

Section (1)

Mechatronics System design (MCT334)

1. VDI Model

→ Modeling Types :-

- ↳ Mathematical Model (Equations)
- ↳ Physical Model (diagrams)
- ↳ Numerical Model (simulations)

→ System Integration :-

↳ **Definition** :- System integration is bringing together of parts (Functions, Components, Subsystems) to form a product.

↳ **types**

1. Integration of distributed Components.

It is The Connecting between Components Such as Sensors and power actuators. Via signal and energy flows with the aid of Communication Systems.

2. Modular integration

The overall is made up of modules of defined functionality and standardized dimensions.

3. Spatial integration :-

All Components are spatially integrated and form a complex functional unit

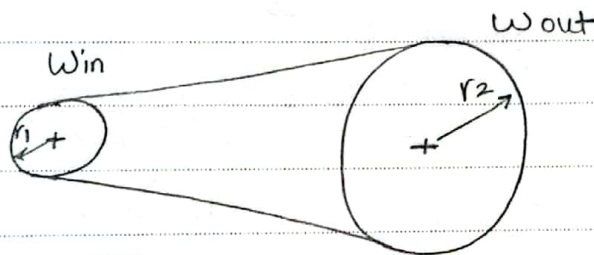
3. testing performance Visualization

- ↳ 1. Software on the Loop
- ↳ 2. Processing on the Loop
- ↳ 3. hardware on the Loop

Check on Computer
processing on Micro Controller
Real operation of
The product.

Actuator Sizing.

$[\dot{\theta}, T_{max}, T_{rms}] \rightarrow$ Required.



$$I_{torque} = I \alpha$$

$$T_{motor} - T_r = (I_{total}) \alpha$$

↳ restoring

$$\frac{1}{2} I_{out} \omega_{out}^2 = \frac{1}{2} I_{in} \omega_{in}^2 \times \mu$$

↓
effective

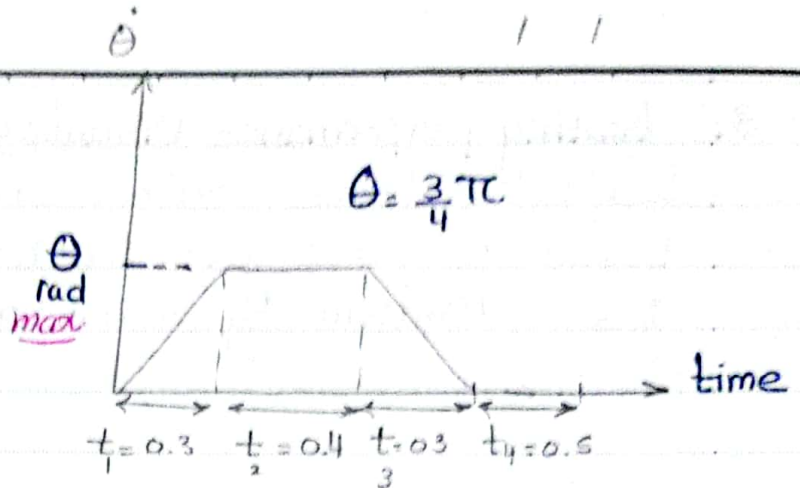
i.e. (I) of the axis of motor
↳ losses.

$$I_{eff} = \frac{I_{out}}{\mu} \times \frac{\omega_{out}^2}{\omega_{in}^2} \rightarrow \frac{1}{N^2}$$

$$I_{eff} = \frac{I_{out}}{\mu} \times \frac{1}{N^2}$$

Example 3:

Given :-



Solution ...

1. $\dot{\Theta}$:-

$$\Theta = \text{area under the curve} = \int \dot{\Theta} dt$$

$$\Theta = \frac{1}{2} \dot{\Theta} t_1 + \dot{\Theta} t_2 + \frac{1}{2} \dot{\Theta} t_3$$

given \downarrow

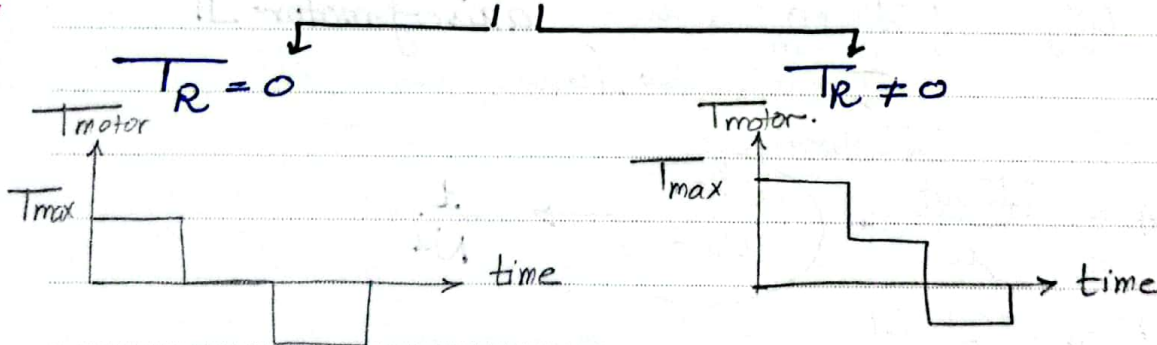
$$\frac{3}{4} \pi = \frac{1}{2} (0.3 \dot{\Theta}_{\max}) + 0.4 \dot{\Theta}_{\max} + \frac{1}{2} (0.3 \dot{\Theta}_{\max})$$

required

$$\Rightarrow \dot{\Theta}_{\max} = \frac{15}{14} \pi$$

Is value is also derivative of $\dot{\Theta}$ above.

2. Motor torque (T_m)



$$3- T_{\text{rms}} = \sqrt{\frac{1}{T} \int_0^T T^2 dt}$$

periodic time