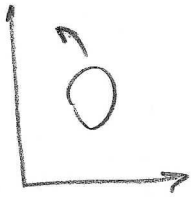
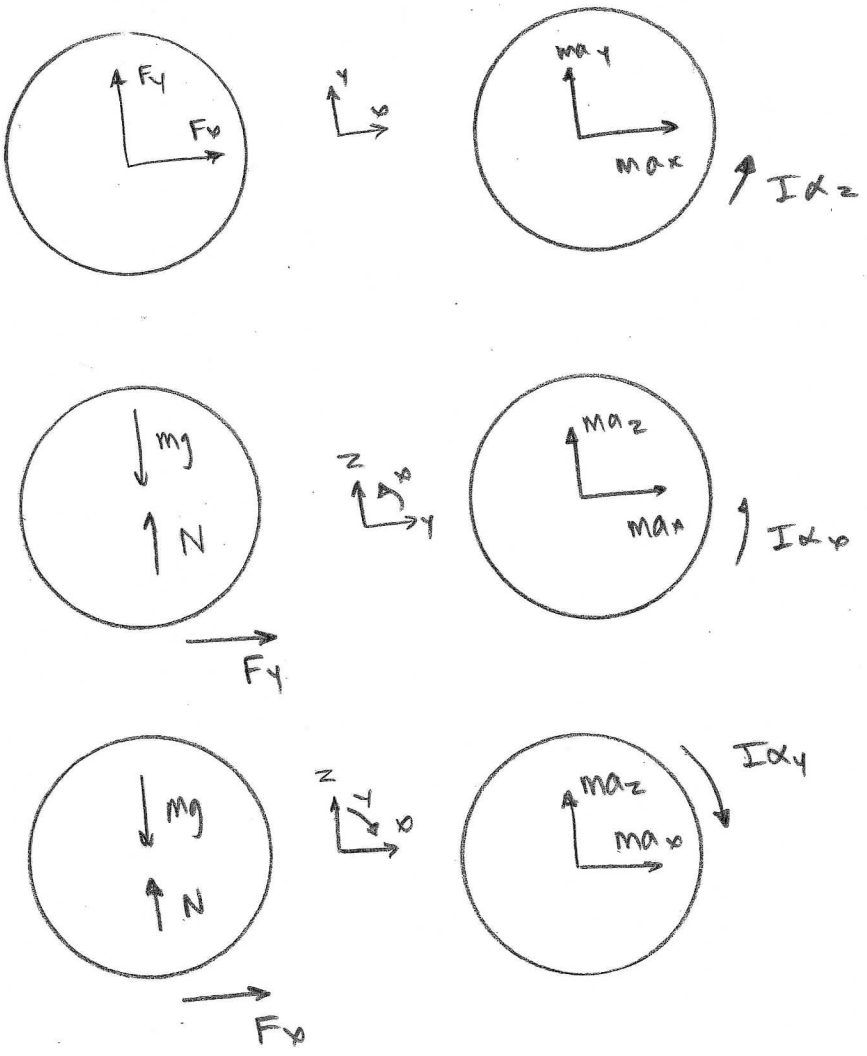
LAB 4 HAND CALCULATIONS

RAHUL GOYAL



FBDs

KDs



① $\Sigma F_x = ma_x$

$\frac{F_x}{m} = a_x$

$\frac{F_y}{m} = a_y$

② $\Sigma F_z = m\cancel{a_z}^{0}$

$N = mg$

$\Sigma M_x = \bar{I}\alpha_x$

$\alpha_x = \frac{F_y \cdot r}{\bar{I}}$

③ $\Sigma F_z = m\cancel{a_z}^{0}$

$N = mg$

$\Sigma M_y = \bar{I}\alpha_y$

$\alpha_y = -\frac{F_x \cdot r}{\bar{I}}$

LAB 4 HAND CALCULATIONS

CONTINUED

$$\bar{x} = \begin{bmatrix} v_x \\ v_y \\ \omega_x \\ \omega_y \\ x \\ y \end{bmatrix}$$

$$\frac{d}{dt}\bar{x} = \begin{bmatrix} F_x/m \\ F_y/m \\ F_y r/I \\ -F_x r/I \\ v_x \\ v_y \end{bmatrix}$$

$$\vec{v_c} = \vec{v_B} + \vec{v_{c/B}}$$

$$\vec{v_c} = (v_x\hat{i} + v_y\hat{j}) + (\omega_x\hat{i} + \omega_y\hat{j}) \times -r\hat{k}$$

$$\vec{v_{cx}} = (v_x - \omega_y \cdot r)\hat{i}$$

$$\vec{v_{cy}} = (v_y + \omega_x \cdot r)\hat{j}$$

$$\theta = \arctan\left(\frac{v_{cy}}{v_{cx}}\right)$$

When slipping

$$|F| = \mu_k N$$

$$\vec{F_x} = \mu_k N \cos\theta\,\hat{i}$$

$$\vec{F_y} = \mu_k N \sin\theta\,\hat{j}$$

When not slipping

$$|F| = 0$$

$$\vec{F_x} = \vec{0}$$

$$\vec{F_y} = \vec{0}$$