Third Simulation Project. Control engineering.

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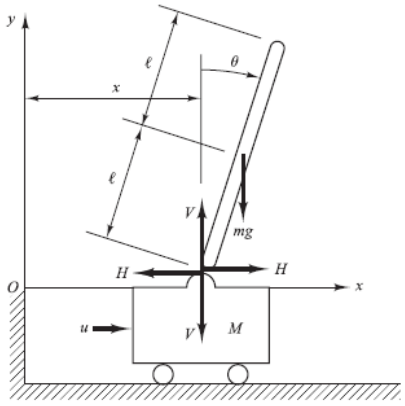
"In accordance with the Tecnológico de Monterrey Student Code of Honor, my performance in this exam will be guided by academic honesty."

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. These files (.m and .mdl) should only be provided for verification if necessary. The exam will be graded with the word or PDF file.

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. Consider the model of the inverted pendulum (see notes).



For each of the enlisted systems Compute, Design and Simulate as required:

1. (20p) M S D

Design a state feedback such that the bar is completely vertical (angular position =0) and the car is also in position 0.

2. (30p) M S D

Design a state feedback such that the bar follows a reference in the angular position equal to 0.05sin(t).

Part 2. Consider the following transfer function

The parameters for this section are:

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

(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 in the report.

$$G(s) = \frac{Y(s)}{U(s)} = \frac{4(s + 1.1b)}{(s + 2b)(s - b)(s + 3b)}$$

For each of the enlisted systems Compute, Design and Simulate as required:

1. (15p) M S D

Design a state feedback such that the output of the system follows a reference r(t)=c; Consider that the state vector can be directly measured.

2. (15p) M S D

Design a state feedback such that the output of the system follows a reference r(t)=2c, assuming that the state vector cannot be directly measured (i.e. it needs an observer)

3. (25p) M S D

Design a state feedback such that the bar follows a reference in the angular position equal to 0.05sin(t). Also, assume that the state vector cannot be directly measured (i.e. it needs an observer)

Variable assignation.

A00232029	1
A00570388	2
A01066478	3
A01113487	4
A01113778	5
A01113841	6
A01113857	7
A01113951	8
A01221582	9
A01226468	10
A01227856	11

A01228027	12
A01228347	13
A01228409	14
A01228679	15
A01228717	16
A01240084	17
A01363997	18
A01372328	19
A01630910	20
A01631195	21
A01631203	22

A01631854	23
A01632076	24
A01632241	25
A01632342	26
A01632379	27
A01632691	28
A01633025	29
A01633071	30
A01633119	31
A01755490	32

To use the variables, use the workspace named: PS3.mat

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

For Part 2, use the variables M, m and l.

VariableName(n)

For instance, for a student with n=15, `M(15)` is mass of the car that moves horizontally.