EMCoS Antenna VirtualLab

Antenna Simulation Has Never Been So Easy

EMCoS Antenna VirtualLab is a powerful program package especially suited for antenna calculations. The program package allows in a very convenient way to design and model complicated antenna structures, calculate them accurately and easily process the results. It provides very convenient tools for comfortable and flexible CAD data processing. Various material properties can be assigned. Antennas can be loaded or fed with many kinds of circuits.

Antenna VirtualLab contains a convenient graphical interface for fast prototyping of a calculation model. The user interface easily controls the powerful solver modules and gives accesses to results.

Antenna VirtualLab can import and process complex geometry models from standard CAD formats (ACIS SAT, IGES, STEP, Parasolid, CATIA V4 and V5).

Triangulated geometry data can also be imported from NASTRAN or STL file formats.

Calculation core of Antenna VirtualLab consists of an efficient and accurate 3D field solver especially designed for calculation of scattering by surface structures. A parallel option for Linux or Windows cluster systems can increase further the performance to calculate extremely large models.

Antenna VirtualLab offers convenient tools to visualize compare and present your results. The post processing functions are fully integrated into the Antenna VirtualLab environment. This gives very easy access to data from last and data from former simulations. Arbitrary styled graphs can be displayed and modified according to your demands.

EMCoS has long recognized the need for special EMC Software that allows engineer to solve EMC problems easily and with high accuracy.

The most appropriate numerical methods for EMC problems were combined with user-friendly interface to make pre-compliance EMC analysis as accurate and fast as possible.
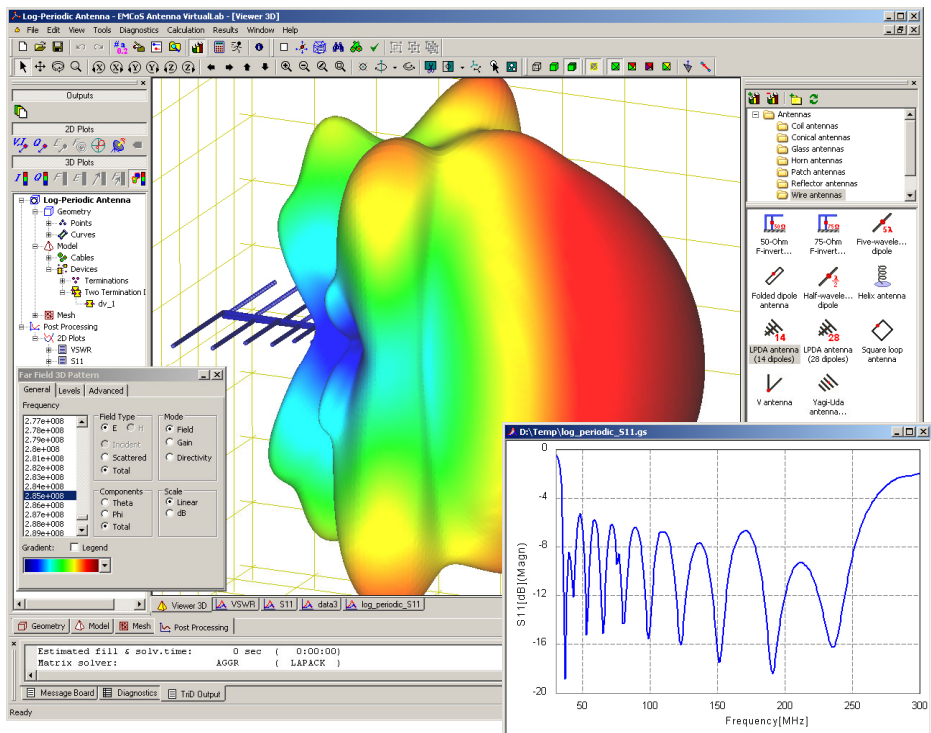
The EMCoS Antenna VirtualLab User Interface

EMCoS Overview

The work of EMCoS Ltd. focuses on the generation of special simulation software for electromagnetic field calculation and data visualization as well as on consultation on EM problems.

We help our customers with simulations of complex EMC problems by offering appropriate tools, or we support them with processing of, in most cases, complex data.

We do not claim to produce software to model everything, but we focus on specific directions:

- EMC in large systems
- Antenna calculations
- PCB data pre-processing
- Mesh and cable harness pre processing

We see our mission in the generation of special methods and programs that are on the cutting edge of science and provide the most appropriate solution for each specific problem.

Company Background

EMCoS Ltd. was founded as a spin-off of scientists of the Laboratory of Applied Electrodynamics of the Tbilisi State University of Georgia. The Laboratory of Applied Electrodynamics has more than 20 years of experience in the field of data visualization and simulation of electromagnetic problems.

The fields of interest cover a wide range. Starting from the simulation of the non-linear arc resistance as generated by ESD or electrical switches to the calculation of field coupling, or radiation of complex cable harness systems in automobiles.
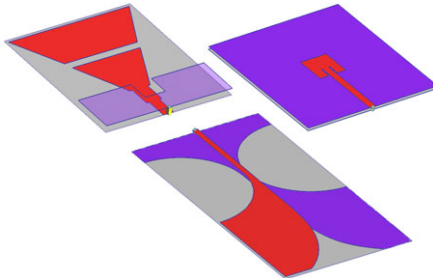
Application Examples

EMCoS Antenna VirtualLab covers a wide range of antenna design, analysis and optimization problems. Some examples are shown here:
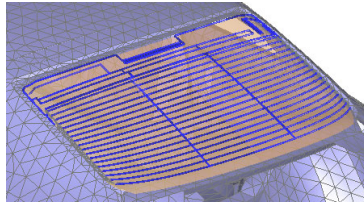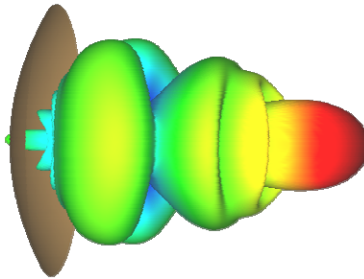

Automotive Antennas
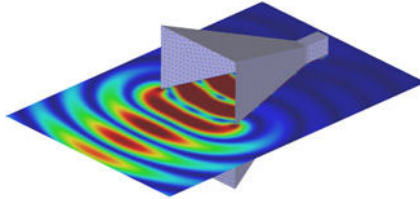
Waveguide and Wire Antennas for EMC/EMI Analysis

Patch and Microstrip Antennas

Large Reflectors and Beam Forming Antennas

Main Features

- Accurate and very efficient methods for computation of large antenna systems
- Powerful Method of Moment Solver
- Special Green function method for simulation of metallic antennas printed on dielectric substrates
- Easy modeling of complex antenna terminations (amplifiers, modulation circuits, filters, etc.)
- Very convenient model generation
- Large antenna models library
- Standard CAD formats import and processing (ACIS SAT, IGES, CATIA V4 and V5, STEP and Parasolid)

- Sophisticated mesh checking routines
- Automatic mesh refinement and adjustment features
- Frequency and time domain analysis
- Matrix-Partitioning functions for fast optimization calculations
- Multi-Excitation option
- PO (Physical Optics) calculation core for very high frequencies
- Fast and accurate out-of-core equations system solver
- Easy-to-use post-processing tools including 2D & 3D visualization, Smith chart, polar plots, etc
- Parallel solvers for Linux and Windows cluster systems

Pre Processing

EMCoS Antenna VirtualLab gives a convenient interface for fast prototyping of a calculation model. It controls the powerful solver modules and accesses the results. Complicated 3D-antenna structures can be constructed using geometrical primitives and Boolean operations in a very convenient way.

Pre processing and objects handling in EMCoS Antenna VirtualLab is divided into three modes:

- Geometry Mode – used for initial geometry primitives construction. Here geometry data can be defined with comfortable CAD features.
- Model Mode – used for assignment of physical properties to geometry objects.
- Mesh Mode – model objects are converted automatically to discrete elements ready for calculations. In this mode advanced user can further process or tune the discrete calculation model, if required.
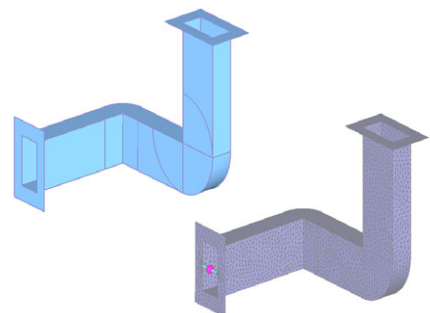

Rectangular Waveguide in Geometry and Mesh Modes

Product Feature Summary

- Powerful antenna calculation and optimization functions
- Accurate and very efficient methods
- Method of Moments for 3D electrodynamic problem
- Physical Optics method for very high frequencies
- Large antenna models library
- Very convenient model generation and modification
- Geometry – Model – Mesh modes for preparation of computational model
- Standard CAD formats processing (ACIS SAT, IGES, STEP, Parasolid, CATIA V4 and V5)
- Advanced CAD functions
- Easy modeling of complex antenna terminations (amplifiers, modulation circuits, filters, etc.)
- Sophisticated mesh checking routines
- Automatic mesh refinement and adjustment features
- Physical properties of ground and system environment
- 3D and 2D post processing tools to present comfortable models and results
- Matrix-Partitioning functions for fast optimization calculations
- Multi-Excitation option
- Adaptive Frequency Sampling for fast frequency sweeps
- Frequency and time domain analysis
- Calculation of scattering matrix

Antenna Models Library

To simplify modelling of standard antennas EMCoS Antenna VirtualLab contains a library of models, which can be easily modified changing value of corresponding parameter. Models can be further processed and extended without restrictions.
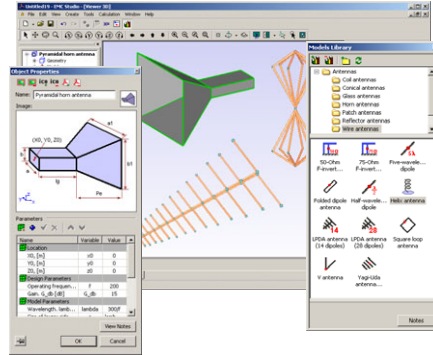

Antenna Models Library

Calculation Core

The calculation core of **EMCoS Antenna VirtualLab** is the **TriD** solver based on Method of Moments (MoM). This integrated program offers fast and accurate results even for very large calculation models due the out-of-core solver for the resulting equation system. All important antenna parameters like current, impedance, power characteristics, antenna gain, or efficiency are calculated.

Matrix Partitioning

This outstanding calculation technique is very helpful for fast optimization calculations. A special MoM implementation can handle a series of geometries having a larger common part but small differences. This scheme is based on a partitioned calculation and separate inversion of the unvarying (basis) and the differing (additional) parts of impedance matrices to quickly obtain solutions of EM problems on a series of geometries.
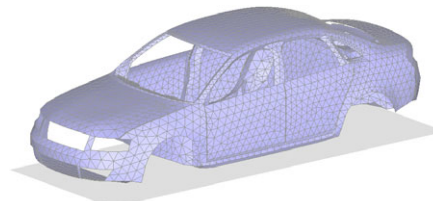
Base matrix (car geometry)
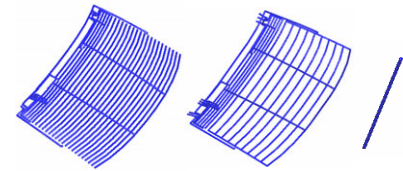
Additional layer matrix (antenna models)
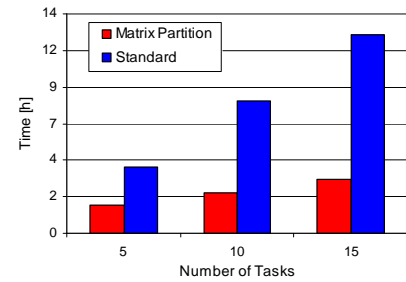
Calculation Time Comparison Chart

Physical Optics (PO)

This special solution method allows reduction of computational time and memory for very high frequencies.

Adaptive Frequency Sampling (AFS)

This approach results in much faster calculation of frequency characteristics of antennas. With a minimum number of frequency points based on construction of rational fitting polynom correct frequency sweeps can be obtained.

Port-Network Solution Technique

Interactions between multiple electrical ports can be calculated and exported as S, Z, or Y-parameters in Touchstone format to file.

Post Processing

Comfortable post-processing features help user to visualize and analyze results. 2D results can be shown as XY-graphs, polar plots, or Smith chart. Linear or logarithmic scaling with automatic dB labelling is possible. Multiple 3D options permit static results evaluation or production of movies showing dynamic properties of results.
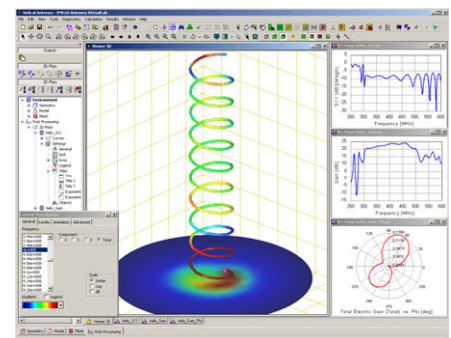

Mixed 2D and 3D Post-Processing

- Fast and accurate out of core equations system solvers
- Parallel solvers for Linux and Windows
- Hardware based and floating licensing
- CPU and CPU core based licensing for computational core

2D Post Processing

- Current, voltage, and charge on wire segments
- Current and charge on triangles
- Calculation error estimation on triangles
- Source data (impedance, admittance, S11, VSWR, power balance, etc.)
- Near electric and magnetic field in observation points
- Far field pattern for fixed directional angle
- S, Z, Y matrix observation (Touchstone data)
- Linear, polar and Smith chart data representation
- Linear, logarithmic and dB scales support
- IFFT option for fast data transformation to Time Domain
- Import/export data from/to 2D plot
- Export data to MATLAB

3D Post Processing

- Current and charge distribution on surface and wire segments
- Near electric and magnetic field distribution on arbitrary surfaces
- Analysis of near field distribution based on defined reference level
- Calculation error distribution on surface
- Arrow plot for current and field distribution
- Far field pattern
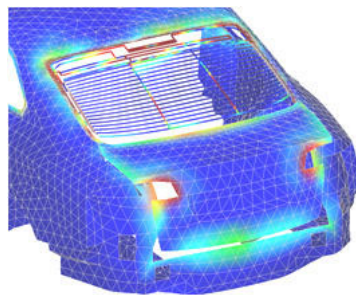
Current Distribution of an Automotive Glass Antenna

Licensing

Several options are available:

- Node locked license
- Floating license via single or redundant licence server configurations
- Fully functional student version with minor model size limitations for calculation of large problems
- Free 45 days fully function evaluation license

Other Features

- Powerful model editor
- Point-and-click drawing and editing
- Advanced CAD and meshing functions
- Large array of primitives for model creation
- Boolean operations
- Object transformation operations
- Dielectric material support
- Definition of geometrical and physical properties via variables
- Definition of frequency dependent physical properties
- Automatic and manual control of mesh size
- Validation of computational model
- Physical properties of ground and system environment
- Frequency domain analysis from DC up to several GHz
- Time domain analysis with powerful FFT functions
- Comfortable pulse construction and pulse shape influence analysis features
- 3D and 2D post processing tools to present comfortable models and results
- Parallel solvers for Linux and Windows
- MATLAB® link