VRIJE UNIVERSITEIT BRUSSEL

SIEMENS
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Regeltechniek WPO 2– Control engineering exercises

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Materials

Simulink overview:
https://youtu.be/Nef17ProSGk

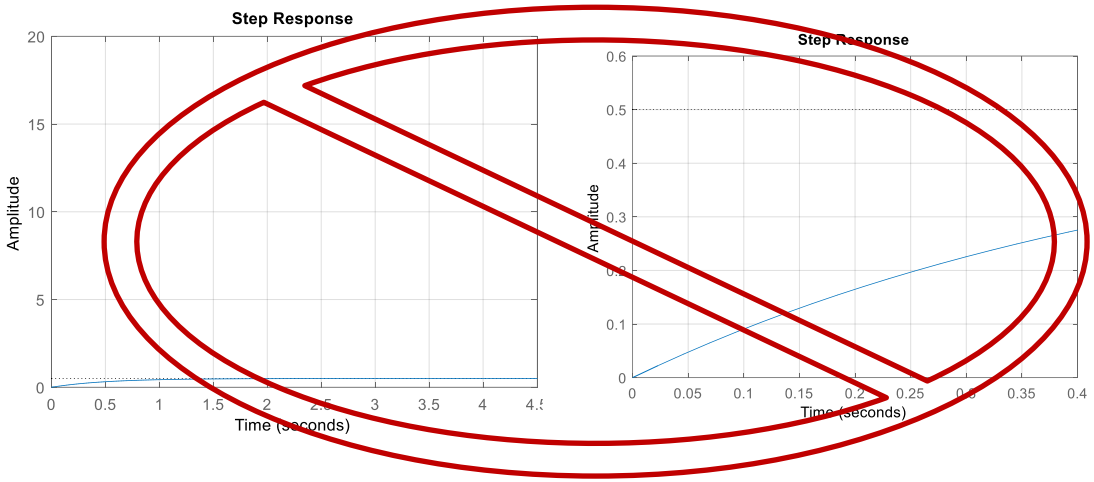
My videos for PID design:
From previous year, using codes instead of Simulink.
What is important here: how to read graphs to design PID controller.
You do not have to write any codes, just understand the context.
https://youtu.be/QejsribaIBo
https://youtu.be/LkQWgbSTAdQ
https://youtu.be/LkQWgbSTAdQ

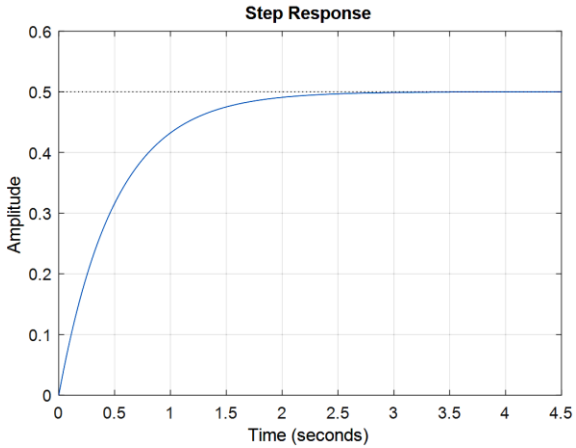
Instructions:
http://homepages.vub.ac.be/~pcsurcsi/regeltechniek/WPO2.docx

Exercise

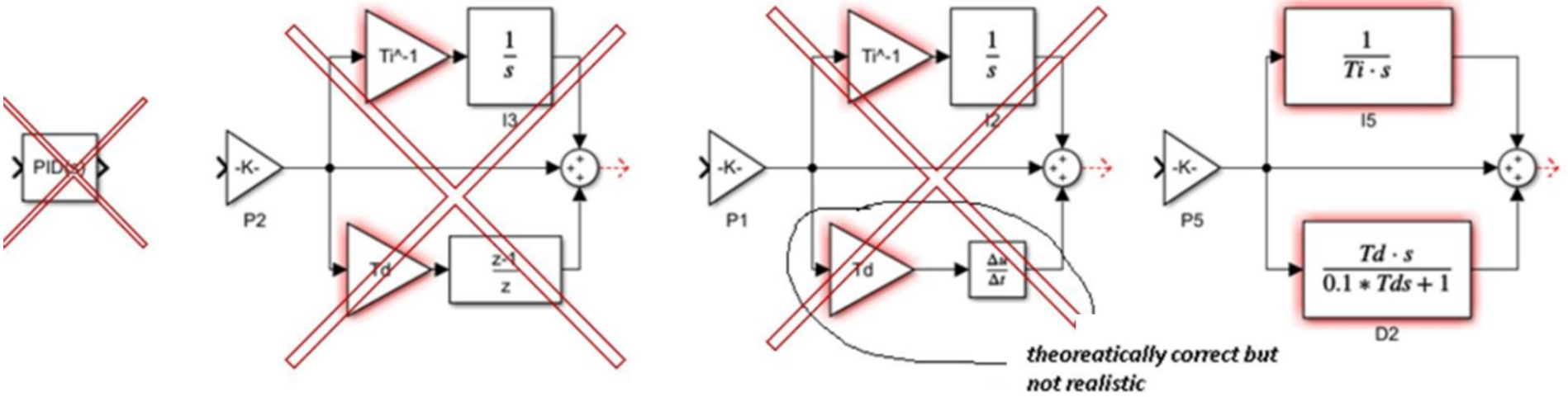
Some various materials from previous year:
http://homepages.vub.ac.be/~pcsurcsi/teaching.html

- **Typical mistakes**
  - Simulation time is too short and/or wrong scaling



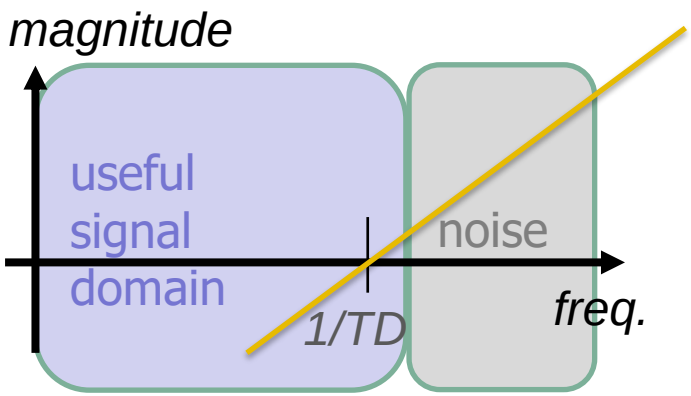


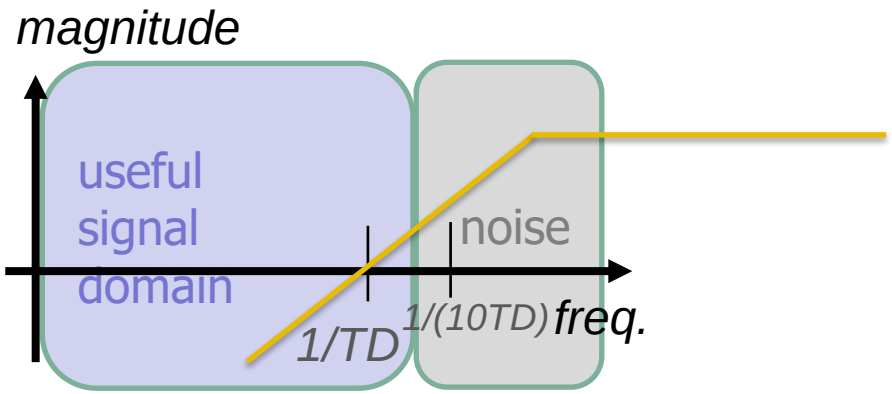
Exercise – accepted PID structure



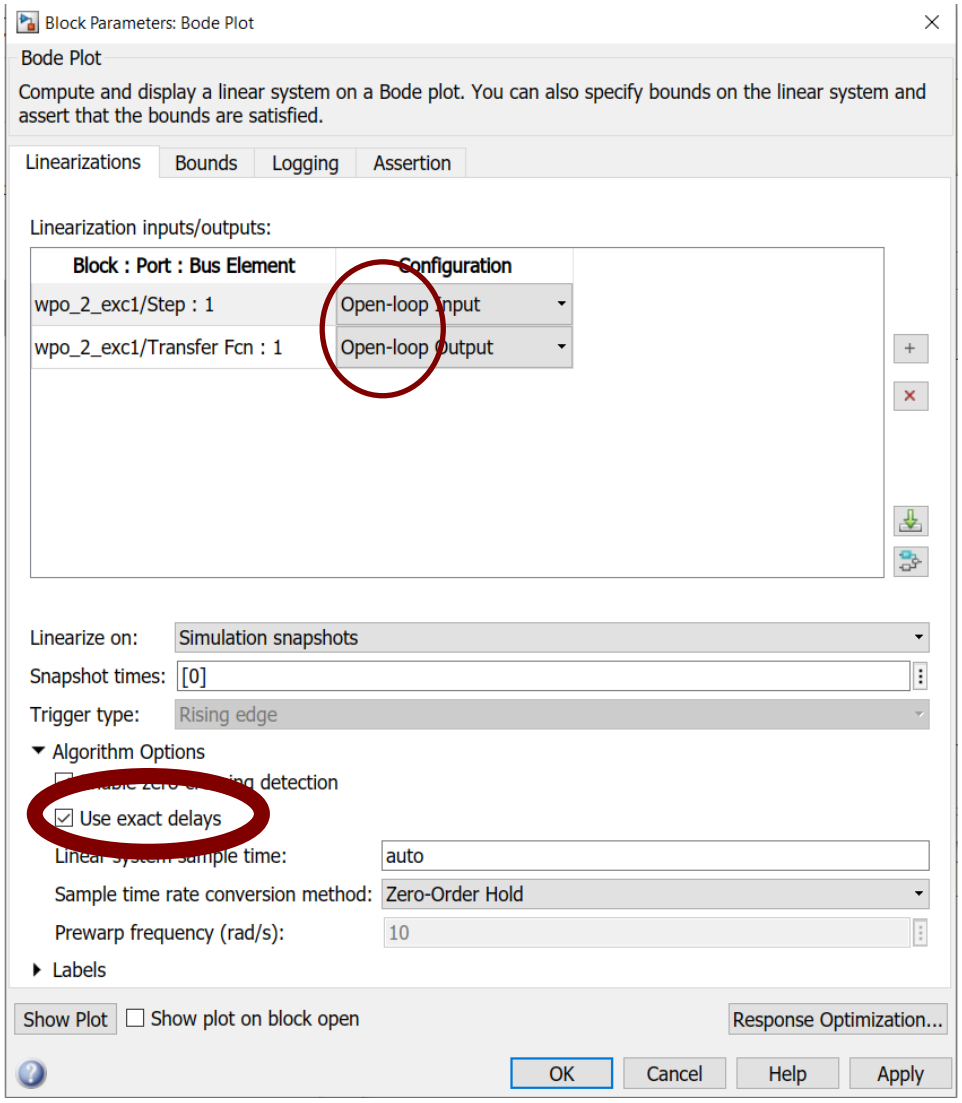
The third solution is theoretically correct but in practice it would result in a very 'jumpy' behavior because D term amplifies high frequency noise components.

So, in practice, D term is usually accompanied with a (1st order) low-pass filter.





Bode diagram block

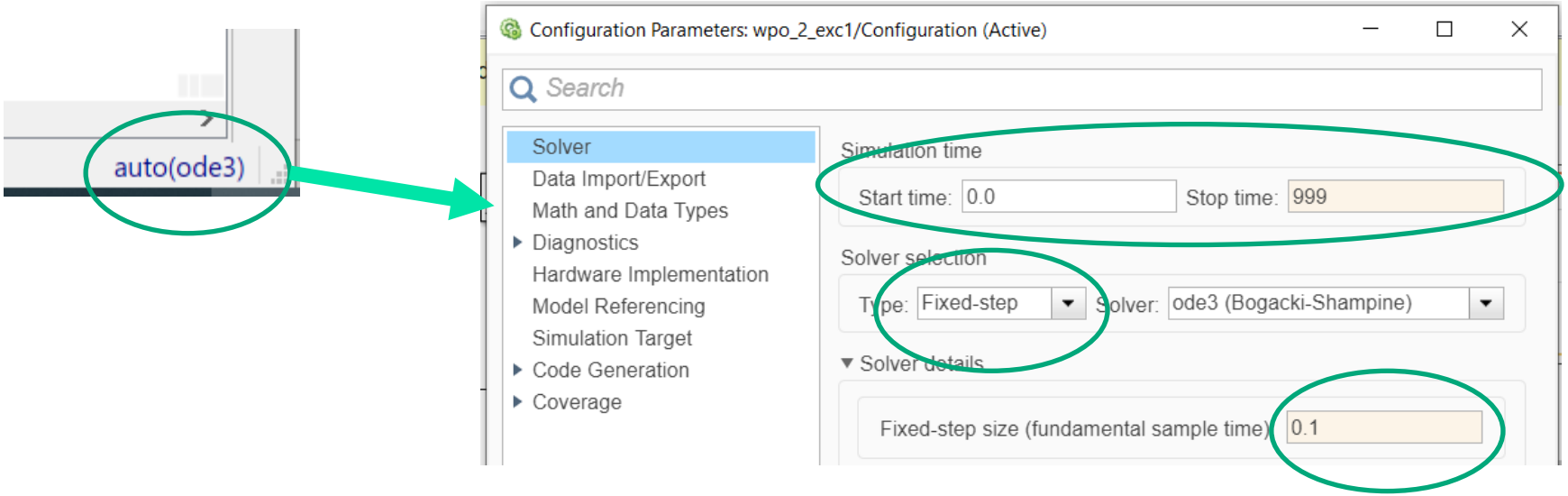


Make sure you use open-loop signals

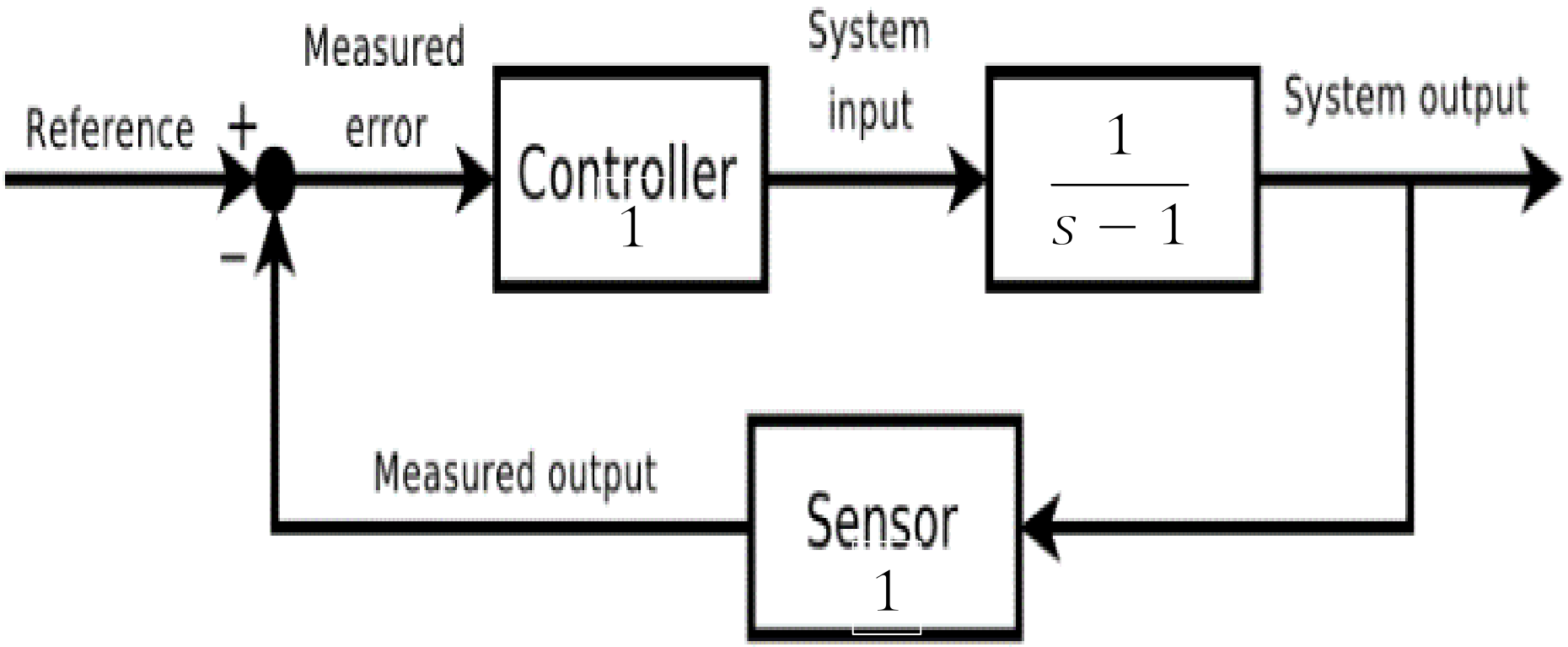
Use exact delay should be ticked (otherwise your dead-time is not shown correctly)

Solver options

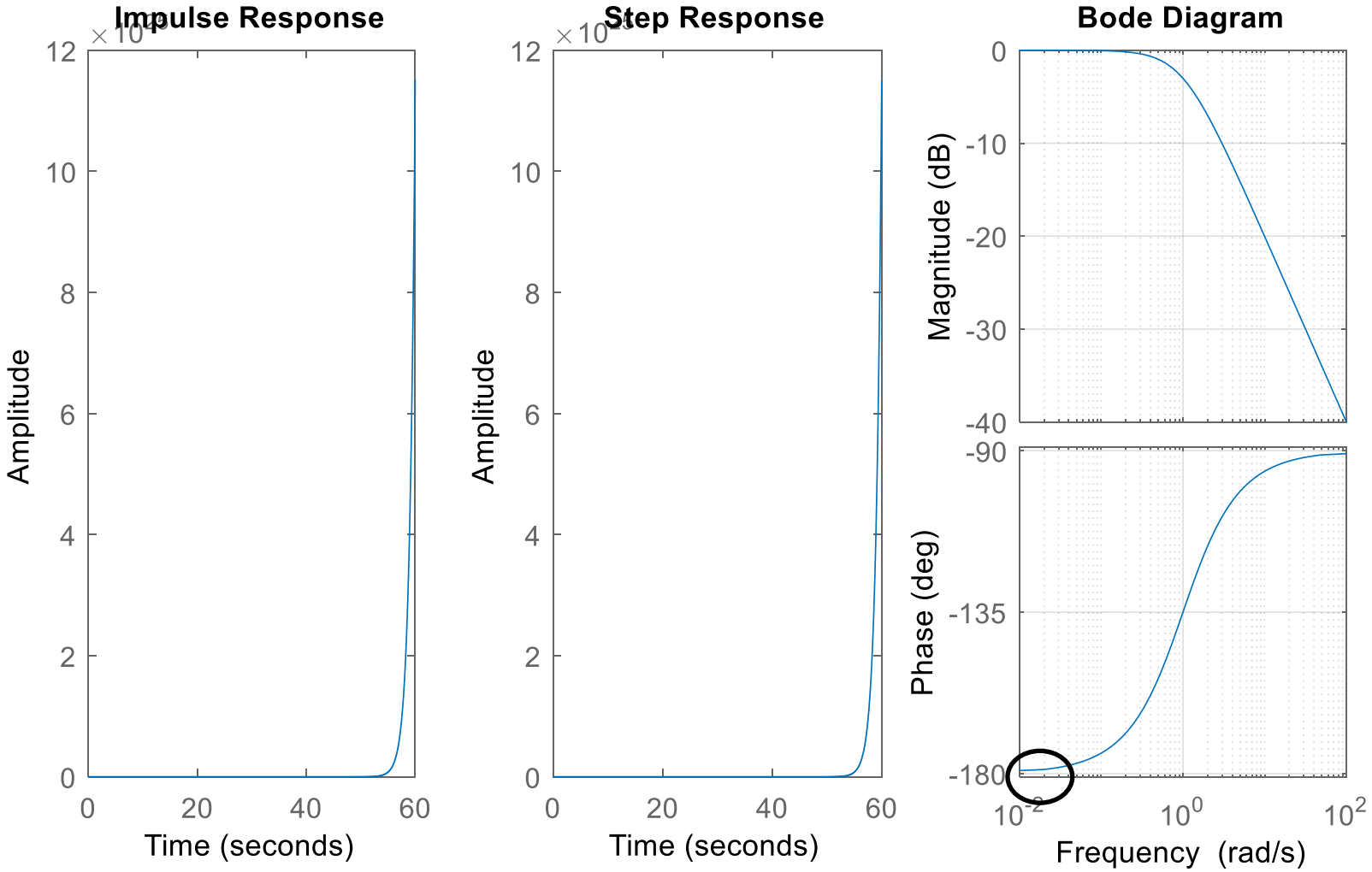
The sampling frequency (sampling time) can be set by modifying the solver parameters (fixed step size, see the icon on the bottom right corner of the Simulink window).



Control example



Control example



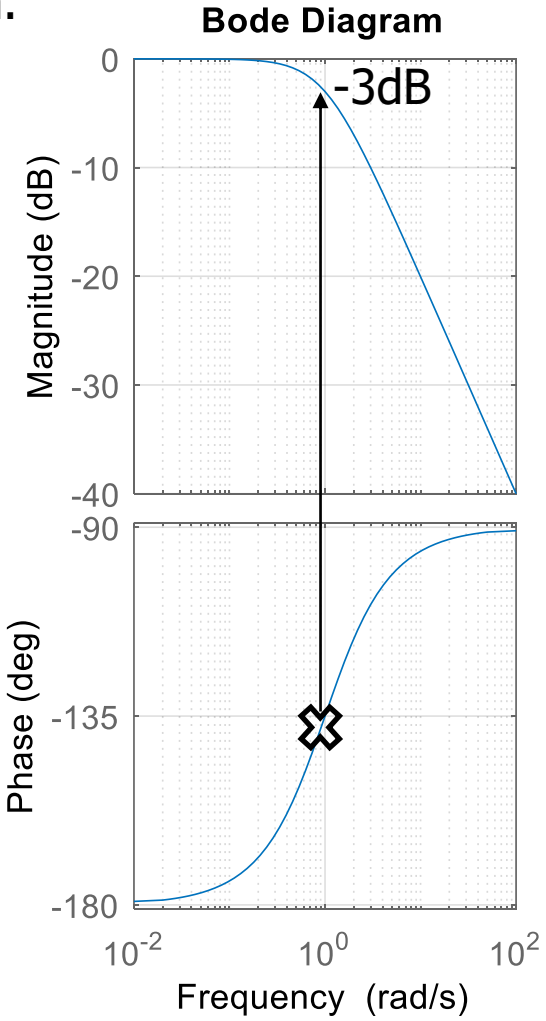
Control example

Design of a P controller with 45 degrees of phase margin.

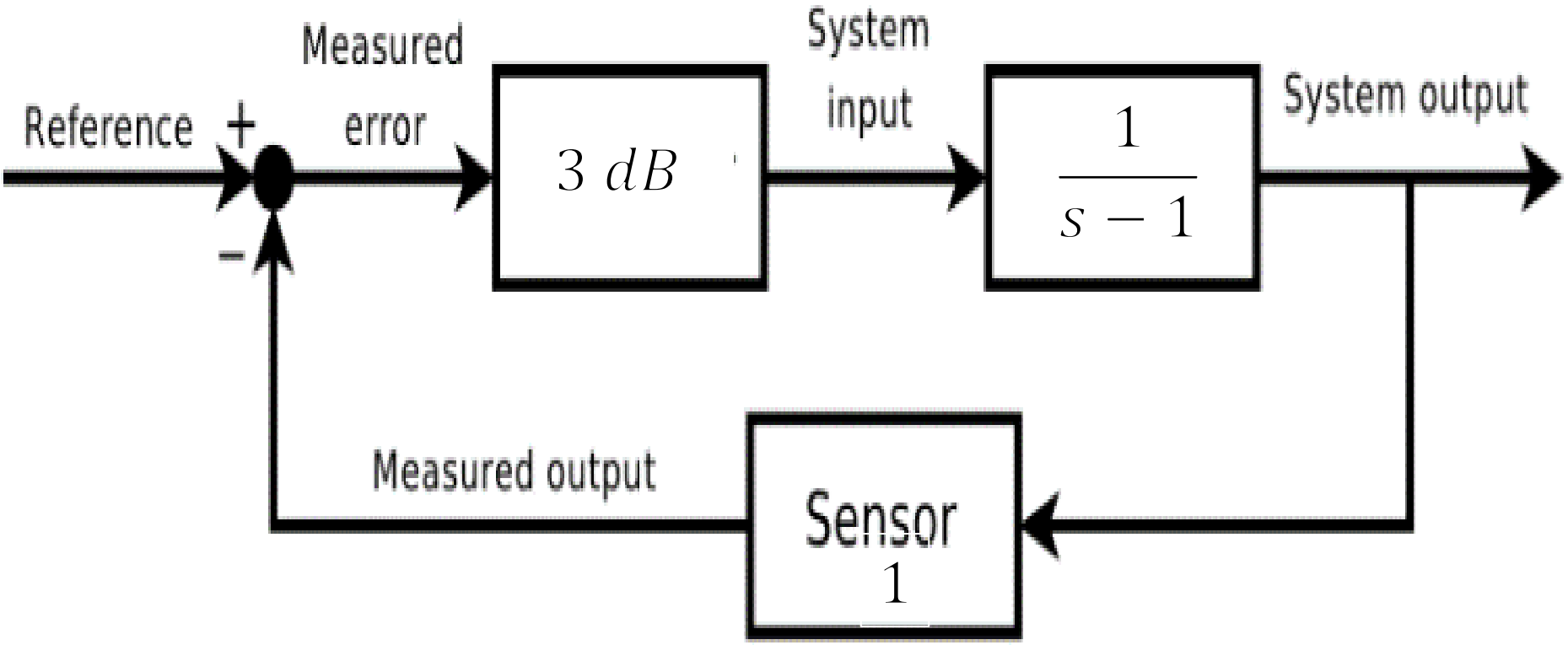
1. Look for the phase where 45 degrees PM would be
2. Check the magnification at this level
3. Move the diagram with the gain needed to be that point the new cross-over

Additional advise:

1. Choose dominant time constant as integration time
2. Second dominant constant as diff time
3. Check after adding I and D the PM (and GM)



Control example



Control example