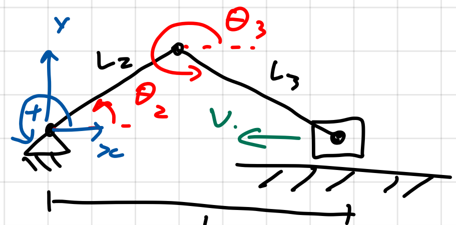
from lecture slide.

$$F_{in}\partial L = K_1\phi_1\partial\theta_2 + K_2\phi_2(\partial\theta_2-\partial\theta_3)+K_3\phi_3\partial\theta_3$$



$$F_{in} = K_1(\theta_2-\theta_{20})\frac{\partial\theta_2}{\partial L_1} + K_2\left((\theta_2-\theta_{20})-(\theta_3-\theta_{30})\right)\left(\frac{\partial\theta_2}{\partial L_1}-\frac{\partial\theta_3}{\partial L_1}\right)+K_3(\theta_3-\theta_{3.0})\frac{\partial\theta_3}{\partial L_1}$$

Unknowns.

$$\frac{\partial\theta_2}{\partial L_1}=\frac{\omega_2}{V_1} \qquad \frac{\partial\theta_3}{\partial L_1}=\frac{\omega_3}{V_1} \qquad \theta_2=\theta_3.$$

Displacement analysis

$$L_2\cos\theta_2+L_3\cos\theta_3=L_1$$
$$L_2\sin\theta_2+L_3\sin\theta_3=0. \Rightarrow \theta_3=\sin^{-1}\left(\frac{L_2}{L_3}\sin\theta_2\right)$$

Velocity analysis

$$-L_2\omega_2\sin\theta_2-L_3\omega_3\sin\theta_3=-V_1$$
$$L_2\omega_2\cos\theta_2+L_3\omega_3\cos\theta_3=0.$$
$$\omega_2=-\frac{L_3\cos\theta_3}{L_2\cos\theta_2}\omega_3.$$

$$\Rightarrow\left(\frac{L_3\cos\theta_3\sin\theta_2}{\cos\theta_2}-\frac{L_3\cos\theta_2\sin\theta_3}{\cos\theta_2}\right)\omega_3=V_1$$

$$\frac{L_3\sin(\theta_3-\theta_2)}{\cos\theta_2}\omega_3=-V_1$$

$$\frac{\omega_3}{V_1}=\frac{-\cos\theta_2}{L_3\sin(\theta_3-\theta_2)} \xrightarrow{\theta_3=\sin^{-1}\left(\frac{L_2}{L_3}\sin\theta_2\right)} \boxed{\frac{\omega_3}{V_1}=-\frac{\cos\theta_2}{L_3\sin\left(\sin^{-1}\left(\frac{L_2}{L_3}\sin\theta_2\right)-\theta_2\right)}}$$

$$\omega_3=-\frac{L_2\cos\theta_2}{L_3\cos\theta_3}\omega_2$$

$$-L_2\omega_2\sin\theta_2+\frac{L_2\cos\theta_2\sin\theta_3}{\cos\theta_3}\omega_2=-V_1$$

$$\frac{L_2\sin(\theta_3-\theta_2)}{\cos\theta_3}\omega_2=V_1$$

$$\frac{\omega_2}{V_1}=\frac{-\cos\theta_3}{L_2\sin(\theta_3-\theta_2)} \xrightarrow{\theta_3=\sin^{-1}\left(\frac{L_2}{L_3}\sin\theta_2\right)} \boxed{\frac{\omega_2}{V_1}=-\frac{\cos\left(\sin^{-1}\left(\frac{L_2}{L_3}\sin\theta_2\right)\right)}{L_2\sin\left(\sin^{-1}\left(\frac{L_2}{L_3}\sin\theta_2\right)-\theta_2\right)}}$$

$$F_{in}=K_1(\theta_2-\theta_{20})\frac{-\cos\left(\sin^{-1}\left(\frac{L_2}{L_3}\sin\theta_2\right)\right)}{L_2\sin\left(\sin^{-1}\left(\frac{L_2}{L_3}\sin\theta_2\right)-\theta_2\right)}+K_2\left((\theta_2-\theta_{2.0})-\left(\theta_3=\sin^{-1}\left(\frac{L_2}{L_3}\sin\theta_2\right)-\theta_{30}\right)\right)\left(-\frac{\cos\left(\sin^{-1}\left(\frac{L_2}{L_3}\sin\theta_2\right)\right)}{L_2\sin\left(\sin^{-1}\left(\frac{L_2}{L_3}\sin\theta_2\right)-\theta_2\right)}+\frac{\cos\theta_2}{L_3\sin\left(\sin^{-1}\left(\frac{L_2}{L_3}\sin\theta_2\right)-\theta_2\right)}\right)+K_3\left(\sin^{-1}\left(\frac{L_2}{L_3}\sin\theta_2\right)-\theta_{30}\right)\frac{-\cos\theta_2}{L_3\sin\left(\sin^{-1}\left(\frac{L_2}{L_3}\sin\theta_2\right)-\theta_2\right)}$$

$$\boxed{\theta_{20}=\frac{1}{10}\pi \qquad \theta_{30}=2\pi-\frac{1}{10}\pi}$$

Initial conditions. $\theta_{20},\theta_{30}\neq 0$

Singularity.

$$K_1=K_2=K_3=\frac{EI}{l}=\frac{E}{l}\cdot\frac{wt^3}{12}$$

Given Values.

$l=0.05m$ $\quad W=0.05m$ $\quad t=0.005$ $\quad E=8GPa \approx 8\cdot10^9 Pa.$

$L_2=0.2m$ $\quad L_3=0.25m$