Classical Control (M1 CORO / M1 JEMARO)

Exercises 2 (Lab.) for Group 1

Friday 12 November 2021

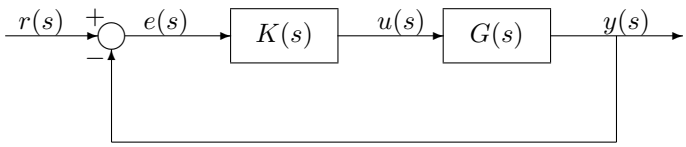
Deliverables	**Type :** subgroups of 2 students
Format : PDF file report	**Due date :** 26 November 2021

During this 4 hours lab, you will first read the document "ASTA_Help_M1_CORO.pdf", which is a tutorial for the use of ASTA (1h or 1h15). In a second time, you will have to synthesize three type of controllers for a given transfer function.
You will write a report which describes the key-points of each controller synthesis and compare the performances of each closed loop. The report will be uploaded on hippocampus. The report must be a PDF file with the name "**Ex2_CLACO21_G1_nameofstudent1_nameofstudent2.pdf**"

The aim of this study is to synthetize different PID type controllers, $K(s)$, with the code called ASTA for the system

$$G(s) = \frac{1}{(1+s)^2(1+10s)} \tag{1}$$

in the following closed loop architecture



1 Proportional controller

Tune a proportional control $K(s) = P$ such that the maximum of the complementary sensitivity function is $2.3\,db$. In order to compare the performances of the different closed loop that will be designed, note the characteristics of the step response (M_p, t_p, $t_{r5\%}$, $t_{r2\%}$, ϵ_r) and of the frequency response (M_r, ω_r). Note also the stability margins. (Note that $M_r \neq 2.3\,db$ and that M_p is far from 23%. What is the value of P which gives $M_r = 2.3\,db$?)

2 Proportional and Integral controller

Tune a PI controller $\left(K(s) = P(1 + \frac{1}{sT_i}) \right)$ which gives the same maximum of the complementary sensitivity function ($2.3\,db$).
Compare the performances of the closed loop with the performances of the previous loop.

3 Lag controller

Tune a lag compensator $\left(K(s) = P\left(\frac{1+sT}{1+sTb}\right) \right)$ which gives the same maximum of the complementary sensitivity function ($2.3\,db$) but a steady state error equals to 5% for the step response.
Compare the performances of the closed loop with the performances of the previous proportional loops.