

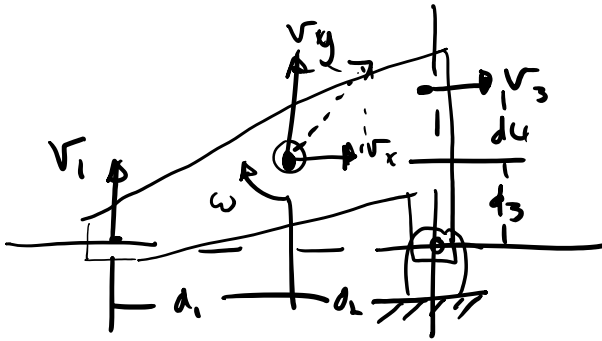
- Lab 3 : 20th
- HW 6 : will have some probs due Tuesday

Mid term

- mean/median 72
 - max: 98
 - min: 44
- A: 5
B: 9
C: 9
D: 10
F: 7

- T/F 81% correct
P1 89% correct
P2 56% correct
P3 60% correct

mid term reflection : due tomorrow 11:59 AM
+ 5 points



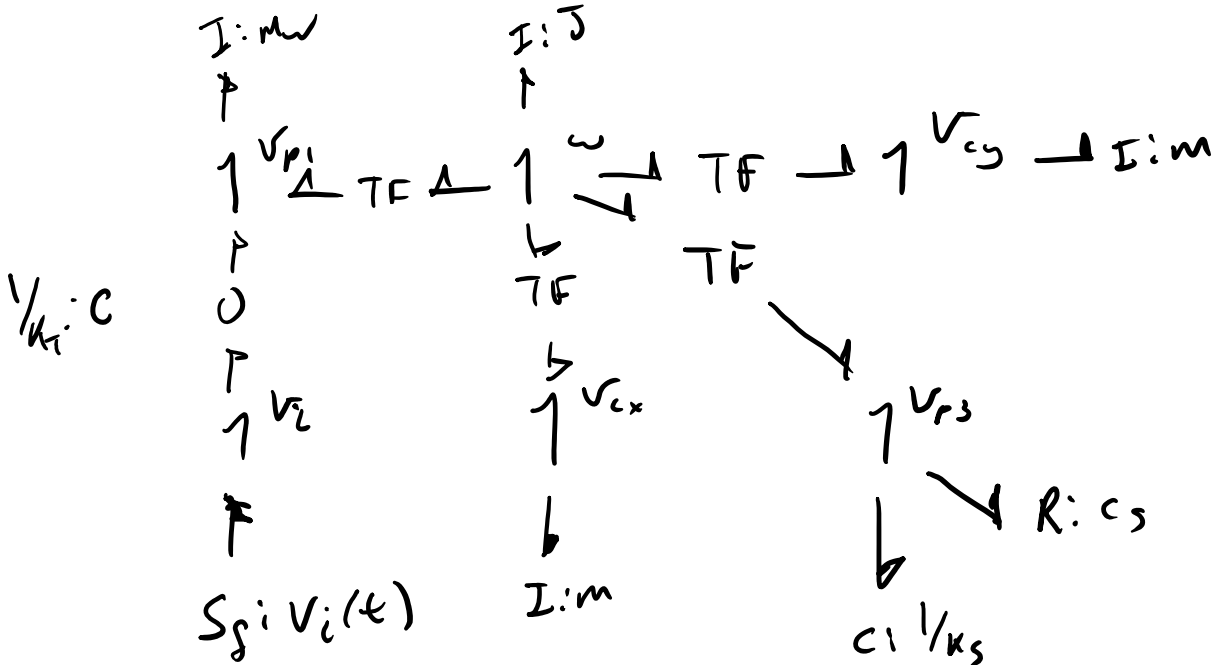
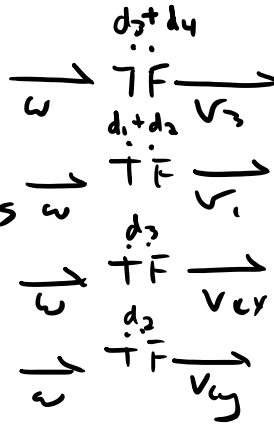
$$V_3 = (d_3 + d_4) \omega$$

$$V_1 = (d_1 + d_2) \omega$$

$$V_{cx} = d_3 \omega$$

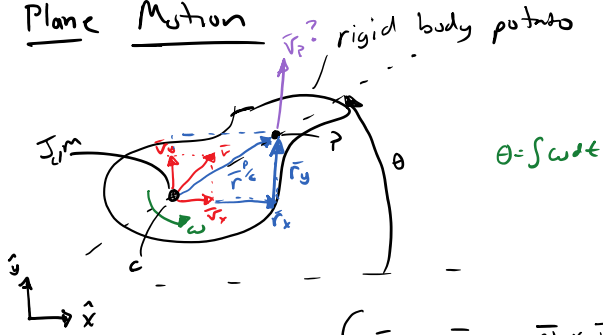
$$V_{cy} = d_2 \omega$$

4 eqns



done

Plane Motion



$$\theta = \int \omega dt$$

$$\vec{v}_P = \vec{v}_c + \vec{\omega} \times \vec{r}_{cP} \quad \begin{cases} v_{Px} = v_{cx} + \omega \times r_{cP_x} \\ v_{Py} = v_{cy} + \omega \times r_{cP_y} \end{cases}$$

$$|\vec{r}_{cP}| = r \quad |\vec{\omega}| = \omega \quad |\vec{r}| = r$$

$$v_{Px} = v_{cx} + \omega r \cos\theta \quad (r_{cP_x})$$

$$v_{Py} = v_{cy} + \omega r \sin\theta$$

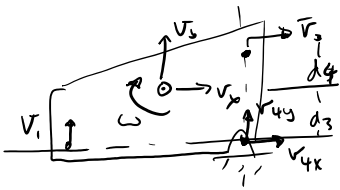
$$\sin\theta = \theta$$

$$\cos\theta = 1$$

$|\vec{r}_y|$
Small angle

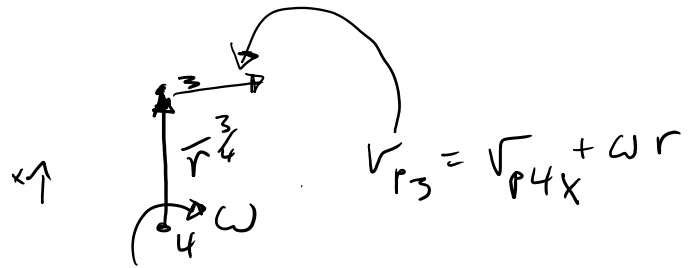
$$v_{Px} = v_{cx} + \omega r$$

$$v_{Py} = v_{cy} + \omega r \theta$$

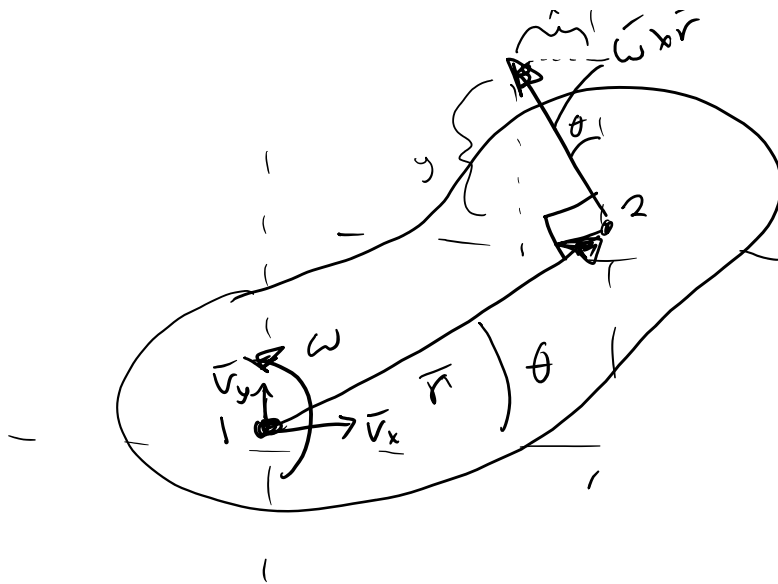


$$\vec{v}_3 = \vec{v}_{4x} + \vec{\omega} \times \vec{r}_{43}$$

$$\vec{v}_3 = \vec{v}_{4x} + \omega(d_3 + d_4)$$

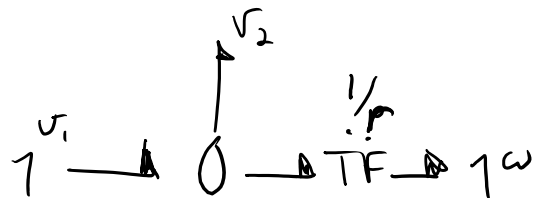


$$v_{P1} = v_{4y} + \omega r$$



$$\vec{v}_1 = \vec{v}_2 + \omega r \Rightarrow$$

$$v_1 - v_2 - \omega r = 0$$



Added after class.

$$\vec{v}_p = \vec{v}_c + \vec{\omega} \times \vec{r}^{P/c} \leftarrow \text{two point theorem}$$

\Downarrow planar motion decomposition

⇓ planar motion decomposition

$$\vec{v}_p = v_{px} \hat{x} + v_{py} \hat{y}$$

$$\vec{v}_c = v_{cx} \hat{x} + v_{cy} \hat{y}$$

$$\vec{\omega} = \omega \hat{z}$$

$$\vec{r}^{P/c} = r_x^{P/c} \hat{x} + r_y^{P/c} \hat{y}$$

expressed as
x, y components
scalar \times unit vector
 $\omega \cdot \hat{z}$

Do cross product:

	\hat{x}	\hat{y}	\hat{z}
$\vec{\omega}$	0	0	ω
$\vec{r}^{P/c}$	$r_x^{P/c}$	$r_y^{P/c}$	0

$$\Rightarrow \vec{\omega} \times \vec{r}^{P/c} = -\omega r_y^{P/c} \hat{x} + \omega r_x^{P/c} \hat{y}$$

So:

$$v_{px} = v_{cx} - \omega r_y^{P/c}$$

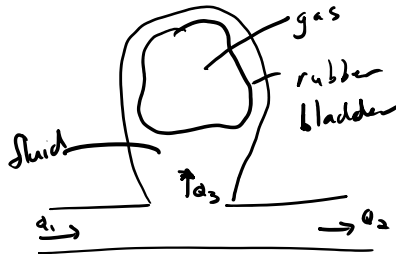
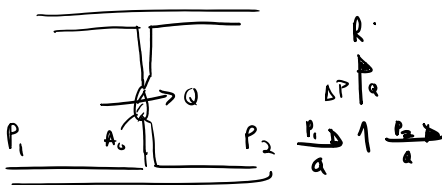
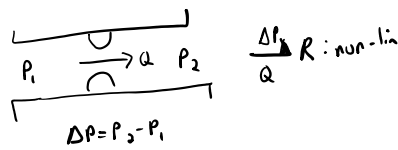
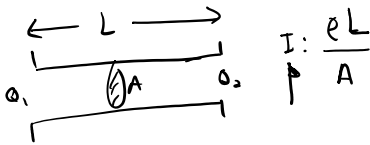
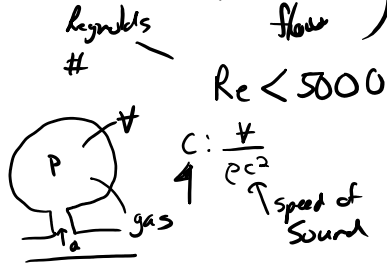
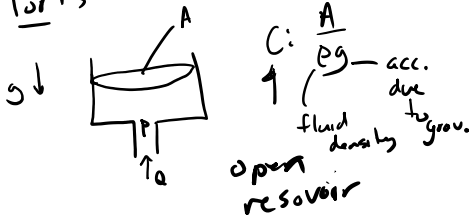
$$v_{py} = v_{cy} + \omega r_x^{P/c}$$

two point theorem
for planar motion
in x, y component
form

Hydraulic, Pneumatic Systems

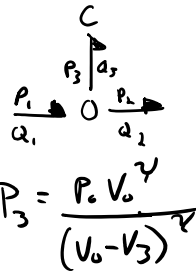
based on assumptions hydrostatic (high pressure / low fluid flow)

Ports



$$\Delta P = \frac{\rho |Q|}{2 C_d^2 A_0}$$

↑ discharge coeff. ≈ 0.6 for sharp round orifice



$$P_3 = \frac{P_0 V_0^\gamma}{(V_0 - V_3)^\gamma}$$

γ : specific heat ratio of gas

P_0, V_0 : initial pressure & volume of bladder

P_3, V_3 : instantaneous pressure & volume

Steps

1. Show positive directions for fluid flow and pressure.

2. For each distinct pressure establish a 0-Junction and attach elements that act on the absolute pressure. Include atmospheric pressure as 0-junctions
3. Insert R-, C-, and I- between appropriate 0-Junctions using 1-junctions.
4. Eliminate 0-Juncs. for atmospheric pressure.
5. simplify