Using Matlab SISOTOOL 2016 part 1

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http://controleducation.group.shef.ac.uk/indexwebbook.html

Introduction

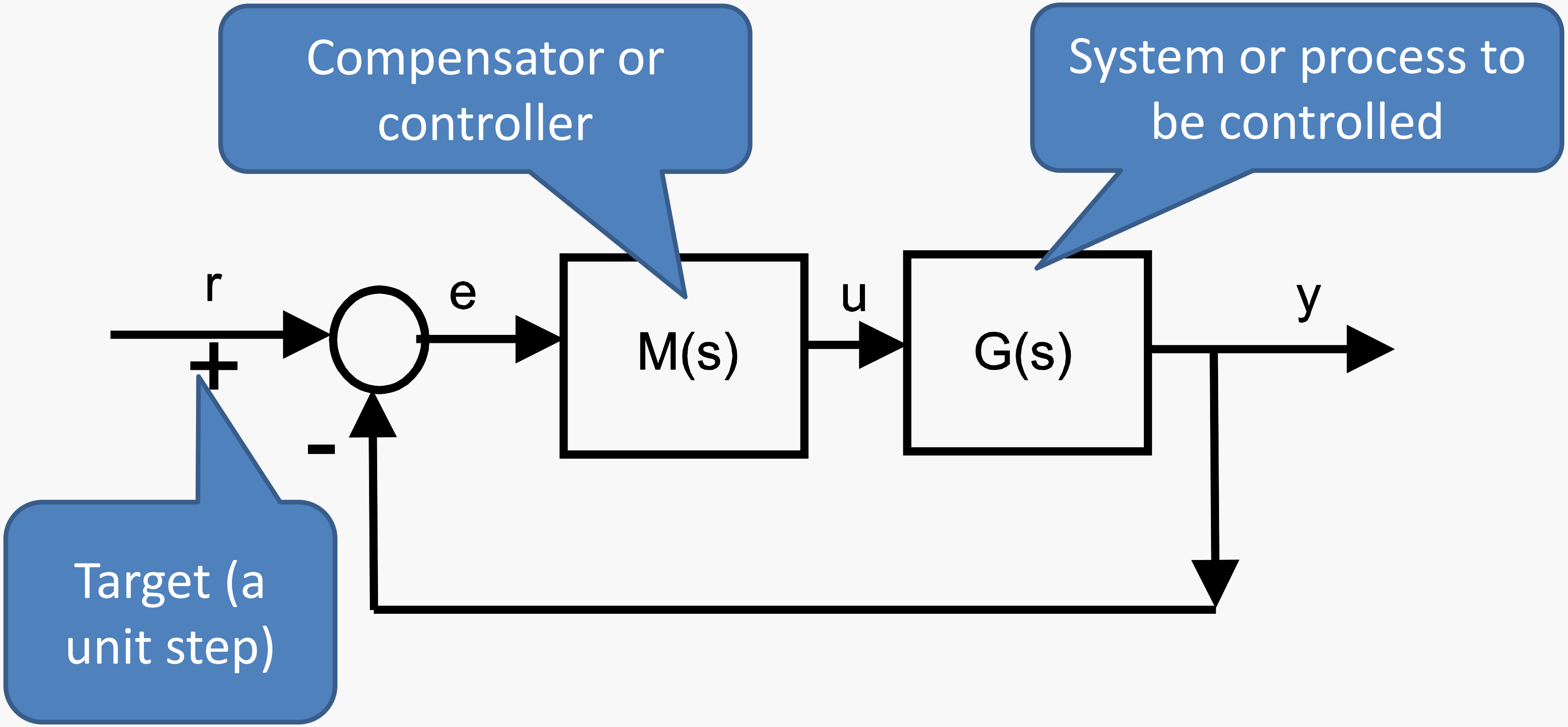
- Many earlier videos by this author use the original version of sisotool.
- However, there has been a relatively major change in the presentation and functionality of this tool in MATLAB 2016, so this resource gives a quick overview of the new tool.
- Focus is on students doing a single course in classical control methods such as Bode, Nyquist, gain and phase margins and lead and lag design.

Core skills

- Changing compensator gain by hand (drag) and explicitly (enter a number).
- Interactive views as all plots update instantly as compensator changes are made.
- Changing compensator poles and zeros by hand (drag) and explicitly (enter a number).
- Overlaying step responses and frequency response graphs from different compensators.
- The first video focuses on views and options; the later ones deal with compensator design.

Assumptions

This resource assumes a simple feedback structure as follows (although sisotool will deal with more complicated structures).



Overview

First the slides outline the core skills and notation:

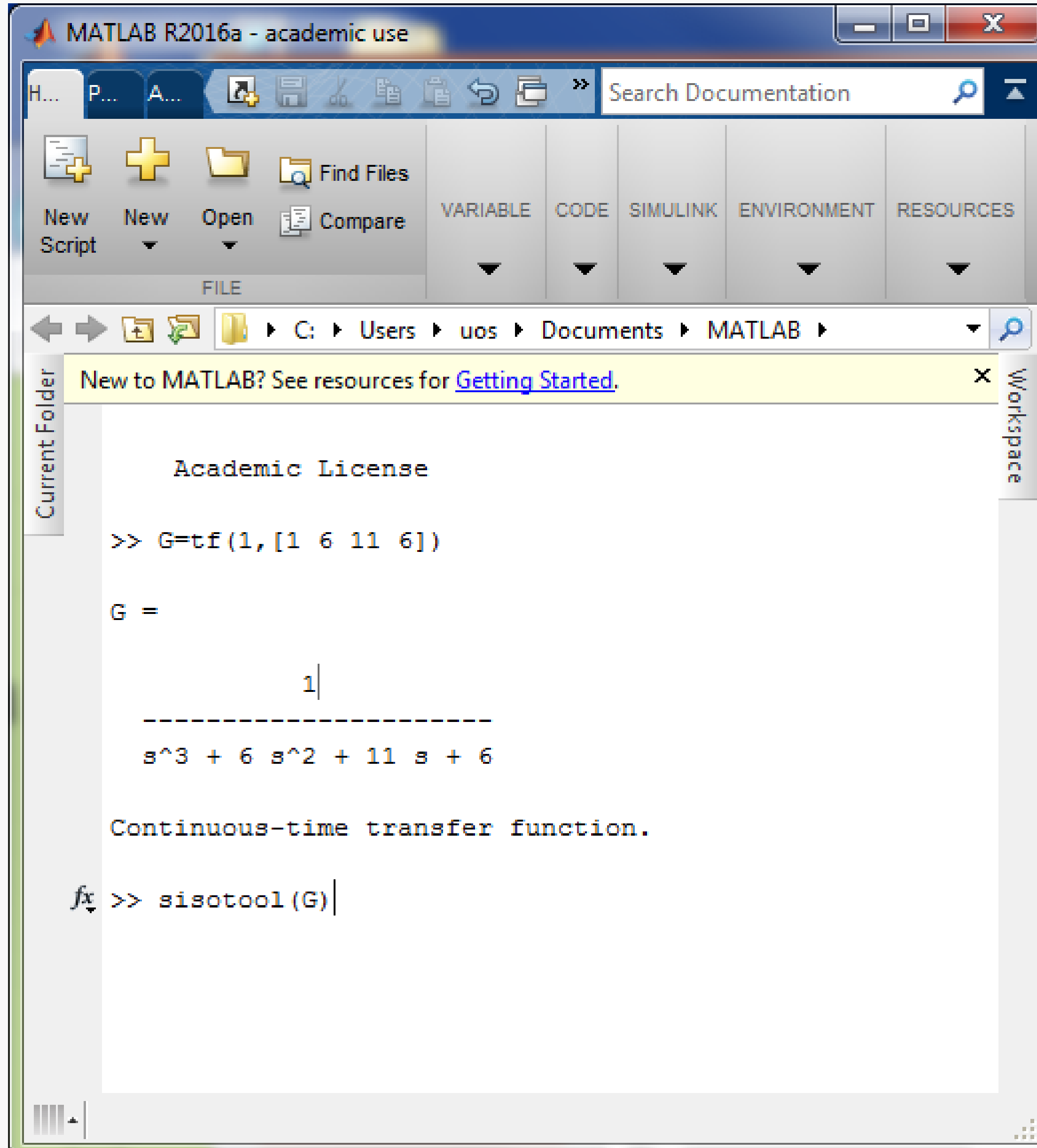
- Loop structure and naming assumptions.
- Obtaining core plots.
- Changing the compensator gain.

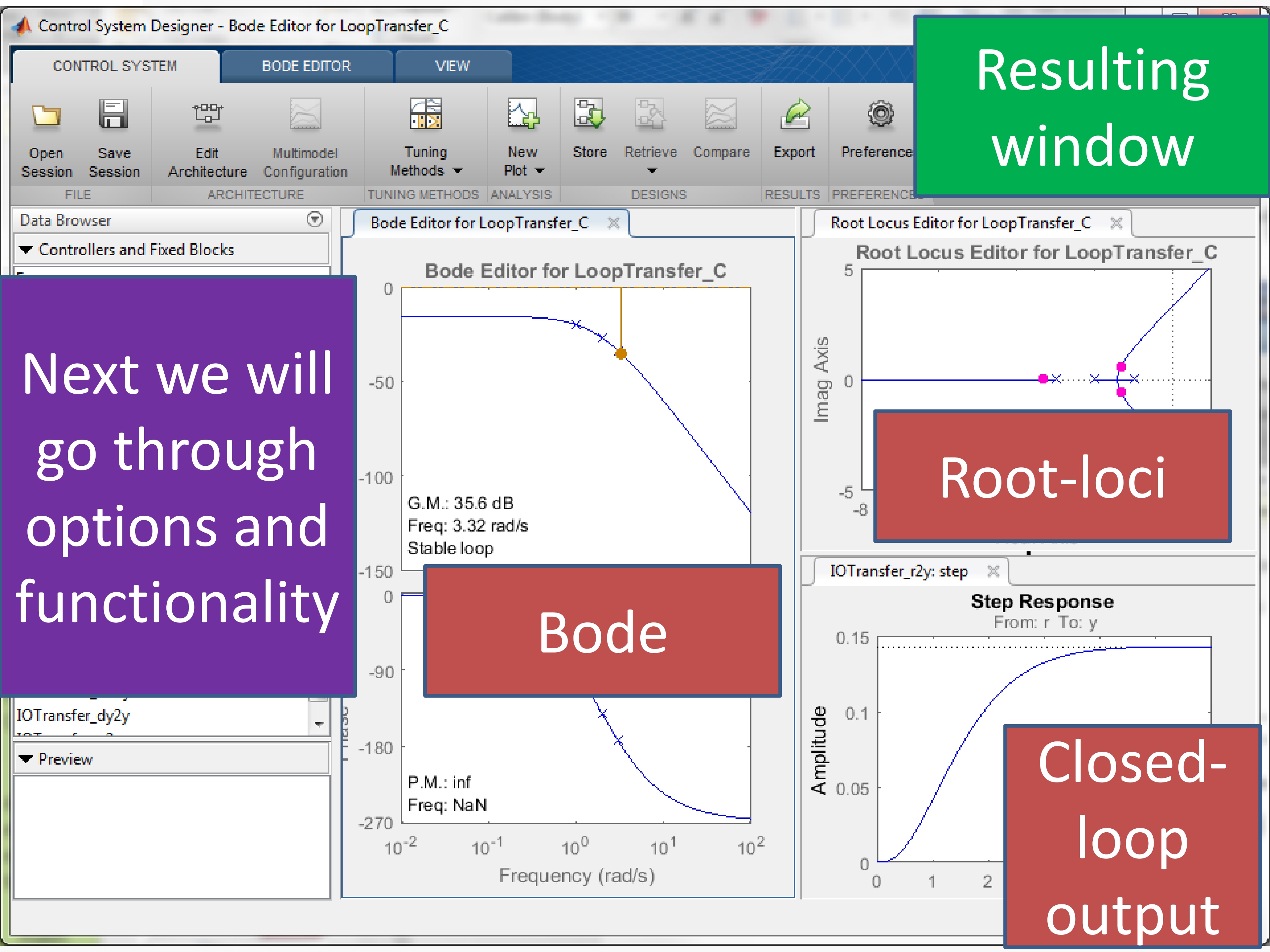
Secondly a live demonstration will be given on MATLAB.

Getting started

Define the system transfer function in the command window and then start sisotool as follows.

I tend to use G(s) as this is conventional and matches sisotool notation.

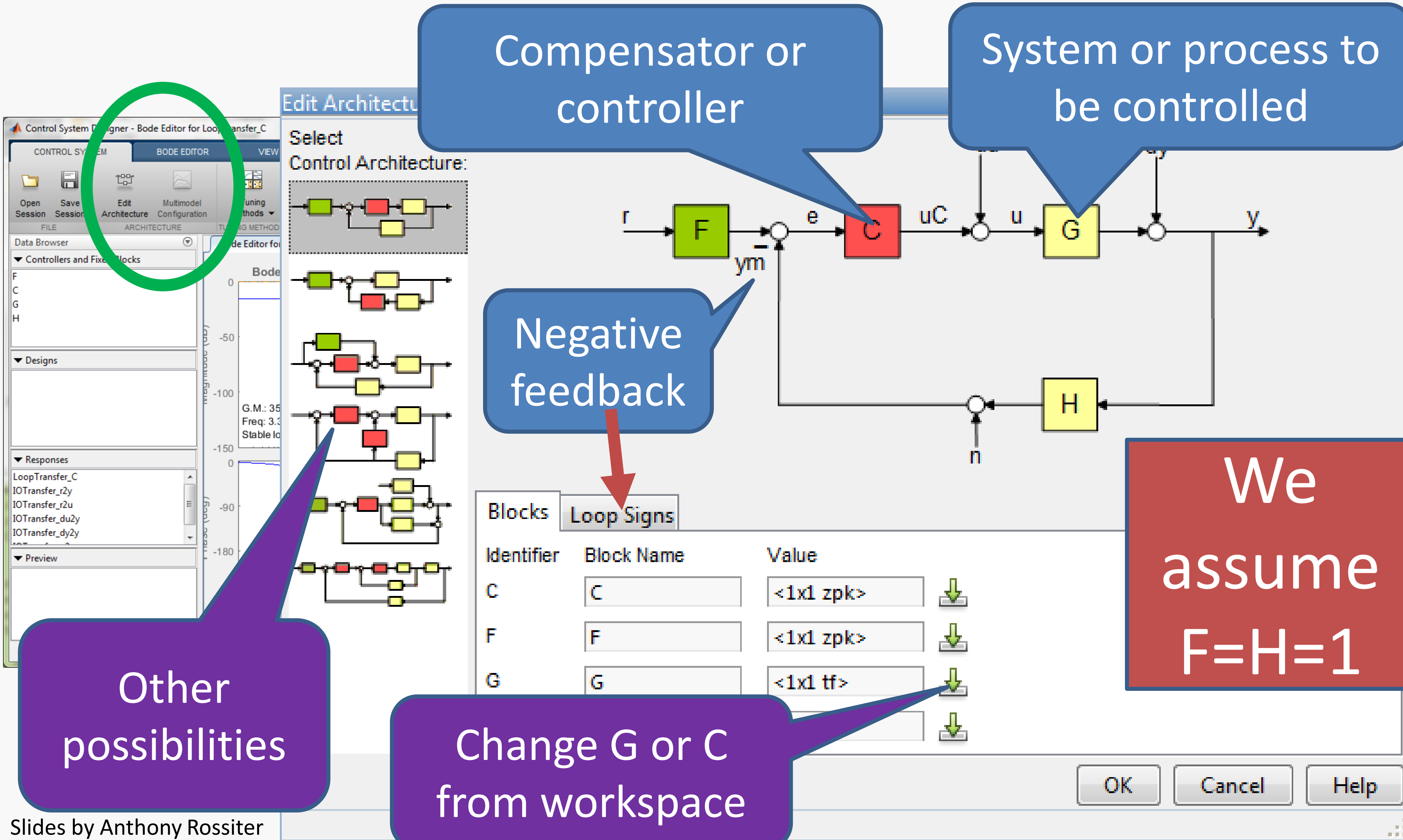




Control System Designer - Bode Editor for LoopTransfer_C
CONTROL SYSTEM
BODE EDITOR
VIEW
Open Session
Save Session
Edit Architecture
Multimodel Configuration
Tuning Methods
New Plot
Store
Retrieve
Compare
Export
Preferences
FILE
ARCHITECTURE
TUNING METHODS
ANALYSIS
DESIGNS
RESULTS
PREFERENCES
Resulting window
Data Browser
Controllers and Fixed Blocks
Next we will go through options and functionality
IOTransfer_dy2y
Preview
Bode Editor for LoopTransfer_C
G.M.: 35.6 dB
Freq: 3.32 rad/s
Stable loop
P.M.: inf
Freq: NaN
Frequency (rad/s)
Bode
Root Locus Editor for LoopTransfer_C
Imag Axis
Root-loci
IOTransfer_r2y: step
Step Response
From: r To: y
Amplitude
Closed-loop output

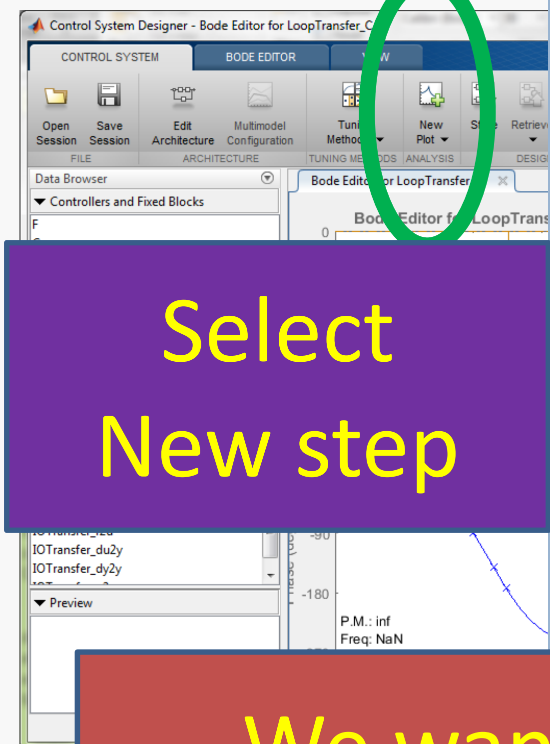
Loop structure assumed in sisotool

Options are available under the architecture tab.

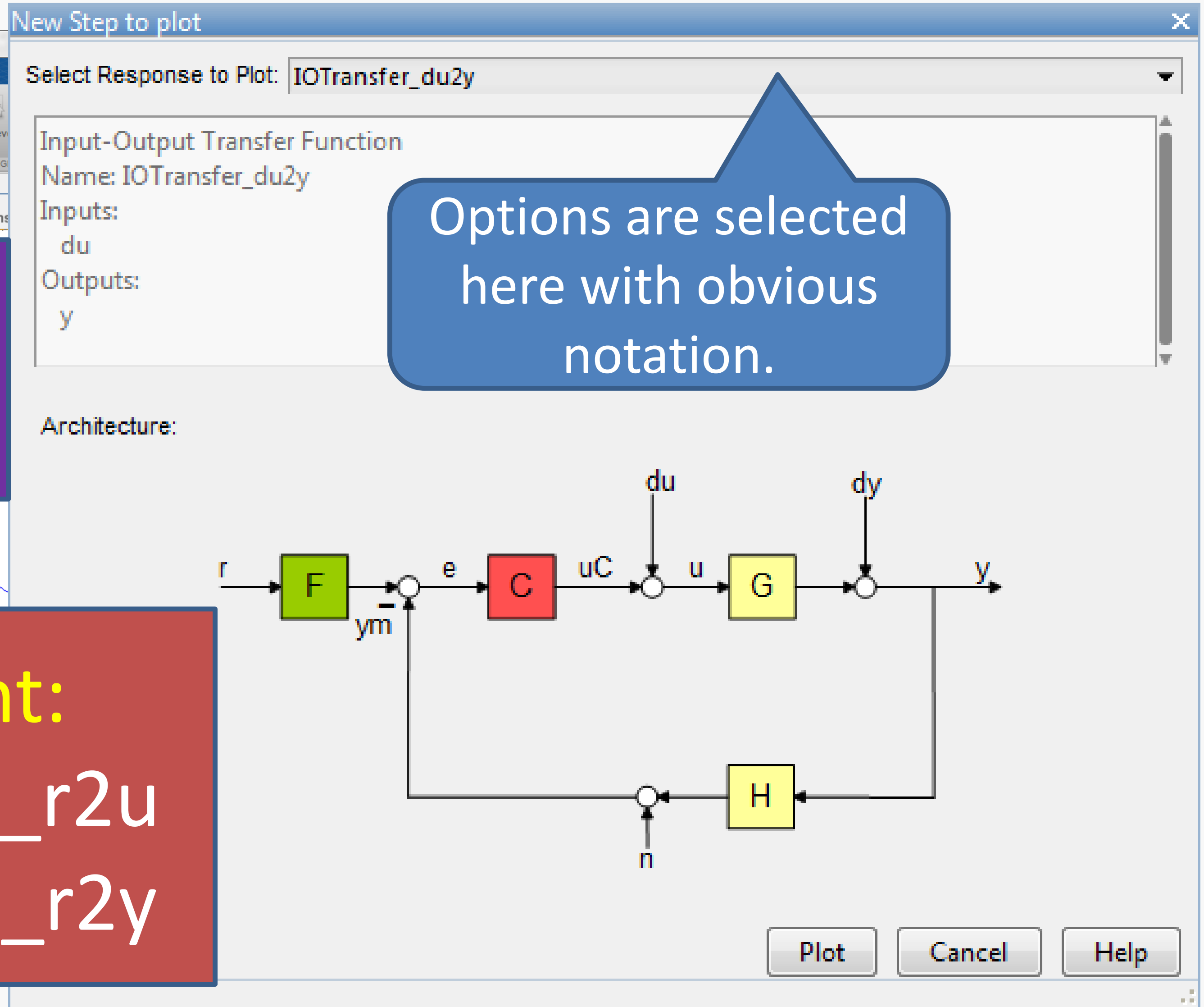


Viewing closed-loop input responses

These are available under the tab ‘new plot’

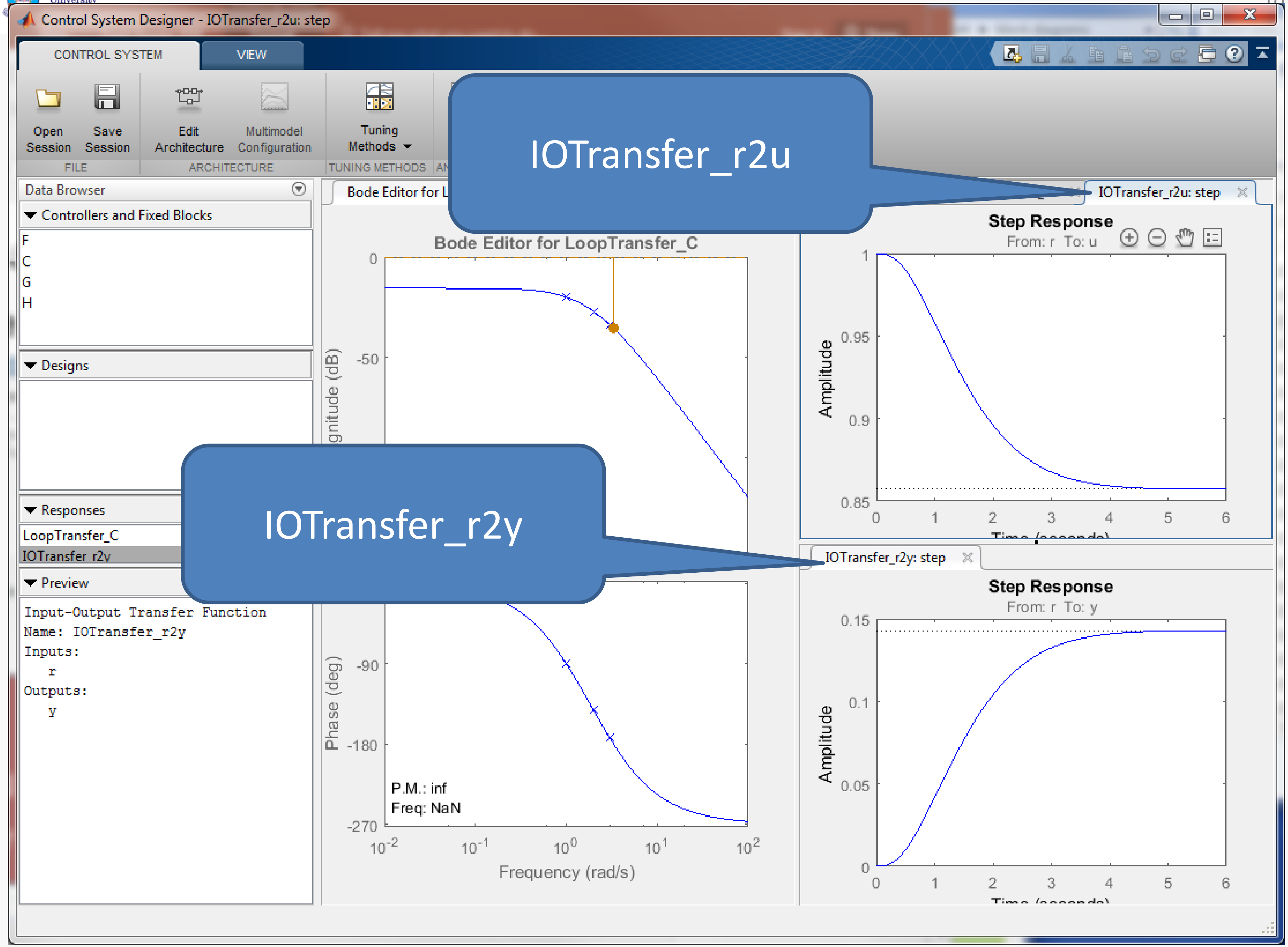


Select
New step



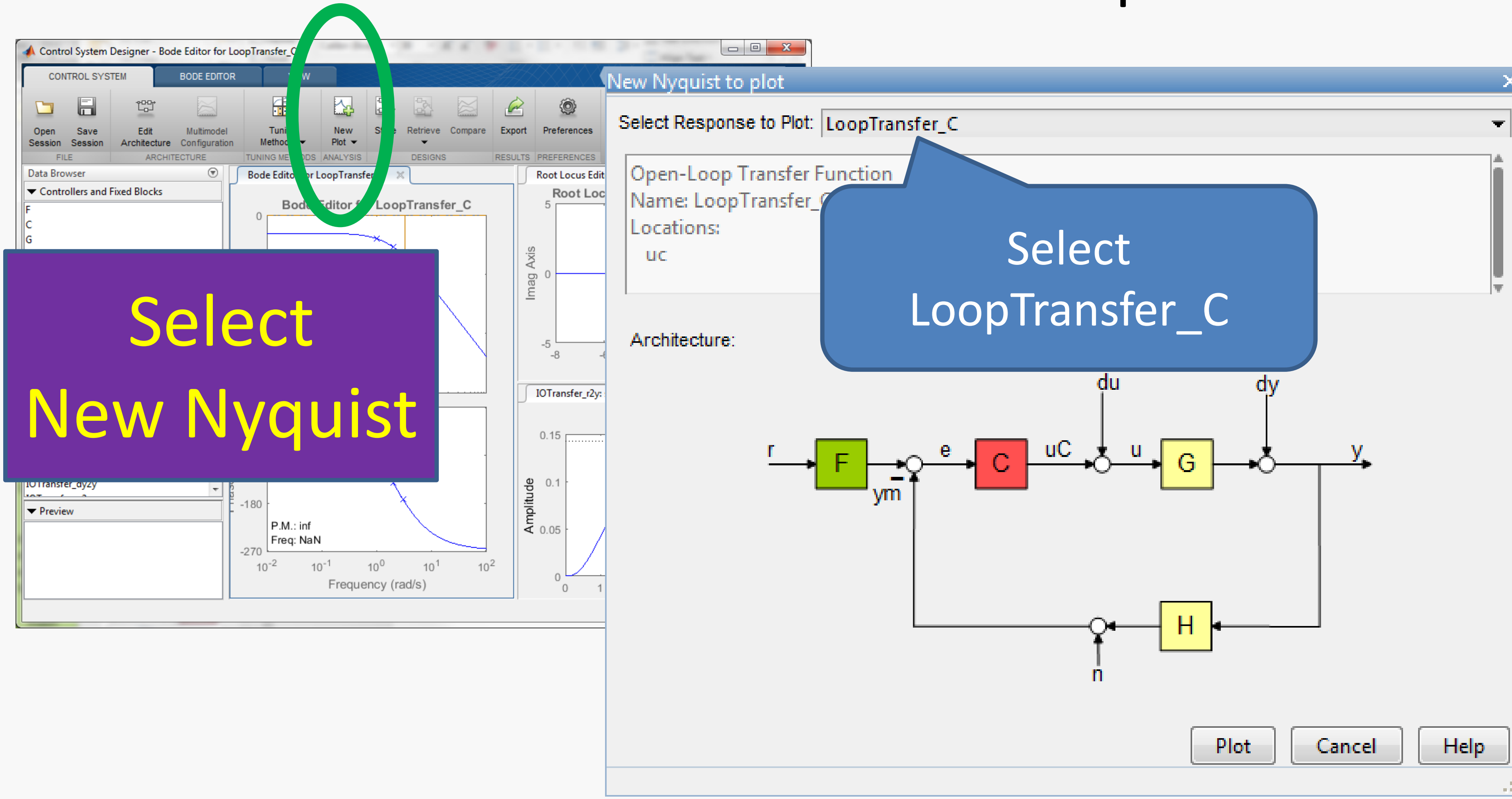
Options are selected here with obvious notation.

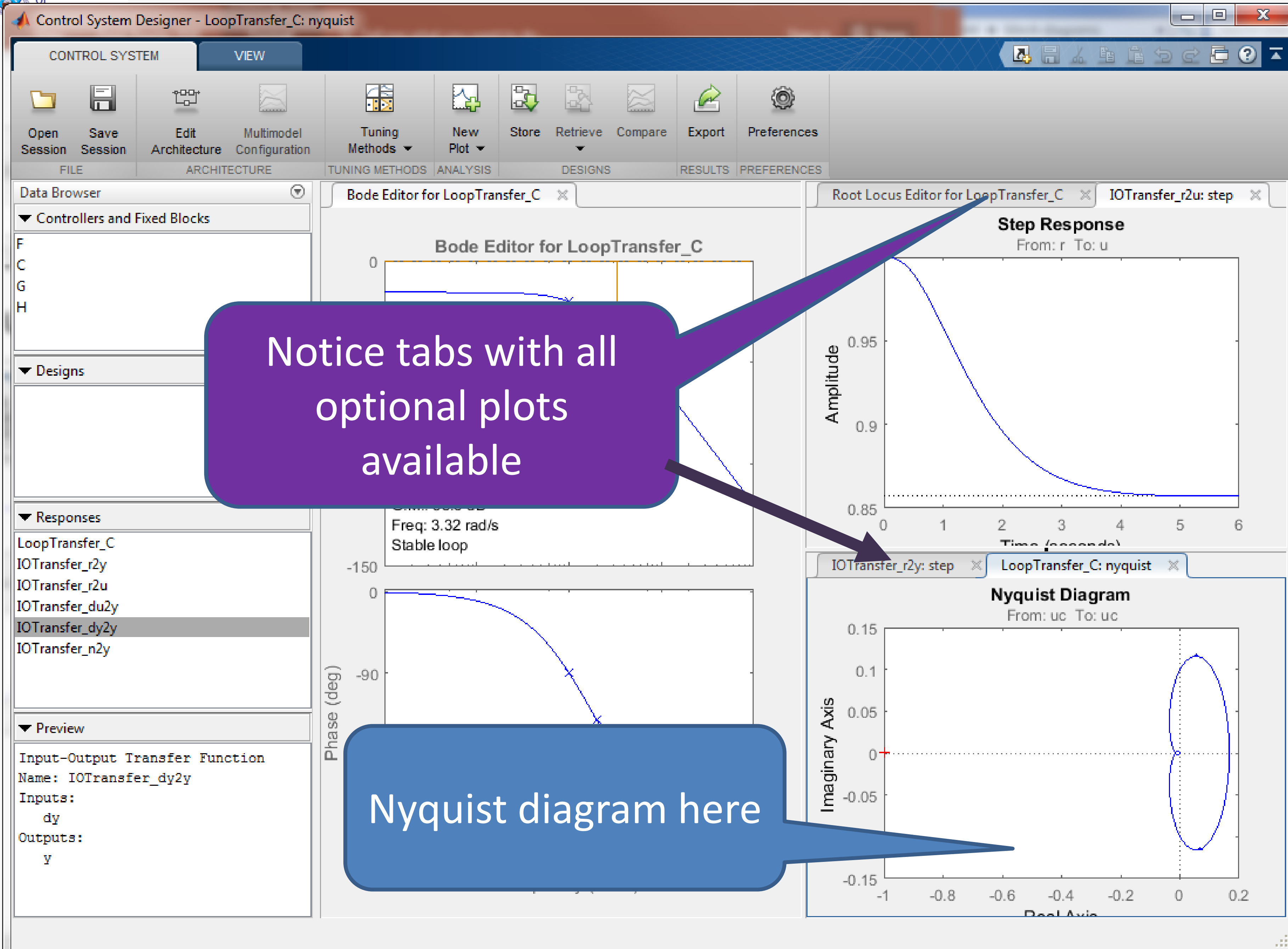
We want:
IOTransfer_r2u
IOTransfer_r2y


Control System Designer - IOTransfer_r2u: step
CONTROL SYSTEM
VIEW
Open Session
Save Session
Edit Architecture
Multimodel Configuration
Tuning Methods
FILE
ARCHITECTURE
TUNING METHODS
IOTransfer_r2u
IOTransfer_r2y
Data Browser
Controllers and Fixed Blocks
F
C
G
H
Designs
Responses
LoopTransfer_C
IOTransfer_r2y
Preview
Input-Output Transfer Function
Name: IOTransfer_r2y
Inputs:
r
Outputs:
y
Bode Editor for LoopTransfer_C
Phase (deg)
Frequency (rad/s)
P.M.: inf
Freq: NaN
IOTransfer_r2u: step
Step Response
From: r To: u
Amplitude
IOTransfer_r2y: step
Step Response
From: r To: y
Amplitude

Viewing Nyquist plots

These are available under the tab ‘new plot’





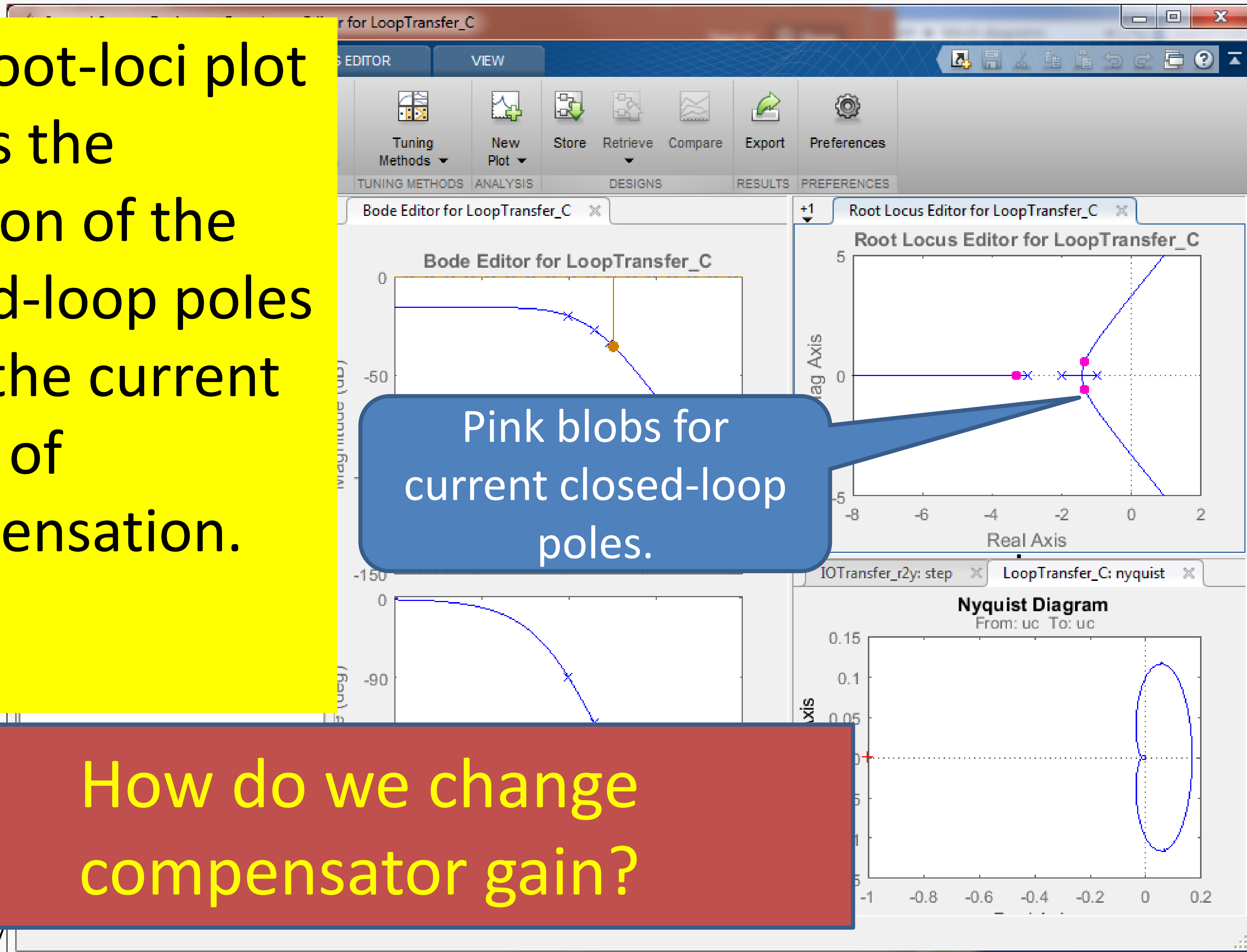
Notice tabs with all optional plots available

Nyquist diagram here

The University Of Sheffield.

Root-loci plot

The root-loci plot marks the position of the closed-loop poles with the current value of compensation.



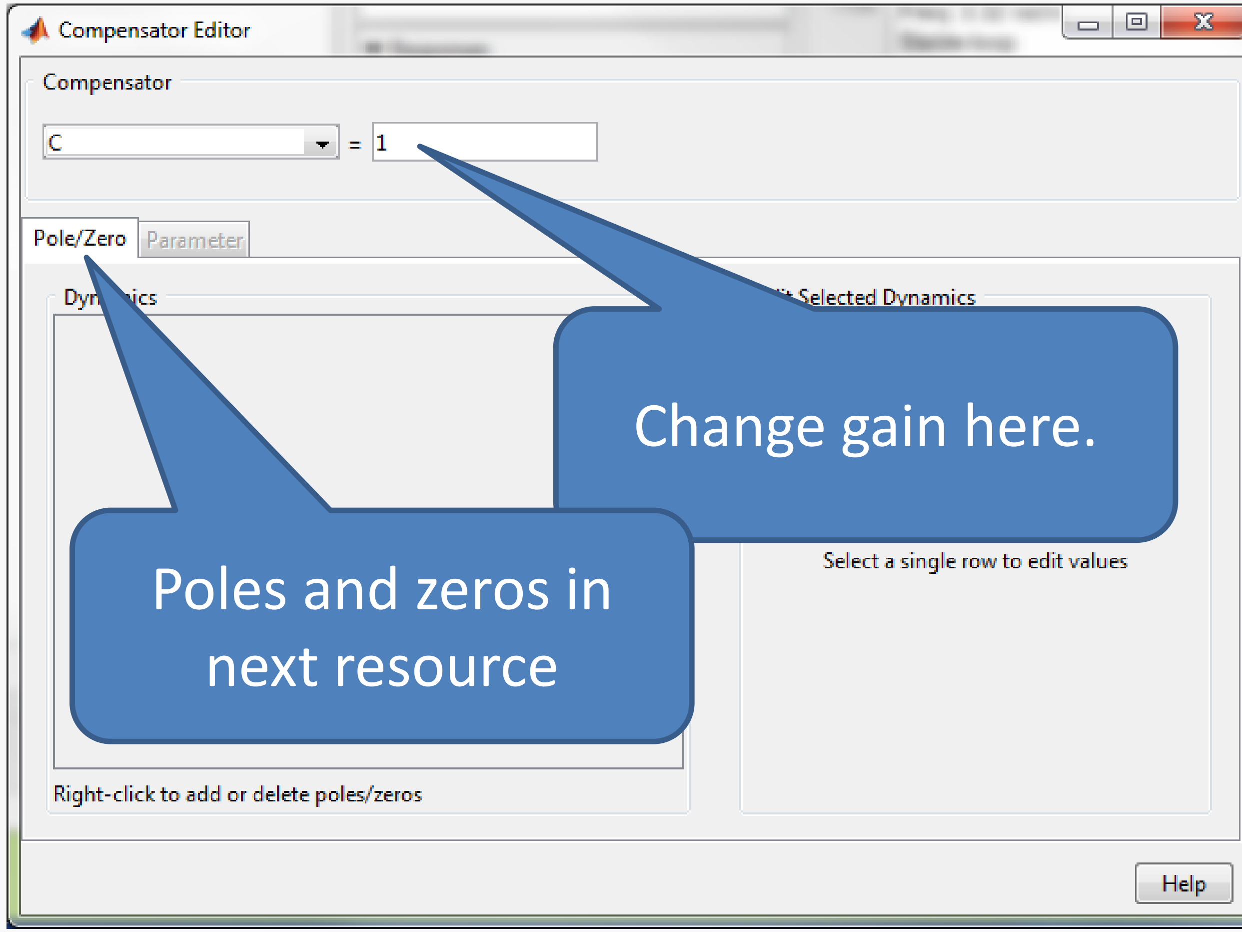
Pink blobs for current closed-loop poles.

How do we change compensator gain?

Compensator gain

Right click on the Bode diagram and select ‘edit compensator’.

The following appears.



Live demonstration

- Opening sisotool
- Adding closed-loop inputs
- Adding a Nyquist plot
- Changing the compensator gain.
- Importing a different G(s).

Conclusion

This short video has demonstrated the basic use of sisotool in MATLAB 2016.

We have not covered every option, but rather focussed on core functionality to support students doing a 1^{st} course in classical control.

The following videos show how to use the tool for comparing compensator designs and then doing design.

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