EE3331C Feedback Control Systems Assignment 1

Let a, b and c be the last, second and third last digits of your matric number. If any digit is 0, replace by 1. For example, if your matric number is A1234560Z, then $a = 1$, $b = 6$ and $c = 5$.

Consider a second-order system

$$G(s) = \frac{K\omega_n}{s^2 + 2\zeta\omega_n s + \omega_n^2}$$

you may assume that the system has a DC gain of c. Simulate the step response for the following cases:

(a) Let the poles be located at $s = -a \pm jb$. Simulate the step response for 3 different values of $0.7b$, b and $1.3b$ fixing the value of a. (Note that $0.7b$ means $0.7 \times b$) Plots the 3 step responses on the same plot, comment on what you observe.

(b) Let the poles be located at $s = -a \pm jb$. Simulate the step response for 3 different values of $0.7a$, a and $1.3a$ fixing the value of b. Plots the 3 step responses on the same plot, comment on what you observe.

(c) Let the poles be located at $s = -\zeta\omega_n \pm j\omega_n\sqrt{1-\zeta^2}$. Let $\zeta = 0.1a$. Simulate the step response for 3 different values of $\omega_n = 0.7b$, $\omega_n = b$ and $\omega_n = 1.3b$ fixing the value of ζ. Plots the 3 step responses on the same plot, comment on what you observe.

Copy your matlab plots and code (add comments to your code so that it is readable!) into a word file, name it as A1234560Z.pdf where A1234560Z is your matric number. Submit to the assignment folder in LumiNUS by **27 Sep 2024 2359hrs**.

Some useful Matlab commands:

- To create model in system, e.g. if your model is $G(s) = \frac{k\omega_n}{s^2+2\zeta\omega_n s+\omega_n^2}$, the following commands can be used:
  $k = 1$; $z = 0.5$; $\omega = 1$; (where k, z and ω are any numbers)
  sys = tf($k * \omega$,[1 $\quad 2 * z * \omega \quad \omega * \omega$])
- To generate step response, use: step(sys)
- To generate plots on the same figure, you can use the "hold" command