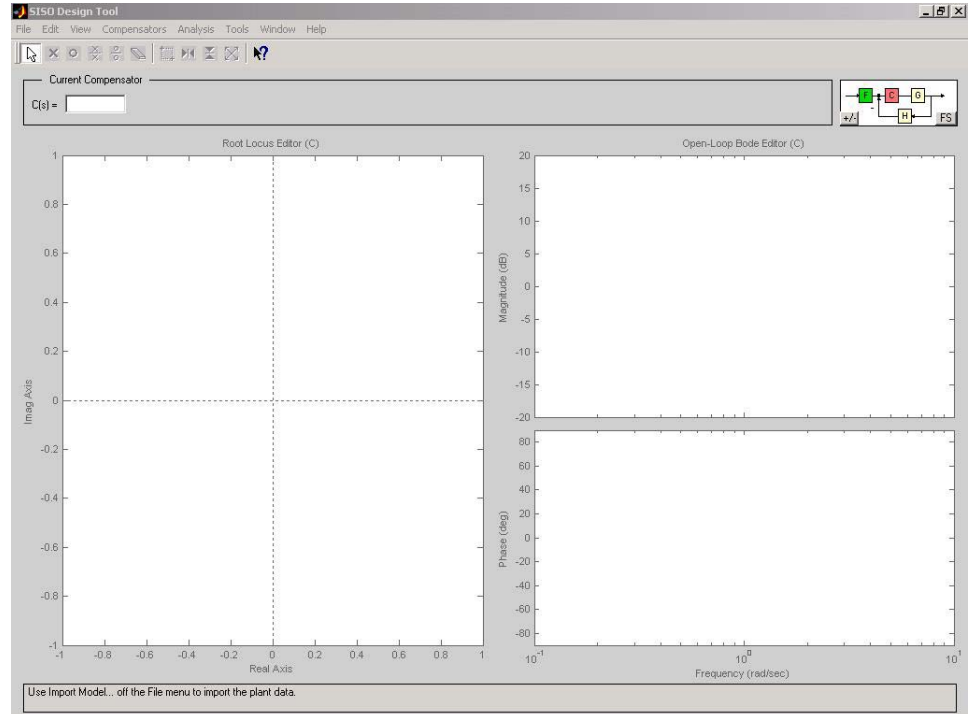


SisoTool Quick Tutorial

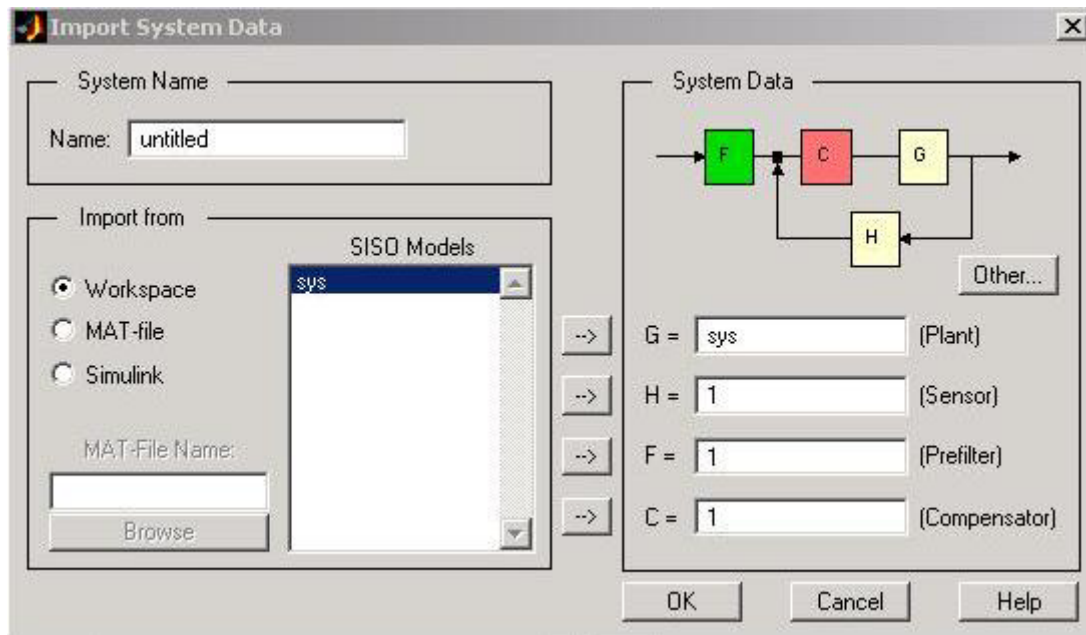
To start, you type **sisotool** (lower case) in the command prompt. You should get the screen on the right.

The plot on the left is the root locus, and the plots on the right are the magnitude and phase plots of the Bode diagram.

The plots are now empty because no model is imported yet.



To import $G(s)$, click on **import** under **file** menu on the top right. You should get the screen:

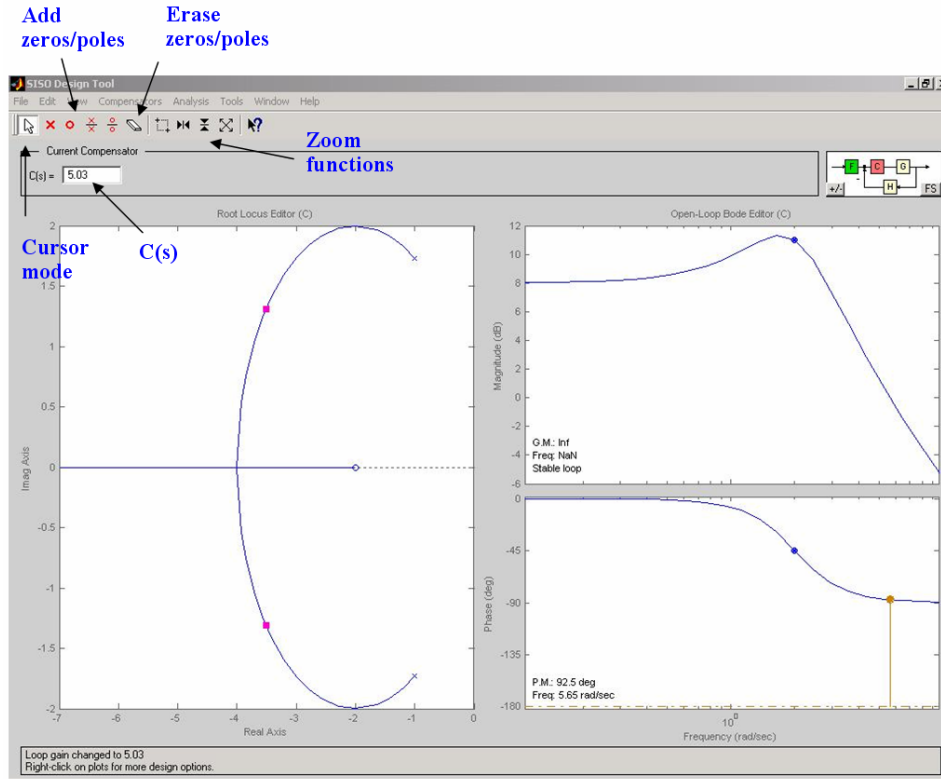


By default F, C, G, and H blocks are all set to one. You can set any of these blocks to a model of a plant you have set up by functions **tf**, **ss**, etc. in the workspace, MAT-file, or Simulink. Here this case the model **sys** has already been created in the workspace and imported to G block. Select the model of interest and use the arrow buttons in the middle to put them into F, C, G, or H blocks.

As an example, consider the plant transfer function:

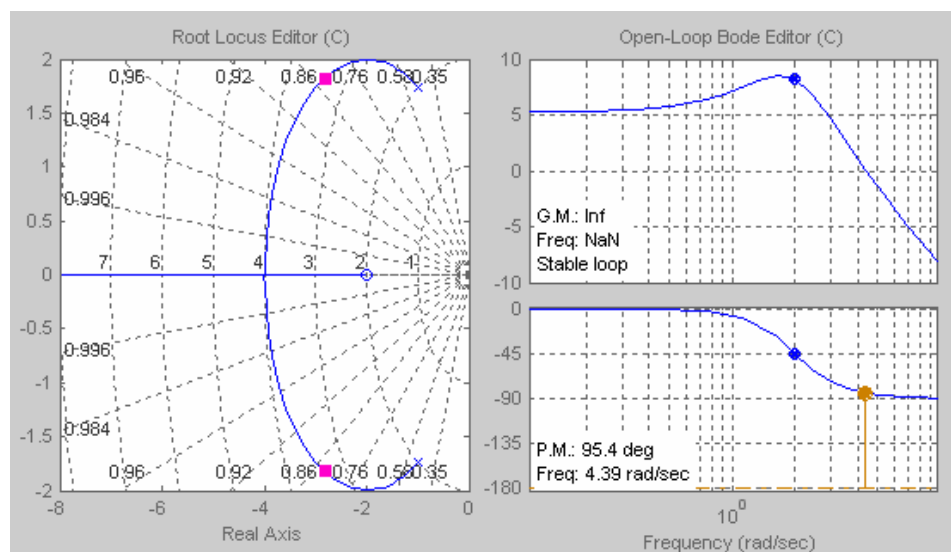
$$G(s) = \frac{s + 2}{s^2 + 2s + 4}$$

Let's input the above transfer function by typing `sys = tf([1 2],[1 2 4])` and import it to G from the workspace. Click OK and you get the following the root locus and the bode diagram shown below. You can move the red square around on the root locus to change the gain, and the Bode plots will adjust accordingly. You can also use the red "cross" and "circle" icons on the upper left hand corner to add extra poles and zeros (the double crosses/circles stand for complex conjugate poles/zeros). The eraser icon will delete the added poles or zeros (but not the ones already imported from the workspace).



The next four icons allow you to zoom in by boxing, zoom in horizontally or vertically, and zoom out. Right-click when the cursor is on either the root locus or Bode plot to select **grid** if you need it.

See, for example, the grid on the root locus, where the radial and circular lines are constant damping ratio and natural frequency contours respectively.

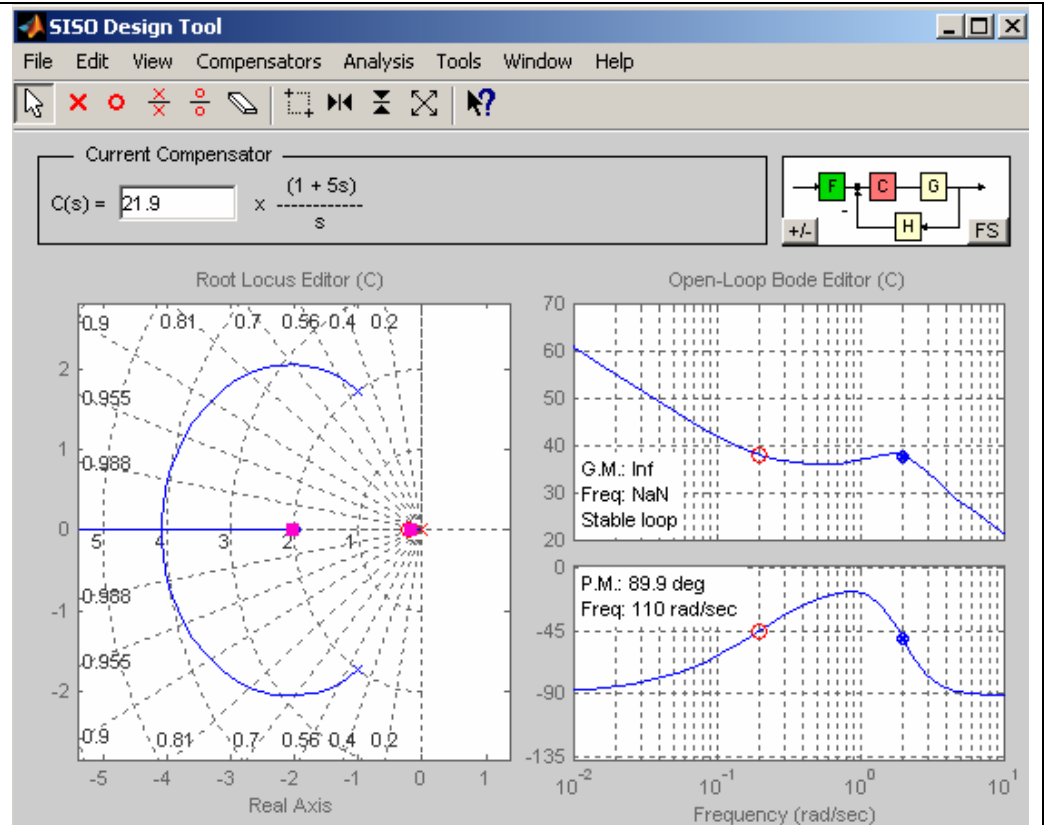


Notes:

- 1) The root locus is a locus describing the roots of the characteristic equation (of the unity-feedback system with the open-loop transfer function KGH) plotted on the s-plane as function of K.
- 2) The Bode diagram consists of two plots, the magnitude and phase of the open-loop transfer function KGH. You could however see a closed loop Bode plot by selecting Closed-loop Bode under the Analysis menu.
- 3) In the screen shown above, C=K (proportional controller) and H=1 (unity-feedback).

The ability to add/erase poles and zeros graphically is extremely handy when you are designing a control for a plant. In **sisotool**, G is assumed to be a given plant. The added poles, zeros and gains are for the C block (or the transfer function of the controller) under **Current Compensator**.

For example, a PI controller has been added – a pole at the origin and a zero at -0.2. The values can be edited by clicking the current compensator.



Sisotool is capable of much more. Here the tutorial will highlight a few of the more useful functions.

Response to Step Command (Located under **Analysis** menu): It gives the closed loop unit step input response of the system in question. It includes the output from the plant as well as the control signal coming from the control block C. It can be updated in real-time.

Rejection to Step Disturbance: (Located under **Analysis** menu): Similar to **response to step command** except it gives the closed-loop unit step disturbance response of the system in question. The disturbance signal is nominally injected between C and G block via a summation junction.

System Data (Located under **View** menu): It allows you to see the transfer function and properties of the transfer function you have already imported, in case you forgot.

Closed-Loop Poles (Located under **View** menu): It allows you to see the values of the closed-loop poles and closed-loop damping ratio and natural frequency where relevant.

Design History (Located under **View** menu): It records all of what you have done to the design of your system, allowing you to backtrack if necessary.