University of Idaho HW # 7 Due Fri Oct 29 (Session 27).

For planar motion of rigid bodies, we have two sets of Newton Laws

$$\sum \vec{F} = m\vec{a}_G \qquad \sum \vec{F} = m\vec{a}_G$$

$$\sum \vec{M}_G = I_G \vec{\alpha} \qquad \sum \vec{M}_P = I_P \vec{\alpha} + m\vec{r}_{G/P} \times \vec{a}_P$$

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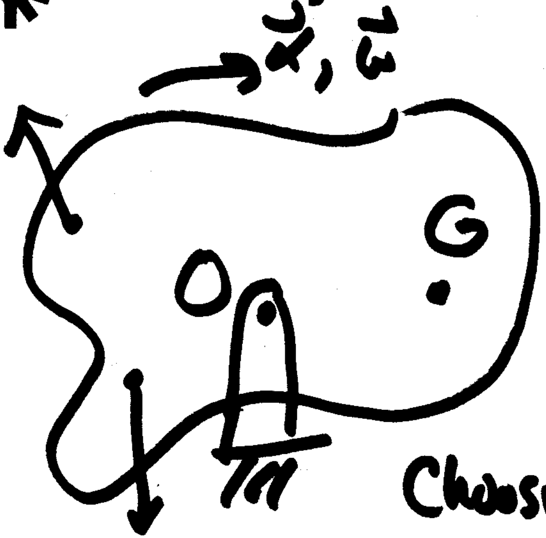
Fixed Axis Rotation



$$\sum \vec{F} = m\vec{a}_G$$

$$\sum \vec{M}_G = I_G \vec{\alpha}$$

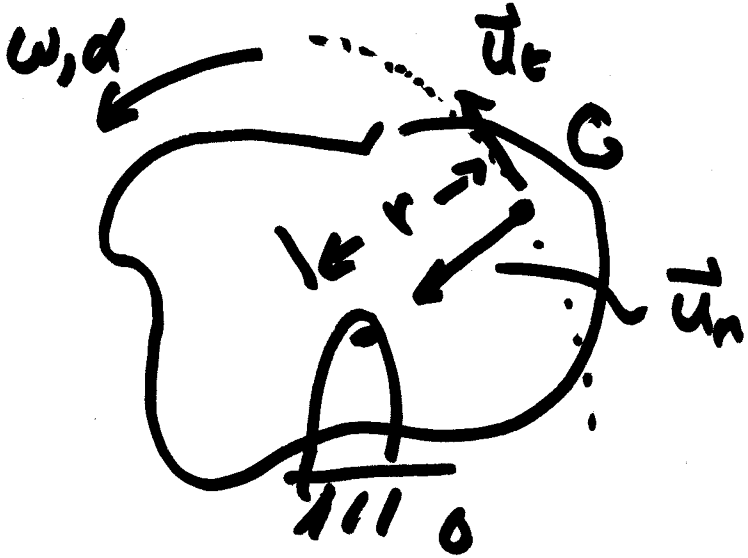
Choosing P=O (Eliminates Rxns at O from moment equation)

$$\sum \vec{F} = m\vec{a}_G$$

$$\sum \vec{M}_O = I_O \vec{\alpha} + m \cdot \vec{r}_{G/O} \times \vec{a}_O$$

$$\sum \vec{M}_O = I_O \vec{\alpha}$$

University of Idaho For fixed axis rotation, its sometimes convenient to use nt coordinates to calculate $\vec{a}_G$:



$$\vec{a}_G = r\alpha\vec{u}_t + r\omega^2\vec{u}_n$$

nt coordinate for translation

$$\Sigma F_n = m a_n = m r \omega^2$$

$$\Sigma F_t = m a_t = m r \alpha$$

$\Sigma M_O = I_O \alpha$ to solve a problem.

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Section 17.5 General Plane

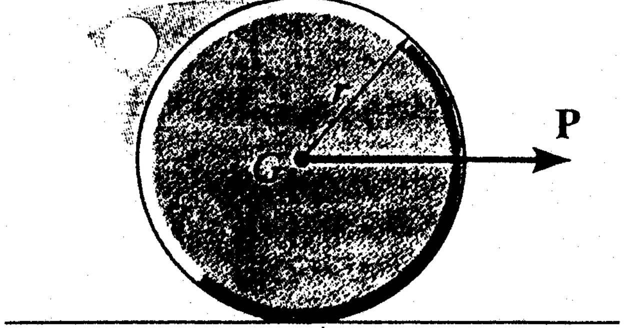
Motion:

Again, we'll use the following

$$\sum \vec{F} = m\vec{a}_G \; ; \; \sum \vec{M}_G = I_G \vec{\alpha}$$

$$\sum \vec{F} = m\vec{a}_G \; ; \; \sum \vec{M}_P = I_P \vec{\alpha} + \vec{r}_{G/P} \times \vec{a}_P$$

But, we'll sometimes need add'nl equation to determine the unknowns.



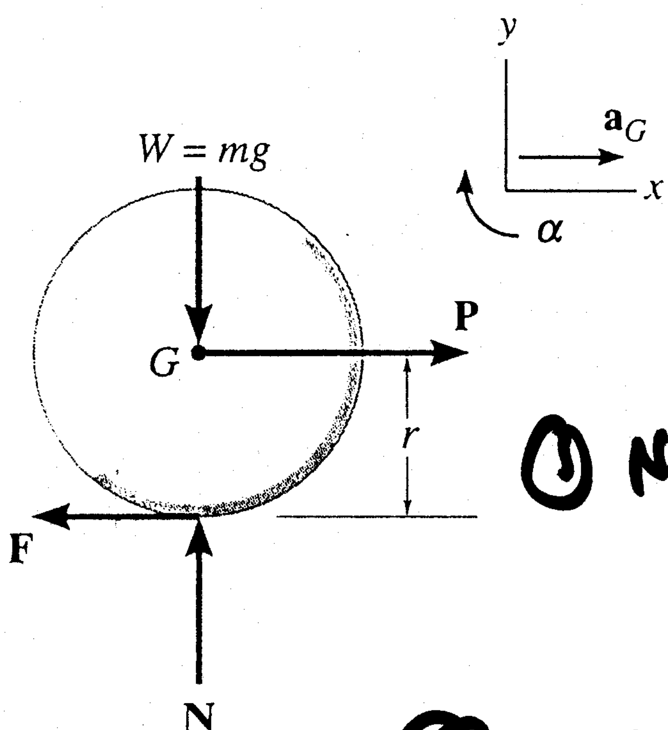
(a)

Frictional Rolling Problems

EQM's: $\sum F_x = m(a_G)_x$

$\sum F_y = m(a_G)_y$

$\sum M_G = I_G \alpha$



(b)

Unkns: $F, N, \alpha, (a_G)_x$ $\quad (a_G)_y = 0$

① No slip; $(a_G)_x = r\alpha$

requires $F \leq \mu_s N$

② Slip $(a_G)_x \neq r\alpha$, $F = \mu_k N$

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