A LECTURE NOTE
ON
TH.1 THEORY OF MACHINE
SEMESTER -4

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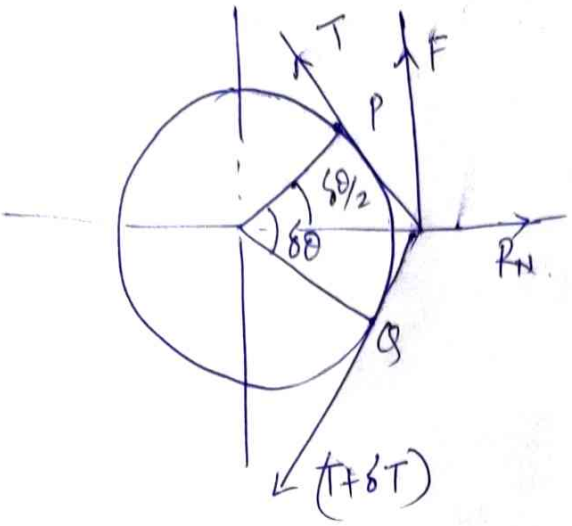
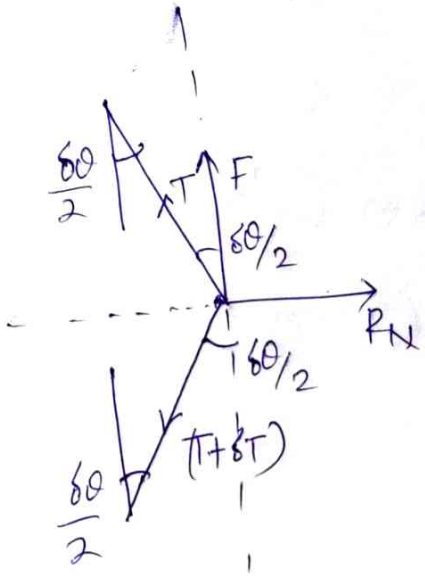
Sr. Lecture Mechanical Engineering

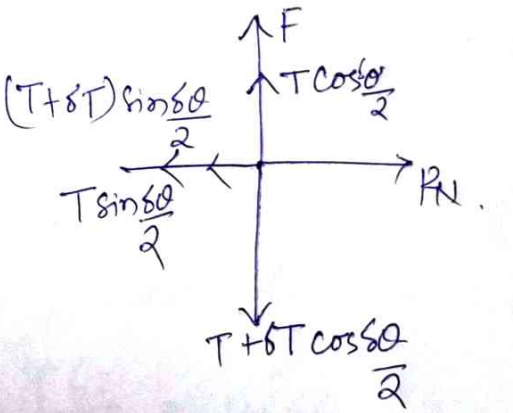
Mechanical Engineering

GOVT. POLYTECHNIC, MALKANGIRI

Ratio of Tensions for Flat Belt







X-axis $\Rightarrow$ $R_N = T\sin\frac{\delta\theta}{2} + (T+\delta T)\sin\frac{\delta\theta}{2}$ ——— (i)

Y-axis $\Rightarrow$ $F + T\cos\frac{\delta\theta}{2} = T+\delta T\cos\frac{\delta\theta}{2}$ ——— (ii)

$$R_N = (T+\delta T)\sin\frac{\delta\theta}{2} + T\sin\frac{\delta\theta}{2}$$

$$\left[\because \sin\frac{\delta\theta}{2} = \frac{\delta\theta}{2}\right]$$

$$= T\sin\frac{\delta\theta}{2} + \delta T\sin\frac{\delta\theta}{2} + T\sin\frac{\delta\theta}{2}$$

$$= 2T\sin\frac{\delta\theta}{2} + \delta T\sin\frac{\delta\theta}{2}$$

$$= 2T\cdot\frac{\delta\theta}{2} + \delta T\cdot\frac{\delta\theta}{2} \to 0$$

$$R_N = T\cdot\delta\theta \quad \text{——} \langle II \rangle$$

Putting the value of R_N in eqn $\langle 1 \rangle$

$$F + T\cos\frac{\delta\theta}{2} = (T+\delta T)\cos\frac{\delta\theta}{2}$$

$$\left[\because \cos\frac{\delta\theta}{2} = 1\right]$$

$$f = \mu\cdot R_N$$

$$\mu\cdot R_N + T = (T+\delta T)$$

$$\mu\cdot T\cdot\delta\theta + f = f + \delta T$$

$$\mu T\delta\theta = \delta T$$

$$\frac{\delta T}{T} = \mu\cdot\delta\theta$$

Integrating both side eqn with T_2 to T_1 & 0 to θ.

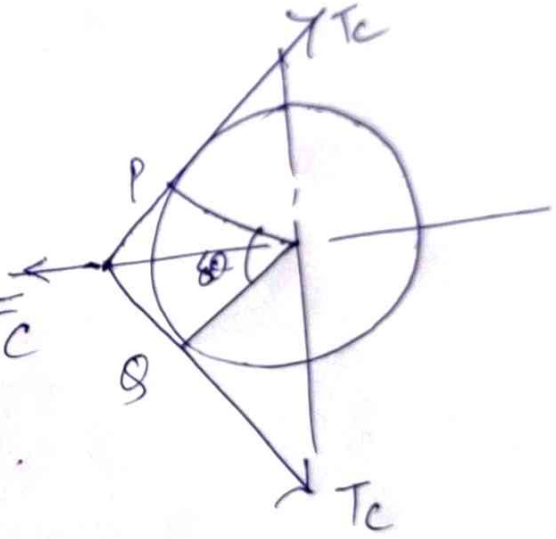
$$\int_{T_2}^{T_1}\frac{\delta T}{T} = \mu\int_0^{\theta}\delta\theta$$

$$\log_e\left(\frac{T_1}{T_2}\right) = \mu\theta$$

$$\frac{T_1}{T_2} = e^{\mu\theta}$$

$$2.3\log\left(\frac{T_1}{T_2}\right) = \mu\theta$$

Centrifugal Tension



m = mass per unit length in kg.

v = linear velocity m/s.

r = radius of pulley

T_C = centrifugal tension.

F_C = centrifugal force

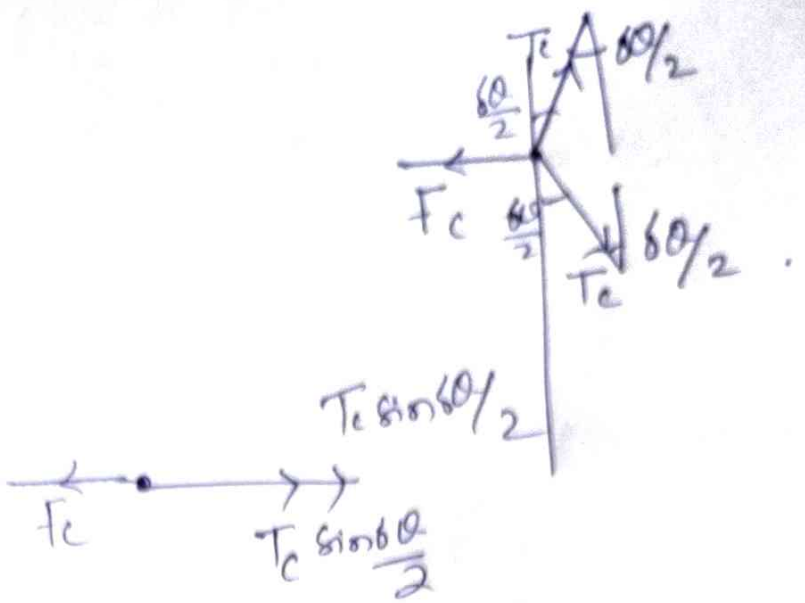
Length of belt PQ = $r \cdot d\theta$ —— (1).

mass of belt m = $m \times r \times d\theta$ —— (2).

centrifugal force $F_C = \frac{mv^2}{r}$

$= m \times r \times d\theta \times \frac{v^2}{r}$

$= m \cdot v^2 \cdot d\theta$ —— (3)



$$F_c = T_c \sin\frac{\delta\theta}{2} + T_c \sin\frac{\delta\theta}{2}.$$

$$F_c = T_c \cdot \frac{\delta\theta}{2} \cdot 2$$

$$m \cdot v^2 \cdot \delta\theta = T_c \cdot \delta\theta$$

$$\boxed{T_c = m \cdot v^2}$$

Total tension in tight side

$$T_t = T_1 + T_c.$$

Total tension in slack side

$$T_{t_2} = T_2 + T_c.$$

Power Transmission

$$P = (T_1 - T_2) \cdot v$$

$$= [(T_1 + T_c) - (T_2 + T_c)]v$$

$$\boxed{= (T_1 - T_2)v}$$

Max Tension in Belt

σ = max safe stress N/mm^2

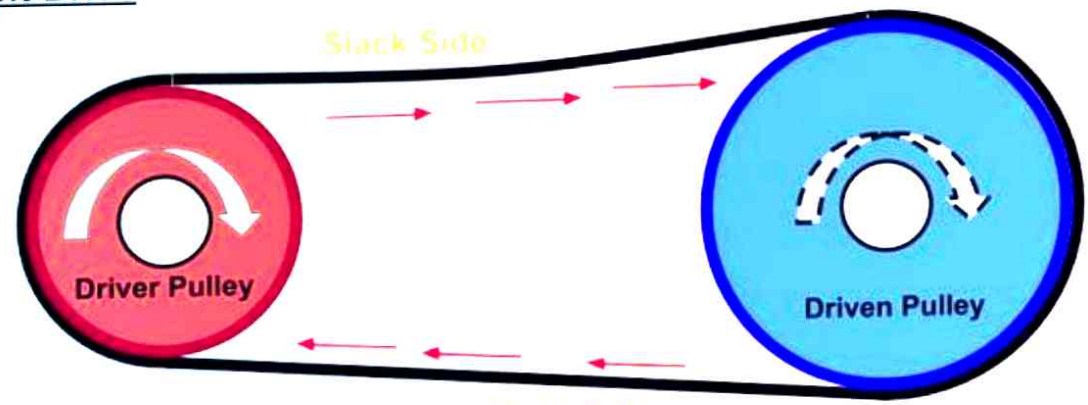
b = width in mm

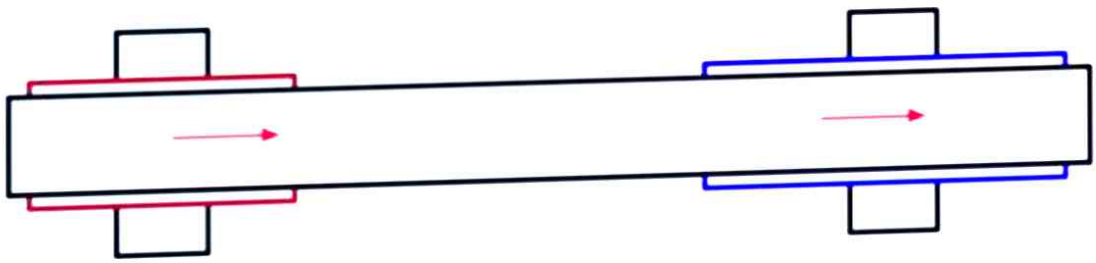
t = thickness in mm.

Max Tension (T) = Stress$_{(max)}$ $\times$ Cross. sectional area

$$\boxed{T = \sigma \times b \times t}$$

Open Belt Drive





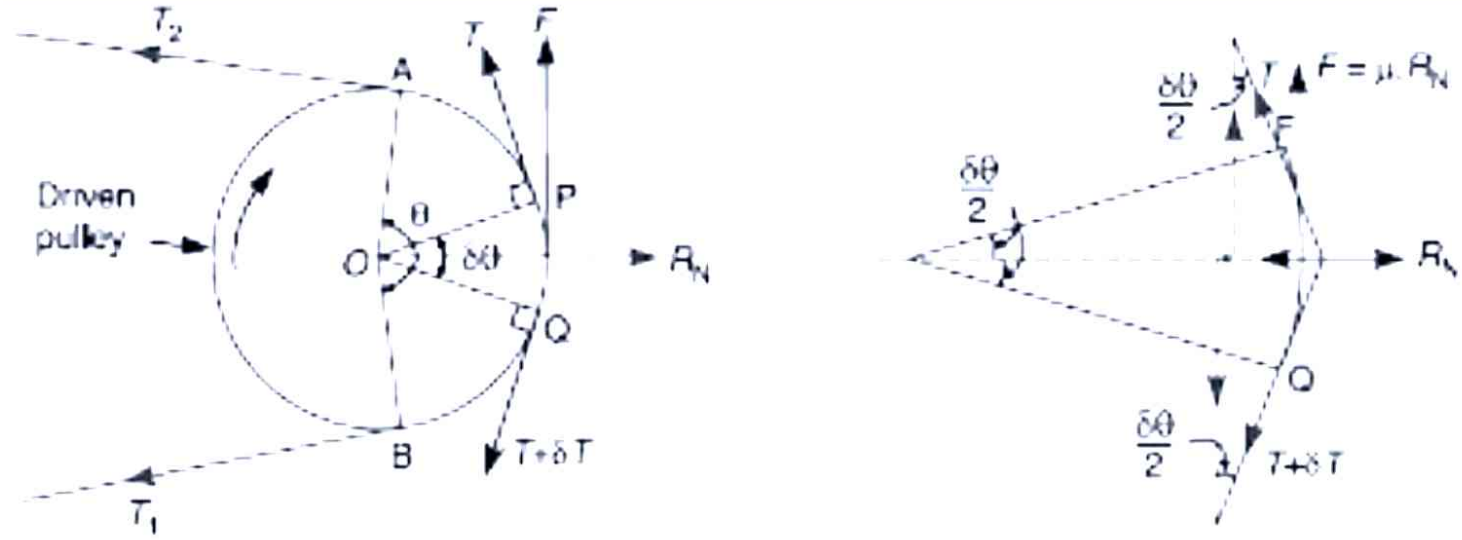


Fig. Ratio of driving tensions for flat belt