ENGINEERING EQUATION SOLVER

Creating Lists and Graphing Data

To begin using EES, click on **Start→All Apps→ E→ EES (folder) →EES**.

Example:

There are two parallel connected resistors, Ra and Rb, across an ideal E=12V DC power supply. The resistance of Ra is to be varied in 0.5 -ohm steps over the range from 0.5 to 10 ohms while Rb will have two distinct values, Rb1 = 1 ohm and Rb2 = 10 ohms. The following equations will apply:

E = I1 * R1
1/R1 = 1/Ra + 1/Rb1
E = I2 * R2
1/R2 = 1/Ra + 1/Rb2
Rb1 = 1
Rb2 = 10
E = 12

where **R1** and **R2** are the equivalent system resistance for the two different values of **Rb**, and **I1** and **I2** are the corresponding currents through the power supply. Curves of **I1** and **I2** as a function of **Ra** will be produced on one plot.

Procedures:

1. Click the **Continue** button to dismiss the initial dialog window.

2. Type in the set of equations shown above in the **Equations** window.

3. Under the **Options** menu, select the **Unit System** to set the correct unit in the calculation. Make sure that **SI** is selected here. Then click **OK**.

4. Under the **Calculate** menu, select the **Check/Format** command to check the syntax of the equations. A window should appear saying: "There are 7 equations and 8 variables. No syntax errors were detected." If a syntax error occurs check the equations for any errors in typing.

5. Under the **Options** menu, select the **Variable Info** command to check the guess values, units, and the lower and upper bounds for the variables. Make necessary changes if needed and click **OK**.

6. Under the **Tables** menu, select the **New Parametric Table** command. For this example, enter **20** as the **No. of Runs**. Select **Ra** from the **Variables in equations** list, then click on **Add >>** to add Ra to the **Variables in Table** list. Likewise, add **I1** and **I2** to the table, then click **OK**

7. To automatically enter the values of Ra from 0.5 to 10 in the **Parametric Table**, select **Alter Values** in the **Tables** menu. In the **Alter Parametric Table Values** dialog, enter **0.5** for the **First Value**, and **0.5** for the **Increment**, then click **OK**.

8. Under the **Calculate** menu, select the **Solve Table** command. In the **Solve Table** dialog window, enter **20** as the last run number and click **OK**. Calculated values for I1 and I2 will be displayed in the **Parametric Table** window.

Plotting:

1. Under the **Plot** menu, select **New Plot Window** and then **X-Y plot**.

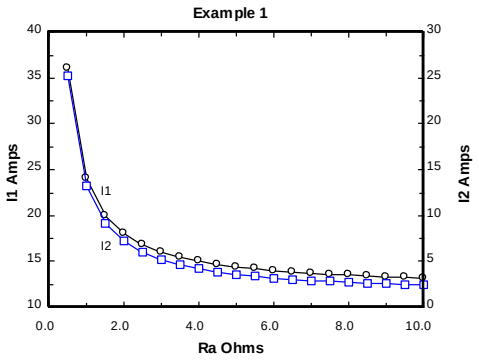
2. In the **New Plot Setup** window highlight **Ra** to select it as the **x-axis** and highlight **I1** to select it as the **y-axis**. Scale limits, grid lines, number of divisions, and line colors and symbols can also be changed in this dialog box if desired. Click **OK**; a plot will be displayed in the **Plot Window**

3. Under the **Plot** menu, select **Overlay Plot.** Choose **Ra** to be the **x-axis** and **I2** to be the **Y2-axis,** you can change this by switching *Y1 (left Y-scale)* to *Y2 (right Y-scale)* underneath the list of Y axis options, and click **OK** - curves of I1 and I2 as function of Ra will be produced on one plot.

4. If desired, select **Modify Axes** under the **Plot** menu to modify the axes

5. Double click on the x-axis label '**Ra**' in the **Plot** window and change it to **Ra Ohms**. Do the same thing to change the labels of both y-axes '**I1**'and '**I2**' to **I1 Amps** and **I2 Amps** respectively. The font and color of the labels can also be changed in this dialog.

6. In the Plot window, select **abc** button from the toolbar to enter a title and the names of the curves. Note: text can be moved anywhere on the graph simply by clicking on the title and dragging it to the desired position. The finished plot should look something like this:



Printing:

1. Under the **File** menu, select **Printer Setup** to choose the printer you want to use. For this plot make sure that **Landscape** mode is selected under **Orientation** for the desired printer.

2. Under the **File** menu, select **Print**. In the **Print** dialog box make sure an **check** appears in the check box corresponding to the windows you want to print, and the check boxes for the windows you don't want to print are clear. If you are printing multiple windows, have the **Page breaks** box checked to insert a page break between the different widows. Select **Formatted equations** to have the equations appear in mathematical notation. Click on **Print**. to send the plot to the printer.

Note: The EES program automatically prints a header at the top of each page of output.

Save and Exit:

1. Under the **File** menu, select **Save** to save the data to an EES file.

2. Under the **File** menu, select **Exit** to quit the EES program