

MARKING CRITERIA AND STUDENT FEEDBACK

This section details the assessment criteria. The *extent* to which these are demonstrated by you determines your mark. The marks available for each criterion are shown. Lecturers will use the space provided to comment on the achievement of the task(s), including those areas in which you have performed well and areas that would benefit from development/improvement.

Common Assessment Criteria Applied		Marks available	Marks awarded
1. Research-informed Literature Extent of research and/or own reading, selection of credible sources, application of appropriate referencing conventions.			
<i>Some evidence of reading and partial referencing.</i>		10	4
2. Knowledge and Understanding of Subject Extent of knowledge and understanding of concepts and underlying principles associated with the discipline.			
<i>Very little knowledge demonstrated. Rather confused at times. Ref T1. Superficial answer to T3. - T4 quite lost at times.</i>		50	13
3. Analysis Analysis, evaluation and synthesis; logic, argument and judgement; analytical reflection; organisation of ideas and evidence			
<i>Very little evidence</i>		10	1
4. Practical Application and Deployment Deployment of methods, materials, tools and techniques; application of concepts; formulation of innovative and creative solutions to solve problems.			
<i>Some evidence of Matlab but incorrect conclusions in T4)</i>		25	5
5. Skills for Professional Practice Attributes in professional practice; individual and collaborative working; deployment of appropriate media; presentation and organisation.			
<i>Rather Poor and use of first person!</i>		5	1

Assignment Mark Overall (Assessment marks are subject to ratification at the Exam Board. These comments and marks are to give feedback on module work and are for guidance only until they are confirmed.)	Late Submission Penalties (tick if appropriate)		24 %
	Up to one-week late		
	Over one week late		

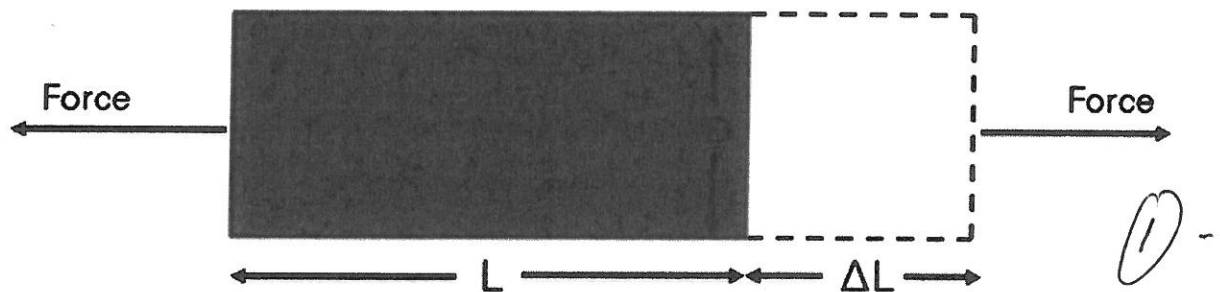
Dynamics, control and instrumentation assignment

Assignment task 1

Task a)

The strain is basically the ratio of two lengths, so it is a dimensionless quantity. The strain rate is dimensionally the reciprocal of time. Strain is defined as extension per unit length. Strain has no units because it is a ratio of lengths. ✓

"The four different types of strain are axial, bending, shear, and torsional. Axial and bending strain are the most). Axial strain measures how a material stretches or compresses as a result of a linear force in the horizontal direction. Bending strain measures a stretch on one side of a material and the contraction on the opposite side due to the linear force applied in the vertical direction. Shear strain measures the amount of deformation that occurs from a linear force with components in both the horizontal and vertical directions. Torsional strain measures a circular force with components in both the vertical and horizontal directions"



To measure strain you have to have the original length and the length that it opens to. You can measure strain several different ways but the most popular is strain gauges ✓

Task b)

1.5mn and 2.5mn with elasticity of 210gpa

h 2m (2000mm)

W 100mm

L 50mm

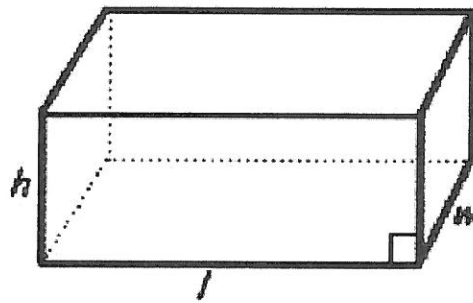
$A = 2 (100 \times 2000 + 50 \times 100 + 50 \times 2000)$

$= 610000$

Rectangular Prism

Surface Area

$$A = 2 (wh + lw + lh)$$



Volume

$$V = lwh$$

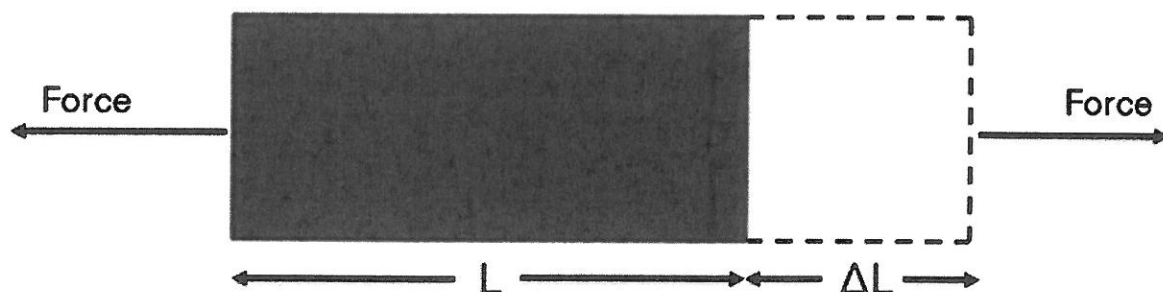
$$\text{stress} = \frac{\text{force}}{\text{area}}$$

$$\text{Stress} = 210 / 610000 = 2904.76$$

Strain original length 2m

Extended 2.2m

Strain



$$\text{Strain} = 2.2/2m$$

$$= 0.2m(200mm)$$

Modulus

$$E = \text{stress/strain}$$

$$E = 2904.76/0.2 = 14,523.8pa$$

So force/area x strain

$$210/610000 \times 0.2$$

And

$$210 \times 2/61 \times 2904.76$$

$$= 19999.987$$



Assignment task 2

Task a)

Set point

From research that I have done I have learnt that a set point is a target value at which a controller attempts to maintain a process variable. I have also learnt that there are different types of set points; these are remote set points, alternative set points active set points. A remote set point signal can be used to adjust the value of the effective set point, as an alternative to using manually entered local set points. Some controllers have several set point sources. Usually there is a local set point and one or more alternative set points, only one set point can choose as the active at a time for alternative set point. An active set point is used to describe the currently selected set point and one or more alternative set points.

Overshoot

Modern Control Engineering by Ogata book

"The maximum overshoot is the maximum peak value of the response curve measured from unity. If the final steady-state value of the response differs from unity, then it is common to use the maximum percent overshoot"

I have found that the overshoot is the occurrence of a function exceeding its target it arises especially in step response of bandlimited systems such as low pass filters. An important application of the term is to the output signal of an amplifier. Overshoot also represents a distortion of the signal. There are also a lot of different versions of overshoot that is used in maths electronics physics etc.

$$PO = \left[e^{\left(-\pi\zeta / \sqrt{1-\zeta^2} \right)} \right] \cdot 100\%$$

$$T_s = \frac{4}{\zeta\omega_n}, \quad \omega_d = \omega_n \sqrt{1-\zeta^2}$$

Plant

A plant in control theory is the combination of process and actuator. A plant is often referred to with a transfer function. . An example would be an actuator with its transfer of the input of the actuator to its physical displacement. In a system with feedback, the plant still has the same transfer function, but a control unit and a feedback loop are added to the system.

Control variable

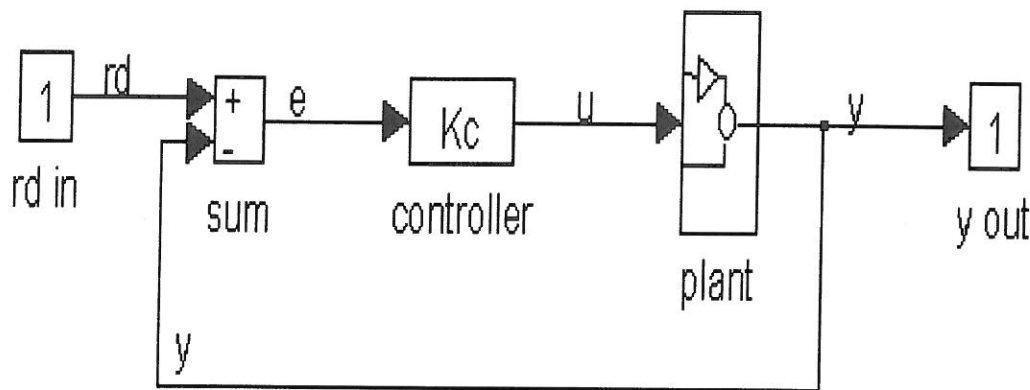
It is the value that is determined and controlled. These variables are independent variables and are usually not influenced by external factors. These variables are controlled by the engineer, designing the control system, and those values are chose for these variables at which the system gives the best output. ✓

Controller

There are various types of controllers used to improve the performance of control systems you can also use la place transforms to work out the equations from using the different controllers an example of a controller is a proportional controller, the proportional controller produces a output, which is proportional to error message. ✓

Control law

Control law is usually part of the controller. The control law compares the reference speed to the current speed. Control law is a mathematical formula used by the controller to determine the output that is sent to the plant. ✓



Task b)

Transfer function

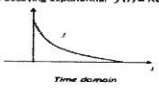
The transfer function usually works alongside the control system it is also known as a mathematical part of the system. The input is also related to the output with a transfer function this also leads to having a controlled output. There are also 2 major ways of obtaining a transfer function for the control system these are block diagram method but isn't very convenient to derive a complete transfer function for a complex control system. The way is a signal flow graph which is a modified form of a block diagram it gives you a pictorial ✓

representation of a control system. It also shortens the representation of a control system. The transfer function is generally expressed in Laplace transform.

I was looking on google chrome for examples and these were the best I found:

Example A signal response from a system (temperature, for example) respond, after an external excitation has stopped, by decaying exponentially. Let's find out how such decay is characterized by a Laplace transformation.

f is a decaying exponential: $f(t) = Ae^{-\alpha t}$



Time domain

$$F(s) = \int_0^{\infty} f(t) e^{-st} dt$$

$$F(s) = \int_0^{\infty} Ae^{-\alpha t} e^{-st} dt$$

$$= \frac{A}{s + \alpha} \quad (2)$$

Laplace domain

Example. As we mentioned in the introduction, the system response is governed by differential equations. We would like to know then, how $\frac{df}{dt}$ and $\frac{d^2f}{dt^2}$ transform by a Laplace transformation. For simplicity, and clarity, let's use the notation: $\frac{df}{dt} = f'$ and $\frac{d^2f}{dt^2} = f''$.

• If $F = \mathcal{L}\{f\}$, evaluate $\mathcal{L}\{f'\}$

$$\mathcal{L}\{f'\} = \int_0^{\infty} f'(t) e^{-st} dt$$

$$= f(t) e^{-st} \Big|_0^{\infty} + s \int_0^{\infty} f(t) e^{-st} dt$$

$$= -f(0) + s \int_0^{\infty} f(t) e^{-st} dt$$

$$= -f(0) + s [\mathcal{L}\{f\}] = -f(0) + sF(s)$$

Laplace transformation of the derivative (3)

Typically, one proceeds putting the initial conditions equal to zero. (The situation with initial conditions different than zero are added in a separate simpler procedure). Thus,

$$\mathcal{L}\{f'\} = sF(s) \quad \text{Laplace transformation of the derivative with the initial conditions equal to zero} \quad (3')$$

• If $F = \mathcal{L}\{f\}$, evaluate $\mathcal{L}\{f''\}$

du/nanogroup/sites/www.pdx.edu.nanogroup/files/NOTES_Transfer%20func

from which, for a given $R=R(s)$ the function $C=C(s)$ can be obtained.

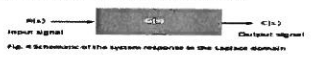


Fig. 1. Schematic of the system response in the Laplace domain

Example. A system is characterized by the transfer function: $G(s) = \frac{2s+3}{(s+3)(s+6)}$. Find out how the system respond to a exponentially decaying input: $r(t) = e^{-t}$.

Answer:

The Laplace transformation of r gives, using expression (2), $R(s) = \frac{1}{s+1}$.

The output signal, in the Laplace domain, is then given by: $C(s) = \frac{2s+3}{(s+3)(s+6)} \cdot \frac{1}{s+1}$.

In a typical procedure, when possible, $C(s)$ is re-written in the following form:

$$C(s) = \frac{N(s)}{D(s)} = \frac{N(s)}{(s+1)(s+3)(s+6)}$$

with N_1, N_2, N_3 to be determined.

Notice: $N(s) = C(s) \cdot D(s) = 0.8$

$N_1 = C(s)(s+3)(s+6) = 0.8$

$N_2 = C(s)(s+1)(s+6) = -0.3$

$N_3 = C(s)(s+1)(s+3) = -0.6$

Thus,

$$C(s) = \frac{0.8}{s+1} + \frac{-0.3}{s+3} + \frac{-0.6}{s+6}$$

Now, using (3) we identify the same dependent functions: these individual Laplace transforms come from:

$$c(t) = 0.8e^{-t} - 0.3e^{-3t} - 0.6e^{-6t} \quad \text{Answer.}$$

Recomputing the process.



Task c)

From information gathered I have found out that a closed loop system is also known as a feedback system. It's basically an open loop system with a feedback loop. There is no real name for this loop onbut what the loop does is simply outputs but retrieves some back along the "feedback tube" the closed loop can be used in many different things and also can replace the open loop in a few machinery.

An example of where an open loop has been replaced with a closed would be a tumble dryer if we put something to monitor the dryness of the clothing that would make it a closed loop meaning that some information would need to come back to the sensor to turn the tumble dryer off making sure that the clothing doesn't burn.

Task d)

There are a lot of advantages and disadvantages to both open and closed loops. The biggest difference I can see is that open circuits do not use current but closed loops do but closed loops are able to make a system that can control its self and not need an operator to operate it like an open loop, I would use closed loops where I

could but use open loops in places that I might not. But the big advantage to closed is the amount of control the system has it can maintain at a steady working pace without any supervision, the system can knock itself off if any problems occur and also stop any problems before they happen

And open loop control system works on fixed operation conditions and there are no disturbances while a closed loop will react on any internal or external variations also with open loops there is no effect on the gain and they are mostly stable which is the only let down for closed loops is stability but there is no-linear change in system gain

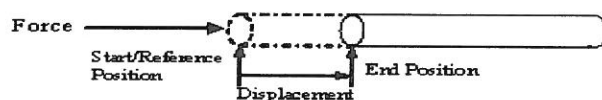
A closed loop is basically an advanced version of an open loop that can be controlled and keep a measured input and output it outperforms the open loop on many different occasions as it cannot control anything it either sits at 1-0 and doesn't change at all without any human interaction or a machine that will change the state. Depending on the price of the machine I would recommend using closed loop systems as you wouldn't need any physical interact with the machine the saving money.

Assignment task 3

Task a)

Linear displacement

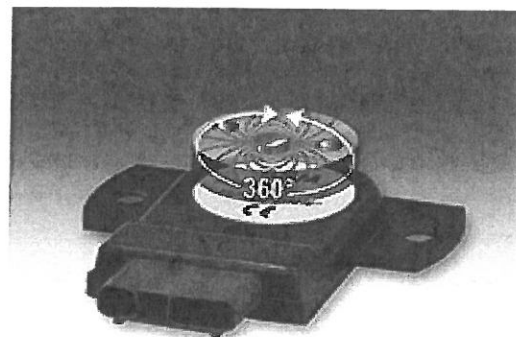
A linear displacement transducer is a electromechanical device used to convert mechanical motion or vibration, usually moves in a rectilinear motion into a variable electrical current voltage or electrical signals and the reverse. It includes conversion principles. They continuously indicate position



Rotational displacement

the difference between linear and rotational is that rotational can rotate up to 360 degrees. Many industrial control processes require angular displacement feedback. Angular/rotational sensors are utilized to measure the angular displacement of various parts of the machines. Angular sensor can be a simple potentiometer or a more advanced Hall-Effect device

"POSIROT"



"The POSIROT® angle sensors of the PRAS/PRDS series are based on a contact-free and absolute measurement principle. The position sensing element is a permanent magnet."

Pressure

Pressure is an expression of the force required to stop a fluid from expanding, and is usually stated in terms of force per unit area. A pressure sensor usually acts as a transducer, it generates a signal as a function of the pressure imposed. J

Presence(of a metallic item)

Presence sensors are used to detect the location and whereabouts of the item where needed. And example of a presence sensor is a metal detector which detects the presence of metal nearby which often consist of a handheld unit with a sensor probe. J

Vibration

Stable and precise, there is loads of different transducers with vibration this includes impact hammers vibration calculators, impedance heads. Uses quartz and ceramics to make the sensors, they are mostly used to measure displacement linear velocity and acceleration. J (2)

Task b)

4-20ma

Sensors with 4-20ma are extremely common within industrial measurement and control applications they also have a wide power supply requirements.

0 10v

Typically used in lighting

Doing research I have found out that 0-10v is known to voltage drop especially the longer the cable. On the other hand a 4-20ma system offers increased immunity to both electrical interference and signal loss over long cable runs also 4-20ma outputs low noise also 0 volt can be carried by a disconnected wire. ✓ (2)

Assignment task 4

Task a)

"In dynamic control systems, stability addresses the stability of solutions of differential equations and of trajectories of dynamical systems under small perturbations of initial conditions. The heat equation, for example, is a stable partial differential equation because small perturbations of initial data"

Task b)

i)
$$\frac{(s+4)(s-1)}{(s+4)(s+2)(s+3)}$$

Num= [4,-1]

Dom= [4,2,3]

= tf [4,-1];[4,2,3]

This system is unstable

X

ii)

$$\frac{(s-2)}{s(s+1)(s+4)}$$

Num=[-2]

Dom=[2,8,1,4]

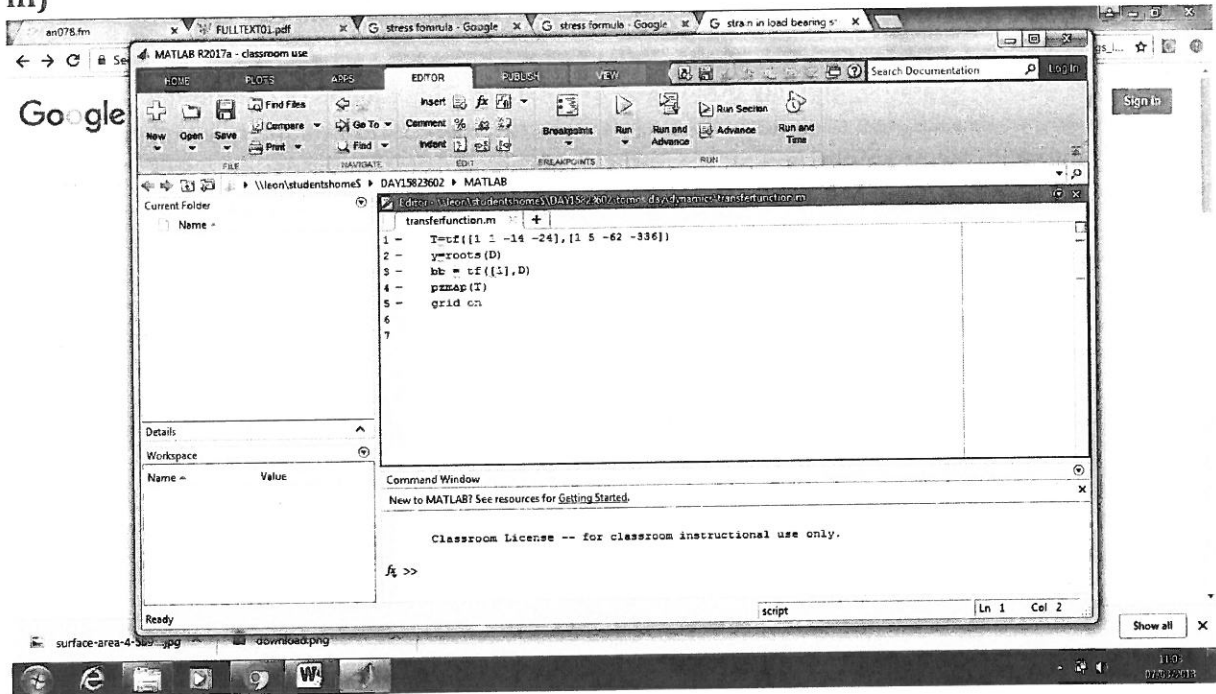
Tf=[-2];[2,8,1,4]

This system is stable

✓

①

iii)



references

<https://cds.cern.ch/record/1100534/files/p73.pdf>

http://ece.gmu.edu/~gbeale/ece_421/eqns/second_order_04_eq05.gif

<https://electronics.stackexchange.com/questions/179878/exact-definition-of-overshoot>

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<http://www.ni.com/white-paper/3638/en/>

<https://www.sciencedirect.com/science/article/pii/S0960077999000120>