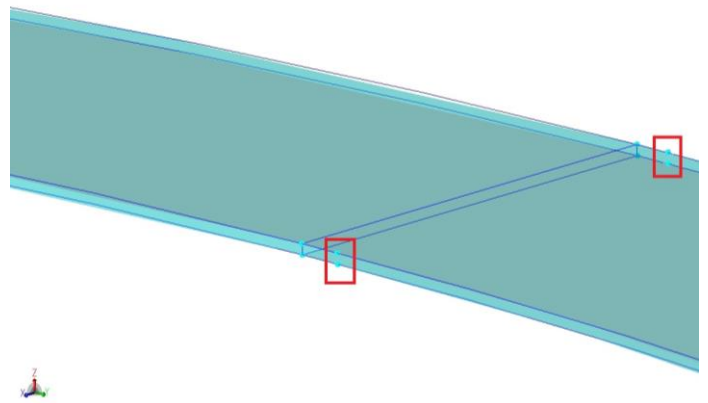
4. Remove Redundant Vertices

This feature introduced among other Repair tools in WIPL-D Pro CAD allows to remove unnecessary vertices that lie on smooth connection of two edges, i.e. on a smooth line.

Removing such vertices on one hand doesn't influence the geometry of the model and on the other hand it brings the important benefit: small mesh elements will not appear in the meshed model. This way mesh becomes suited for faster computations and accurate results ensuring high numerical efficiency of WIPL-D's MoM kernel.
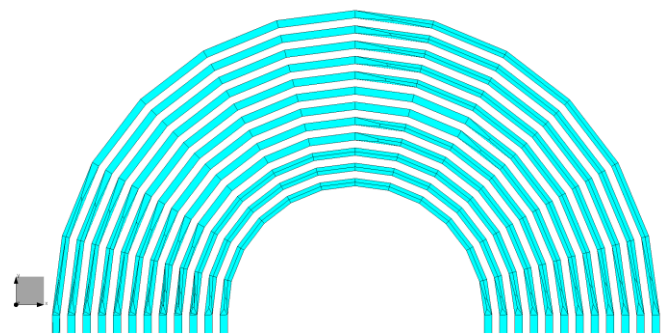
Fig. 3 shows spiral antenna, its redundant vertices and part of the antenna's mesh with redundant vertices and without redundant vertices. It is obvious that the latter is more regular and without unnecessary elements.
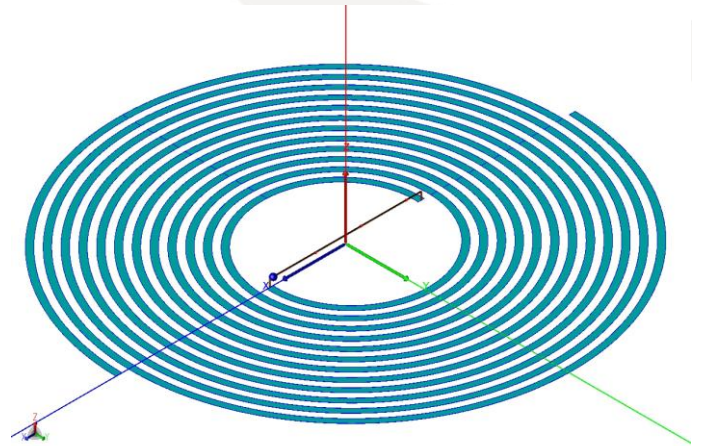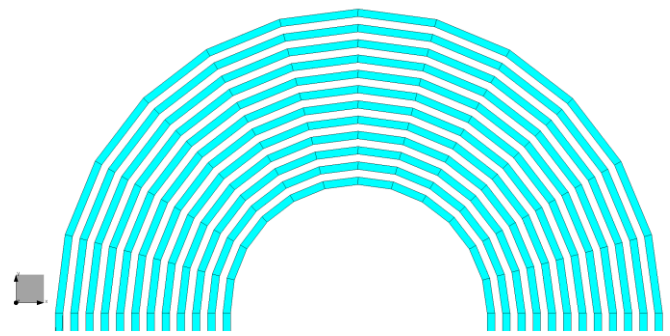

a) spiral antenna

b) redundant vertices that lie close to regular ones

c) part of the mesh, with redundant vertices

d) part of the mesh, without redundant vertices

Fig. 3. Removing redundant vertices on spiral antenna.

5. Sweep is Enhanced

The sweep operation is more robust now due to more tolerance parameters gradually changeable in an iterative procedure to obtain a regular body after the operation is finished.

This approach has been proven to ensure a successful sweep in most of the cases. Furthermore, the operation is much accelerated on complex twisted paths. Finally, sweep along the closed paths is enhanced, too.

Sweep command, if necessary, adjusts a tolerance trying to obtain a good output. In some cases when profile tool is unable to sweep along the path, applying small rotation of profile around its axis defined by LSQ plane, is useful. This rotation is negligible and does not change geometry but applied iteratively, i.e. in steps, can lead to a successful output from the operation.

Sweep is now much faster for complex paths, usually twisted lines, with many bandages. It appears that dividing those complex paths to many simple paths, sweeping the profile along them and connecting the obtained bodies create final body significantly faster.

The figure below shows helix antenna around the dielectric rod. Helix wire has 12 turns. The helix itself is obtained by sweeping a quadrilateral along the wire, see Fig. 4. This problem is, in general, demanding for "normal" sweep which tries to preserve profile-path relation all the time along the path that constantly curves. Previous sweep would take around ~23 sec to complete while new would take around ~3 sec (on the machine Intel(R) Core(TM) i7-10700K CPU @ 3.80GHz 3.79 GHz).
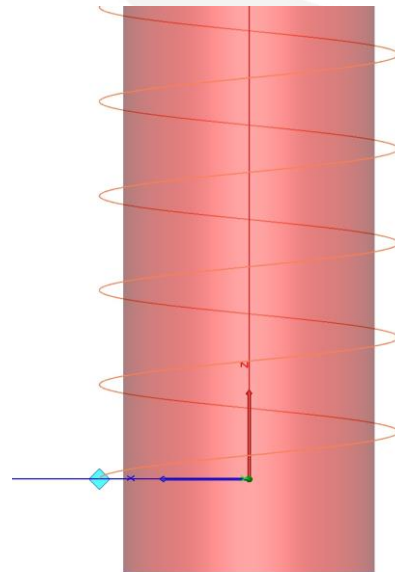
b) quad as profile and helix wire as path for sweep
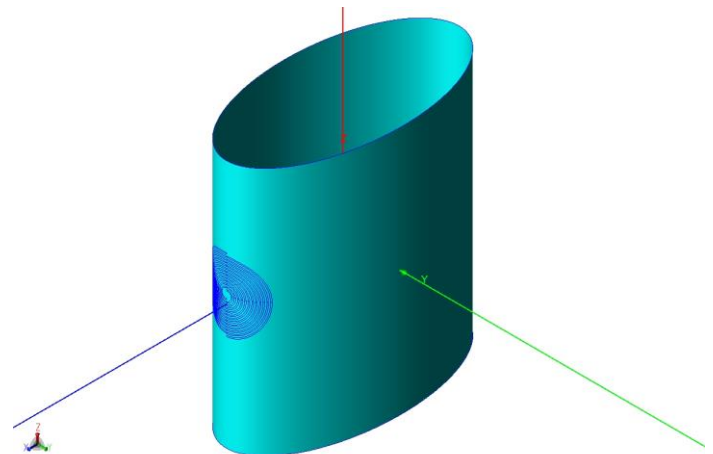
Fig. 4. Sweep quad along helix wire.

Sweep command now allows the operation to finish even if the resulting body has small irregularities (e.g. some faces are not connected but are very close). Such irregularities can be further removed, for instance, by using *Sewing faces* or some other commands.
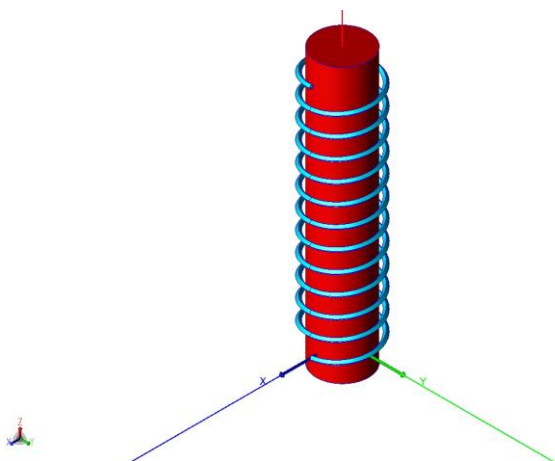
6. Wrap is Enhanced

Wrapping option now allows the use of general sheet bodies including bodies that can be wrapped over a curved body.
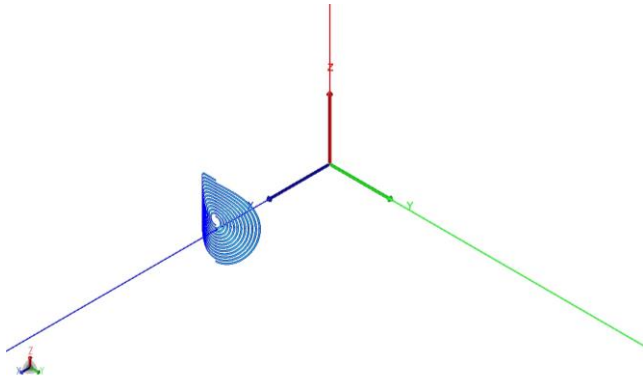
The new feature also enables deletion of surrounding faces. Fig. 5 shows such an example, RFID tag spiral antenna, over the hand modeled as ellipsoidal cylinder.

a) helix antenna over dielectric rod

a) wrapping without deletion of surroundings

b) wrapping with deletion of surroundings

Fig. 5. Wrapping sheet body.

This additional feature can be useful in situations where, for example, the sheet which should be wrapped around some body changes during the optimization process, while at the same time the user wants to exclude the surrounding faces from the simulation.

7. Crop is Enhanced

Crop command now allows to choose whether to retain the metallic and/or dielectric plates in the plane where it is performed. Its sub-command '*Keep Solids*' is upgraded too, taking into consideration body regions.

Crop is also enhanced in case where handling entities that lay within the crop plane or that are bounded with the plane, is required.

Furthermore, the consistency of transferring the attributes while performing Booleans inside *Crop* is improved.

## 8. Recover Body Regions on Geometry Import

When importing non-native geometry to WIPL-D Pro CAD using the well-known translators (e.g. Parasolid, SolidWorks, CATIA, STEP, IGES, etc.), the differences in model drawing accuracy, steps during model creation, compatibility of original software and translator version can possibly create some irregularities in the imported model. WIPL-D Pro CAD has already several tools to handle inconsistencies in the imported model geometry like: repairment, sewing and simplifying.

In addition, a new feature for recovering body regions forces WIPL-D Pro CAD to check and, if necessary, properly reconstruct the regions (closed areas of bodies) of the imported geometry.

9. Drag and Drop to Assembly in Project Tree

Project tree enables drag and drop operation when adding bodies/assemblies to the assembly. This is much easier, simpler and more intuitive than applying the same command from the ribbons or popup menu.

Fig. 6 shows the Project tree before and after Body1 drag & drop to the Assembly1.
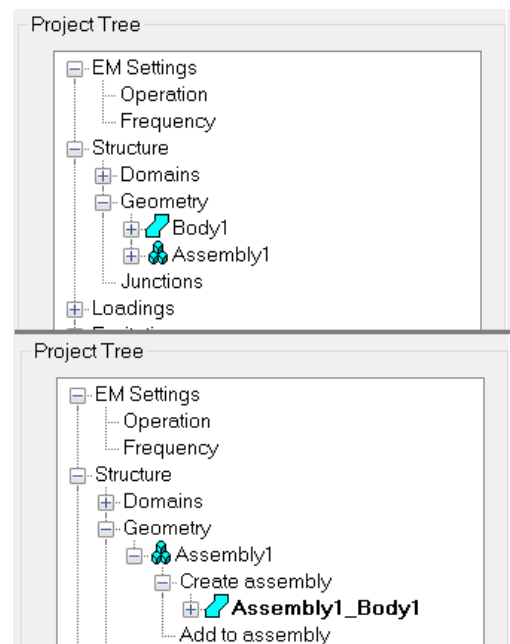
Fig. 6. Drag and drop in the tree.

10. Other options/improvements

a) WIPL-D Pro projects import improved

The import of WIPL-D Pro native files now better supports loadings, junctions and excitations.

Starting from this version the user is warned about small irregularities of the model, but that will not prevent simulations from running. In case several irregularities are combined (e.g. non-convex plates and too close nodes), it might slightly change the results.

b) CAD projects import

The import of CAD native files enables other CAD projects to be imported to the current one.

Besides the corrections of the model, which has been done thoroughly, in the latest release of the software the import is enhanced so that WIPL-D Pro CAD transforms an imported model to the locally set coordinate system and therefore allows the user to

position the imported model if necessary. The import is accelerated so the model import with even thousands of symbols runs quickly and smoothly.

c) Symbols

The Symbol table enables all the symbols to be displayed in a text box so that they are all available for editing before the model gets refreshed i.e. with the effects of all of the changes combined rather than refreshing each time after a single symbol changes.

Further, the symbols in the symbol list can be edited in-place on double click or long double click.

d) Set frequency by step size

In previous versions of WIPL-D Pro CAD simulation frequencies were defined by number of frequency points within the bandwidth defined with start-stop frequencies. From this software version the simulation frequencies can also be defined by a value of a frequency step between adjacent frequency points and start-stop frequencies.

e) Plate domain integrity check on Create Mesh/Run

In an irregular model, mesh elements with irregular domain specifications are possible, which can cause severe simulation errors. In the last release all mesh elements are checked with the respect to domains they belong to and the user is warned if plate domain integrity is violated.

f) 'Set as Unused' includes structures with excitations

Until this version of the software, model parts with the excitations could not be excluded from simulation simply by choosing 'Set as Unused' option, unless the excitation has been deleted.

The operation 'Set as Unused' is now modified to include excitations which can be very useful in situation where, for example, the user imports a number of antennas to some platform and wants to temporarily exclude some of them from the simulation. If the antenna is an assembly entity, the whole assembly can be 'Set as Unused'.

g) Improved Copy Layer

The option of *Copy Layer* better handles so-called general bodies.

A sheet body can have several faces and in some cases faces' normals are not consistently oriented. Some of the normals can be directed "inside" and some of them "outside" of the body. Such bodies could not be thickened.

WIPL-D Pro CAD now tries to align the faces' orientations so they all consistently point "inside" the body or "outside" of the body. The next figure shows previous behavior where *Copy Layer* fails and new behavior where all the faces are oriented in the same way allowing *Copy Layer* to be performed as expected.

a) airplane model

b) non-consistently oriented faces, Copy layer fails

c) consistently oriented faces, Copy layer succeeds
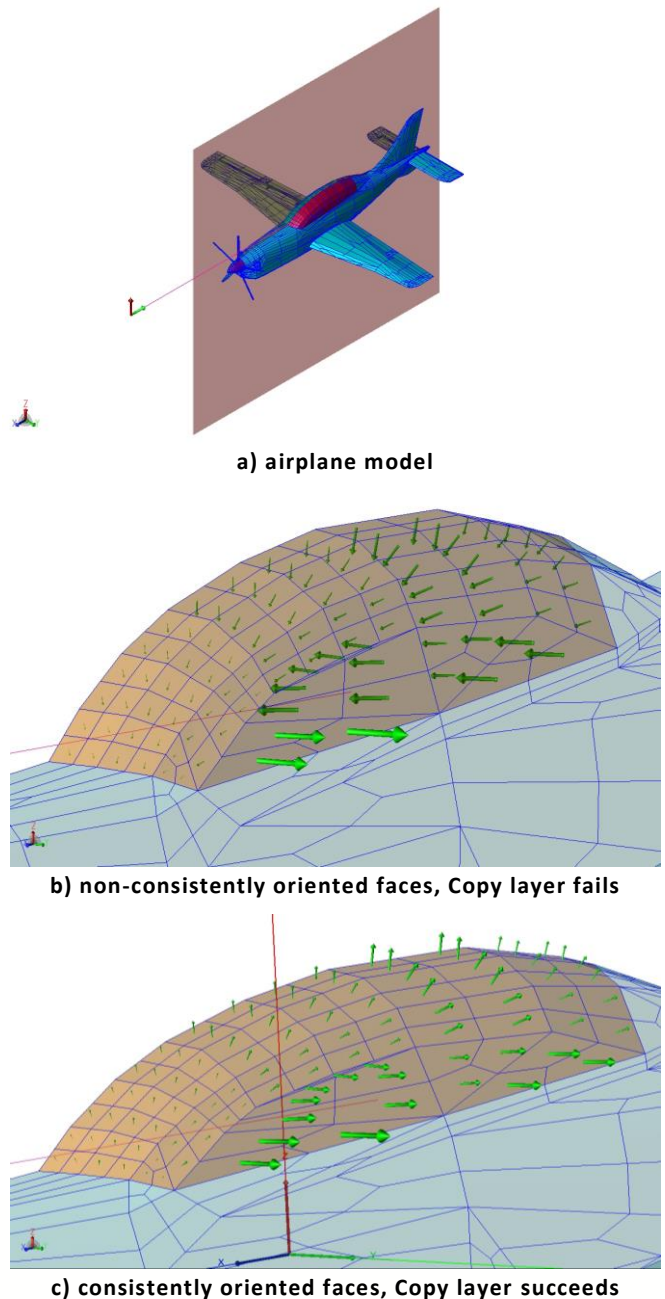
Fig. 7. Model of airplane imported from WIPL-D Pro. Faces orientations for Copy layer.

h) 'Save as' via command line

The 'Save as' command is now available to execute from command line. It's important that the current directory should be set to the installation's *WCAD* folder before running this command.

The syntax of the command with arguments for calling from command line:

wiplcadportal.exe *"Original WCM project name with full path"* **-s** *"New WCM project name"*