

Mechanical Principles Formula Sheet 2

General

$$v = \omega r \qquad T = I\alpha \qquad W = T\theta \qquad \text{Power} = \frac{2\pi NT}{60}$$

Friction Clutches

Constant Wear

Constant Pressure

For plain disc clutches:

$$T = \frac{2n\mu W(r_2 + r_1)}{2}$$

$$T = \frac{2}{3} \mu W \left(\frac{r_2^3 - r_1^3}{r_2^2 - r_1^2} \right) \times 2n$$

For conical clutches:

$$T = \frac{\mu R}{3 \sin \beta} \left[\frac{D_o^3 - D_i^3}{D_o^2 - D_i^2} \right]$$

$$T = \frac{\mu W(D_o + D_i)}{4 \sin \beta}$$

Belt Drives

$$F_1 + F_2 = \text{constant}$$

Assuming negligible belt mass

$$\frac{F_1}{F_2} = e^{\mu\theta}$$

$$P = v(F_1 - F_2)$$

Assuming belt mass per meter, m

$$F_c = mv^2$$

$$\frac{F_1 - F_c}{F_2 - F_c} = e^{\mu\theta} \qquad P = v(F_1 - F_c) \left(1 - \frac{1}{e^{\mu\theta}} \right)$$

Flywheels and inertia

$$I = \frac{\beta W}{\omega_m^2 \phi}$$

$$\phi = \frac{\omega_2 - \omega_1}{\omega_m}$$

$$\omega_m = \frac{\omega_1 + \omega_2}{2}$$

$$I = Mk^2$$

$$I = \frac{Mr^2}{2}$$

Balancing

$$F = M\omega^2 r$$

$$F = \frac{Mv^2}{r}$$

$$\text{For balance: } m_1 r_1 = m_2 r_2$$

Gear Trains

$$\text{Gear ratio} = \frac{N_1}{N_2} = \frac{t_2}{t_1}$$

$$\eta = \frac{\text{Power Out}}{\text{Power In}}$$

$$t_i + t_o + t_h = 0$$