$$\sum M_z = I_z \dot{\omega}_z^{\,0} - I_x \Omega_y \omega_x^{\,0} + I_y \Omega_x \omega_y^{\,0}$$

$$A_y(.4) - B_y(.4) = 0$$

$$A_y = B_y$$

$$\sum F_x \Rightarrow A_x - B_x = 0 \quad \Rightarrow A_x = B_x$$

$$\sum F_y \Rightarrow A_y + B_y - mg = 0$$

$$A_y + B_y = 2.5\,kg(9.81\,kg\text{-}\tfrac{m}{s^2}) =$$

$$A_y + B_y = 24.525\ N$$

$$\sum F_z \Rightarrow B_z + A_z = 0$$

$$A_z = -B_z$$

Solve Equations:

$A_y = B_y$, $A_x = B_x$

$A_y + B_y = 24.525\ N$

$A_z = -B_z$

$-A_z + B_z = -506.4775\ kg\text{-}\frac{m}{s^2}$

$2B_z = -506.4775$ (1006.4 N ≈ 226 lbs)

$B_z = -253.23875\ kg\,\frac{m}{s^2} \Rightarrow A_z = +253\ N$

$2A_y = 24.525\ N$

$B_y = A_y = 12.2625\ N$

$A_x = B_x = 0$

Discussion

Largest load is B_z & $A_z = \pm 253\ N$

Next is $A_y = B_y = 12\ N$.

The radial loads generated by the angular momentum are large (~50 lbs force), but this does not seem to be too extreme. I need bearings to take this ~250 N radial load. It seems that is a relatively low load requirement and I imagine head tube bearings could take this, considering when one hits a bump there is a significant moment load on the head tube bearings.

* However, Mitch did bring up a good point regarding head tube bearings not designed for high rpm. If they are sealed bearings it shouldn't be a problem, and if they are we could build a bearing block to take the head tube

Further Considerations:

- Need to look @ effects as we speed up design speed as there will be a $\ddot{\omega}$ term → slow will help
- Effect of Inertia terms due to drive motor mounted on primary axis.
  - ↳ Does not seem to effect bearing loads But will effect drive requirements as it will be an inertia term we are trying to drive.
- The inertia term I used does not account for the mass of the batteries. Looking @ the governing equation

$$\sum M_y = I_y \dot{\omega}_y^{\,0} - I_z \Omega_x \omega_z + I_x \Omega_z^{\,0} \omega_x$$

$$.4(-A_z + B_z) = -I_z \Omega_x \omega_z$$

$$\Rightarrow 2B_z = \frac{-1}{0.4}\left(I_z \Omega_x \omega_z\right)$$

$$B_z = -1.25\left(I_z \Omega_x \omega_z\right)$$

So, we are linearly & directly related to each of the terms.

- Loads on primary axle
- Single sided support