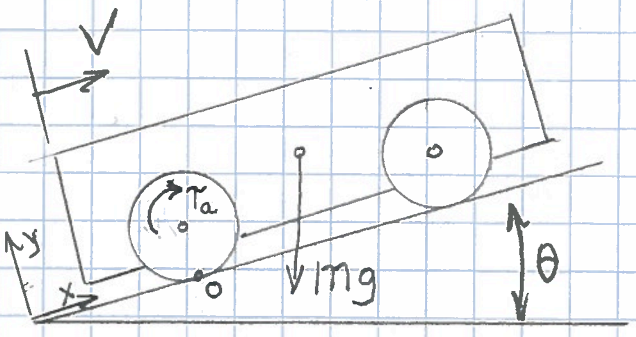


Car driving up hill with rear wheel drive, Torque from motor applied to rear axle.

Assume mg is evenly split between front, rear axles.

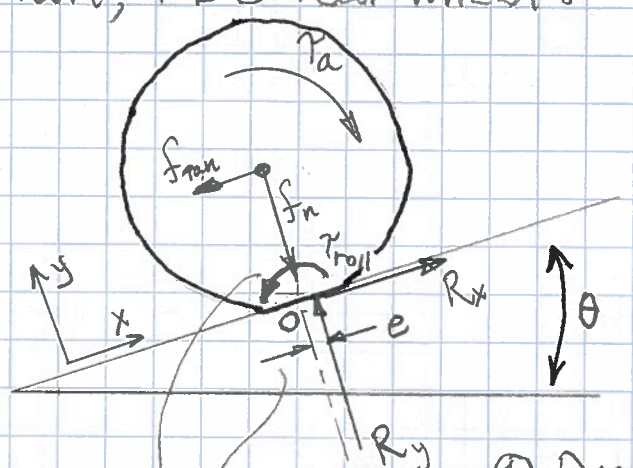
θ = hill angle

V = car velocity = $r_{wheel} \cdot \omega$

mg = car eight

τ_a = Torque from motor about rear axle.

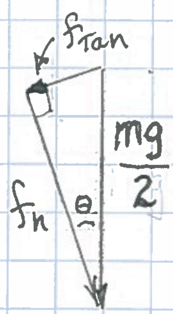
Detail, FBD rear wheel:



$f_n = \frac{1}{2} mg \cos\theta$

$f_{Tan} = \frac{1}{2} mg \sin\theta$

τ_{roll} = Tire rolling resistance Torque = $R_y \cdot e$



① Due to rolling resistance, R_y is not exactly beneath f_n; it is slightly toward front of contact area, by amount "e".

② R_x is the Traction force required to climb uphill. Note: $R_x \leq \mu f_n$

> R_x is not part of P_{loss}!

ΣF_x: $R_x - f_{Tan} = 0$ ΣF_y: $R_y - f_n = 0$

ΣM_o: $-\tau_a + \tau_{roll} + f_{Tan} \cdot r_{wheel} = 0$ or

$\tau_a = f_{Tan} \cdot r_{wheel} + \tau_{roll}$, where $\tau_{roll} = R_y \cdot e$

Power: $\underbrace{\tau_a \cdot \omega}_{P_{in}} = \underbrace{f_{Tan} \cdot r_{wheel} \cdot \omega}_{P_{climb}} + \underbrace{\tau_{roll} \cdot \omega}_{P_{loss}}$