EE402 Mini Project 5

M. Mert Ankarali*
Department of Electrical and Electronics Engineering
Middle East Technical University

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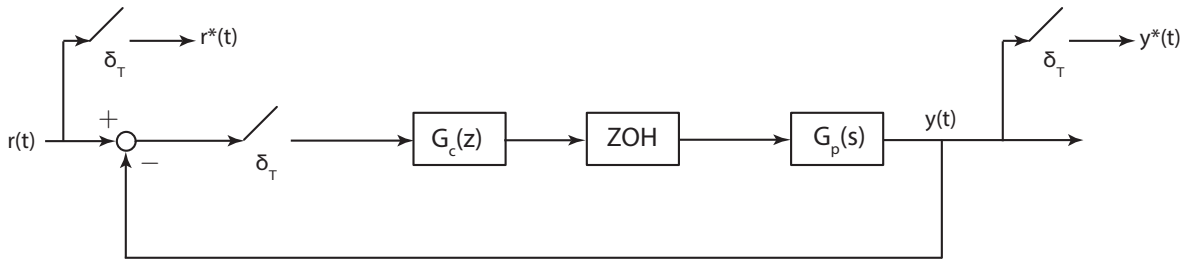
Important: In this mini project, you are supposed to perform some computations in MATLAB, perform simulations in MATLAB or Simulink, and plot some results using MATLAB and Simulink. You should provide all of your source codes, Simulink models, and graphical results with your hard copy submission. For Simulink models a snapshot figure of the model is satisfactory.

1. Consider the fundamental discrete time control system block given in the Figure below. Let



$$G_P(s) = \frac{1}{s^2+1} \quad , \quad T_1 = 0.1s \quad , T_2 = 0.5s$$

Then

(a) For each sampling-time value ($T_1 = 0.1s$ and $T_2 = 0.5s$), design two different digital Phase-Lead compensators such that

- closed-loop system is stable (for all cases),
- steady state error to the unit step response is less than %10 (for all cases),
- and phase-margin requirements for the compensated systems (for both sampling times) are
  - $\phi_{m,1} \in [10^o \ , \ 15^0]$,
  - $\phi_{m,2} \in [25^o \ , \ 30^0]$.

After the design of compensators provide the (discrete-time) bode plots of all cases and label the phase margin values on the bode plots.

(b) Using MATLAB or Simulink, plot the step responses of all four closed-loop systems and compare the results in terms of steady-state error, over-shoot, and settling-time.