First Simulation Project. Control engineering.

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"In accordance with the Tecnológico de Monterrey Student Code of Honor, my performance in this exam will be guided by academic honesty."

You should upload a **word** or **PDF** file in which all the results are provided. The word or PDF should be self-explaining, i.e. it should contain images of the Simulnk ® diagram, the transfer function of the system, the control equation, the Sisotool plots (if needed), the output of the system and the input to the system. Also, you can do your mathematical computation on a paper and include images of them.

The report should be presented by System, not by question. You should also include a .m file per system, which generates all the required variables, and a Simulink ® file per system. The exam will be graded with both the word or PDF file and the workspace.

The simulation project is **individual** and depends on the following parameters. If there were 2 people with the same data, both exams will be cancelled with a violation to Academic Honesty will be reported, with a final grade of the course equal to 1/100.

Part 1. 80 points. The parameters for this section are:

$$\boldsymbol{a} = Birth\ Day,\ \ \boldsymbol{b} = Birth\ Month \text{ and } \boldsymbol{c} = a + b + 2$$

(For instance, for someone born in Sep 16th $a = 16, b = 9$ and $c = 25$)

make sure to include the values used for a, b and c at the beginning of the report.

System 1. (15p)

$$G(s) = \frac{Y(s)}{U(s)} = \frac{c}{as + b}$$

System 2. (15p)

$$G(s) = \frac{Y(s)}{U(s)} = \frac{bc\ e^{-0.004s}}{4s^2 + c(a/22)s + c^2}$$

System 3. (15p)

$$G(s) = \frac{Y(s)}{U(s)} = \frac{4a\ e^{-0.006s}}{(s + c)(s + b)}$$

System 4. (15p)

Identification of the assigned Step Response.

(Make sure to include the validation plot in your report)

Symbology:

M – Requires Math computation. It can be made in paper or in Matlab®. Make sure it's easy to follow on your report.

S – Requires Simulink® Simulation. Include clear images of the plots and the Simulink Diagram.

D – Requires Diagrams, for instance in Sisotool®.

For each of the enlisted systems Compute, Design and Simulate as required:
If any of the methods cannot be used, justify and put all your answers in the cell equal to 0.

1. **(8p)** M S D

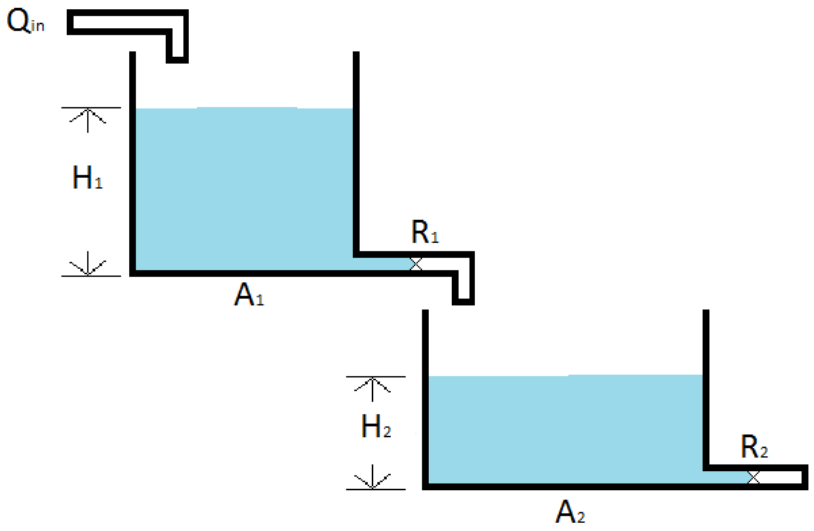
   Lead Compensator. Design a Lead compensator with e(t)=10%. Reference r(t)=a.

2. **(12p)** M S D

   Lead-Lag Compensator. Design a Lead Lag compensator with e(t)=5%. Reference r(t)=b. *Make assumptions about the maximum static gain on the Lead and improve it.*

Sistema 5. (20p)

Consider the following system. The flow in the tank above is the input to the system (manipulated variable Qin). The parameters for this example are given in the Workspace file for this project, and individually assigned.



Parameters H1 and H2 can be the output of the system. Parameter H1max and H2max correspond to the real height of the tank and will be used on the final question. Finally, parameters A1, R1 and A2, R2 are the area and the resistance to the laminar flow of Tank 1 and Tank 2 respectively.

1. (0p – it is already done) Obtain the symbolic transfer function M
    a. H1(s) / Qin(s)
    b. H2(s) / Qin(s)
2. (0p – it is already done) Obtain the transfer function with the parameters assigned to you. M
    a. H1(s) / Qin(s)
    b. H2(s) / Qin(s)
3. **(10p)** For H1(s)/Qin(s) Design a Lead Compensator. Target: 10% error M S D
4. **(10p)** For H2(s)/Qin(s) Design a Lead-Lag Compensator. Target: 3% error and a pre-defined maximum input (selected by you) M S D

Variable assignation.

1	A00344409	17	A01363486
2	A00344428	18	A01631444
3	A00570573	19	A01632075
4	A00822807	20	A01632356
5	A01114179	21	A01632375
6	A01114386	22	A01632891
7	A01227638	23	A01633112
8	A01227986	24	A01633890
9	A01228016	25	A01633920
10	A01228040	26	A01633921
11	A01228146	27	A01633983
12	A01229322	28	A01634452
13	A01229383	29	A01634592
14	A01229441	30	A01635321
15	A01229596	31	A01757780
16	A01229851	32	A01756812

To use the variables, use the workspace named: PS1.mat

The assignation for each student is on the table above and it will be used in code as a variable "n".

For System 4, use the variable DataID.

You can access such variable with: `MyVariable=DataID{n}`

MyVariable can have any name and will have two columns.

You can plot them using: `plot(MyVariable(:,1), MyVariable(:,2)`

To access the rest of the variables, use VariableName(n)

For instance, for a student with n=15, `A1(15)` is the Area of the first tank.