Perform calculation on primary axle.

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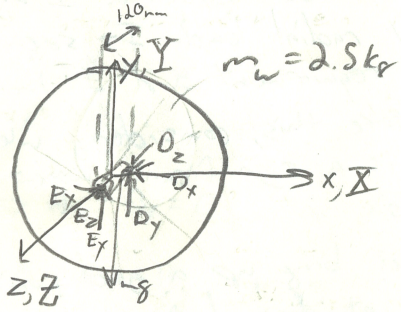
FBD



Aside: as wheel rotates about X, w_n There will be loads in the z axis

$\sum F_x$: $D_x - E_x = 0 \Rightarrow D_x = E_x$

$\sum F_y$: $E_y + D_y - mg = 0$

$E_y + D_y = 24.525\ N \rightarrow E_y = D_y = \frac{1}{2}(24.525N)$

$E_y = D_y = 12.26\ N$

$\sum F_z$: $-E_z + D_z = 0$

$D_z = E_z = 0$

$\sum M_x = I_x \dot{\omega}_x - I_y \Omega_z \omega_y + I_z \Omega_y \omega_z$

$-E_x(.06m) + D_y(.06m) = 0$

$D_y = E_y$

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

$D_x(.06m) + E_x(.06m) = -(.15313\ kg\,m^2)\left(63\frac{rad}{s}\right)\left(21\frac{rad}{s}\right)$

$D_x + E_x = \frac{-1}{.06m}(.15313\ kg\,m^2)(63)(21)\left(\frac{rad}{s}\right)^2$

$D_x + E_x = 3376.517$

$2D_x = 3376.5\ N$

$D_x = 1688.258\ N \rightarrow 2000N \rightarrow 198MPa$

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

$0 = 0$

Results

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The loads on the primary spin axis are more than triple those on the secondary. 1688 – 1700N radial loads on the axle. This is rather significant, and may make it difficult to use standard bike wheels. I'm not sure if standard cones will take this load.

→ Quick Test: I weigh 150lbs → 68kg ⇒ 668 N

Normal riding, the bearings must take each a quarter of this load – 167 N. Impact could require more, so a mountain bike might take this load. Sealed bearings this is not a completely ridiculous number.