DIGITAL CONTROL ARCHITECTURES AND TECHNOLOGIES

MSc. degree in Mechatronic Engineering and Computer Engineering

Laboratory practice n. 3

Objective: Control of CT systems with digital 1dof architecture.

Given the continuous time LTI system described by the transfer function.

$$G_{cont}(s) = \frac{10}{1 + \frac{s}{50}}$$

Assume a sampling time of $T_s = 0.01\ \text{s}$. Design a digital controller using a 1dof architecture to meet the following requirements.

1. $\left|y_{d_2}^{\infty}\right| \leq 0.5$, in the presence of a parabolic ramp disturbance signal of the form $d_2(kT_s) = \frac{(kT_s)^2}{2!}$.
2. $\left|y_{d_1}^{\infty}\right| \leq 0.05$, in the presence of a parabolic ramp disturbance signal of the form $d_1(kT_s) = \frac{(kT_s)^2}{2!}$.
3. $\hat{s} = 15\%$.
4. $t_{s,1\%} \leq 0.8\ \text{s}$.

In the view of the exam, develop the design procedure through a

- MatLab script named **`sxxxxxx_design.m`** following the naming described below for the relevant transfer functions and variables:
  - **`Gcont`** → continuous time plant transfer function $G_{cont}(s)$;
  - **`G`** → discrete time plant transfer function $G(z)$;
  - **`C`** → discrete time cascade controller $C(z)$;
  - **`Ts`** → sampling time T_s;
  - **`zeta`** → damping coefficient ω_n, **`wn`** → natural frequency ω_n;
  - **`M_S`** → Sylvester matrix M_S.
- Simulink file named **`sxxxxxx_sim.slx`**.

Save all the design results in the **`sxxxxxx.mat`** file using the statement `save sxxxxxx` at the MatLab prompt `>>` → `>> save sxxxxxx`

In all the above files, replace **`sxxxxxx`** with your own id.