Matlab’s SISO tool (single-input/single-output tool)

The version I used was R2016b, but this may still be of some help for other versions.

3/9/19

The SISO tool can be used to draw and manipulate rool-locus plots of single-input / single-output systems. It is part of the Matlab Control System Toolbox.

To use the SISO tool, you first need to create the open-loop transfer function “object” in Matlab. There are several ways to do this, but I recommend this way:

1. Define the variable “s” as a special TF model `s = tf('s');`
   This only needs to be done once, after that any other expression of s will automatically be interpreted by Matlab as a transfer function.
2. Enter your transfer function as a rational expression in s For example, `G = s/(s^2 + 2*s +10);`
   Now G is a “transfer function object” of the transfer function $G(s) = \frac{s}{s^2 + 2s + 10}$

Now type: `sisotool(G)`

3. You can close the Bode plot views by: View -> Float . Now you can close the two Bode windows, leaving the Root Locus and Step Response windows. View -> Left/Right will return to larger windows.
4. The little red squares (or circles) on the root locus (RL) plot show the locations of the closed-loop (CL) poles. You can grab any of these and move then to a new location. Note how the other(s) move as well. Note the effects on the step response. Also note the information given at the bottom of the window as you grab the CL pole.
5. If you choose the ROOT LOCUS EDITOR tab, you can add a pole or zero to the real axis by: click X or O button –> click on plot where you want the pole or zero. You can later drag it left and right. You can erase it with the eraser tool. You can add complex poles or zeros using the buttons that look like x/x or o/o fractions.
6. If you right-click on the root locus plot, you can open “Edit Compensator” and see the gain as well as add, delete or change compensator poles or zeros. (Right-click within the “Dynamics” window to get options.) Note: Each time you add a pole or zero it adds it at -1. Then you have to select it and change the position. The new pole will not automatically be selected. (Big pain in posterior.)
7. If you’ve added any poles or zeroes, then you may have noticed that the format of the compensator is a bit weird. They are in a (1 - s/p) or (1 - s/z) form. To fix this and get gain numbers that will match mine, Choose the CONTROL SYSTEM tab –> Preferences -> Options, click the Zero/pole/gain option to change the format of the poles and zeros from (1 + s/p) to (s + p).
8. If you move any compensator poles or zeros into the right-half plane the gain suddenly becomes negative. I don’t know why or how to fix this, just keep it in mind. If you figure out how to eliminate this weirdness, let me know.
9. In order to effectively evaluate changes, you will need to inhibit Matlab’s constant rescaling of the plot: right-click anywhere on root-locus plot area –> Properties –> Limits –> uncheck the Autoscale boxes and set limits to match the aspect ratio of your window.

You can’t modify the Plant poles and zeros (at least as far as I know).

Play with this until you are ready to start the Homework.

Start Homework RL5. Read up through problem 1a and refer back to homework RL2. Back in the Matlab Command window, type: `G = 1` to create a very simple transfer function. That way all your poles and zeros can be manipulated in the SISO tool. type: `sisotool(G).` Reset you preferences as above (items 3, 7, & 9). (SISOtool used to have a way to import a new G, i don’t see that option anymore.) Add poles at 0, -2, and -4 so that C(s) = 1 x 1/s(s+2)(s+4). You are now ready to work problem 1a.

More information

Google, sisotool help and Matlab help.