Description of the program system EMMCAP

Electro**M**agnetic **M**odeling **C**omputation and **A**nalysis **P**rogram

EMMCAP is a program system for the modeling of 3D arbitrarily shaped wire structures and for the computation and analysis of their electromagnetic behavior, including radiation and scattering problems.

EMMCAP is a "Curved" MoM Code

The computer code is based on an Electric Field Integral Equation (EFIE) expressed in the frequency domain. The current distribution on thin-wire structures is computed by solving the EFIE using a Method of Moments (MoM) formulation with **curved basis and testing functions**. This means that curved wires are modeled by using **curved segments,** which exactly follow the contour of the structure, instead of the typical approximation with straight wire segments. With this technique, the number of unknown currents and memory space can be reduced.

EMMCAP is intended for solving problems in the following areas:

- Antenna analysis and design.
- EMC applications.
- Multiconductor transmission lines.
- Nonradiating networks.

The modeling of the structure can be performed by means of the ***EMMCAP*** specific 3D-tools. Electromagnetic fields, currents, voltages, input impedances, consumed and radiated powers can be computed in a frequency sweep and plotted in 2D and 3D graphical representations.

Supported platform: PC running Windows 95/NT 4.0 or later.

Modeling of wire structures

1. Wire structures can be modeled by combining different types of wires:

    - Straight wires.
    - Circular and elliptic arcs.
    - Circular, elliptic and rectangular loops.
    - Several kinds of tapered helices with arbitrary orientations.
    - Parabolic wires.
    - Hyperbolic wires.
    - Archimedian, logarithmic and tapered spirals.
    - Catenary wires.

2. All wires can be loaded or excited at any position.
3. The structure can also have finite conductivities.

4. Electrical connections of different wires and connections of several wires at one point are possible.
5. Metallic wires in either dielectric or magnetic materials can be analyzed.
6. The structures can be placed in free space as well as over a perfectly conducting ground plane.
7. The cross section of each wire can either be *Circular*, *Square*, *Flat*, *Elliptical* or *Rectangular*.
8. The modeling of the geometry can be performed in suitable unit systems (um, cm, mm, m).

Excitation methods

1. An arbitrary number of voltage sources can be placed at any positions, with equal or different amplitudes and phases.
2. Current sources (e.g. representing impressed currents) can also be arranged at any positions.
3. The voltage and current sources can have inner impedances.
4. An incident plane wave of arbitrary polarization and direction of incidence can also be used as excitation.
5. Short dipoles can be modeled by means of a short straight wire with a current source at its center.

Frequency options

1. The computation can either be performed for a single frequency, for frequencies taken from a list or for a frequency sweep.
2. The list of frequencies can either be created inside the program or loaded from a text file. It could also be saved to a txt file.
3. Linear and logarithmic frequency sweeps are possible.
4. A suitable unit system can be selected (Hz, KHz, MHz, GHz).

Data input

1. The segmentation of the wire geometry is done automatically, but can also be set manually by the user.
2. A wire can be selected and highlighted by clicking with the right/left mouse button on the screen.
3. 3D-tools are implemented for deleting wires, discrete sources and lumped loads or modifying their descriptions.
4. Clicking on a wire shows a pop-up menu with several options.
5. Wire connections can easily be performed by means of a *copy/paste* function for the end points of the wires.
6. The source, load element and ground point positions are shown with special 3D-symbols.
7. All dialog boxes check for valid inputs.
8. Rotation, move and zoom functions with mouse support are implemented.

Data output

1. All computed data is written to storage files for a subsequent graphic evaluation.
2. Input impedances, currents, voltages over loads, radiated and consumed powers, directivity and other system responses are shown as lists in text format and can be plotted vs. frequency.
3. The current distribution on a selected wire can be plotted in amplitude, phase, real and imaginary parts vs. position in a 2D representation.
4. Electromagnetic fields are plotted in 2D radiation diagrams in orthogonal and polar representations.
5. 3D radiation patterns are also possible with arbitrary viewing angles, zoom functions and colored mesh and surface.
6. Suitable unit systems can be chosen for the plotted results (current scaling e.g. in A, mA, uA; voltage scaling e.g. in V, mV, uV).

Hardware requirements

- PC running Windows 95/NT 4.0 or later.
- A Pentium processor or better is recommended.
- Minimum 10 MB free disk space.
- Minimum 8 MB RAM.
- VGA or super VGA graphics card (or equivalent).

For more information visit: http://www.emmcap.com.ar