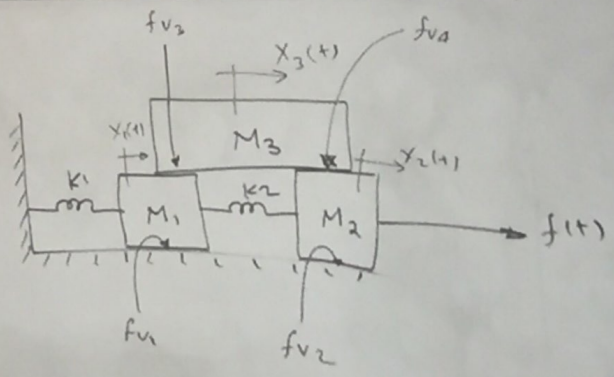
Ex)



Write the equation of motion

$$\left[M_1 s^2 + (f_{v_1} + f_{v_3}) s + (k_1 + k_2)\right] X_1(s) - \left[k_2\right] X_2(s) - \left[f_{v_3} s\right] X_3(s) = 0 \quad (1)$$

$$-\left[k_2\right] X_1(s) + \left[M_2 s^2 + (f_{v_2} + f_{v_4}) s + k_2\right] X_2(s) - \left[f_{v_4} s\right] X_3(s) = F(s) \quad (2)$$

$$-\left[f_{v_3} s\right] X_1(s) - \left[f_{v_4} s\right] X_2(s) + \left[M_3 s^2 + (f_{v_3} + f_{v_4}) s\right] X_3(s) = 0 \quad (3)$$

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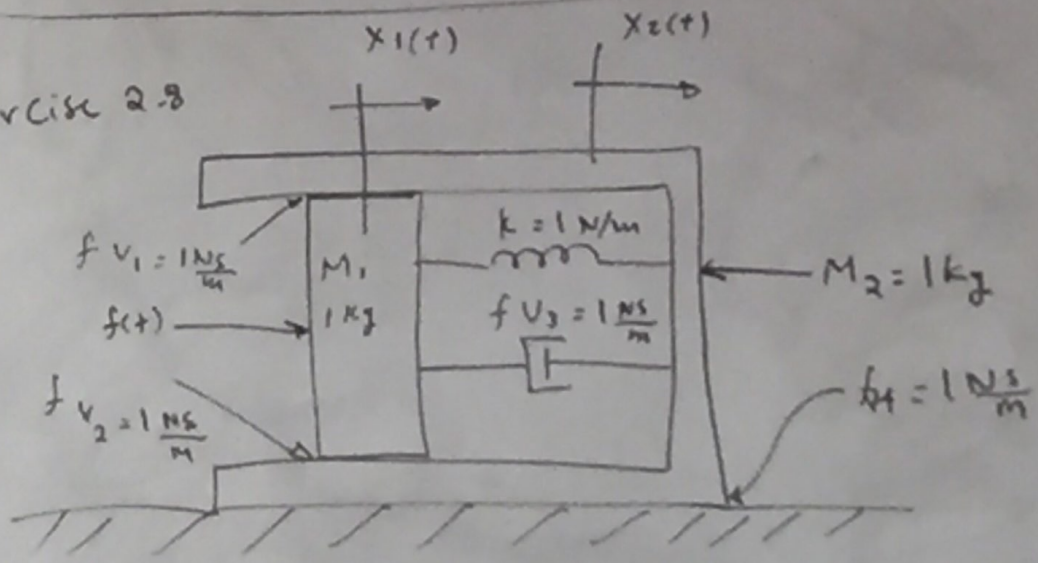
$$-[fv_3 s]X_1(s) - [fv_4 s]X_2(s) + [M_3 s^2 + (fv_3 + fv_4)s]X_3(s) = 0 \quad (3)$$

Exercise 2.8



find $G_1(s) = \dfrac{X_2(s)}{F(s)}$

$(s) - [fv_3 s]X_3(s) = 0 \quad (1)$

$_4 s]X_3(s) = F(s) \quad (2)$

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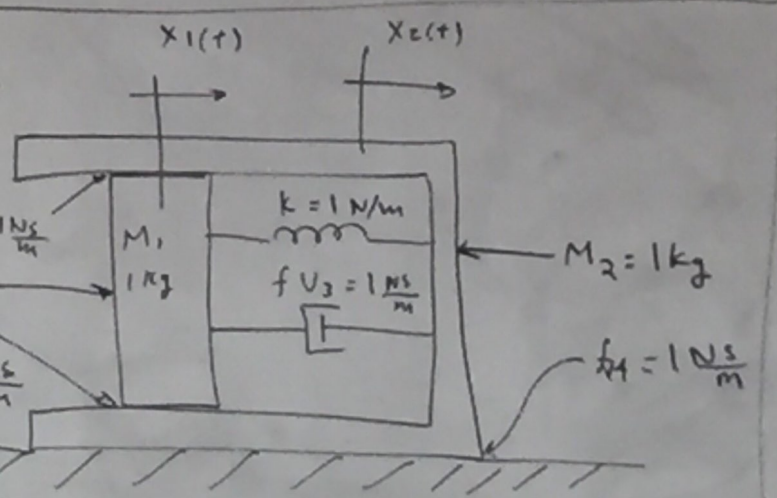
$-[fv_1 s]X_2(s) + [M_3 s^2 + (fv_3 + fv_4)s]X_3(s) = 0$ — (3)



find $G(s) = \frac{X_2(s)}{F(s)}$

$(s^2 + 3s + 1)X_1(s) - (3s+1)X_2(s) = F(s)$ —(1)

$-(3s+1)X_1(s) + [s^2 + 4s + 1]X_2(s) = 0$ —(2)

$$X_2(s) = \frac{\begin{vmatrix} s^2+3s+1 & F(s) \\ -(3s+1) & 0 \end{vmatrix}}{\begin{vmatrix} s^2+3s+1 & -(3s+1) \\ -(3s+1) & s^2+4s+1 \end{vmatrix}}$$

$$= \frac{(3s+1)F(s)}{\left(\begin{matrix} s^4+4s^3+s^2 \\ 3s^3+12s^2+3s \\ s^2+4s+1 \end{matrix}\right) - (3s+1)^2}$$

$$= \frac{(3s+1)F(s)}{s^4+7s^3+14s^2+7s+1-(9s^2+1+6s)}$$

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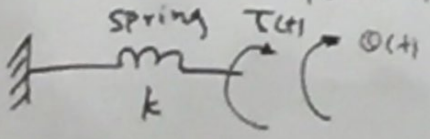
$$\therefore G(s) = \frac{3s+1}{s^4 + 7s^3 + 5s^2 + s}$$

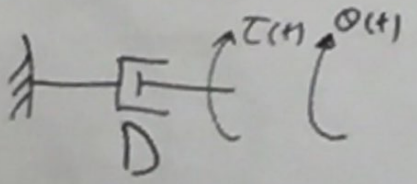
2.6 Rotational mechanical system

Transfer function.

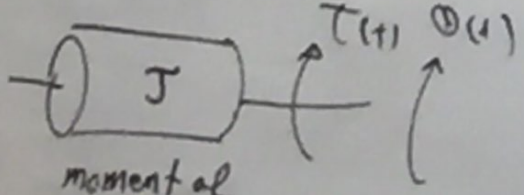


Impedance

$T(t) = k\,\theta(t)$ — k



$T(t) = D \frac{d}{dt}\theta(t)$ — Ds



$T(t) = J \frac{d^2}{dt^2}\theta(t)$ — Js^2

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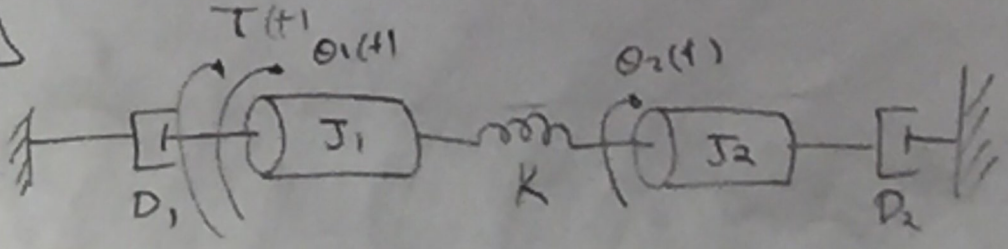
EX)



$(s^2+3s+1)X_1($

$-(3s+1)X_1(s)$

$X_2(s) =$

s^2+3s-1

$-(3s+1)$

$(3s+1$

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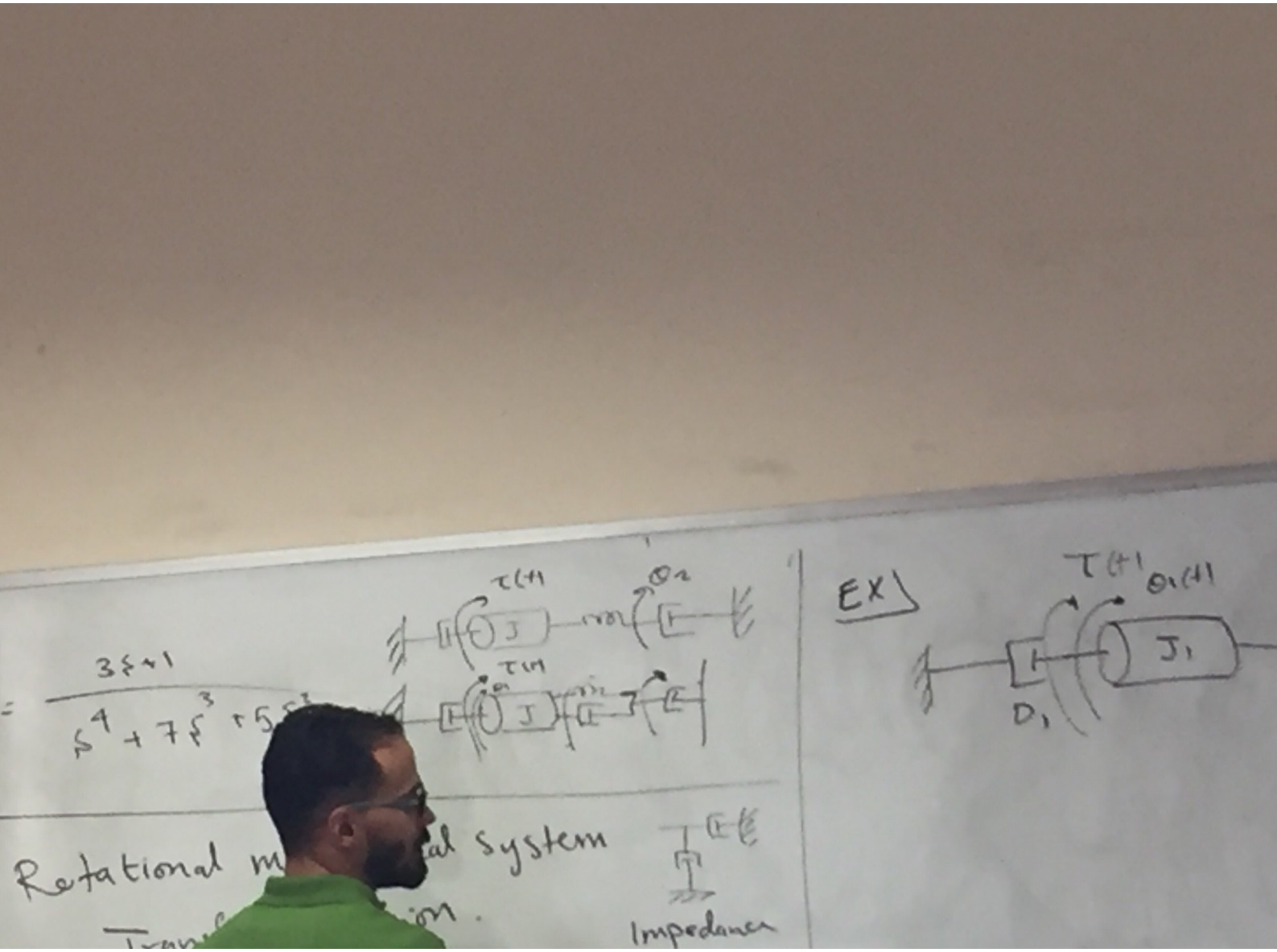

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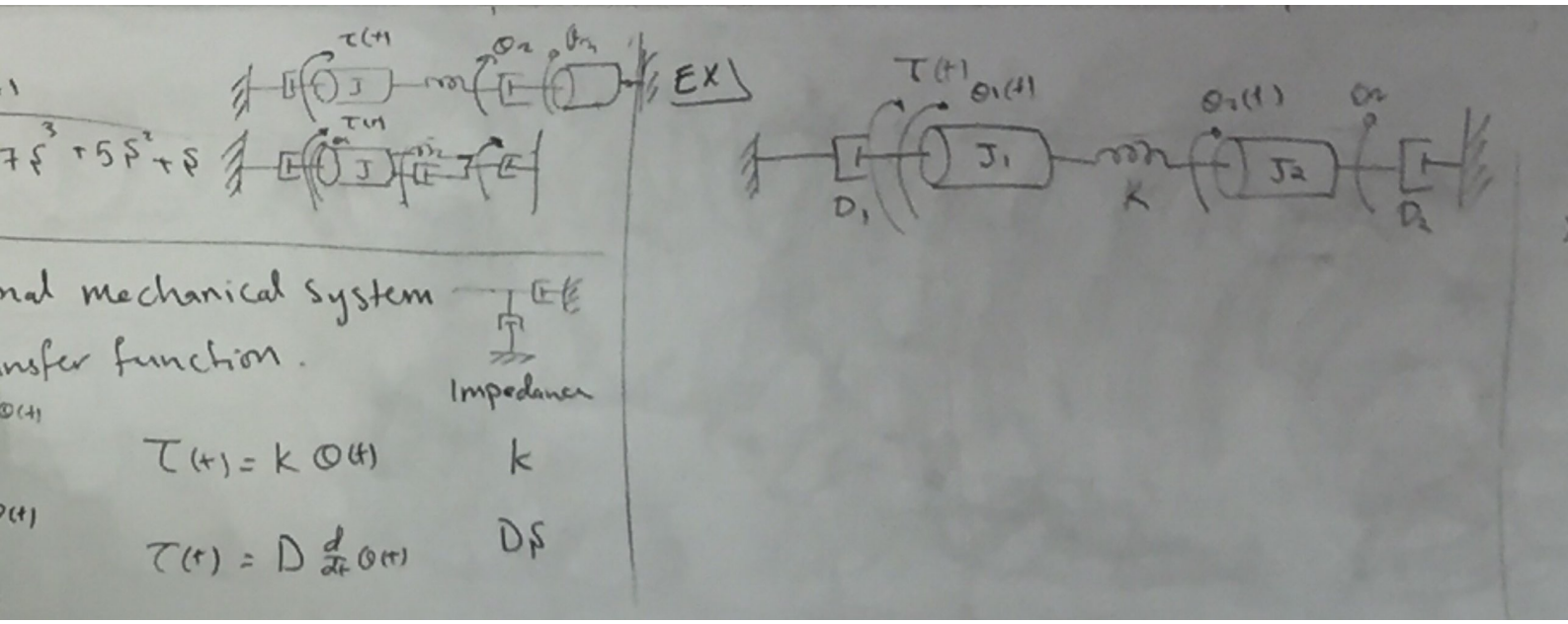

nal mechanical system

nsfer function.

$T(t) = k\,\theta(t)$ k

$T(t) = D\frac{d}{dt}\theta(t)$ Ds

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