WIPL-D Pro CAD: What is New in v2015?

Improvements/new features introduced in v2015 are:

1. Waveguide and Microstrip ports - New types of ports are introduced in WIPL-D Pro CAD in order to enable direct exciting of the structure by using appropriate dominant modes, and to eliminate the need for a relatively complex de-embedding procedure. The new types of ports are:
   a. Waveguide port, which can be rectangular, circular or coaxial
   b. Microstrip port
2. Acceleration of WIPL-D Pro CAD modeler, which enables very efficient work with geometries of high complexity.
3. Tracking of model changes and adjustment of the meshing procedure according to those changes in order to minimize meshing time.
4. Compression of a selected edge into a point in the meshing procedure. This way the appearance of narrow plates in the final mesh is prevented, without significant influence on the accuracy of geometry modeling.
5. Loft operation - A powerful loft operation is introduced in CAD modeler. In addition to basic periodic or non-periodic lofts, it includes advanced options: vertex matching and guide wires.
6. Copy Layer manipulation - This option enables creation of objects with finite thickness walls or multi-layer geometries in a single click, starting from a single surface.
7. Import and export of additional geometry formats
   a. Import of DXF files
   b. Import of WIPL-D 2D models
   c. Export to Gerber files
8. Frequency dependent models, where each symbol can be defined by:
   a. An analytical equation
   b. A user defined data file
9. New rendering mode - Automatic Transparency. All bodies currently not selected and their faces are shown as transparent. Only the selected entities are shown as non-transparent.

10. Minor options/improvements
    a. Copy command in the history list
    b. Silent run
    c. Switching on/off model validation prior to simulation
    d. Uniting plates/strips on IWP/2IW import
    e. Project Notes

1. Waveguide and Microstrip ports

New types of ports are introduced in WIPL-D Pro CAD in order to enable direct exciting of the structure by using appropriate dominant modes, and to eliminate the need for a relatively complex de-embedding procedure.

a) Waveguide port

Waveguide ports are used to define the planes of excitation for waveguide structures. There are three types of waveguide ports in WIPL-D Pro CAD:

- Rectangular waveguide port
- Circular waveguide port
- Coaxial waveguide port

A port can be specified on a flat face by selecting it and using the Set Waveguide Port option. The following parameters can be defined for a waveguide port:

- Orientation – propagation direction of the incident wave
- Polarization – polarization of the electric field
- Power and Phase of the incident wave

Structures fed by different types of waveguide ports are shown in Figure 1.

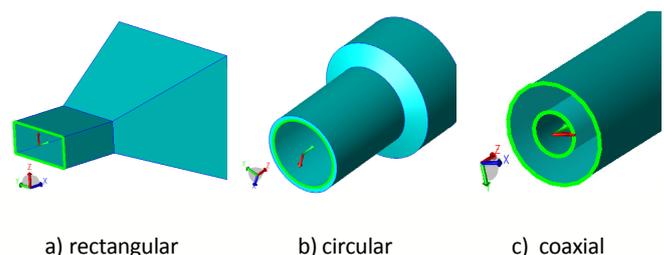a) rectangular   b) circular   c) coaxial

Fig. 1. Different types of waveguide port.

Usage of a waveguide port excitation is illustrated on the model of a band-pass waveguide filter with complementary split resonators, which is shown in Figure 2.
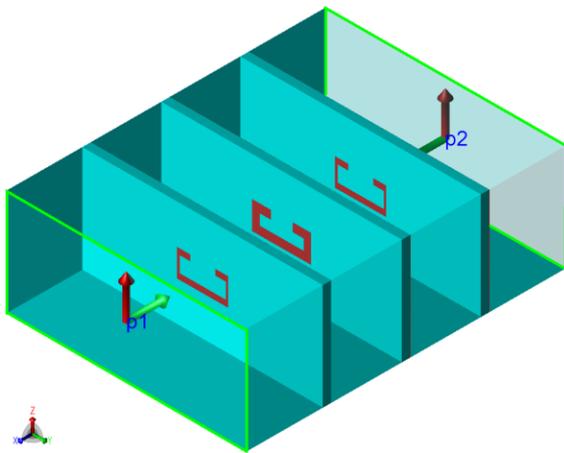

Fig. 2. Waveguide filter with complementary split resonators.

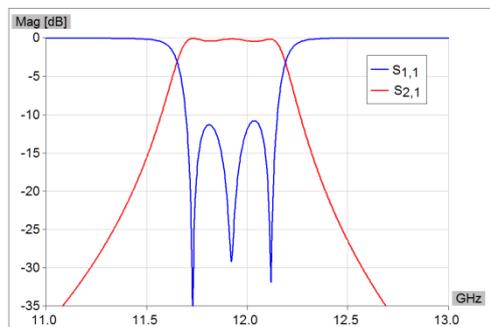S-parameters for this filter are shown in Figure 3.

Fig. 3. S-parameters of a band-pass filter.

b)   Microstrip port

Microstrip ports are used to represent feed lines on a microstrip structure.

A microstrip port can be specified on a single flat dielectric face by selecting it and using the Set Microstrip Port option. The following parameters can be defined for a microstrip port:

- Orientation – propagation direction of the incident wave
- Power and Phase of the incident wave

Model of a microstrip patch antenna fed by a microstrip port is shown in Figure 4.
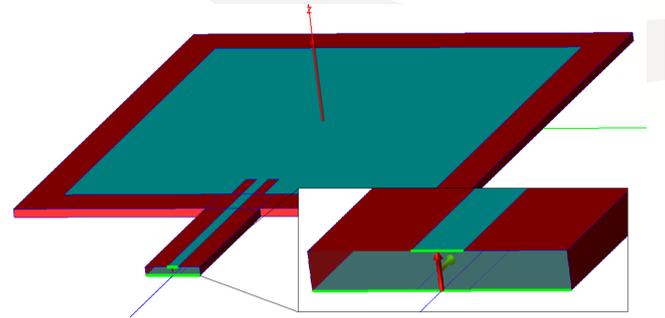

Fig. 4. Patch antenna fed by a mictrostrip line.

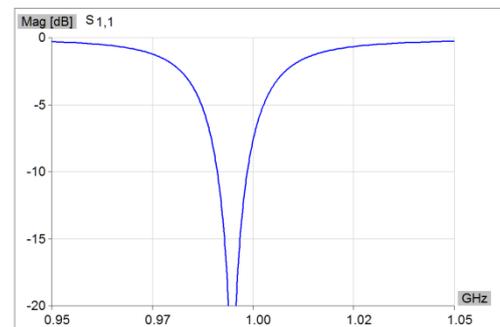S-parameters of the abovementioned patch antenna are shown in Figure 5.

Fig. 5. S_{11} parameter of a patch antenna.

2. Acceleration of WIPL-D Pro CAD

The new version of WIPL-D Pro CAD is significantly accelerated compared to previous versions. This acceleration is achieved by optimization and parallelization of parts of the code which have been identified as the most time consuming.

The acceleration is especially important for very complex models where efficiency of the CAD modeler is dramatically improved.

3. Tracking of model changes

Once the model is meshed all further changes in the model are tracked. In the following runs of the mesher these changes are taken into account. Namely, only in case of changes which affect the model geometry a new mesh is created from scratch. In the case when only EM and/or simulation settings are changed, only the corresponding segments of the IWP file are changed, while the existing mesh of the wire and plate geometry remains unchanged.

Furthermore, for the cases where wire geometry is changed, while the plate geometry remains unchanged, only the time inexpensive wire meshing is performed again.

4. Loft

Lofting creates a sheet or solid body by fitting surfaces through a series of profiles.

The loft operation which is added to our CAD modeler is a powerful operation, and in addition to basic periodic or non-periodic lofts, it includes advanced options: vertex matching and guide wires. An example of a loft manipulation with the vertex matching option is shown in Figure 6.
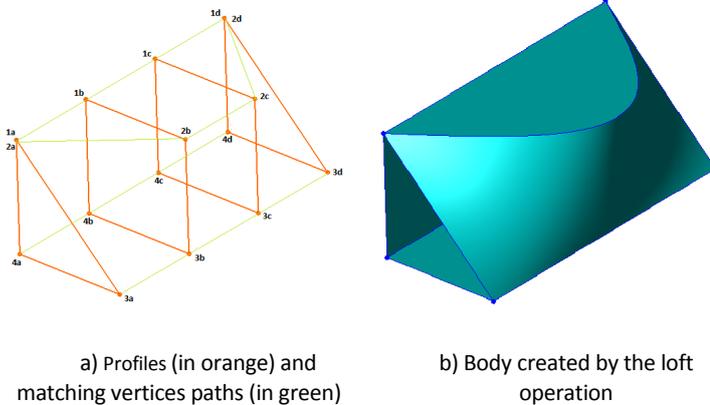

| a) Profiles (in orange) and matching vertices paths (in green) | b) Body created by the loft operation |

Fig. 6. Loft operation.

5. Copy Layer

The Copy Layer option enables thickening of faces i.e. its offsetting in order to create a body with finite thickness walls.

This option enables creation of objects with finite thickness walls or multi-layer geometries in a single click, starting from a single surface. A layer can be created in the direction of the face normal, the opposite direction, or a user defined direction. Additionally, a plane for thickening can be independently defined for any edge of the selected face or a sheet body.

6. Compress Edge to Point

In some models, especially those imported from mechanical design software, very short edges frequently occur. Meshing of these edges results in narrow plates with a very low mesh quality factor. On the other hand, excluding these edges would not corrupt the geometry of the model.

In the new version it is possible to define such an edge as an edge which should be compressed into a single point in the final mesh. This way the appearance of narrow plates in the final mesh is prevented, without significant influence on the accuracy of geometry modeling. An

example of an imported model of the rocket which is meshed with and without this option active is shown in Figure 6.

a)   Without edge compression

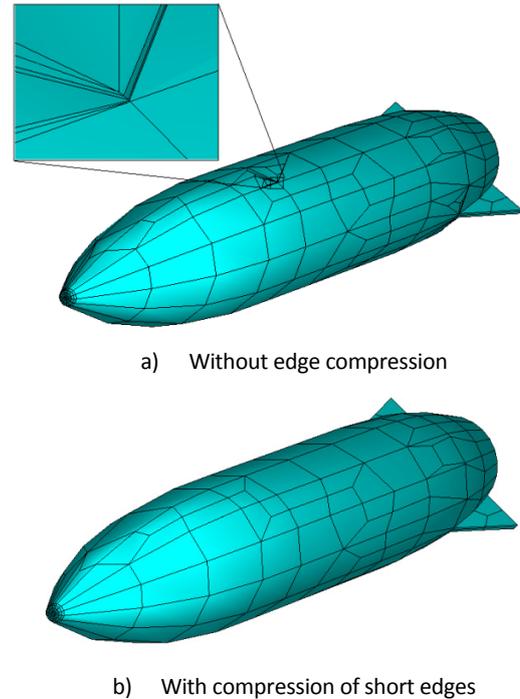b)   With compression of short edges

Fig. 6. Meshing of a model of a rocket.

By applying edge compressing to problematic edges the number of mesh elements is reduced from 356 to 305 with significant increase of the mesh quality factor.

7. Automatic Transparency

The Automatic Transparency option is a new rendering mode where all bodies currently not selected and their faces are shown as transparent. Only the selected entities are shown as non-transparent.

This option is very useful while visualizing a complex model as it conveniently provides a view of the inner structure of the model, without the need to use options like Cutting Planes or Hide/Transparency on individual model parts.
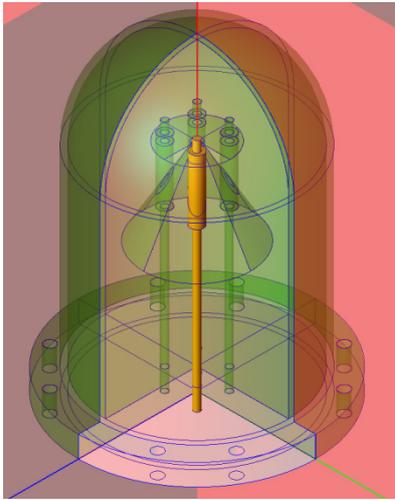
Fig. 7. Automatic transparency mode.

8. Support for import and export of additional geometry formats

In addition to geometry formats for import and export supported in previous version of WIPL-D Pro CAD the new version also supports:

- Import of the DXF file format
- Import of WIPL-D 2D project files
- Export to the Gerber file format.

9. Frequency Dependent Models

In the previous version of WIPL-D Pro the user could define frequency dependent symbols, where the dependence was specified analytically or in the form of user defined files in the list of symbols. Starting from version 2015 this option is also supported in WIPL-D Pro CAD.

This option enables both, EM modeling of frequency dependent materials, and modeling of reconfigurable antennas, whose structure depends on frequency.

10. Minor options/improvements

a) Copy Command in History List

The Copy option in the History List dialog box enables the user to copy the selected command to the clipboard. The content of the command can be added to the History List by pasting it in the dialog box of the Insert or Edit options.

b) Silent Run

During the simulation of a model a DOS window with information about the simulated model and simulation progress is shown by default. In the case when a large number of short simulations are run successively the appearance of this window can be frustrating. The Silent Run option enables the user to opt out displaying this window.

c) Turn on/off model validation before simulation

Before starting the mesh procedure the model is validated by default and if some errors/warnings exist in the model a message box with a validation report appears. In the new version the user can turn off validation before the model meshing. It is very useful in the case of a batch run, when a warning which is unimportant for the simulation results can appear and pause the entire batch process.

d) Uniting Plates on IWP Import

By checking this option all plates from the imported IWP file will be united into a single body upon import. Otherwise, each imported plate is represented by one sheet body.

e) Project Notes

The Project Notes option enables user to create his notes related to the project. Notes are kept as a part of the project and can be easily viewed and edited directly from the Pro CAD user interface.