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SUMMARY OF YAGI/WIN

The YAGI/WIN program models the performance of Yagi type antennas in free space. The program runs in Windows environment, allowing for interactive changes of design and display parameters. With a sufficiently fast processor and video controller, you may practically animate the display of radiation patterns. The program output, such as radiation patterns, plot of gain or SWR vs. frequency or lists of antenna design parameters, can be conveniently printed out. That output can also be stored in the internal clipboard files for insertion to other programs. The mathematical basis used in this program follow the model described in the series of articles on Yagi antenna design by James L. Lawson in *Ham Radio Magazine* in 1980, which were subsequently published by ARRL in a book form.

To start the design process, refer to [Antenna Modeling](#) section in this guide.

Restrictions and limits

Number of elements: The maximum number of elements accepted by the YAGWIN program is 15.

Element lengths: The program uses certain approximations in calculating the self and mutual impedances of the antenna elements. These approximations are valid only if the elements lengths are close to the half wavelength. While the program will accept any length of the element, the element lengths should be within 0.38 - 0.52 wavelengths. Otherwise, the results may be invalid.

PROGRAM WINDOW

Immediately after the program has been loaded, the copyright box will be displayed for about four seconds. Initially, the window will consist of the menu bar located at the top of the screen, and the blank display area. You will select the program actions by clicking the mouse pointing device on the menu selections. Alternately, you may use the combination of the Alt key and the character key indicated by the underline. For example, instead of clicking on the "File" menu selection, you may press the Alt and "F" keys simultaneously.

As soon as you start the modeling process, the blank area of the screen will be divided into three functional windows: Display Screen, Design Data and Antenna Characteristics Summary. In the modeling process you will be changing the values in the Design Data window and observe the results in the Display Screen and Antenna Characteristics Summary windows. The type of data displayed in the Display Screen and the display units can be set by the Options selection. By default, the radiation pattern will be displayed, and the units will be English (inches).

MODELING THE ANTENNA

The modeling process starts with the initial definition of antenna parameters. You can either load the existing antenna data file (such as provided with this program), or create a new set of data.

Entering the Antenna Design Parameters

Click on the "File" menu selection (or Alt -F), and then select "Open" or "New" respectively. If you select "Open" , a dialog box will appear listing the names of antenna files. Select the file by double clicking on the name with the mouse pointer. If the selection is "New", the dialog box will appear, asking for a number of elements in the antenna. After you enter the value, another box will appear with the default values for the design frequency, element diameter, and positions and lengths for each element. Modify the values, as desired, for the initial calculation. The antenna characteristics will be automatically calculated and displayed for these initial values.

Changing the Design Parameters

Now, using the Design Data window, you may change any of the antenna parameters. You can watch the changes on the Display Screen and the Antenna Characteristics Summary windows. Using the selection in the Options menu, you can display the azimuthal field pattern, forward gain together with F/B ratio as function of frequency or SWR as function of frequency. At any time during the modeling, you may print out the content of the Display Screen or save it to a bitmap.

Saving the Design Parameters

At any time during the modeling you may save the current set of antenna design parameters.

Automatic Optimization

One of the features of the program, is an optimization of antenna design parameters. The program will automatically optimize the antenna performance, using the Lawson criteria, for the given design frequency, number of elements and the element diameter.

Rescaling

Another program feature is rescaling the antenna parameters to obtain the same performance for different design frequency or different element diameter.

MODIFYING THE DESIGN PARAMETERS

To change the design or working frequency or to change the element diameter:

- Click on the appropriate parameter box with the mouse pointer,
- enter or modify the value,
- press "Enter" key.

To modify the length and/or position of any of the elements:

- Select the element by clicking on the appropriate element selector pushbutton (the selected button will be highlighted),
- use the scroll box to modify the position or length of the selected element in increment units. The scroll arrows will change the length or position in single increment units, the scroll bars in five increment units. The scroll button will set it to any value in the range . The modified values will be displayed in the parameter boxes.
- Alternately, you may enter the position or length directly into the parameter box by clicking on it, entering the value and pressing "Enter" key.

Note: The element lengths should be within 0.38 - 0.52 wavelengths. Otherwise, the results may be inaccurate.

CHANGING THE DISPLAY SCREEN CONTENTS

The Display Screen window can display the following:

- Azimuthal radiation pattern,
- Forward gain and F/B ratio as function of frequency,
- SWR as function of frequency,
- Antenna design data.

To select the display, click on the "Options" followed by the "Display mode" menu selection. Select the option by clicking on it.

The range of frequencies for which the Gain, F/B ratio and SWR is calculated may be separately adjusted.

CHANGING THE DISPLAY UNITS

The units of displayed or entered design values may be expressed in:

- English units (inches),
- metric (m, mm),
- design frequency wavelengths and English for element diameter,
- design frequency wavelengths and metric for element diameter.

To make a selection, click on the "Options" and then on the "Display units" on the menu bar. You will get the dialog box listing the selections. Click on the appropriate radio button followed by the "OK" pushbutton.

CHANGING THE INCREMENT UNITS

The increment unit on the slide bar is by default 0.02 wavelength. To change this value, click on the "Option" and then on "Increment units". In the dialog box which will appear, click on the data box and enter a new value, followed by the "OK" pushbutton.

CHANGING THE FEEDLINE IMPEDANCE

The feedline characteristic impedance affects the SWR display only. By default, this value is set to 50 ohms. To change this value, click on the "Options" followed by "Feedline impedance". In the dialog box which will appear, click on the data box and enter a new value, followed by the "OK" pushbutton.

RESCALING THE ANTENNA PARAMETERS

The rescaling procedure creates a new set of design parameters that produce the same performance characteristics as the existing antenna, but for the different design frequency and/or element diameter.

Once you arrived at the design you like, or read the selected antenna data file, click on the "Rescale" menu selection. The dialog box will appear with the current design frequency and element diameter. Modify the appropriate value(s) and click on the "OK" pushbutton. The new antenna parameters will be automatically calculated and displayed. The new antenna performance will be identical to the original antenna, with the exception of the imaginary component of the input impedance. You may adjust this value by changing the length of the driven element of the new antenna.

PRINTING THE DISPLAY SCREEN

The content of the display screen (radiation patterns, gain, SWR or design parameters) can be printed on the printer attached to the computer. Click on the "File" and then on "Print Display Screen" menu selection. The appropriate Windows device driver will print the the display screen.

SAVING THE DISPLAY SCREEN TO BITMAP

The content of the display screen (radiation patterns, gain, SWR or design parameters) can be stored on the bitmap file. This allows some other graphic programs, such as CorelDraw, to annotate the image produced by the YAGI/WIN. Also, the bitmap files can be incorporated into a variety of word processing programs.

To save to a bitmap, click on the "File" and then on "Save Screen to Bitmap" menu selection.

AUTOMATIC ANTENNA OPTIMIZATION

You can allow the program to optimize the antenna design parameters (element positions and lengths) for the given design frequency, number of elements and element diameter. The program uses the criterion given by Lawson in the series of articles published in *Ham Radio Magazine*. To optimize, select the initial antenna parameters, and then click on "Optimize" menu selection.

SAVING THE DESIGN PARAMETERS

To save the current antenna design parameters, click on "File" and then on "Save design data" menu selection. When the dialog box appear, click the pointer on file name box, enter the name under which you wish to store the antenna parameters and press the "OK" pushbutton or "Enter" key.

STANDING WAVE RATIO (SWR)

The standing wave ratio is calculated as a function of frequency, assuming that the feedline is connected **directly** to the driven element and there is no other matching network. You may change the feedline characteristic impedance using "Options" menu. You may also change the range of frequencies for which the SWR is calculated.

DESIGN FREQUENCY

The design frequency f_0 is defined as the center frequency for the antenna under design. All the element lengths and spacings are recalculated upon entry in terms of design frequency wavelength and kept by the program. Thus, the **actual** element lengths and spacings will be automatically **modified** whenever the design frequency is changed.

WORKING FREQUENCY

The working frequency f_w , is the frequency at which the antenna performance is calculated. By default, the *initial* working frequency is equal to the design frequency.

FREQUENCY RANGE

The frequency range value is used in calculation of Gain vs. frequency or SWR vs. frequency characteristics. In this program, it is expressed in terms of percent of the design frequency. By default, this value is equal to 20 percent. To change this value, select from the main Menu, Options and then the Frequency Range. The dialog box will appear which will include a slide bar control. Use either slide buttons, slide bar or thumb position to change the percent value, which will appear to the left of the slide bar. Press the OK button to confirm your selection.