(Intro to) Automatic Control Systems: December 2025 exam, Matlab simulation, Problem 2.b) PI control design

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Presentation in video: https://personales.upv.es/asala/YT/p2252bsEN.html

Process and Controllers to be tested

```
s=tf('s'); %Laplace Variable
%question 2.b) PI controller design
G=50/(s+10);
M=15/(s+10);
%Cb1=tf(0.12); %P only for poles at -16 (not valid because of error)
Cb1=0.32*(s+10)/s; %cancellation-based PI controller
Cb2=0.44*(s+256/50/0.44)/s; %non-cancellation PI
```

Closed-loop dynamics

```
CLb1=closetheloop(G,M,Cb1);
minreal(zpk(CLb1))
```

```
ans =

  From input "r" to output...
         16
   y:  ------
       (s+16)

       0.32 (s+10)
   u:  -----------
         (s+16)

         s
   e:  ------
       (s+16)

  From input "d" to output...
           15 s
   y:  -------------
       (s+16) (s+10)

        -4.8
   u:  ------
       (s+16)

           -15 s
   e:  -------------
       (s+16) (s+10)

Continuous-time zero/pole/gain model.
Model Properties
```

```
CLb2=closetheloop(G,M,Cb2);
minreal(zpk(CLb2))
```

```
ans =

  From input "r" to output...
```

```
        22 (s+11.64)
   y:  ------------
         (s+16)^2

        0.44 (s+10) (s+11.64)
   u:  ---------------------
              (s+16)^2

        s (s+10)
   e:  --------
       (s+16)^2

  From input "d" to output...
         15 s
   y:  --------
       (s+16)^2

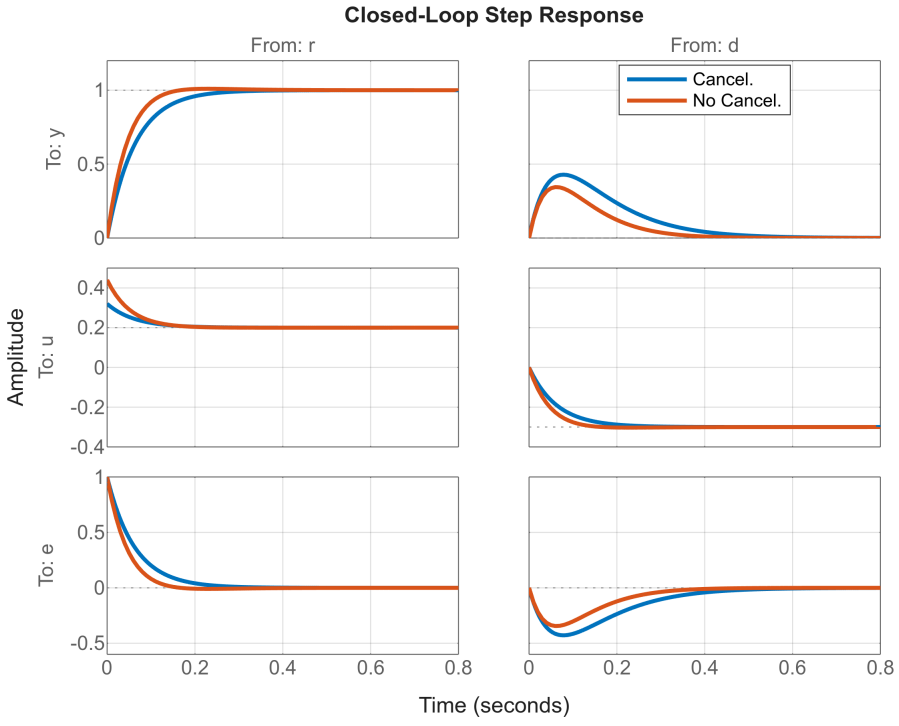
       -6.6 (s+11.64)
   u:  --------------
          (s+16)^2

        -15 s
   e:  --------
       (s+16)^2

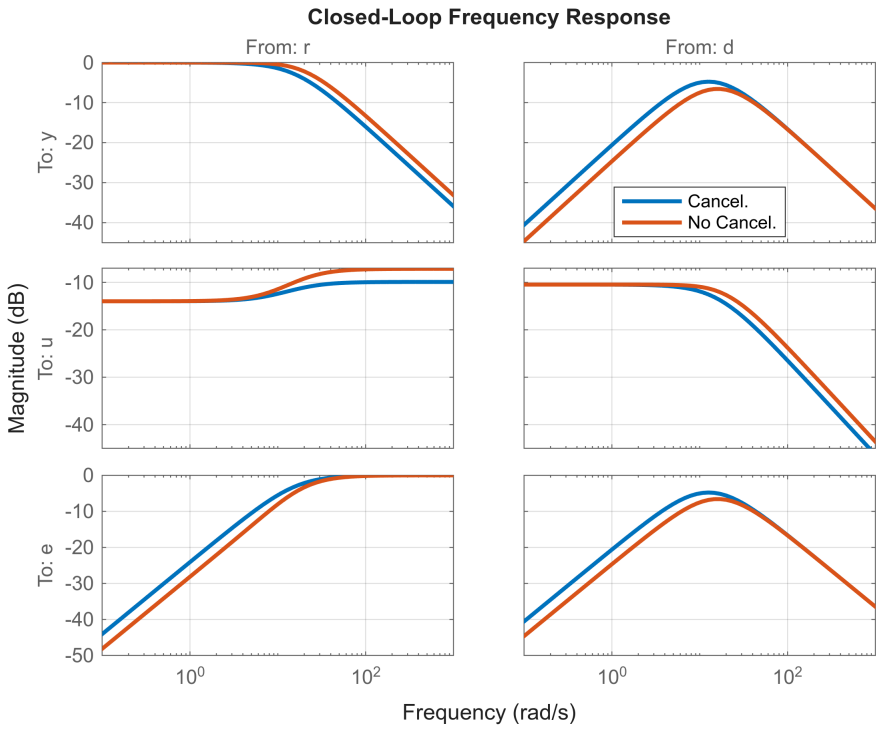
Continuous-time zero/pole/gain model.
Model Properties
```

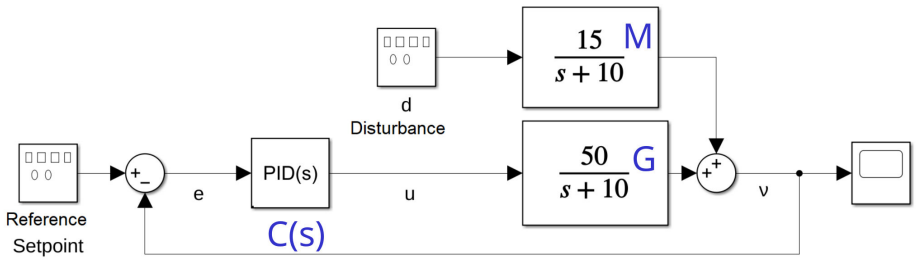
Time and frequency responses

```
figure(1)
h=stepplot(CLb1,CLb2);
h.Responses(1).LineWidth=2;
h.Responses(2).LineWidth=2;
grid on;
title('Closed-Loop Step Response');
legend('Cancel.', 'No Cancel.', Location="best");
```



```
figure(2)
bodemag(CLb1,CLb2);
h=gca;
h.Responses(1).LineWidth=2;
h.Responses(2).LineWidth=2;
grid on;
title('Closed-Loop Frequency Response');
legend('Cancel.', 'No Cancel.',Location="best");
```






```
function CL=closetheloop(G,M,C)
G.InputName="u";
M.InputName="d";
Process=[G M]; %y=Gu+Md, as a 1x2 transfer function matrix
Process.OutputName="y";
C.InputName="e";
C.OutputName="u";
S=sumblk("e=r-y");
CL = connect(Process, C, S, {'r','d'}, {'y','u','e'});
end
```