$ # Table of Contents

$ Table of Contents

id_00

$ # AWAS

AWAS for Windows is a versatile program for analyzing wire antennas and scatterers assembled from arbitrarily located and interconnected straight-line segments. The program consists of a shell for user-friendly interface and a kernel for numerical analysis.

The wire structure can be in free space or located above a perfectly conducting plane. Antennas can be analyzed in the transmitting or receiving modes, resulting in port matrix parameters, current distribution, near fields, and far fields. The analysis of scatterers results in monostatic or bistatic cross sections, in addition to the current distribution and near fields.

Numerical analysis is performed by solving an integro-differential equation for the current distribution. This equation is solved using the method of moments with polynomial approximation for the current. See User's Manual for further information.

AWAS for Windows can be run on a configuration consisting of a 386, 486, Pentium, or higher platform running Windows, preferably with a mathematical coprocessor, at least 4MB of extended memory available to the program, and a hard disk with at least 10MB of free space.

The structure to be analyzed is defined by a set of points (nodes) and wire segments. Segments can have ports (for antennas) and concentrated (lumped) or distributed loadings. Also required for the analysis are the operating frequency, data defining where near and far fields are to be evaluated, as well as data defining plane waves exciting receiving antennas or scatterers.

Results of the analysis are written to files and they can be displayed on the screen in text or graphic forms.

See also GENERAL,
PROGRAM RESTRICTIONS.

$ AWAS

id_01

$ # GENERAL

AWAS for Windows consists of a powerful kernel for numerical analysis of wire antennas and scatterers and a user-friendly interface consisting of a set of windows for data input, output, and monitoring.

A computation cycle typically consists of defining input data, running the numerical kernel, and examining results.

All program activities are initiated from the Main window.

The user is assumed to be familiar with Windows and the basic antenna theory.

See also WINDOWS,
MAIN WINDOW.

$ GENERAL

id_02

$ # WINDOWS

Windows and dialog boxes are designed to give a user-friendly interface to the program: allow the input of all data required for the analysis, examine results of the analysis by listing or plotting, monitor computations, perform setup, etc.

Windows and dialog boxes are organized in a hierarchical manner, starting with the AWAS Main window.

All windows have menu bars (from which pull-down menus can be opened), buttons, and hot keys. The Main window also has a toolbar. The dialog boxes only have buttons.

Each window has context-sensitive on-line help, which can be accessed by pressing F1 or by selecting Help in the menu bar. Subordinated windows are accessed by pressing the corresponding hot key, clicking a button, or selecting an item in a menu. Press Ctrl+X or Alt+F4, select Exit or Close in a menu, or double click the Control-menu box to leave the window and return to the parent window. In some critical cases, to prevent an accidental abandoning of the window or the program, exiting must be confirmed in a dialog box.

Most dialog boxes also have on-line help.

If an error occurs, an error message is displayed in a dialog box. Read the message and click OK to continue.

See also MAIN WINDOW.

$ WINDOWS

id_03

$ # NUMBERS

Real numbers can be entered using floating-point notation and respecting the units for data entered. The characters entered from the keyboard are filtered so to allow only the digits 0-9, decimal point, and minus sign to pass.

When integer numbers are entered, only the digits 0-9 are allowed to pass.

See also RANGE OF PARAMETERS,
SETUP DIALOG BOX.

$ NUMBERS

id_04

$ # PROGRAM RESTRICTIONS

The program can handle the following maximal numbers:

- the maximal number of nodes: **500**,
- the maximal number of segments: **320**,
- the maximal number of ports: **16**,
- the maximal number of frequency steps: **199**,
- the maximal number of plane wave groups: **8**,
- the maximal number of near field groups: **9**,
- the maximal number of far field groups: **9**,
- the maximal number of coordinate steps within a group: **199**,
- the maximal polynomial degree: **9** (10 coefficients),
- the maximal number of unknown polynomial coefficients: **640.**

See also RANGE OF PARAMETERS.

$ PROGRAM RESTRICTIONS

id_05

$ # RANGE OF PARAMETERS

In the data input, the following restrictions apply for data read from an input data set:

- The number of nodes must be between 2 and 500.
- The number of segments must be between 1 and 320.
- The number of ports must be between 0 and 16; for a scatterer the number of ports must be zero, and for an antenna it must be between 1 and 16.
- The coordinate z for a node must be zero or greater if the ground plane is present.
- The node indices for a segment must be between 1 and the total number of nodes.
- The segment radius must be positive.
- The polynomial degree must be between 1 and 9 for manual segmentation, and it is 0 for automatic segmentation.
- The real part of a loading impedance must be zero or greater, but the imaginary part can be positive, negative, or zero.
- The segment index for a port must be between 1 and the total number of segments.
- At least one port electromotive force must differ from zero for transmitting antenna operating mode when all ports are simultaneously excited.
- The port nominal impedance must be greater than zero.
- start and stop frequencies must be positive.
- The number of frequency steps must be between 0 and 199.
- The number of plane wave groups must be between 0 and 8, it must be between 1 and 8 for scatterers and receiving antennas, and it is irrelevant for transmitting antennas.
- The number of far field groups must be between 0 and 9; it is not used for receiving antennas or for scatterers if the monostatic scattering is evaluated (when the plane wave excitation automatically defines the far field groups).
- The angle θ for plane waves and far fields must be between -90° and 90° if the ground plane is present, and between -180° and 180° if there is no ground plane.
- The angle φ for plane waves and far fields must be between -180° and 180°.
- The number of near field groups must be between 0 and 9.
- The lower and upper z-coordinate limits in near field groups must be zero or greater if the ground plane is present.
- The number of coordinate steps must be between 0 and 199.

Similar restrictions apply for data entered from the keyboard.

See also NUMBERS,
PROGRAM RESTRICTIONS.

$ RANGE OF PARAMETERS

id_06

[$] [#] CHECKING

Geometry data in the Input Data window are checked against errors by pressing Ctrl+F9. Checking is also automatically performed before attempting to save input data and before starting computations. If an error occurs, it is displayed in a dialog box.

All input data are also checked by the program kernel for numerical analysis and errors are reported in the output data file *WIREOUT.DAT*.

See also INPUT DATA WINDOW,
RANGE OF PARAMETERS.

[$] CHECKING

[#] id_07

$ # FILE LOADING

In some cases files are loaded individually and in other cases as data sets. A data set is always represented by the name of one file.

The File Name menu opens in the Load dialog box displaying file names with the default name extension. Change the directory or drive, if necessary, and select a file name. Click the OK button to load the file or the corresponding data set.

Input data files and files containing data for plotting output results are checked during reading.

See also INPUT FILES,
OUTPUT FILES.

$ FILE LOADING

id_08

$ # FILE SAVING

Input data files and some other files are created by writing the contents from the program memory to corresponding files and saving to disk. Output data files created by the program kernel are saved by copying.

In some cases files are saved individually, but in other cases as data sets. In all cases, the file name is supplied by the user in the Save dialog box and the file name extension is automatically supplied by the program.

If a file with the specified name and extension already exists, the user is asked whether or not to overwrite the old file.

Input data are always checked before being written.

See also INPUT FILES,
OUTPUT FILES.

$ FILE SAVING

id_09

$ # HEADER

Each group of data defining the geometry of a wire structure has a header consisting of three lines, 76 characters long. These lines can contain useful information about the structure. The header also appears in the main output data file *WIREOUT.DAT*.

See also INPUT FILES,
HEADER EDITING,
OUTPUT FILES.

$ HEADER

id_10

$ # OPERATING MODE

The wire structure can be analyzed in seven operating modes:

- transmitting/receiving antenna,
- transmitting antenna, one port excited at a time,
- transmitting antenna, all port simultaneously excited,
- receiving antenna,
- scatterer, monostatic scattering,
- scatterer, bistatic scattering.

See also RANGE OF PARAMETERS,
OUTPUT DATA,
OPERATING MODE INPUT.

$ OPERATING MODE

id_11

$ # GROUND PLANE

The structure analyzed can be located either in free space or above a perfectly conducting ground plane. If present, the ground plane coincides with Cartesian xy-plane.

See also GROUND PLANE INPUT.

$ GROUND PLANE

id_12

$ # GEOMETRY

The geometry of a wire structure is defined by a set of nodes, which are interconnected by straight-line segments, and by ports.

Each node is defined by its Cartesian coordinates (x,y,z).

Each segment is defined by an ordered pair of two node indices, by its radius, and possible loading impedances.

Each port is defined by the index of the segment on which it resides, by the driving electromotive force (voltage), and the nominal impedance.

Geometry data can be edited in the Input Data window.

See also NODES,
SEGMENTS,
PORTS,
GROUND PLANE,
INPUT DATA,
RANGE OF PARAMETERS,
GEOMETRY INPUT.

$ GEOMETRY

id_13

$ # NODES

The geometry of a wire structure is defined by a set of nodes, which are interconnected by straight-line segments.

Each node is defined by its Cartesian coordinates (x,y,z).

Data for nodes can be edited in the Input Data window.

See also INPUT DATA,
GEOMETRY,
GEOMETRY INPUT,
SEGMENTS.

$ NODES

id_14

$ # SEGMENTS

The geometry of a wire structure is defined by a set of nodes, which are interconnected by straight-line segments.

Each segment is defined by an ordered pair of two node indices. A local coordinate axis is associated with the segment. The segment is oriented from the first node (origin, labeled by **a**) towards the second node (terminal, labeled by **b**).

Additional data associated with a segment are its radius and loadings: the concentrated loading at the segment origin (labeled by Za), the concentrated loading at the segment terminal (labeled by Zb). and the loading uniformly distributed along the segment (labeled by Zd). A segment can also carry a port at its origin or terminal (or both).

Data for segments can be edited in the Input Data window.

See also INPUT DATA,
GEOMETRY,
GEOMETRY INPUT,
NODES,
PORTS,
LOADINGS.

$ SEGMENTS

id_15

$ # LOADINGS

Each wire segment can carry concentrated and distributed loadings. A concentrated loading can be located at the segment origin or segment terminal. A distributed loading is assumed to be uniform along the segment length. Each loading is defined by its complex impedance.

A loading is assumed to consist, in the general case, of a series combination of a resistive loading and an inductive or a capacitive loading. The real part of the loading impedance is assumed to be independent of frequency. The imaginary part is assumed to be linearly proportional to the frequency if it is positive (inductive) and inversely proportional to the frequency if it is negative (capacitive). The imaginary part is specified at the reference frequency.

Data for loadings can be edited in the Input Data window.

See also SEGMENTS,
GEOMETRY INPUT.

$ LOADINGS

id_16

$ # PORTS

An antenna must have at least one pair of closely spaced terminals (one port). A port can be located at the origin or at the terminal of a wire segment. Thus a wire segment can carry none, one, or two ports.

In the transmitting mode, generators are connected at the antenna ports. In the numerical model used in the program, these generators are assumed to be ideal voltage generators. The reference direction of a generator coincides with the orientation of the segment. These ideal generators can replace, by force of the compensation theorem, any kind of generators actually connected to the antenna. There are two transmitting operating modes in the program. In the first mode, all ports are simultaneously excited by generators of given electromotive forces. In the second mode, the antenna is assumed to be driven one port at a time, with all other ports short circuited. As a result, in this case the program evaluates the scattering (s), admittance (y), and impedance (z) matrix parameters of the antenna.

If the receiving mode is selected, the wire structure is analyzed as a receiving antenna, with all ports short circuited, but also as a transmitting antenna when one port at a time is driven. By combining the analysis in the two modes, matrix parameters are evaluated, which can completely characterize the receiving antenna as a generator.

The transmitting/receiving mode is a combination of the transmitting mode when one port is excited at a time and the receiving mode.

A port is fully characterized by the complex electromotive force of the generator and the nominal (characteristic) impedance. The electromotive force is irrelevant for the antenna in the receiving mode, as well as for the transmitting mode when ports are excited one at a time. The port nominal impedance is solely used to evaluate the scattering parameters.

Data for ports can be edited in the Input Data window.

See also INPUT DATA,
GEOMETRY,
GEOMETRY INPUT,
SEGMENTS.

$ PORTS

id_17

$ # FREQUENCY

The analysis of the wire structure is performed at a set of equispaced frequencies. These frequencies are defined by the following parameters:

- fstart - the first frequency,
- fstop - the last frequency,
- nf - number of frequency steps.

The frequency step is calculated as ∆f=(fstop-fstart)/nf, and the operating frequencies are

- f(i)=fstart+i*∆f, i=0,...,nf.

Note that the analysis is performed at (nf+1) frequencies. Thus, nf=0 means that the analysis is to be performed at one frequency (when fstart=fstop).

See also FREQUENCY INPUT.

$ FREQUENCY

id_18

$ # REFERENCE FREQUENCY

Any wire concentrated or distributed loading is assumed to consist, in the general case, of a series combination of a resistive loading and an inductive or a capacitive loading. A loading is defined by its complex impedance. The real part of this impedance is assumed to be independent of frequency. The imaginary part is assumed to be linearly proportional to the frequency if it is positive (inductive) and inversely proportional to the frequency if it is negative (capacitive). The imaginary part is specified at the reference frequency.

The reference frequency is defined in the Setup dialog box.

See also SETUP DIALOG BOX,
LOADINGS.

$ REFERENCE FREQUENCY

id_19

$ # PLANE WAVES

A receiving antenna or a scatterer are assumed to be excited (illuminated) by one or more plane waves, one at a time. The waves can arrive from various directions and have various polarizations of the electric field. A plane wave is defined by the direction of incidence, i.e., by the spherical angles θ and φ and the (complex) components of the electric field, $E\theta$ and $E\varphi$.

Plane waves can be organized in several groups. Each group has a unique pair of electric field components, but the directions of incidence vary within the group. These angles within a group are $(\theta(i),\varphi(j))$, where

- $\theta(i)=\theta start+i*\Delta\theta$, $i=1,...,n\theta$,
- $\varphi(j)=\varphi start+j*\Delta\varphi$, $j=1,...,n\varphi$,

θstart and φstart are the minimal values of the angles, θstop and φstop are the maximal values of the angles, $n\theta$ and $n\varphi$ are numbers of angular steps in appropriate directions, and $\Delta\theta=(\theta stop-\theta start)/n\theta$ and $\Delta\varphi=(\varphi stop-\varphi start)/n\varphi$ are angular steps.

For a scatterer whose monostatic (radar) cross section is evaluated, plane wave groups are, at the same time, far field groups. In this operating mode, far field points are not specified at data input. However, when the far fields are plotted, the information on the plane waves is used to define the far field directions as if they were actually input.

See also PLANE WAVE INPUT,
OPERATING MODE,
FAR FIELDS.

$ PLANE WAVES

id_20

[$] [#] NEAR FIELDS

Near fields can be evaluated at several groups of points. A group of points is located at nodes of a spatial orthogonal grid in Cartesian system. Coordinates of points within a group are (x(i),y(j),z(k)), where

- x(i)=xstart+i*Δx, i=0,...,nx,
- y(j)=ystart+j*Δy, j=0,...,ny,
- z(k)=zstart+k*Δy, k=0,...,nz,

xstart, ystart, and zstart are the minimal values of the coordinates, xstop, ystop, and zstop are the maximal values of the coordinates, nx, ny, and nz are numbers of coordinate steps in appropriate directions, and Δx=(xstop-xstart)/nx, Δy=(ystop-ystart)/ny, and Δz=(zstop-zstart)/nz are coordinate steps.

Near fields can be plotted within a group against one coordinate as variable, with constant two other coordinates. The number of steps for the variable coordinate must be at least 1.

At these points, 6 components of the fields are evaluated: Cartesian components of the electric field (Ex, Ey, Ez) and components of the magnetic field (Hx, Hy, Hz).

See also NEAR FIELD INPUT.

[$] NEAR FIELDS

[#] id_21

$ # FAR FIELDS

Far fields can be evaluated for several groups of directions. A group of directions is defined by spherical angles θ and φ, and these angles within a group are (θ(i),φ(j)), where

- θ(i)=θstart+i*dθ, i=1,...,nθ,
- φ(j)=φstart+j*dφ, j=1,...,nφ,

θstart and φstart are the minimal values of the angles, θstop and φstop are the maximal values of the angles, nθ and nφ are numbers of angular steps in appropriate directions, and Δθ=(θstop-θstart)/nθ and Δφ=(φstop-φstart)/nφ are angular steps. A pair (θ,φ) can be considered as a point in the plane the coordinate axes of which are the angles θ and φ.

Far fields can be plotted within a group against one angular coordinate as variable, with constant the other coordinate. The number of steps for the variable angle must be at least 1.

At these points, spherical components of the electric field (Eθ, Eφ) are evaluated. These components are presented in the output results multiplied by the distance r from the antenna, and the field phase is reduced to the coordinate origin, so that the results do not depend on the spherical coordinate r. For antennas in the transmitting mode, the power gain is also evaluated. For scatterers, the monostatic or bistatic cross sections are evaluated.

See also FAR FIELD INPUT,
PLANE WAVES,
OPERATING MODE.

$ FAR FIELDS

id_22

$ # INPUT DATA

Input data required for the analysis of a wire structure consist of five groups.

The first group is data defining the geometry (nodes, segments, and ports), loadings, port electromotive forces and nominal impedances, operating mode, and the ground plane.

The second group is data defining operating frequencies.

The third group is data defining plane waves exciting the structure.

The fourth group is data defining near field points.

The fifth group is data defining far field directions.

The input data can be supplied interactively from the keyboard in a session of AWAS for Windows just before the analysis is performed. These data can also be saved to be analyzed or modified later. The input data can be created externally, by a text editor or another program, and then loaded into AWAS for Windows to be analyzed by its kernel.

See also INPUT FILES,
INPUT DATA WINDOW.

$ INPUT DATA

id_23

[$] [#] INPUT FILES

Input data required for the analysis of a wire structure consist of five groups. Each of these groups is located in a separate data file. These files can be created by saving data during the interactive data input or externally by a text editor or another program. All files are plain ASCII files. Refer to User's Manual for further information on the structure of these files.

For an individual analysis, data can be loaded from various files, possibly modified interactively, and then submitted to the analysis.

For a batch analysis, data must be organized in data sets. An input data set, which is sufficient for one analysis, consists of five files bearing the same name but different extensions.

Files with geometry data have the default name extension *GEO*.

Files with frequency data have the default name extension *FRQ*.

Files with plane wave data have the default name extension *PWE*.

Files with near field points have the default name extension *NFP*.

Files with far field directions have the default name extension *FFP*.

See also INPUT DATA,
INPUT FILE MANAGEMENT.

[$] INPUT FILES

[#] id_24

$ # POLYNOMIAL APPROXIMATION

In AWAS for Windows, the current distribution along wire segments is approximated by polynomials. The polynomial coefficients are evaluated in order to satisfy an integro-differential equation for the current distribution and to satisfy Kirchhoff's current law for the nodes.

The polynomial degrees can be supplied as input data, or they can be determined automatically by the program in a procedure referred to as automatic segmentation. Automatic segmentation is performed if the supplied polynomial degree is 0 or if manually supplied data provide a far-too-low polynomial degree.

The smallest polynomial degree for a segment is 1, so that there exists a charge associated with the current. However, for a wire segment whose both ends are free (not connected to other segments), the minimal polynomial degree is 2.

In order to provide accurate analysis results, it is necessary to accommodate the approximation of the current distribution to the electrical length of wire segments (i.e., length in terms of the wavelength at the operating frequency). As a rule, on average about 8 unknown coefficients of the polynomial approximation are required per wavelength. On the other hand, the maximal allowed polynomial degree in the program is 9 (10 coefficients). As a result, with increasing frequency, a wire segment may have to be divided into one or more shorter segments, each of them having a high-degree polynomial.

The automatic segmentation evaluates the required polynomial degrees and splits segments into smaller ones, if necessary.

Increasing the number of polynomial coefficients also usually increases the accuracy, but at the expense of increasing the computation time.

See also INPUT DATA.

$ POLYNOMIAL APPROXIMATION

id_25

$ # OUTPUT DATA

The results of the analysis by the numerical kernel of AWAS for Windows can be divided into several groups.

The first group is coefficients of the polynomial approximation for the current distribution. These data exist for antennas and scatterers in all operating modes.

The second group is port matrix parameters of antennas. These are the scattering (s), admittance (y), and impedance (z) parameters. For a transmitting antenna, these parameters are only square matrices defining the antenna as a passive network. For a receiving antenna, these parameters include independent source terms defining the antenna as a network with generators. The matrix parameters are evaluated for all antenna operating modes except when all antenna ports are excited simultaneously. These matrix parameters are not evaluated for scatterers.

The third group is near electric and magnetic fields. These data are evaluated for all operating modes if there exists at least one group of near field points.

The fourth group is far fields. For antennas, these data are radiated electric field and power gain, and they are evaluated for all operating modes except for receiving antennas. For scatterers, these data are scattered electric field and cross section (monostatic or bistatic, depending on the operating mode, total, copolar, and crosspolar). These data are evaluated if there exists at least one group of far field directions.

See also OUTPUT FILES,
SAVE OUTPUT FILES,
PLOTTING OUTPUT.

$ OUTPUT DATA

id_26

[$] [#] OUTPUT FILES

The results of the analysis by the numerical kernel of AWAS for Windows are written to seven output data files, which form one output data set. All these files have the same name extension *DAT*, but different names. All files are ASCII files.

In the full format, the main output data file *WIREOUT.DAT* contains all input and output data. However, depending on the format selected in the setup, some of these data may not be written. The setup has no effect on the other output data files. *WIREOUT.DAT* can be listed by the user from List window.

File *SPAR.DAT* contains the passive portion of s matrices.

File *YPAR.DAT* contains the passive portion of y matrices.

File *ZPAR.DAT* contains the passive portion of z matrices.

File *CURR.DAT* contains coefficients of the polynomial approximation for the current distribution.

File *NFLD.DAT* contains near fields.

File *FFLD.DAT* contains far fields.

The latter six files are intended primarily for plotting output results, as well as for exporting the results to other programs. Note that some of these files may contain no valid data for plotting (e.g., files with matrix parameters for scatterers).

Saved copies of the output data files may have any file name, but the extensions are *OUT*, *SPM*, *YPM*, *ZPM*, *CUR*, *NFL*, and *FFL*, respectively.

See also OUTPUT DATA,
SAVE OUTPUT FILES,
PLOTTING OUTPUT.

[$] OUTPUT FILES

[#] id_27

$ # PLOTTING OUTPUT

Output results can be presented in graphic form on the screen. Available for plotting are antenna port scattering (s), admittance (y), and impedance (z) parameters (matrix parameters), wire currents (I) and charges per unit length (Q'), near field components of the electric and magnetic fields (Ex, Ey, Ez, Hx, Hy, Hz), normalized far electric field components (rEθ, rEφ), antenna power gains, and scatterer monostatic or bistatic cross sections (σ: total, copolar, and crosspolar).

Port matrix parameters can be plotted versus frequency.

Currents and charges per unit length can be plotted versus local segment coordinates.

Near and far field quantities can be plotted versus global coordinates, (x,y,z) and (θ,φ), respectively, and far field quantities can in addition be plotted as a function of frequency.

One real or complex quantity can be plotted at a time (e.g., one admittance parameter or one component of the normalized far electric field).

Quantities can be plotted in various formats: as real and imaginary parts of complex numbers, magnitudes, magnitudes in dB, or phases.

See also PLOT WINDOW.

$ PLOTTING OUTPUT

id_28

$ # MAIN WINDOW

AWAS for Windows starts and terminates here, and all activities are initiated from the Main window.

The following **menus** are available in the Main window menu bar:

- **Input** - manage input data defining the wire structure to be analyzed; this menu has the following options:
  - **Load** - load an input data set,
  - **Edit** - edit an input data set; same as the **Input button**,
  - **Save** - save an input data set with the name of the loaded set,
  - **Save As** - save an input data set with a new name,
  - **Quit** - terminate AWAS for Windows.
- **Compute** - perform the analysis; this menu has the following options:
  - **Run** - perform analysis of one data set; same as the **Run button**,
  - **Batch** - perform analysis of several data sets; same as the **Batch button**.
- **Output** - manage analysis results: list and save output data files, and plot analysis results; this menu has the following options:
  - **List Text Report** - list analysis results; same as the **List button**,
  - **Save Output Files** - save analysis results; same as the **Save button**,
  - **Graph Report** - plot analysis results; same as the **Graph button**.
- **Config** - setup certain things; this menu has the following options:
  - **Setup** - define reference frequency, units for coordinates, radii, frequency, and electric field, format output data file, setup complex numbers, sequential questions, background execution, and geometry show; same as the **Setup button**,
  - **Default Frequency** - define the default file for frequency data,
  - **Default Plane Wave Groups** - define the default file for plane waves,
  - **Default Near Field Groups** - define the default file for near field points,
  - **Default Far Field Groups** - define the default file for far field directions.
- **Help** - obtain help; this menu has the following options:
  - **Help** - open the Help window for the Main window,
  - **Index** - open the Help window with the Index of available Help windows,
  - **Contents** - open the Help window with the Table of Contents of available Help windows,
  - **Using help** - open the Help window with instructions on how to use the Help utility,
  - **About AWAS** - display basic information about AWAS for Windows.

Alternatively, the most frequently used functions can be accessed by clicking the corresponding **button** in **t**he Main window **toolbar**:

- **Input** - edit an input data set,
- **Run** - perform analysis of one data set,

$ MAIN WINDOW

id_29

- **Batch** - perform analysis of several data sets,
- **List** - list analysis results,
- **Graph** - plot analysis results,
- **Save** - save output data,
- **Setup** - perform setup,
- **Quit** - terminate AWAS for Windows,
- **Help** - open the Help window with the Table of Contents of available Help windows.

See also AWAS,
GENERAL,
INPUT DATA,
INPUT DATA WINDOW,
ANALYSIS,
BATCH ANALYSIS,
LIST OUTPUT FILE,
SAVE OUTPUT FILES,
GRAPH WINDOW,
CONFIGURATION,
SETUP DIALOG BOX.

$ # HELP

A context-sensitive on-line help is provided in all windows and in most dialog boxes. Help utility can be activated by pressing F1 key, clicking Help button in dialog boxes, or by selecting it from the Help menu in the menu bar in windows. Using the Help utility follows Windows standards, and it includes an index, a table of contents, and hot spots (underlined) with jumps to related topics.

Help menu has the following options:

- **Help** - open the Help window for the current window,
- **Index** - open the Help window with the Index of available Help windows,
- **Contents** - open the Help window with the Table of Contents of available Help windows,
- **Using help** - open the Help window with instructions on how to use the Help utility.

See also WINDOWS.

$ HELP

id_30

$ # INPUT FILE MANAGEMENT

Input data files can be managed from the Main window or from the Input Data window. From the Main window, a data set can be loaded or saved, and editing of a data set can be initialized. In the Input Data window a data set can be edited, loaded, saved, or the memory can be reset.

To load a data set, select Load in the corresponding menu, and then select in the File Name menu the name of the main input file of the set, with the name extension *GEO*. Before loading a *GEO* file, the contents of its header can be examined by clicking the Header button.

If a file in this set does not exist, the corresponding default file is loaded. This file has the name *DEFAULT*, and the proper name extension. The default files are not loaded in the batch processing.

To save a data set, select Save in the corresponding menu or select Save As and supply the file name. Proper extensions are automatically added by the program.

See also INPUT FILES,
MAIN WINDOW,
INPUT DATA WINDOW.

$ INPUT FILE MANAGEMENT

id_31

$ # INPUT DATA WINDOW

Input data can be loaded and edited in the Input Data window, which can be accessed from the Main window.

Data for nodes are displayed and edited in the Node table.

Data for segments are displayed and edited in the Segment table.

Operating mode and ground plane can be defined using corresponding buttons.

Header can be accessed by clicking the Header button.

Data for frequency are displayed and edited in the Frequency area.

Data for plane waves, near field points and far field directions can be accessed by clicking the Change buttons in the Waves and Fields area.

The following **menus** are available in the Input data window menu bar:

- **File** - manage input data defining the wire structure to be analyzed; this menu has the following options:
  - **Load** - load an input data set,
  - **New** - reset the data in program memory,
  - **Save** - save an input data set with the name of the loaded set,
  - **Save As** - save an input data set with a new name,
  - **Save default files** - save frequency, plane wave, near field, and far field data as defaults,
  - **Show** - show geometry; same as the **Show button**,
  - **Exit** - close the Input Data window.
- **Edit** - facilitate editing data in the Node and Segment tables; this menu has the following options:
  - **Copy** - place the selected text in the paste buffer,
  - **Cut** - cut the selected text and place it in the paste buffer,
  - **Paste** - paste text from the paste buffer,
  - **Insert Line** - insert a line in the active table; same as the **InsLine button**,
  - **Delete Line** - delete a line in the active table; same as the **DelLine button**,
  - **Undelete Line** - undelete the last deleted line in the active table; same as the **Undel button**,
  - **Header** - edit header; same as the **Header button**,
  - **Mode** - change operating mode; same as the **Mode button**.
- **Compute** - start computations based on the current input data; this menu has the following options:
  - **Check** - check input data; same as the **Check button**,
  - **Run** - perform the analysis; same as the **Run button**.
- **Help**- obtain help; this menu has the following options:
  - **Help** - open the Help window for the Input Data window,

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$ INPUT DATA WINDOW

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- **Index** - open the Help window with the Index of available Help windows,
- **Contents** - open the Help window with the Table of Contents of available Help windows,
- **Using help** - open the Help window with instructions on how to use the Help utility.

The following **buttons** are available in the middle portion of the Input Data window:

- **Operating mode** - define operating mode,
- **Ground plane** - define ground plane.

The following **buttons** are available in the **Frequency area**:

- **Load** - load a file with frequency data,
- **Save** - save frequency data,
- **Default** - save frequency data as default.

The following **buttons** are available in the **Waves and Fields area**:

- **Change** plane wave, near field, and far field groups - access corresponding data.

The following **function keys** are active which correspond to buttons available at the bottom of the Input Data window:

- **Ctrl+F1** - **Show** - show geometry,
- **Ctrl+F2** - **Focus** - change active table/area,
- **Ctrl+F3** - **Header** - edit header,
- **Ctrl+F4** - **Mode** - define operating mode and ground plane,
- **Ctrl+F5** - **InsLine** - insert a line in the active table,
- **Ctrl+F6** - **DelLine** - delete a line in the active table,
- **Ctrl+F7** - **Undel** - undelete the last deleted line in the active table,
- **Ctrl+F8** - **SavDef** - save frequency, plane wave, near field, and far field data as defaults,
- **Ctrl+F9** - **Check** - check input data,
- **Ctrl+F10** - **Compute** - perform the analysis.

The input data editing acts on data which are present in the program memory. Only one data set is present at a time. Input data can be loaded from disk files, or saved in these files.

All input data are automatically checked upon starting the analysis.

See also INPUT DATA,
INPUT FILES,
INPUT FILE MANAGEMENT,
OPERATING MODE,
GROUND PLANE,
MAIN WINDOW,
OPERATING MODE INPUT,
GROUND PLANE INPUT,
GEOMETRY,
GEOMETRY INPUT,
GEOMETRY SHOW
FREQUENCY,
FREQUENCY INPUT,
PLANE WAVES,
PLANE WAVE INPUT,
NEAR FIELDS,

NEAR FIELD INPUT,
FAR FIELDS,
FAR FIELD INPUT,
HEADER EDITING,
ANALYSIS,
WINDOWS,
CHECKING.

$ # HEADER EDITING

The header can be edited in the Header Edit dialog box, which can be accessed from the Input Data window. The three header lines, each 76 characters long, are displayed in the box, where they can be edited in a standard way.

Click the OK button to terminate editing and return to the Input Data window.

See also HEADER,
INPUT FILE MANAGEMENT.

$ HEADER EDITING

id_33

$ # GEOMETRY INPUT

Data defining wire structure geometry (i.e., nodes, segments, and ports) can be edited in the Input Data window.

Nodes and segments are treated as two separate groups of data.

Data for a node are the three Cartesian coordinates (x,y,z), and they comprise a group.

Data for a segment are the indices of two nodes at which the segment starts (labeled by **a**) and terminates (labeled by **b**), the wire radius, polynomial degree, two concentrated loadings at segment end points (labeled by Za and Zb), the distributed loading (labeled by Zd), and data for ports located at the segment end points (port index, port electromotive force, and the port nominal impedance). All these data for a segment comprise a group.

Node and segment groups are treated identically. When either of the two tables (the **Node table**, with data for nodes, and the **Segment table**, with data for segments) is active, the following specific **keys** and associated **buttons** are active in the Input Data window:

- **Ctrl+F5** - **InsLine** - insert a line in the active table,
- **Ctrl+F6** - **DelLine** - delete a line in the active table,
- **Ctrl+F7** - **Undel** - undelete the last deleted line in the active table,
- **Left** and **Right Arrows**, **End, Home** - change cursor position within the field active for editing,
- **Up** and **Down Arrows**, **PgUp**, **PgDn**, **scroll bars** - change the line with the field active for editing,
- **Tab**, **Enter** - activate the next field for editing,
- **Shift+Tab** - activate the previous field for editing.

To edit a loading, click button in the corresponding field in the Segment table. Thereby, **Za** denotes the loading at the segment origin, **Zb** the loading at the segment terminal, and **Zd** the distributed loading. The Impedance dialog box opens in which the real and imaginary parts of the loading impedance can be edited. Click OK or Cancel when done. When a nonzero impedance loading is defined, label **Z** appears in the Segment table. If no loading is defined (a zero loading impedance), three periods appear instead.

To edit data defining an antenna port, click the corresponding field in the Segment table. Thereby, Port **a** is the port at the segment origin, and Port **b** at the segment terminal. Port dialog box opens in which the port index, the real and imaginary parts of the complex port electromotive force, and the port nominal impedance can be edited. Click OK or Cancel when done. When a port is defined, its index appears in the Segment table. If no port is defined, or its index is set to zero, three periods appear instead.

See also GEOMETRY,
NODES,
SEGMENTS,
LOADINGS,
PORTS,
GEOMETRY SHOW
INPUT DATA WINDOW,
NUMBERS,

$ GEOMETRY INPUT

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RANGE OF PARAMETERS,
REFERENCE FREQUENCY.

$ # GEOMETRY SHOW

The wire structure can be displayed in the Show window while editing input data in the Input Data window. Depending on the setup, the structure can be permanently displayed and automatically updated as the geometry data are edited, or the structure can be displayed only per request.

The displayed structure can be rotated about three principal axes, panned, zoomed in or out, and the indices of nodes and segments can be displayed or left out.

The following **menus** are available in the Show window menu bar:

- **View** - reset or close the Show window; this menu has the following options:
  - **Reset** - reset the Show window to its defaults,
  - **Exit** - close the Show window.
- **Help** - obtain help; this menu has the following options:
  - **Help** - open the Help window for the Show window,
  - **Index** - open the Help window with the Index of available Help windows,
  - **Contents** - open the Help window with the Table of Contents of available Help windows,
  - **Using help** - open the Help window with instructions on how to use the Help utility.

The following thumbwheels are available in the Show window:

- **RotH** - rotate about vertical axis of the screen,
- **RotP** - rotate about horizontal axis of the screen,
- **RotB** - rotate about axis perpendicular to the screen,
- **Step** - change step of rotation (in degrees),
- **Scale** - zoom in or out.

The Up and Down Arrows can be used to rotate the thumbwheels, and PgUp and PgDn can be used in addition for the Scale thumbwheel for a fast rotation. Zoom in can also be performed by selecting a rectangular area using the mouse.

Two **scroll bars** are available for horizontal and vertical panning.

The following **buttons** are available in the Show window:

- **Nodes** - turn node labels on or off,
- **Segments** - turn segment labels on or off.

See also GEOMETRY,
INPUT DATA WINDOW,
SETUP DIALOG BOX.

$ GEOMETRY SHOW

id_35

$ # OPERATING MODE INPUT

The operating mode can be defined in the Input Data window. Click the Operating mode button at the middle of the window, click the Mode button at the bottom of the window, or press Ctrl+F4. The **Operating Mode menu** opens, which has the following options:

- **Transmitting/receiving** antenna mode,
- **Transmitting** antenna mode, **one** port excited at a time,
- **Transmitting** antenna mode, **all** ports simultaneously excited,
- **Receiving** antenna mode,
- **Scatterer** mode, **monostatic** cross section,
- **Scatterer** mode, **bistatic** cross section.

Select an option and click **OK** or **Cancel** to continue.

If the Operating Mode menu was opened upon clicking the Mode button at the bottom of the window or pressing Ctrl+F4, the Ground Plane dialog box opens after closing the Operating Mode menu.

See also INPUT DATA WINDOW,
OPERATING MODE,
GROUND PLANE INPUT.

$ OPERATING MODE INPUT

id_36

$ # GROUND PLANE INPUT

The ground plane can be defined in the Input Data window. Click the Ground Plane button, or click the Mode button at the bottom of the window, or press Ctrl+F4. In the first case, the status of the ground plane is toggled (yes/no ground plane). In the other two cases, the Operating Mode window opens first. After closing this window, the Ground Plane dialog box opens, which has two buttons: Yes and No. Click the Yes button if the ground plane is present. Click the No button if there is no ground plane.

See also INPUT DATA WINDOW,
OPERATING MODE INPUT,
GROUND PLANE.

$ GROUND PLANE INPUT

id_37

$ # FREQUENCY INPUT

Frequency data can be edited in the Input Data window. Make the Frequency area active using Ctrl+F2 or the mouse and edit the start frequency, the stop frequency or the number of frequency steps.

A file containing frequency data can be loaded by clicking the **Load button** in the Frequency area.

Frequency data can be saved in a file upon clicking the **Save button** in the Frequency area.

Frequency data can be saved as default (in the file *DEFAULT.FRQ*) by clicking the **Default button** in the Frequency area.

The Default Frequency dialog box which is similar to the Input Data window Frequency area opens for editing data in the default file for frequency, when the corresponding option is selected in the Main window Config menu. This box does not have the Save and Default buttons, but it has the OK and Cancel buttons. Click one of these two buttons to close the box.

See also FREQUENCY,
RANGE OF PARAMETERS,
INPUT DATA WINDOW.

$ FREQUENCY INPUT

id_38

$ # PLANE WAVE INPUT

Data defining plane waves exciting the wire structure can be edited in the Plane Wave box, which can be reached from the Input Data window by clicking the Change button for plane wave groups.

Supply the number of plane wave groups. Then supply data for each group, which consist of the complex components of the electric field ($E\theta$ and $E\varphi$), the start and stop values of angles θ and φ, and the numbers of steps.

A file containing plane wave data can be loaded by clicking the **Load button**.

Plane wave data can be saved in a file upon clicking the **Save button**.

Plane wave data can be saved as default (in the file *DEFAULT.PWE*) by clicking the **Default button**.

Click **OK** or **Cancel** to close the Plane Wave dialog box.

A similar Default Plane Wave dialog box opens for editing data in the default file for plane waves, when the corresponding option is selected in the Main window Config menu. This box does not have the Save and Default buttons.

See also PLANE WAVES,
INPUT DATA WINDOW,
MAIN WINDOW,
NUMBERS,
RANGE OF PARAMETERS.

$ PLANE WAVE INPUT

id_39

$ # NEAR FIELD INPUT

Data defining near field points (i.e., points at which the near fields are to be calculated) can be edited in the Near Field dialog box, which can be reached from the Input Data window by clicking the Change button for near field groups.

Supply the number of near field groups. Then supply data for each group, which consist of the start and stop values of the coordinates x, y, and z, and the numbers of steps.

A file containing near field points can be loaded by clicking the **Load button**.

Near field data can be saved in a file by clicking the **Save button**.

Near field data can be saved as default (in the file *DEFAULT.NFP*) by clicking the **Default button**.

Click **OK** or **Cancel** to close the Near Field dialog box.

A similar Default Near Field dialog box opens for editing data in the default file for near fields, when the corresponding option is selected in the Main window Config menu. This box does not have the Save and Default buttons.

See also NEAR FIELDS,
INPUT DATA WINDOW,
MAIN WINDOW,
NUMBERS,
RANGE OF PARAMETERS.

$ NEAR FIELD INPUT

id_40

$ # FAR FIELD INPUT

Data defining far field directions (i.e., directions for which the far fields are to be calculated) can be edited in the Far Field dialog box, which can be reached from the Input Data window by clicking the Change button for far field groups.

Supply the number of far field groups. Then supply data for each group, which consist of the start and stop values of the angles θ and ϕ, and the numbers of steps.

A file containing far field directions can be loaded by clicking the **Load button**.

Far field data can be saved in a file by clicking the **Save button**.

Far field data can be saved as default (in the file *DEFAULT.FFP*) by clicking the **Default button**.

Click **OK** or **Cancel** to close the Far Field dialog box.

A similar Default Far Field dialog box opens for editing data in the default file for far fields, when the corresponding option is selected in the Main window Config menu. This box does not have the Save and Default buttons.

See also FAR FIELDS,
INPUT DATA WINDOW,
MAIN WINDOW,
NUMBERS,
RANGE OF PARAMETERS.

$ FAR FIELD INPUT

id_41

[$] [#] ANALYSIS

The analysis of one set of input data can be started by selecting Run in the Main window Compute menu, by clicking the Run button in the Main window, by selecting Run in the Input Data window Compute menu, by clicking the Compute button, or by pressing Ctrl+F10 in the Input Data window. In this case, the analysis is performed based on data which are currently located in the program memory (individual analysis). These data could be supplied in the Input Data window interactively, or loaded from an input data set. The data should be error-free, which can be checked in the Input Data window.

A batch procedure can be started by selecting Batch in the Main window Compute menu or by clicking the Batch button in the Main window. In this procedure several sets of input data can be analyzed. These sets must exist on the disk before the analysis starts.

While the analysis procedure is active, the Work window box stays opened. If the background execution is selected in the setup, the analysis is slower, but it can be interrupted and other programs in Windows environment can be run concurrently. If this option is deselected, the analysis is faster, but it cannot be interrupted and the screen remains frozen until the analysis is done.

See also INPUT DATA,
MAIN WINDOW,
BATCH ANALYSIS.

[$] ANALYSIS

[#] id_42

[$] [#] BATCH ANALYSIS

The analysis of several input data sets can be performed in the batch mode, which is initiated in the Batch dialog box. This box can be accessed from the Main window Compute menu, or by clicking the Batch button in the Main window. An input data set consists of five files bearing the same name and having proper name extensions (*GEO*, *FRQ*, *PWE*, *NFL*, and *FFL*), and the main file for each set bears the extension *GEO*.

Type in the path and file name for the *GEO* file or select it upon clicking the **Select button**. Repeat this procedure as required. Click **Run** when done to start the batch procedure.

In the batch procedure, an input data set is read, the analysis is performed, and all seven output data files are saved with the same name as the set, with proper extensions *OUT*, *SPM*, *YPM*, *ZPM*, *CUR*, *NFL*, and *FFL*. The message **done** is posted upon a successful completion of analysis of a data set. If an error occurs, the message **denied** is displayed instead. When the batch procedure is finished, click **Close** or **Cancel** to close the Batch dialog box.

See also INPUT FILES,
MAIN WINDOW,
ANALYSIS,
OUTPUT FILES.

[$] BATCH WINDOW

[#] id_43

$ # LIST OUTPUT FILE

The file *WIREOUT.DAT* contains a printout of the latest analysis. Each analysis cycle destroys the old file *WIREOUT.DAT* and replaces it by a new file. This file can be listed in the List window, which can be accessed by selecting the option List Text Report in the Main window Output menu, or by clicking the List button in the Main window.

The following **menus** are available in the List window menu bar:

- **File** - manage files to be listed and printed; this menu has the following options:
  - **Load** - load a file to be listed,
  - **Printer Setup** - configure printer,
  - **Print** - print the listed file,
  - **Exit** - terminate listing.
- **Search** - facilitate moving through the listed file; this menu has the following options:
  - **Find** - find a character sequence,
  - **Repeat Find** - find the sequence again,
  - **Goto** - go to a specified line number or percentage of the listed file.
- **Options** - specify if the display can contain only ANSI or ASCII characters.
- **Help** - obtain help; this menu has the following options:
  - **Help** - open the Help window for the List window,
  - **Index** - open the Help window with the Index of available Help windows,
  - **Contents** - open the Help window with the Table of Contents of available Help windows,
  - **Using help** - open the Help window with instructions on how to use the Help utility.

See also OUTPUT FILES,
MAIN WINDOW.

$ LIST OUTPUT FILE

id_44

$ # SAVE OUTPUT FILES

Output data files are saved by copying them to files with proper default name extensions. Saving these files is accessed by selecting the option Save Output Files in the Main window Output menu.

Supply the common name for the output data set and click OK. Select whether or not each of the seven output data files is to be saved and click OK.

See also OUTPUT FILES,
MAIN WINDOW.

$ SAVE OUTPUT FILES

id_45

$ # GRAPH WINDOW

The Graph window is used to prepare data for plotting output results by making a set of selections. The Graph window is accessed from the Main window by selecting the option Graph Report in the Output menu or by clicking the Graph button.

The selections required for plotting are clustered into seven areas.

The **Target area** defines the target for plotting, i.e., the quantity to be plotted. Available options are

- scattering parameters,
- admittance parameters,
- impedance parameters,
- currents and charges,
- near fields,
- far fields.

Click the corresponding radio button to select the target.

The **File area** defines the file containing the target data. Supply the file name by typing it in or select it from the File Name menu and click the **Open button**.

The **Frequency area** defines the frequency for which the selected target is to be plotted. Select the desired frequency using the thumbwheel. This area is disabled when plotting the scattering, admittance, or impedance parameters or when plotting far fields as a function of frequency.

The **What area** specifies more closely what is to be plotted.

- When plotting the scattering, admittance, or impedance parameters, use the two thumbwheels in this area to specify the port indices for these parameters.
- When plotting the current distribution, select in the first menu the current or the charge distribution.
- When plotting near fields, select in the second menu the electric or magnetic field component (Ex, Ey, Ez, Hx, Hy, Hz).
- When plotting far fields, select in the third menu the electric field component (Eθ, Eφ, total electric field).

The **Location area** specifies the location of the target for plotting.

- When plotting the current or charge distribution, use the first thumbwheel to select the index of the wire segment along which this distribution is to be plotted.
- When plotting near fields, use the second thumbwheel to select the near field group, click the corresponding radio button to select the variable coordinate (x, y, z), and use the third and fourth thumbwheels to select the fixed values of the two remaining coordinates.
- When plotting far fields, use the fifth thumbwheel to select the far field group, click the corresponding radio button to select the variable angle (θ, φ) or frequency (f), and use the remaining thumbwheels to select the fixed values of the remaining coordinate(s).

The **Excitation area** specifies the excitation of the wire structure for which the target is to be plotted. Click the corresponding radio button to select the excitation by a plane wave or by a

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$ GRAPH WINDOW

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generator at a port (or generators at all ports simultaneously). If the plane wave excitation is selected, use the first thumbwheel to select the plane wave group and use the second and third thumbwheels to select the angle of incidence of the plane wave. If the excitation at ports is selected, use the last thumbwheel to select the index of the driven port (if the antenna is driven one port at a time). This area is disabled when the target is the scattering, admittance or impedance parameters.

The **Format area** specifies the format of the plot. Click the corresponding radio button, or select an item in the menu.

- When plotting scattering parameters, available formats are real and imaginary parts (R,I), magnitude, magnitude in dB (LOGMAG), and phase.
- When plotting admittance or impedance parameters, the current or charge distributions, and near electric or magnetic field components, available formats are real and imaginary parts, magnitude, and phase.
- When plotting far fields and Eθ or Eφ are selected, available formats are real and imaginary parts, magnitude, and phase. When the total field is selected, available options are magnitude of the electric field and gain for antennas in the transmitting mode, or magnitude of the electric field, total cross section, copolar cross section, and crosspolar cross section (magnitude and in dB) for scatterers.

When the set of selections is completed, click the **Plot button** to obtain the graph, or click the **Save button** to save the set of selections in a file (with the default extension *GGG*).

A saved set of selections can be retrieved by clicking the **Load button**.

A saved graph can be retrieved by clicking the **Plot Saved button**. A graph can be saved in the Plot window.

The following **menus** are available in the Graph window menu bar:

- **File** - manage files containing selections or data for plotting; this menu has the following options:
  - **Load** - load a file with selections for plotting; same as the **Load button**,
  - **Save** - save a file with selections for plotting; same as the **Save button**,
  - **Plot Saved** - plot saved data; same as the **Plot Saved button**,
  - **Open** - open a file with data to be plotted; same as the **Open button** in the File area,
  - **Plot** - plot data; same as the **Plot button**,
  - **Exit** - close the Graph window.
- **Help**; this menu has the following options:
  - **Help** - open the Help window for the Graph window,
  - **Index** - open the Help window with the Index of available Help windows,
  - **Contents** - open the Help window with the Table of Contents of available Help windows,
  - **Using help** - open the Help window with instructions on how to use the Help utility.

See also PLOTTING OUTPUT,
MAIN WINDOW,
PLOT WINDOW.

$ # PLOT WINDOW

Once all selections are issued in the Graph window, a plot appears in the Plot window. This plot can be edited or saved.

The following **menus** are available in the Plot window menu bar:

- **File** - manage files containing data for plotting; this menu has the following options:
  - **Load** - load a set of files with data for plotting,
  - **Save** - save a set of files with data for plotting; these files have the same name, supplied by the user, and default extensions *LBL* (with axes labels), *RNG* (with plot scale), and *PTS* (with coordinates of points),
  - **Printer Setup** - configure printer,
  - **Print** - obtain a hardcopy of the plot on the printer,
  - **Tabulate** - obtain a table with data comprising the plot; this option opens a menu with the following options:
    - **File** - place the table in a file (with the default name extension *TAB*),
    - **Printer** - print the table,
  - **Exit** - close the Plot window.
- **Options** - supply a title, or change the scale of the plot; this menu has the following options:
  - **Title** - edit the plot title,
  - **Scale** - change the scale of the plot; this option opens a menu with the following options:
    - **Automatic** - restore the scale determined by the program,
    - **Manual** - manually supply the minimal and maximal values of the coordinates.
- **Help** - obtain help; this menu has the following options:
  - **Help** - open the Help window for the Plot window,
  - **Index** - open the Help window with the Index of available Help windows,
  - **Contents** - open the Help window with the Table of Contents of available Help windows,
  - **Using help** - open the Help window with instructions on how to use the Help utility.

See also GRAPH WINDOW.

$ PLOT WINDOW

id_47

$ # HARDCOPY

A hardcopy of the contents of any window of program AWAS for Windows can be made using standard Windows utilities. The Plot window and the List window have in addition their own access to the printer.

See also PLOT WINDOW,
LIST WINDOW.

$ HARDCOPY

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$ # CONFIGURATION

Configuration includes defining the reference frequency, specifying units for data input, formatting the main output data file, defining some modes of program execution, etc., as well as defining default files for frequency, plane waves, near fields, and far fields.

Configuration can be accessed from the Main window Config menu. Options in this menu are to edit the four default files, one by one, as well as to perform the setup of all other items.

The contents of the default files is edited using the same procedures as in the Input Data window (except that the edited data are automatically saved as default files upon clicking OK).

The other items can be setup in the Setup dialog box.

See also MAIN WINDOW,
SETUP DIALOG BOX,
FREQUENCY INPUT,
PLANE WAVE INPUT,
NEAR FIELD INPUT,
FAR FIELD INPUT.

$ CONFIGURATION

id_49

$ # SETUP DIALOG BOX

The Setup dialog box can be accessed from the Main window Config menu or by clicking Setup button. It is used to define the reference frequency (used for wire loadings), specify units for data input, format the main output data file (*WIREOUT.DAT*), and define some modes of program execution.

- The **reference frequency** can be defined by editing the corresponding field. It is always specified in Hz. All other items are set up by clicking the corresponding radio button or checkbox.
- Available units for **coordinates** are: m, mm, foot, and inch.
- Available units for wire **radii** are: m, mm, foot, and inch.
- Available units for **frequency** are: Hz, kHz, MHz, and GHz.
- Available units for **electric field** are: V/m, mV/m, and μV/m.
- **Complex numbers** can be treated as rms or peak values.

Formatting *WIREOUT.DAT* consists of enabling or disabling writing the following groups of data:

- input data,
- automatic segmentation data,
- coefficients of polynomial approximation,
- near fields,
- far fields.

Formatting file *WIREOUT.DAT* does not affect the contents of the remaining output data files.

Available to tailor the program **execution** are the following options which can be enabled or disabled:

- **sequential questions** about file loading and defining the operating mode and ground plane upon entering the Input Data window; and about file saving and computing after the analysis is requested,
- program **execution** in the **background**,
- **automatic display** and update of the sketch of the wire structure while data are edited in the Input Data window.

Click **OK** to save the setup in the file *CONFIG.DAT* or **Cancel** to leave the setup unmodified.

See also MAIN WINDOW,
OUTPUT FILES,
INPUT DATA WINDOW,
ANALYSIS.

$ SETUP DIALOG BOX

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$ # INDEX

$ INDEX

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