

## **AN-SOF Antenna Simulator**

#### www.antennasimulator.com





# What is AN-SOF?



**AN-SOF** is a simulation software for antenna systems, offering precise modeling, analysis, and design capabilities.

#### **Key Advantages**

- Streamlined and **user-friendly** graphical interface for swift and effortless input.
- Achieve remarkable accuracy through the Conformal Method of Moments with exact Kernel.
- Obtain superior results spanning from ultralow frequencies to microwaves and beyond.







## **Fundamentals of Simulation**

- the wires are computed.
- calculated.
- antenna types.
- antennas.

• Any metallic structure can be modeled using a grid of **conductive wires**.

• The electrical currents flowing through

• The fields radiated by the currents are

• AN-SOF enables the modeling of wire antennas, including dipoles, monopoles, yagis, log-periodic arrays, helices, spirals, loops, horns, fractals, and various other

• It allows for the modeling and design of both transmitting and receiving

## **The Method of Moments**

- The Method of Moments (MoM) is a numerical technique used to determine the current flowing in metallic structures accurately.
- The wire structure is divided into **short** segments relative to the wavelength.
- In the traditional MoM, linear approximation is applied to the structure's geometry using straight segments.
- By applying the MoM, an integral form of Maxwell's equations in the frequency domain is transformed into a matrix equation, from which the current in each segment can be calculated.





$$\begin{bmatrix} V_1 \\ V_2 \\ \cdots \\ V_N \end{bmatrix} = \begin{bmatrix} Z_{11} & Z_{12} & \cdots & Z_{1N} \\ Z_{21} & Z_{22} & \cdots & Z_{2N} \\ \cdots & \cdots & \cdots & \cdots \\ Z_{N1} & Z_{N2} & \cdots & Z_{NN} \end{bmatrix} \cdot \begin{bmatrix} I_1 \\ I_2 \\ \cdots \\ I_N \end{bmatrix}$$

## **The 7 Limitations of the Traditional MoM**

No curved wires Straight segments yield poor results for helices, loops, and spirals.

**Issues with** bent wires

3

Lack of convergence when wires are bent at right angles or less than 30°.

Short segment constraint

4

Segment length must exceed 0.001 of a wavelength.

Thin wire requirement

5

2

1

Thick wires deviate from thin-wire approximation with current along wire axis.





#### **Spacing limitation** Parallel wires must be separated by at least a quarter of the segment length.



Tapered wire issues

Discontinuities arise from changes in radius between adjacent segments.

**Proximity to** real ground plane affects horizontal wires

**Diverging input** impedance.

# **The Conformal MoM**

- The Conformal Method of Moments (CMoM) is a modern MoM technique employed in AN-SOF.
- Within the CMoM, conformal segments are utilized, accurately tracing the contour of the structure and providing an exact representation of its geometric details.
- Unlike other software packages that rely on thin-wire approximations, the CMoM employed in AN-SOF addresses the integral equation's Kernel precisely, eliminating all limitations associated with the traditional MoM.
- AN-SOF stands out as the only software available in the market with a calculation engine based on the **CMoM** with an **Exact Kernel**.



## **Conformal vs. Traditional Method of Moments**





## **Circular Reflector Model for a Helical Antenna**











- **X** Curved segments
- **X** Short spacing
- **X** Bent wires



## **Broadcast Towers with Elevated Radials**

## **Conformal MoM**

- Short spacing
- **Bent wires**
- ✓ Radials close to ground

- **X** Short spacing
- **X** Bent wires
- **X** Radials close to ground





#### **Convergence of the Dipole Input Impedance**







## **Conformal MoM**

- ✓ Thick wires
- Very short segments
- ✓ Tapered dipoles

- **X** Thick wires
- **X** Very short segments
- **X** Tapered dipoles

# AN-SOF

#### **Antenna Simulation Software**



## **The Main Advantages of AN-SOF**

- design decisions.
- simulate antennas.
- saving time and effort.

• High accuracy: AN-SOF provides high accuracy in simulation results, allowing users to make informed

• User-friendly interface: The software has a user-friendly interface that makes it easy for users to design and

• Wide simulation capabilities: AN-SOF offers a wide range of simulation capabilities, including the ability to simulate antennas of various sizes, shapes, and configurations.

• Time-saving: AN-SOF enables users to design, optimize, and simulate antennas more quickly and efficiently,

• Improved project success: With AN-SOF, users can ensure the success of their projects by designing and simulating antennas with confidence and accuracy.



## **The AN-SOF Interface**

- Data entry in AN-SOF is effortless. Clicking on a wire brings up an edit box displaying the relevant dimensions, making it quicker and easier compared to searching through spreadsheets.
- Sources, loads, and transmission lines can be viewed graphically.
- For visualizing output data, we can gather and save a variety of plotted images to compare as we progress through a design.
- AN-SOF offers numerous options, including wire skin effect and insulation, perfect and lossy ground planes, dielectric substrates, various wire cross-sections, suitable unit systems, frequency sweeps, and extensive visualization capabilities.







# **AN-XY Chart**

The "AN-XY Chart" app is specifically designed for visually representing 2D plots in Cartesian coordinates.

It excels in displaying various data, including current distributions versus position, impedance and VSWR versus frequency, and radiation patterns.







# **AN-Smith**

The "AN-Smith" app implements the renowned Smith chart, providing a graphical representation of impedances and admittances.

It offers convenient mouse support, enabling users to obtain reflection coefficients and VSWR with just a single click.

AN-Smith - Pla

Ref. Impedance 75 [Ohm

Freq = 19 MHz Rho = 0.487 (-65.5°) **VSWR = 2.9** 







# **AN-Polar**

The "AN-Polar" app is a versatile tool for representing electromagnetic fields versus azimuth and zenith angles using the widely adopted polar diagram.

It offers calculations for beamwidth and front-to-back ratio, enhancing its utility for various applications.

AN-Polar - Plot Eile Edit Plot

> Max: .0.000512 dB at 2.5 deg 5 dB/Div

at 332.5, 30 deg Back: -8.715 dB at 180 deg





Wires 291 Sources 1 Loads 0



## **AN-3D Pattern**

The "AN-3D Pattern" app provides a user-friendly graphical tool for effortlessly handling 3D views of radiation and scattering patterns.

It also offers color maps for visualizing current distributions and near fields, enhancing the analysis capabilities of the software.

Min: -9.774 Distance (cm): Zc [Ohm]: 376.73





## **Download Examples**

#### Antennas and Beyond!

You can find examples on our <u>Resources</u> and <u>Blog</u> pages.

Additionally, we invite you to **subscribe** to our Newsletter, and to follow us on our social media channels for updates.







Unlock the full potential of your antenna designs and discover the limitless possibilities offered by antenna simulation – contact us today to learn more!



## **Contact Us**