Worked Example 2

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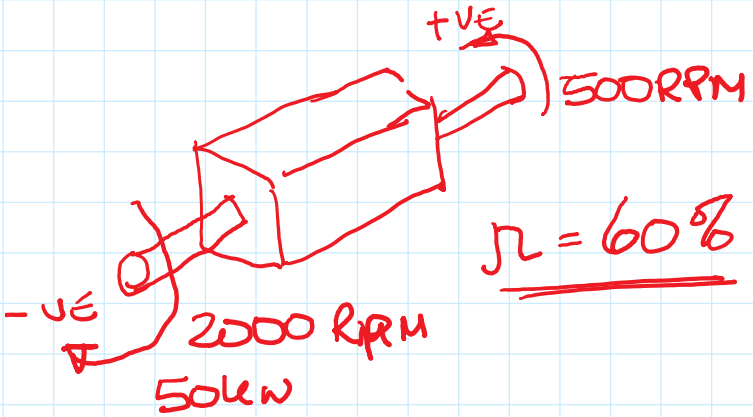
The input shaft of a gear box rotates **clockwise** with an input speed of **2000 RPM**, whilst the output shaft rotates at **500 RPM** and rotates **anticlockwise**. If the input power is **50 KW** and the gearbox is **60%** efficient calculate the following:

1. The input torque
2. The output power
3. The output torque
4. The holding torque



1) Input Torque (T_1)

$$P_1 = \frac{2\pi N_1 T_1}{60}$$

$$T_1 = \frac{P_1 \times 60}{2\pi N_1} = \frac{50000 \times 60}{2 \times \pi \times 2000}$$

$$T_1 = \frac{238.73\ Nm}{\text{Clockwise (-VE)}}$$

2) Out Put Power (P_2)

$$\text{Efficency } \eta = \frac{\text{Power out}}{\text{Power in}} \times 100 = \frac{P_2}{P_1} \times 100$$

$$0.6 = \frac{P_2}{50000} = 0.6 \times 50000$$

$$P_2 = \underline{30,000\ W} \text{ or } \underline{30kW}$$

3) OUTPUT TORQUE (T_2)

$$\text{Power out} = \frac{2\pi N_2 T_2}{60}$$

$$T_2 = \frac{P_2 \times 60}{2\pi N_2} = \frac{30000 \times 60}{2\pi \times 500}$$

$$T_2 = 572.96 \text{ Nm}$$

Anti Clockwise (+VE)

4) HOLDING TORQUE (T_3)

$$T_1 + T_2 + T_3 = 0$$

$$-238.73 + 572.96 + T_3 = 0$$

$$T_3 = 238.73 - 572.96$$

$$= -334.23 \text{ Nm}$$

'Clockwise'