Using Matlab SISOTOOL 2016 part 3

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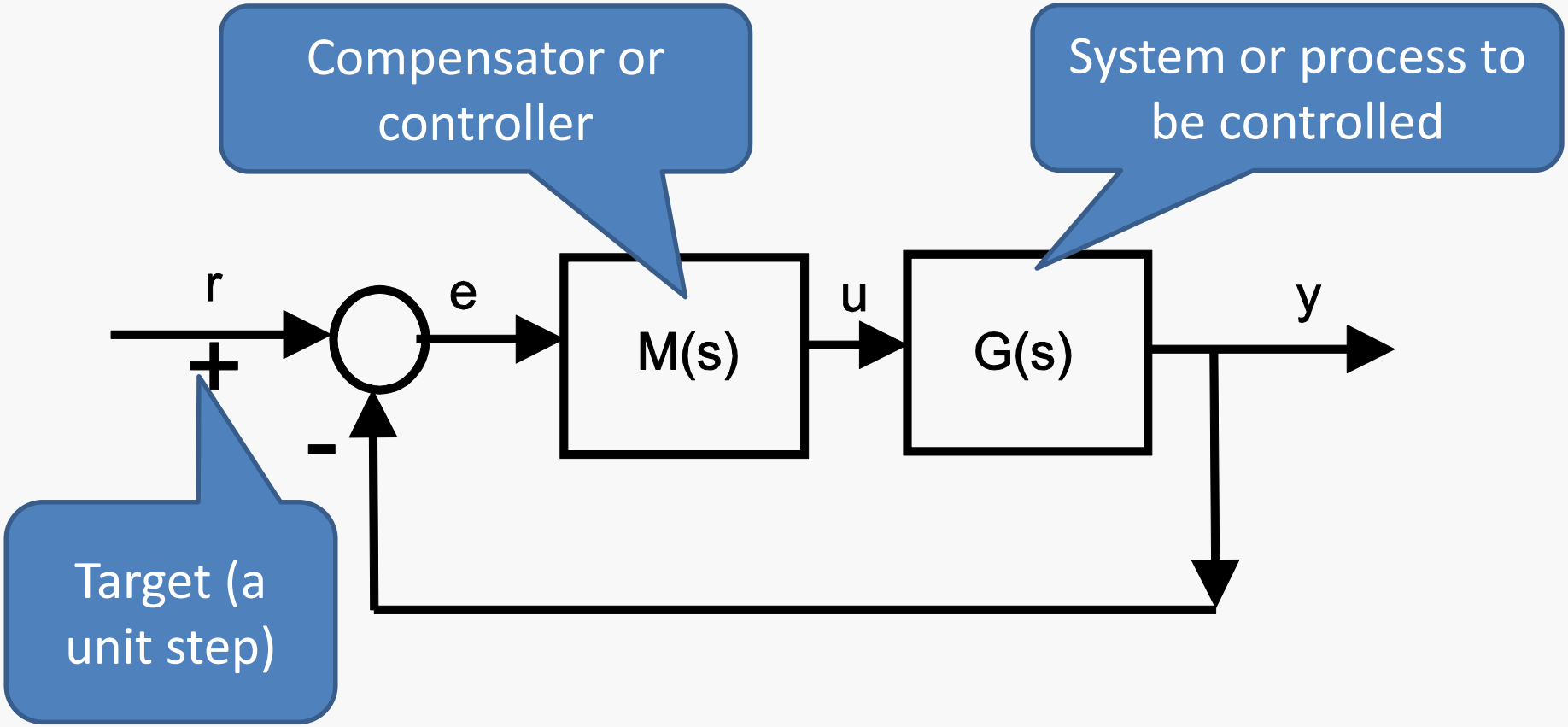
http://controleducation.group.shef.ac.uk/indexwebbook.html

Introduction

- There has been a relatively major change in the presentation and functionality of sisotool in MATLAB 2016.
- This resource gives a quick overview of how to do proportional compensator design.
- Principally, it demonstrates the drag facility, but also the ease with which fine tuning can be done via the compensator editor.
- Real time demonstrations are given at the end of the video.

Assumptions

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



Proportional design

A common requirement is to find the ‘best’ proportional compensator.

This may be true where the poles and zeros are pretty much in the correct place, or cannot be changed.

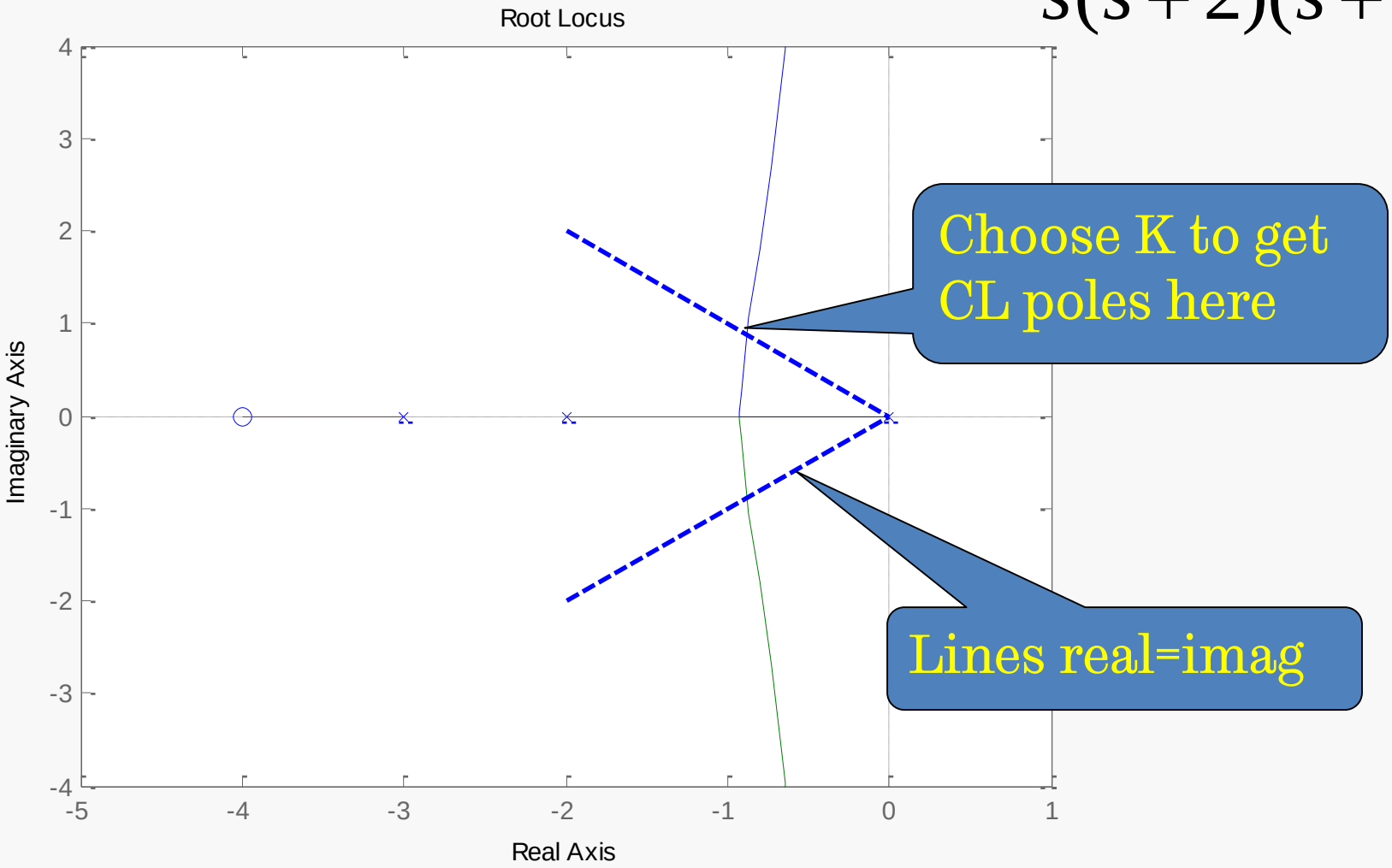
- One option is to design through the root-loci, that is to find a desired damping ratio for the dominant poles.
- A second option is to consider design via gain and phase margins.

The use of sisotool to support these design methods is demonstrated.

ROOT-LOCI DESIGN

Target closed-loop poles

$$G = \frac{(s+4)}{s(s+2)(s+3)}$$



Design via root-loci

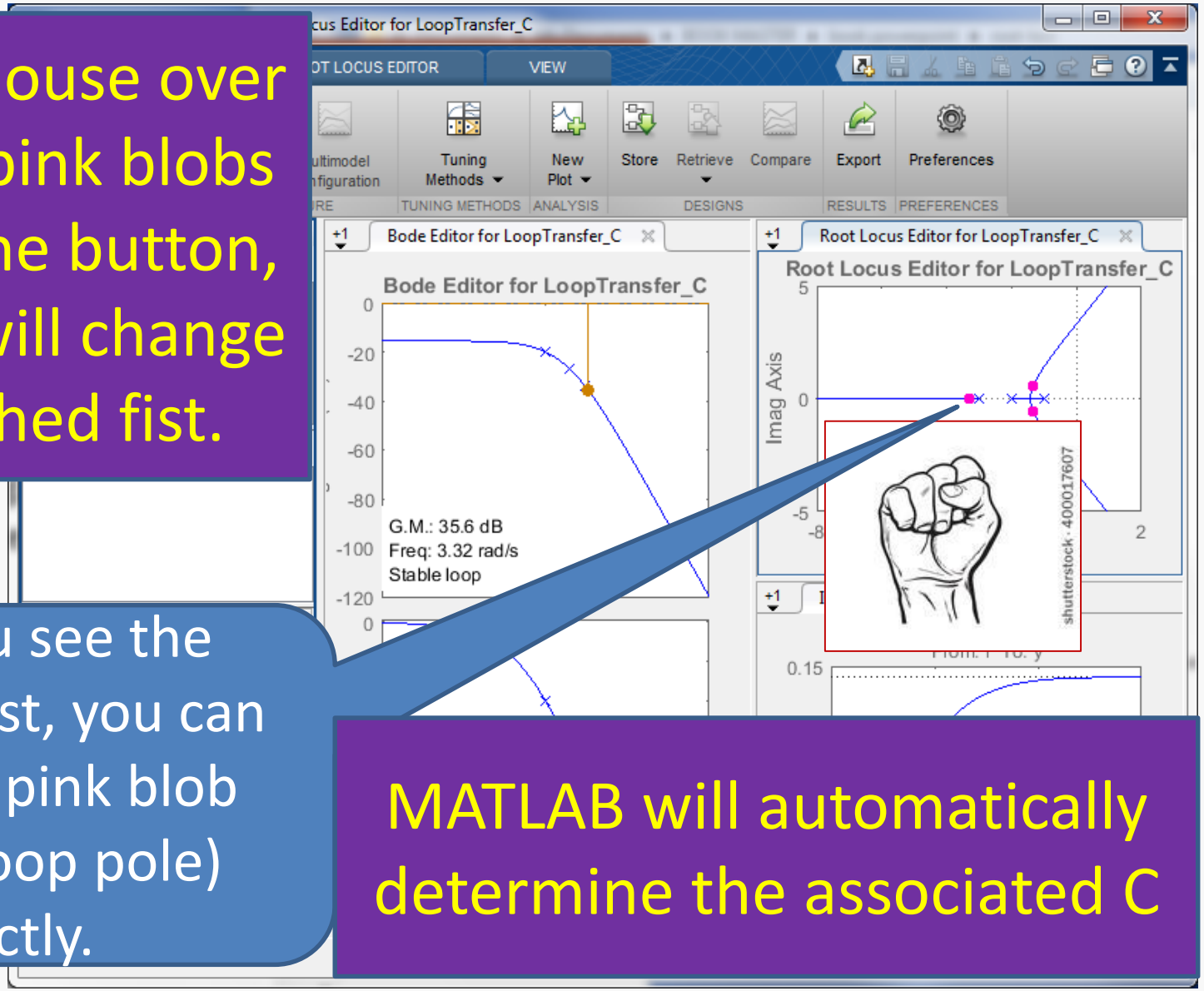
A common design method will aim for a damping ratio of about 0.7 as this maximises gain while keeping any oscillation to a reasonable minimum.

This is straightforward on sisotool due to:

- Drag of ‘closed-loop’ poles in root-loci plot.
- Direct entry of gain C in compensator editor.

Drag in root-loci plot

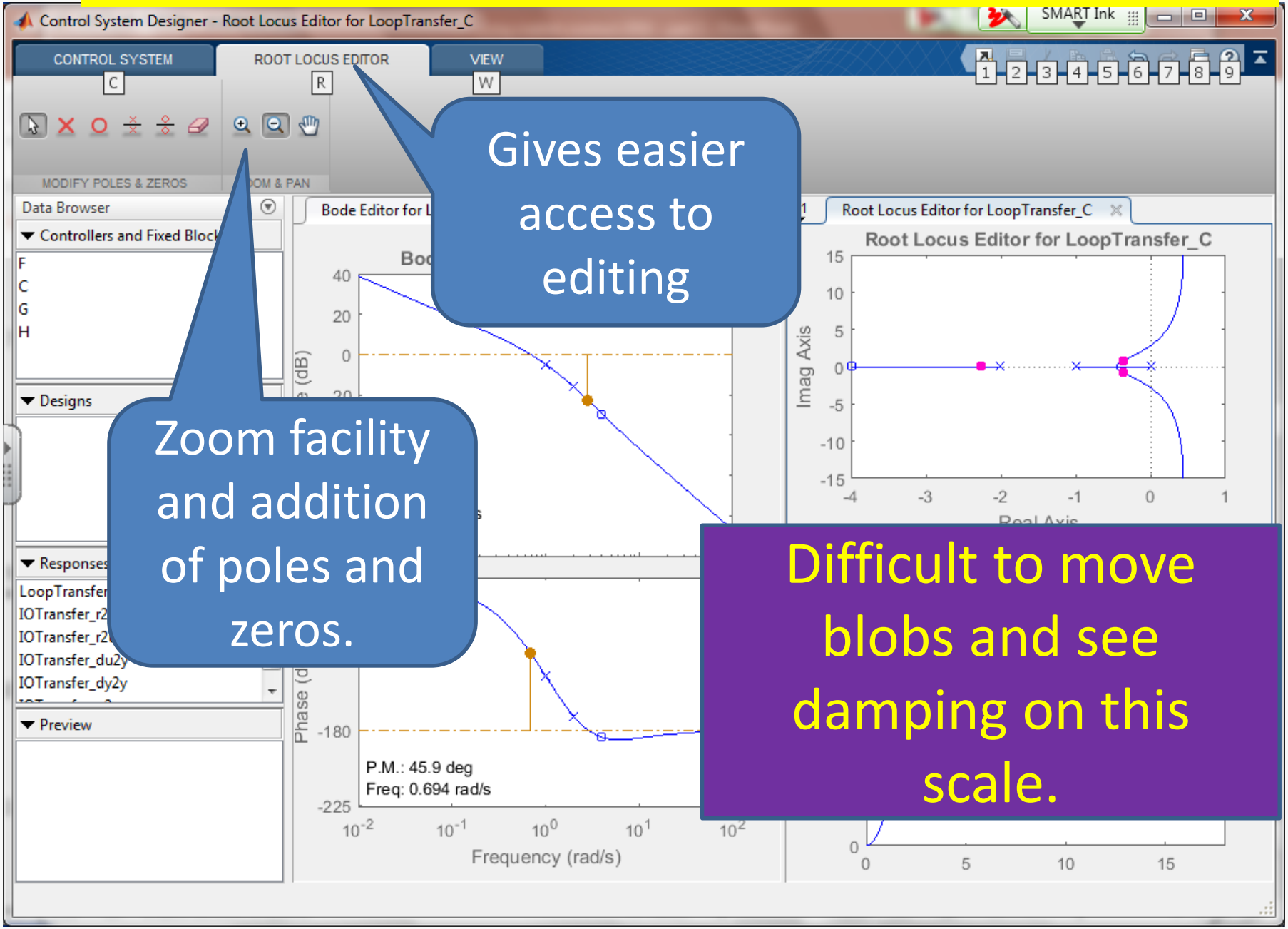
Move the mouse over one of the pink blobs and press the button, the cursor will change to a clenched fist.



Once you see the clenched fist, you can move the pink blob (closed-loop pole) directly.

MATLAB will automatically determine the associated C

Root locus editor



LIVE DEMONSTRATION NOW

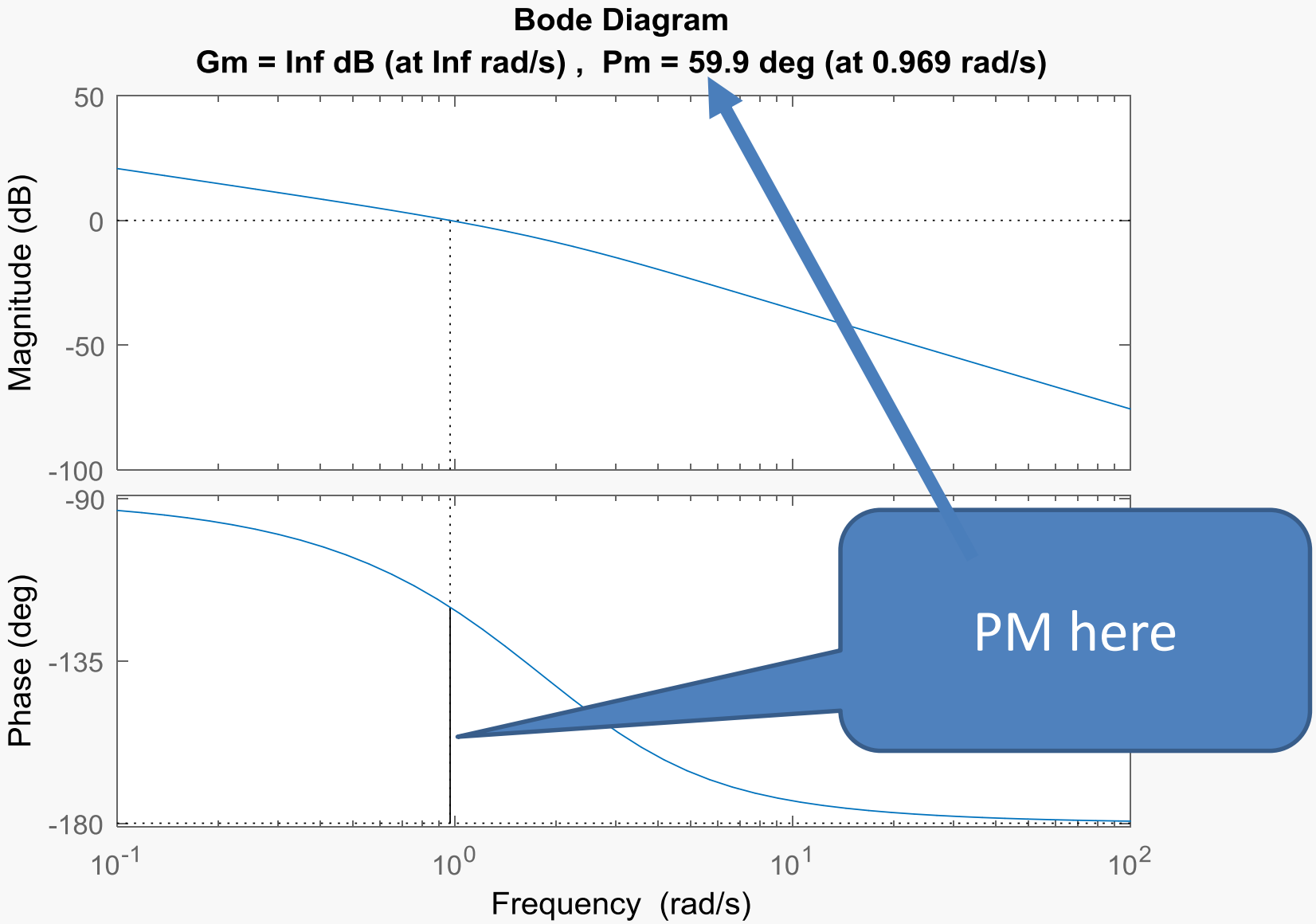
$$G = \frac{(s+4)}{s(s+2)(s+3)}$$

Issues with using drag on a root-loci

1. Quite useful to get a compensator gain to have broadly the correct value.
2. However, using the mouse precisely is difficult with small plots and so the result is likely to need some fine tuning.
3. Fine tuning can be done via the compensator editor .

PHASE MARGIN DESIGN

Phase margin close to 60°



Using drag facility

Sisotool allows you to ‘grab’ the bode gain plot and move it up and down.

As you do so, the phase margin changes because the gain cross-over frequency changes.

Simply move the gain plot until the phase margin has the desired value.

TO GRAB: Place cursor over the gain plot, a hand appears, select the mouse button and a clenched fist appears.

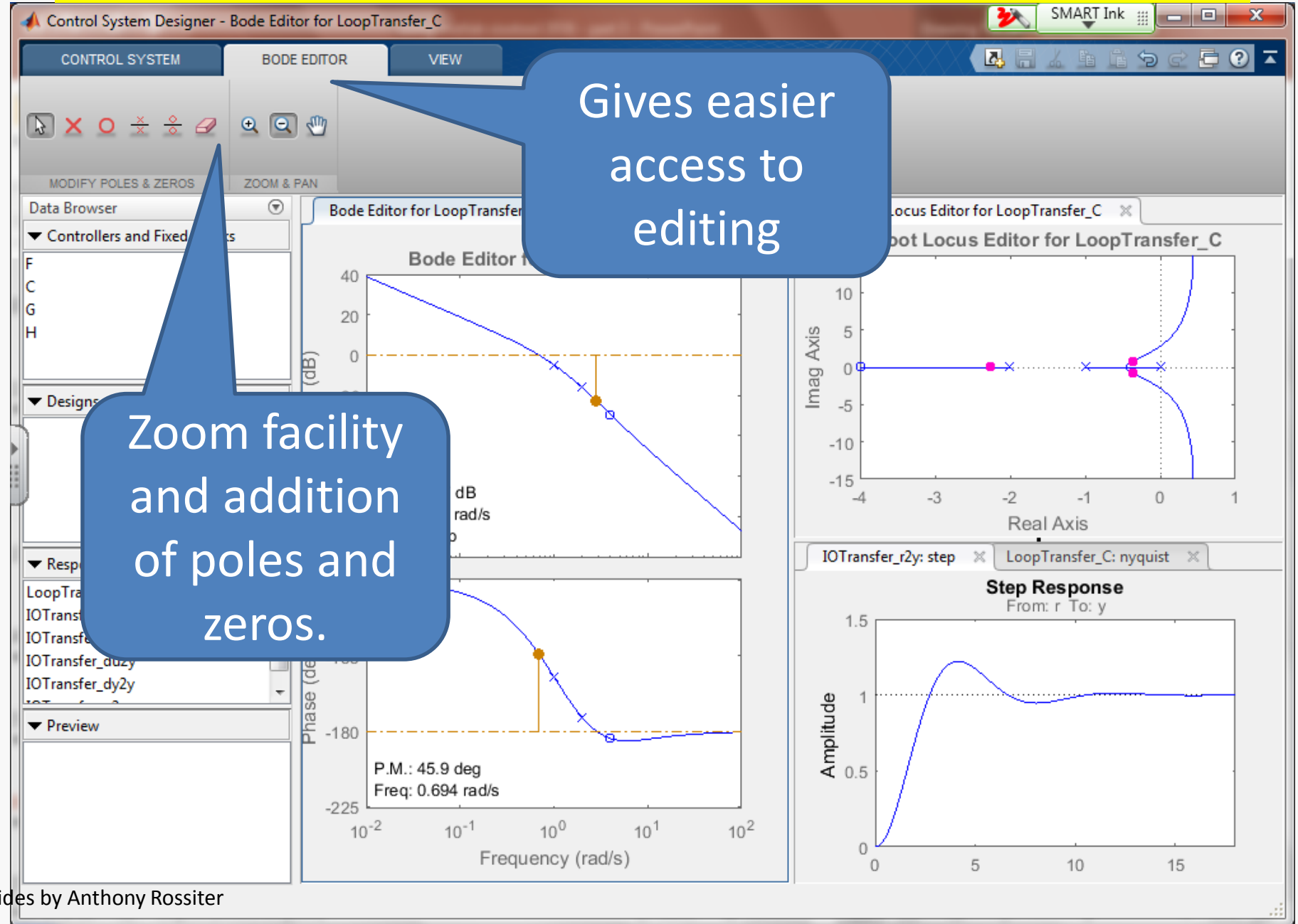
Now you can move via the mouse.

Phase margin design using gain

- A simple design strategy, where only gain can be changed, is to initially aim for a phase margin around 60 degrees.
- Using sisotool, the drag facility allows this to be done quickly and without explicit computation, especially if one recalls that the key objective is **ABOUT 60 – not exactly!**
- **Use the bode editor tab to see options more clearly.**

- **The drag is hard to make precise, so use the compensator editor for fine tuning.**

Bode editor



Slides by Anthony Rossiter

LIVE DEMONSTRATION NOW

$$G = \frac{(s+4)}{s(s+2)(s+3)}$$

Conclusion

This video has demonstrated the basic use of the drag facility in sisotool in MATLAB 2016 for doing proportional compensator design.

Drag allows the user to quickly put the closed-loop poles close to the desired position or the phase margin close to the desired value.

The compensator editor can be used for fine tuning.

The next video looks at compensator designs including poles and zeros.

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