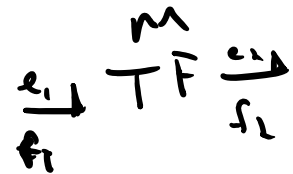
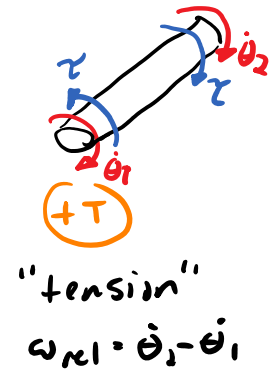
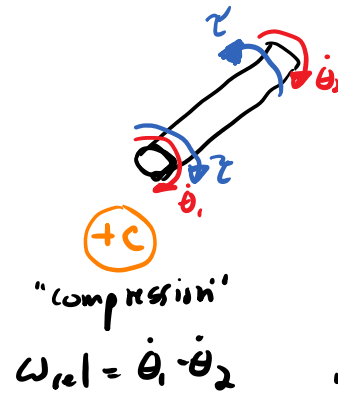
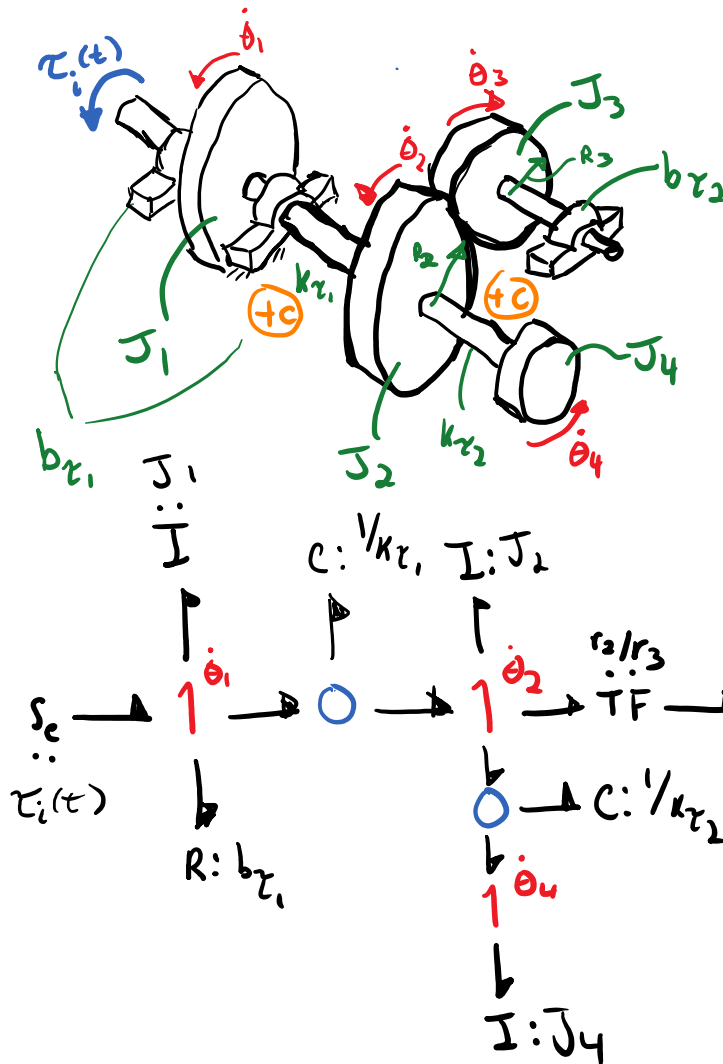


- Lab 2 due tomorrow
- HW #5 due Sunday : 4.16, 4.22, 4.23, 4.24

Midterm

- T/F or MC (20 min)
- 2 or 3 problems (60 mins)
- Open notes, closed book, no electronic devices
 - 1) you write them!
 - 2) my class notesyou create materials! not others
- Chapters
 - 1.1-1.6
 - 2.1-2.4
 - 3.1-3.5
 - 4.1-4.2
- Question related to first 2 labs

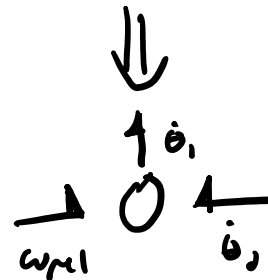
Exercise: Complete bond graph



$$e_1 = m e_2$$

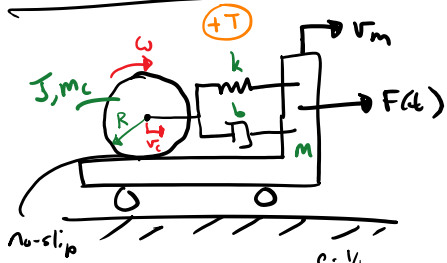
$$m f_1 = m_2$$

$$(+C) \quad \omega_{rel} = \dot{\theta}_1 - \dot{\theta}_2 \Rightarrow \omega_{rel} - \dot{\theta}_1 + \dot{\theta}_2 = 0$$



$$-\omega_{rel} + \dot{\theta}_1 - \dot{\theta}_2 = 0$$

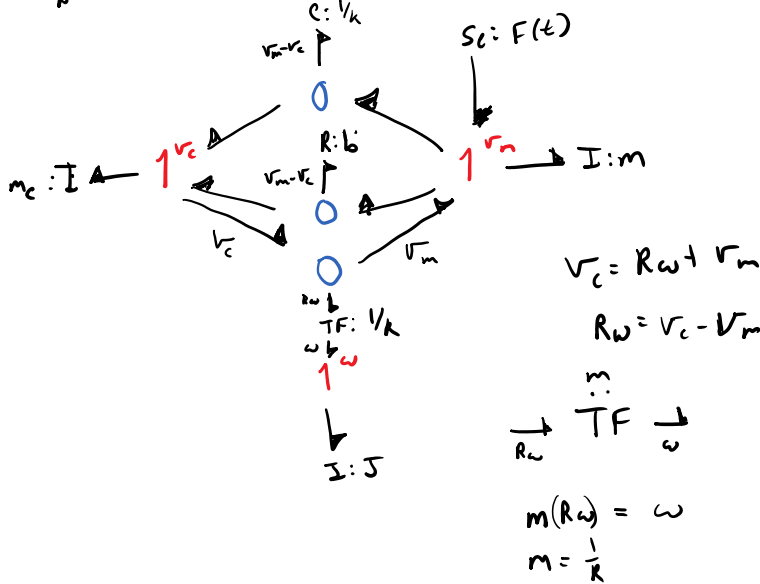
Rotation + Translation



$$v_c = R\omega + v_m \quad \leftarrow \text{kinematic constraint}$$

$$\underbrace{v_c}_{\text{absolute velocity}}$$

$$v_{rel} = v_m - v_c$$

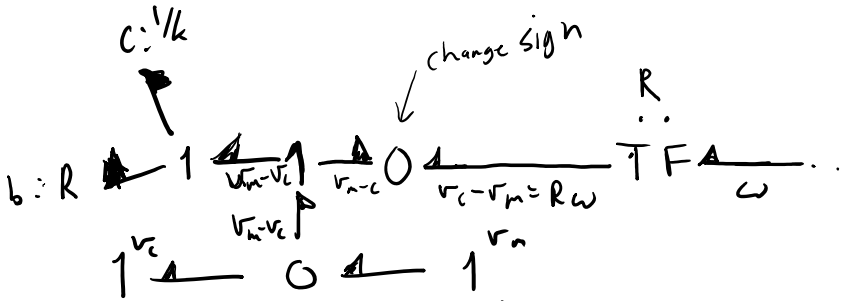


$$v_c - v_m - R\omega = 0$$

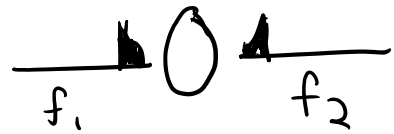
$$v_c - v_m = R\omega$$

$$-R\omega = v_m - v_c$$

Alternative graph of above section:



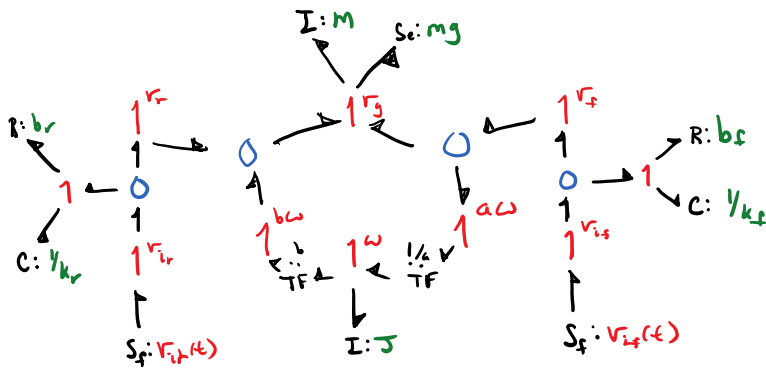
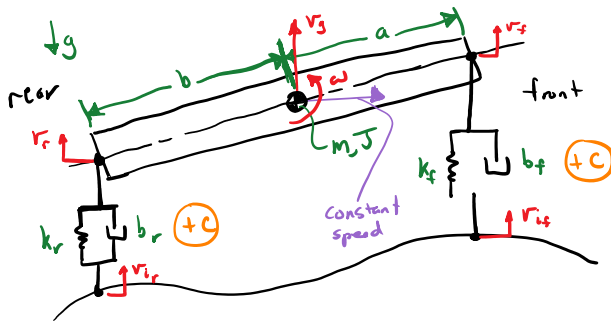
How to change sign of a flow:



$$f_1 + f_2 = 0$$

$$f_1 = -f_2$$

Example: Half-Car Suspension Model



$$v_g = v_r + \omega b$$

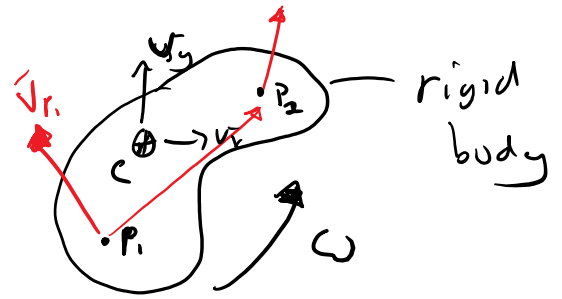
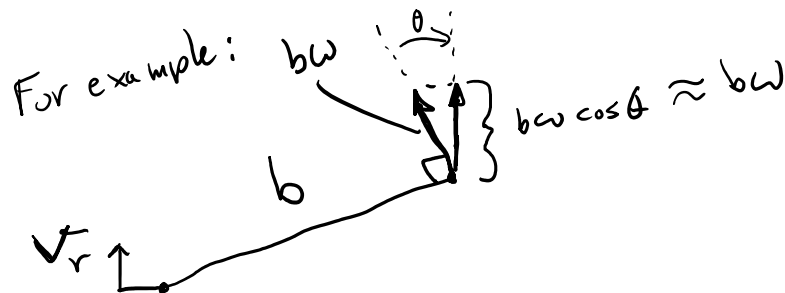
$$v_f = v_g + \omega a$$

Small angles

$$\sin \theta \approx \theta$$

$$\cos \theta \approx 1$$

$$\tan \theta \approx \theta$$



Two point theory

If you velocity of 1 point on rigid body and it ang. velocity, then you calculate any other points velocity

$$\bar{v}_{P_2} = \bar{v}_{P_1} + \bar{\omega} \times \bar{r}_{P_2/P_1}$$

$$m \bar{v}_g = -mg$$

$$m \bar{v}_g + mg = 0$$

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