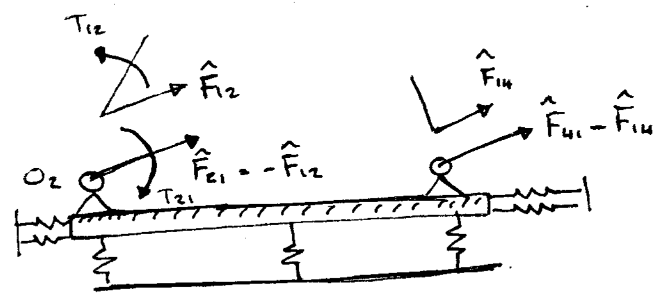
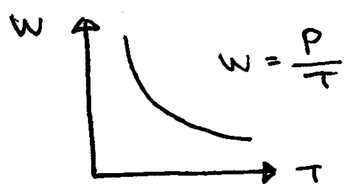


$\omega_2 = \text{const.} = 50 \text{ rad/s}$

$\alpha_2 = 0$



$T_{AVG} = \frac{1}{2\pi}\int_0^{2\pi} T\,d\theta = 70.2 \text{ lb}\cdot\text{in}$

$T_{AVG}\, 2\pi = \int_0^{2\pi} T\,d\theta$ work

$P_{AVG} = (70.2)(50) = 3510 \text{ lb}\cdot\text{in/s}$

or 0.53 hp

Kinetic Energy of Rotating Disk (Flywheel)

$T_L - T_{AVG} = I(d\omega/d\theta)\,\omega$

$$\int_{\theta @ \omega_{min}}^{(\theta @ \omega_{max})} (T_L - T_{AVG})\,d\theta = \int_{\omega_{min}}^{\omega_{max}} I\omega\,d\omega$$

$$\int_{\omega_{min}}^{\omega_{max}} I\omega\,d\omega = \frac{1}{2} I\omega^2 \Big|_{\omega_{min}}^{\omega_{max}} = \frac{1}{2} I(\omega_{max}^2 - \omega_{min}^2)$$

$$= I\,\frac{(\omega_{max} - \omega_{min})}{\omega_{AVG}}\,\frac{(\omega_{max} + \omega_{min})}{2}\,\omega_{AVG}$$

$$= I\,\frac{\omega_{max} - \omega_{min}}{\omega_{avg}}\,\omega_{avg}^2$$

$$= \int_{\theta @ \omega_{min}}^{\theta @ \omega_{max}} (T - T_{avg})\,d\theta = \Delta E$$

$$\omega_{AVG} = \frac{\omega_{max} + \omega_{min}}{2}$$

$$K = \frac{\omega_{max} - \omega_{min}}{\omega_{avg}}$$ Coeff. of Speed Function

ω_{max} at $E_{min} = -60.32$ Pumping

ω_{min} at $E_{max} = 200.73$

$\Delta E = -60.32 - 200.73 = -261.05 \text{ lb}\cdot\text{in}$

I if K is specified.

$$I = \frac{|\Delta E|}{K\cdot\omega_{avg}^2}$$

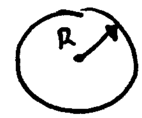
Pumping $K = 0.05$, $\omega_{AVG} = 50$

$$I = \frac{261.05}{(0.05)(50)^2} = 2.0884 \text{ in·lb·s}^2$$

$$I = \left(\tfrac{1}{2}\right) m R^2$$

$$= \left(\tfrac{1}{2}\right) \rho \pi R^2 h R^2$$

$$R = \sqrt[4]{\frac{2I}{\pi h \rho}} = 7.78 \text{ in}$$



Steel

h = thickness = 0.5 in

$\rho = 0.28$ lb/in^3

$\boxed{\text{Example}}$ $a_1 = \dfrac{n\sum x_i y_i - \sum x_i \sum y_i}{n\sum x_i^2 - (\sum x_i)^2} = 19.47024$

$a_0 = \bar{y} - a_1\bar{x} = -234.2857$

where $y = a_0 + a_1 x$

$\rightarrow F = -234.2875 + 19.47024V$

$F = 641.8733\ N$

$\boxed{\text{Example}}$

i	x_i	y_i	x_i^2	x_i^3	x_i^4	$x_i y_i$	$x_i^2 y_i$
1	0	2.1	0	0	0	0	0
2	1	7.7	1	1	1	7.7	7.7
3	2	13.6	4	8	16	27.2	54.4
4	3	27.2	9	27	81	81.6	244.8
5	4	40.9	16	64	256	163.6	654.4
6	5	61.1	25	125	625	305.5	1527.5
$\sum$	15	152.6	55	225	979	585.6	2488.8

$$\begin{cases} 6a_0 + 15a_1 + 55a_2 = 152.6 \\ 15a_0 + 55a_1 + 225a_2 = 585.6 \\ 55a_0 + 225a_1 + 979a_2 = 2488.8 \end{cases}$$

$$\left.\begin{aligned} a_0 &= 2.4786 \\ a_1 &= 2.3593 \\ a_2 &= 1.8607 \end{aligned}\right\} \quad y = 2.4786 + 2.3593x + 1.8607x^2$$

$\rightarrow y = 2.4786 + 2.3593(2.5) + 1.8607(2.5)^2$

(If the question asked for $y\ @\ (x = 2.5)$)

MAR. 18/19

Smooth - no Friction

"Smooth link in complex motion"

Example

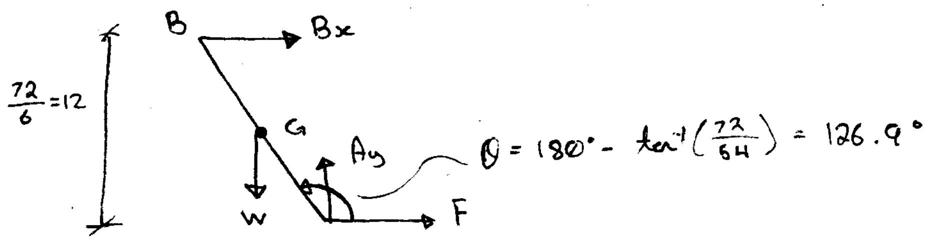
Eqn's of motion: V_A, A_A

(1) $\omega = 0.8333$ rad/s ccw using IC

$\alpha = 1.188$ rad/s^2

single link in complex motion (slide)

(2) FBD



2ND Law:

$F + B_x = m A_{Gx}$

$A_y - W = m A_{Gy}$

$F(3) + A_y(2.25) - B_x(3) = I_G \alpha$

$\hat{A}_G = \hat{A}_A + \hat{A}^t_{GA} + \hat{A}^n_{GA} = 2 - 4.757$ Ft/s

$m = \frac{W}{g} \rightarrow \frac{50}{32.2} = 1.553$ slug

$I_G = \left(\frac{1}{12}\right) m l^2 = \left(\frac{1}{12}\right)\left(\frac{50}{32.2}\right)(1.5)^2 = 1.219$ slug·Ft^2

(1) $F + B_x = 1.553(2) = 3.106$

(2) $A_y - 50 = 1.553(-4.757) = -7.388$

(3) $3F + 2.25A_y - 3B_x = 7.2179(1.188) = 8.648$

(2) $A_y = -7.388 + 50 = 42.612$ lb

(3) $3F - 3B_x = 8.648 - 2.25(42.612) = -87.229$

Solve (1) + (3) $F = -12.99$ lb, $B_x = 16.1$ lb

$\boxed{\text{Example}}$ (slide 19)

$a_{G2x} + a_{G2y} = \emptyset$

link 2: $F_{12x} + F_{32x} = \emptyset$

$F_{12y} + F_{32y} = \emptyset$

$T_{12} - \emptyset.25 F_{32x} = \emptyset.625(-2\emptyset) = -12.5$

link 3: $F_{13x} - F_{32x} = 5 a_{G3x} - F_{px} = -149.8$

$-F_{32y} = 5(-31.54) - 141.4 = 299.1$

$\hat{a}_{G3} = \hat{a}_A + \hat{a}_{G3A} = \hat{a}_A^t + \hat{a}_A^{\hat{n}} + \hat{a}_{G3A}^t + \hat{a}_{G3A}^{\hat{n}}$

$= -1.682 \quad -331.54$

$-0.4247 F_{32x} - 0.0148 F_{32y} - 0.225 F_{13x} = 0.4406(116.25) \ldots$

$-0.26(14.14) + 0.15(141.4) = -8.394$ (6)

(5) $F_{32y} = 299.1$

(4) and (6) $F_{13x} = -91.82$, $F_{32x} = 57.98$

(1) $F_{12x} = -F_{32x} = -57.98$

(2) $F_{12y} = -F_{32y} = -299.1$

(3) $T_{12} = -12.5 + \emptyset.25(57.98) = 1.988$

Consider $\mu = \emptyset.3$

$V_B < \emptyset$, $F_{13x} = -91.82 \sim$ if $\mu = \emptyset$

$F_{13y} = -\mu F_{13x}$