**Control Assignment**

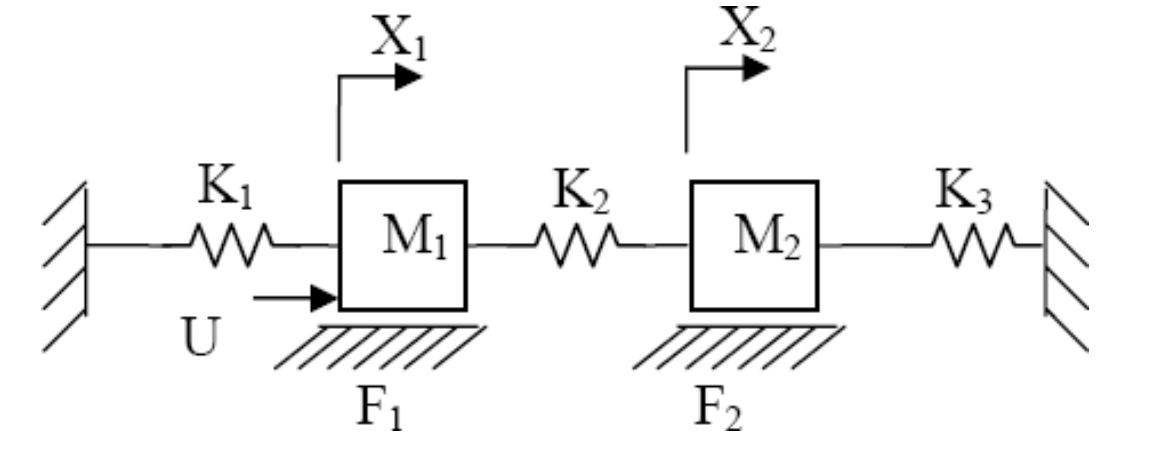
**ELC 3252**

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| --- | --- | --- |
| **Name** | **Section** | **BN** |
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| بموا عريان عياد | 1 | 18 |
| مارك ياسر نبيل | 2 | 12 |

***Team Members***

Block Diagram: [*Link*](https://drive.google.com/file/d/1cFy5M5Vbqa_fztm7AiotJyVKdfv6QU6D/view?usp=sharing)

1. **Dynamic equations of the system**

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**Forces affecting M1:**

k1x1🡨

F1🡨

U 🡪

K2x1🡨

K2x2🡨

**Forces affecting M2:**

K2x1🡪

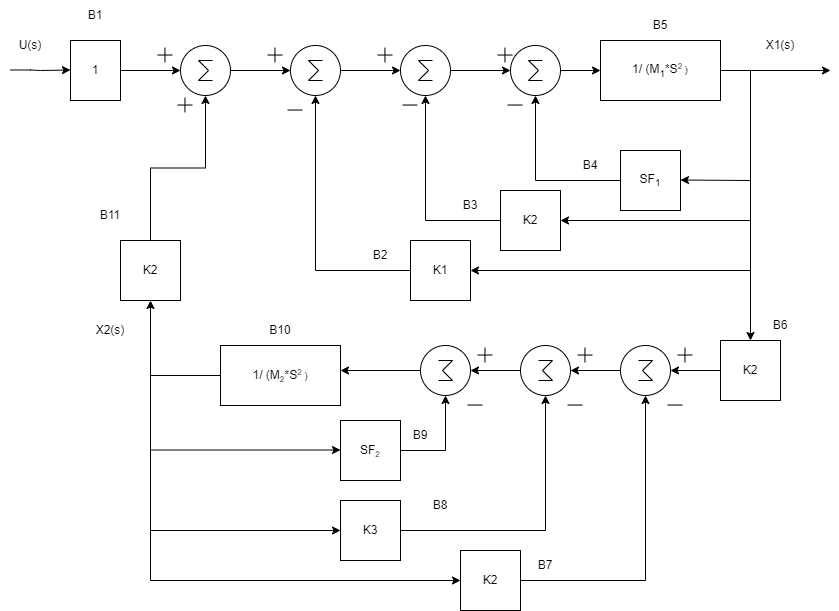
K2x2🡨

F1🡨

K3x2🡨

**Equations**

**Laplace**

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1. **Stability Test**

All poles exist in the left half plane, then the system is stable.

Chart, box and whisker chart

Description automatically generated

This can also be verified using Routh table:

**Given**

M1 = M2 = 100Kg.

K1 = K3 = 5 N/m and K2=50 N/m.

F1 = F2 = 100 Kg/sec.

Routh Table:

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |

**4. Steady state**

**Steady state response as plotted from MATLAB:**

Chart

Description automatically generated

X1steady state = 0.105

X2steady state =0.0952

**Hand calculation on steady state values:**

u = 1 \* u(t)

U(S) = 1/S

X1steady state =

=

X2steady state =

=

**5. System modification**

Diagram

Description automatically generated

This figure shows the modification to the system as described, where Xd is the input to the system and X2 is the output.

**6. Simulate the system for a desired level (Xd) of 2 m. showing the response of X2.**

**Chart

Description automatically generated**

**7. For the response of X2 calculate the value of the rise time, peak time, max peak, and settling time. Also calculate the value of ess.**

ess = 2 – 0.174 = 1.826

rise time = 58.7 sec

settling time = 107 s

max peak = 0.18

peak time = 160 s

**8. As a solution to reduce the value of ess a proportional controller can be used. Study the effect of the value of proportional controller on both ess and transient response by simulating the system with the following values of P controller: 1, 10,100, and 1000. Calculate transient response parameters for each case. Comment on your results.**