WIPL-D Pro CAD

- Features and Improvements in Previous Versions -

2024

New features/improvements in WIPL-D Pro CAD 2024:

- 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…
- WIPL-D scripting in Python:
    - o Open and run WIPL-D suites
    - o Access and modify symbol lists
    - o Obtain simulation results
- Expanded Domains in Project tree – All operations with body regions listed along with their materials, i.e. domains are enabled from the main Project tree
- Repair tools – Remove redundant vertices
- Sweep is enhanced and accelerated for complex paths, using multiple tolerances
- Wrap is enhanced – allows the use of general sheets and deleting wrapped objects' surrounding faces
- Crop is enhanced – smart crop with attribute transfer, keeping the structure parts in the crop plane
- Recover body regions on geometry import
- Drag and drop to the assembly in the Project tree
- Other options/improvements:
    - o WIPL-D Pro projects import has improved
    - o CAD projects import: transformation to the currently set local coordinate system, accelerated import for projects with a large number of symbols
    - o Symbol list can take an alternative shape of an editable text box so that symbols can be modified with double and long-double click
    - o Set simulation frequencies by step size
    - o Plate domain integrity check on Create Mesh/Run
    - o Set as Unused option includes structures with excitations
    - o Copy Layer is more robust for general bodies, automatic unification of faces' normals where possible
    - o Command 'Save as' available via command line

New features and improvements in version 2024 are described in more detail in the document **WIPL-D Pro CAD v2024 - What is New.pdf**.

2023

New features/improvements in WIPL-D Pro CAD 2023:

- Wrap command - Wrapping of flat bodies over arbitrary complex developable surfaces
- Validate command - automatic validation and robust error fixing, adaptive to changes in model topology
- Advanced import of IWP files - automatic creation of simulation-ready WIPL-D Pro CAD projects
- Accelerated modeler – smooth work with highly complex geometries
- Support for:
    - o Frequency and Sweep parallel run
    - o Periodic Boundary Condition
    - o Region selection mode
- Other options/improvements:
    - o Improved export to non-Parasolid CAD formats

- o Automatic deletion of auxiliary Point Bodies in Snap to Topology/Geometry modes
- o Comments in History list, enabling selective execution of the commands list
- o Increased accuracy in creation of analytical curves and surfaces
- o New antenna types in the Component Library
- o Expanded list of Predefined Materials
- o Improved Automatic Transparency rendering mode

New features and improvements in version 2023 are described in more detail in the document **WIPL-D Pro CAD v2023 - What is New.pdf**.

2022

New features/improvements in WIPL-D Pro CAD 2022:
- Assembly: The new instance at the top of the topological hierarchy
- Component library, comprising:
  - o Simulation-ready antennas
  - o Platforms
- Improved import of CAD models:
  - o Renaming and merging of common symbols
  - o Merging of common domains
- New naming algorithm – increased robustness when working with very complex models
- Improvements in the meshing algorithm:
  - o Extraction of poles in the pre-meshing phase
  - o Improved mesh when working with complex models with several small faces and isolated vertices
- Blending operation
  - o Rolling-ball and chamfers blend
  - o Propagating or non-propagating blend
- Import of fully parametrized Ansys Nuhertz FilterSolutions filter models
- New options for frequency-dependent materials:
  - o Export to an .frN file
  - o Show numerical values of domain parameters
- Other options/improvements:
  - o New functions in the symbolic mechanism
  - o Improvements in the Crop by Plane option when parts of a wire are placed in the cutting plane
  - o Characteristic Modes Analysis
  - o Setting of local mesh size and angular tolerances on the body level

New features and improvements in version 2022 are described in more detail in the document **WIPL-D Pro CAD v2022 - What is New.pdf**.

2020

New features/improvements in WIPL-D Pro CAD 2020:
- Accelerations of the CAD modeler:
  - o Project tree reconstruction
  - o Rendering
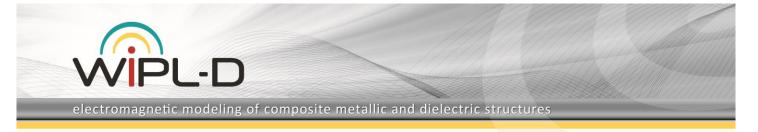 - o Select operations
  - o Validation

- Improvements in the meshing algorithm:
  - Reduction in the number of mesh elements from 10% to 50%, significantly decreasing the number of unknowns
  - Improvement in pre-meshing of complex faces
  - Overall acceleration of the meshing process
- Introducing a Material library with over 80 predefined materials, and three new ways to define frequency-dependent material properties:
  - Frequency table
  - Cole-Cole approximation
  - Djordjevic-Sarkar approximation
- New selection mode options:
  - Select all faces connected with the selected one
  - Select bodies by size
- Local settings:
  - Distributed loading on the body level
  - Reference frequency on the level of the body, face, and edge of wire bodies
- Preview of the model on Open
- Remote Run
- Other options/improvements:
  - AutoSave
  - Automatic selection of a laminar (open) loop in the Fill Hole operation
  - Symbol table is non-modal and dockable
  - Setting radiation pattern and near-field by setting step per angle and length

New features and improvements in version 2018 are described in more details in the document **WIPL-D Pro CAD v2020 - What is New.pdf**.

2019

New features/improvements in WIPL-D Pro CAD 2019:
- **Advanced import of DXF(DWG) files:**
  - Automated multi-layer model build starting from imported DXF files
  - Multi-layer stack definition using a technology file
  - Imaging technique for multi-layer DXF (for highly accurate EM modeling of strongly coupled layers)
- **Enhanced model validation:**
  - Detection of wire-to-body intersections and automatic segmentation of wires
  - Detection of inconsistent wire domains and automatic correction
- **Redesigned user interface – ribbons instead of toolbars and menus**
- **Import of fully parameterized WIPL D Pro CAD models**
- **New platform – HOOPS 24.00, Parasolid v31.1, and 3D InterOp 2019**
  - Improved reliability of Boolean operations
  - More robust manipulations for complex geometries
- **Export of selected model parts to various CAD formats**
- **Other options/improvements:**
  - Support for custom-defined excitation waves
  - Determining the required number of unknowns
  - Improved distance measuring tool

New features and improvements in version 2018 are described in more detail in the document **WIPL-D Pro CAD v2019 - What is New.pdf**.

2018

New features/improvements in WIPL-D Pro CAD 2018:

- **Advanced auto-repair options for imported CAD models -** automatic detection and removal of redundant model parts:
  - Coinciding faces
  - Small edges and faces
  - Open loops
  - Isolated vertices
- **New built-in geometric primitives:**
  - Analytical surface
  - Segmented loop/arc
  - BoR - Body of Revolution
  - BoCC - Body of Constant Cut
- **Improved meshing**
  - Reduces the number of mesh elements
  - Meshing of faces, which was not possible earlier
  - Accelerated meshing procedure
- **Smart port analysis available for parametric sweep and optimization**
- **Support for Sweep, Optimization, and Time Domain simulations in Batch runs**
- **Other options/improvements:**
  - Unite all in Multiple Copy manipulation
  - Delete vertex and edge
  - Custom-defined cutting planes
  - Circular and slant-polarized mode excitations now include waveguide ports intersected by (A)Symmetry planes
  - Improved Sew faces operation
  - Control points insertion via text box for polyline-like primitives…

New features and improvements in version 2018 are described in more detail in the document **WIPL-D Pro CAD v2018 - What is New.pdf**.

2017

New features/improvements in WIPL-D Pro CAD 2017:

- **Waveguide and Microstrip Loads** – New types of loads were introduced in WIPL-D Pro CAD to simplify the termination specification for waveguide and microstrip structures. The new types of loads are:
  - Waveguide loads (rectangular, circular, or coaxial)
  - Microstrip loads
- **Circular polarization** and orthogonal modes for a waveguide port excitation – The user can choose to add the analysis of the orthogonal mode to the basic, dominant mode analysis. Circular polarization of a mode is also supported for a circular waveguide port.
- **Outer shell selection** – Automatic selection of the faces on the outer shell.
- **Advanced Import options,** including automatic Repair, Simplify, and Sew.
- Improved topology validation and **automatic Boolean Unite** of all of the bodies before EM simulation starts.

- **Direct mesh algorithm parallelization** – Parts of the meshing algorithm that are identified as most time-consuming are parallelized.
- Modification of the meshing algorithm to **improve the division of complex faces**.
- **New types of transformation of the working coordinate system** (WCS) are introduced for:
  o Align WCS to 3 points
  o Align WCS to the edge
  o Align WCS to face
- **Align body to working coordinate system** – This option provides transformation (translation and/or rotation) of a body/bodies by aligning one of the faces of selected body/bodies to the working coordinate system.
- **Additional snap modes** have been introduced – The new snap to topology modes simplify the creation process of a primitive. Starting from this version, a primitive can be created simply by using points of a topology that has already become a part of the model, like a vertex, edge center, and face center.
- Other options/improvements:
  o Translate operator allows drawing of a translation vector in 3D view and using the advantages of snap modes.
  o **Unused entity** – The user can specify the entities that will be excluded from the final mesh and consequently from EM simulation.
  o **Smart port analysis.**
  o Abort the mesh procedure while meshing the model.
  o Edit History List in an ASCII edit box.

New features and improvements in version 2017 are described in more detail in the document **WIPL-D Pro CAD v2017 - What is New.pdf**.

2015

New features/improvements in WIPL-D Pro CAD 2015:

- **Waveguide and Microstrip ports** – New types of ports are introduced in WIPL-D Pro CAD 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:
  o Waveguide port, which can be rectangular, circular, or coaxial
  o Microstrip port
- **Acceleration of WIPL-D Pro CAD modeler**, which enables very efficient work with geometries of high complexity.
- **Tracking** of model changes and **adjustment** of the meshing procedure according to those changes to minimize meshing time.
- **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.
- **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.
- **Copy Layer manipulation** - This option enables the creation of objects with finite-thickness walls or multi-layer geometries in a single click, starting from a single surface.
- Import and export of **additional geometry formats**
  o Import of DXF files
  o Import of WIPL-D 2D models
  o Export to Gerber files
- **Frequency-dependent models**, where each symbol can be defined by:
  o An analytical equation
  o A user-defined data file
- **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.

- Minor options/improvements
  - Copy command in the history list
  - Silent run
  - Switching on/off model validation before simulation
  - Uniting plates/strips on IWP/2IW import
  - Project Notes

New features and improvements in version 2015 are described in more details in the document **WIPL-D Pro CAD v2015 - What is New.pdf**.

2014

New features/improvements in WIPL-D Pro CAD 2014:

- **Automatic healing tools.** – Imported CAD models often require additional rebuilding and repair actions to obtain the model that best fits the needs of the EM simulation. The new version introduces new, very useful healing tools:
  - Fill hole (rebuild tool) - an automatic method that fills a hole in a body with a set of faces
  - Repair geometry (repair tool) – enables repair of entities that have any geometrical error (marked with a red exclamation mark)
  - Simplify geometry (repair tool) – enables geometry simplification of selected entities
  - Mark Open Edges – enables selection of edges that are "hanging" (not an intersection of two adjacent faces)
- A hybrid algorithm is developed as a new mesh algorithm - it combines the best features of both direct and uniform mesh algorithms, to achieve the best appropriate mesh for planar structures with a large number of details
- The direct mesh algorithm has two major enhancements:
  - improved meshing of very complex faces
  - increased quad mesh Q-factor, i.e., reduced number of unknowns
- A new type of primitive called **point** is introduced – it is a vertex that can be defined either numerically or through a symbolic mechanism and can be used in modeling as a stand-alone primitive
- New curve primitives are introduced to simplify the model creation:
  - **analytical curve** – definition of parametric curve by specification of the curve parameter range and X, Y and Z curve coordinates in the form of an analytical function
  - **curve from edge** – creation of a curve from selected edge(s)
- Improvement of the existing curve primitives – fitted spline, NURBS, polyline, and irregular polygon can be specified through control points from a user-defined input file
- Improvement of the existing Helix & Spiral primitives (non-wire types) – which brings regular mesh and reduction of the number of unknowns
- Enhanced functionality of Boolean operations and better domain inheritance for entities involved in Boolean operations
- Export of CAD models (wire or geometry planar intersection) to 2D Solver
- Manipulation of a 3D model with a 3D mouse through various operations
- Expansion order for entities can be manually specified
- Removal/deletion and copying of the coordinate system
- Ability to run more projects in batch mode
- "Set as read-only" option for project
- The ability to simply disable/enable near-field and radiation pattern calculations via a button
- Option to close all open projects together

New features and improvements in version 2014 are described in more detail in the document **WIPL-D Pro CAD v2014 - What is New.pdf**.

2013

New Features

- Advanced direct meshing technique - The new quadrilateral meshing technique, optimized for higher-order basis functions. The technique is based on the direct creation of a quadrilateral mesh, unlike the other meshing techniques used in WIPL-D Pro CAD, which are based on a triangular mesh and the conversion of this mesh into a quadrilateral mesh.
- Export to all CAD formats for which the import is supported (IGES, STEP, etc.)
- Support for add-on tools - Optimizer, Time-Domain Solver, and Sweeper are now supported directly from WIPL-D Pro CAD.
- Support for frequency-dependent symbols, which enable analysis of frequency-dependent materials, loadings, geometry...
- Power balance calculation for lossy materials (antenna efficiency, losses in different regions, corrections of gain and admittance, estimations of errors)
- Advanced calculations of near field (accurate characterization in the vicinity of wires, high resolution at the boundary of weak field region and strong field region, specific absorption rate (SAR) calculation...)
- Calculation of radiation pattern over the sphere of finite user-defined radius and presentation with/without standard radiation pattern (at infinite distance)
- Simultaneous analysis of a structure excited by various sets of Field Generators based on a single LU decomposition of MoM matrix
- Automatic recognition of wire-to-plate junctions can be optionally combined with manually defined junctions.
- New platform - HOOPS 19.10, Parasolid V25.1.139 and 3D InterOp R23.1 - faster rendering and selection, more robust file import

Improvements of Existing Features

- Direct creation of wires
- Rotation and translation in select mode
- New shortcuts in preview, structure tree, and all tables
- Selection of bodies and faces by names
- Custom-defined steering angles for Field Generators
- Support for all improvements in the graphical representation of the results

2012

New Features

- **Solid modeling** using built-in primitives - curve, surface, solid, reflector and spiral/helix
- **Easy manipulations** and **Boolean operations** on objects - Move, Rotate, Scale, Copy, Multiple Copy; Unite, Intersect, Subtract, Imprint
- Modeling in **local coordinate systems**
- Editable **history list** of all actions in the project
- Full support for symbolic modeling, symmetry, GPU acceleration and other standard WIPL-D features
- **Powerful mesh control**
- **New platform** - HOOPS 19.10, Parasolid V22.0.149, and 3D InterOp R23 - faster rendering and selection, more robust file import

* HOOPS is a trademark of TechSoft 3D, Parasolid is a trademark of UGS Inc., 3D InterOp is a trademark of Spatial.

Improvements of Existing Features

- Intuitive organization of the entire project through Project Tree
- Enhanced inspection of the model in the making

- More powerful healing and repairing tools, enhanced with the Remove Blend tool
- Various improvements in the user interface

2011

This version brought bug fixes and minor improvements in the user interface, and it represents the last version of WIPL-D Pro CAD as an import tool, before it became the full modelling and import interface.

2010

New Features

- **Mesh coarsening (decimation)** - The new algorithm offers automatic coarsening of the mesh to optimize it for EM simulation speed. Starting from the result of the uniform or the adaptive algorithm, it reduces the number of mesh elements and enlarges them maximally or up to the user-specified size limit on the flat and quasi-flat model parts.
- Excess mesh **detail elimination** - Removes all mesh elements that fall under a user-specified tolerance, thus allowing the same geometry approximation to be achieved with fewer mesh elements. The algorithm can be applied independently of mesh coarsening (decimation) or successively.
- **Wire radius** global and local specifications - Enables specification of all wire radii in the model by a single command, and/or locally, for individual wires.
- New platform - HOOPS 17.10, Parasolid V22.0.149, and 3D InterOp R20 - faster rendering and selection, more robust file import
- Support for WIPL-D Pro 8.0 file formats

* HOOPS is a trademark of TechSoft 3D, Parasolid is a trademark of UGS Inc., 3D InterOp is a trademark of Spatial.

Improvements of Existing Features

- Region regeneration after face deletion is now more robust
- Wire segmentation improved in the case of uniform meshing and inches as valid units
- Corrected focus problems after context menu activation in 3D View, after which no action was performed
- Error reporting during the mesh process is now more informative
- Model validation is automatically invoked before meshing (conversion to WIPL-D project)
- Undo/redo functionality is now robust after multiple face deletion operations
- Crop operation on wires is corrected
- Removed focus problems after multiple selections were made in the Model Tree
- Model Tree is kept expanded on the Body level at all times

2009b

New Features

- **Model cropping** and **symmetry** - model into a half by all three coordinate planes, enabling easy application of symmetry in EM simulation
- **Remove Hole** and **Remove Feature** - enables easy removal of unnecessary cylindrical or polygonal holes as well as complex tunnel and cavity structures from the model
- **Delete Face** - enables non-intrusive deletion of arbitrarily selected faces from a body, as a means of model simplification
- **Faster and more robust operation of Model Tree** – the operation of the tree is optimized in terms of the number of events it is reacting to and background operations that it performs (especially important for large models)
- Enhanced control of Mesh Growth Speed – higher resolution of the slider in the most important ranges,

- Hide and Transparency characteristics are kept wherever possible (at body and face deletion, at change of selection level,...), which facilitates handling of the model,
- Imported models encompassing assemblies are unpacked into a regular Body-Face-Edge-Vertex structure, which enables application of all the program features to the model.
- Angle Tolerance now influences segmentation of model curves into quads – lower angle tolerance means a larger number of segments per circumference of a circle, for instance

Improvements of Existing Features

- Project is marked as changed after the Explode command
- Dialogs for information about computationally intensive operations being done in the background are replaced by Status Bar messages
- Dialogs for domain and mesh size specification are extracting information from the attributes of selected model parts if all the selected parts' attributes have the same values. Otherwise, they display default values
- Bottom section of Model Tree now displays for each face to which region that face belongs (or what two regions it divides)
- Corrected bugs for export into some geometry and picture formats. All formats are now functioning correctly
- Support for STL files containing more than one entity
- Disabling the Domains subtree in Model Tree if STL file is loaded (it makes no sense to assign domains in that case)