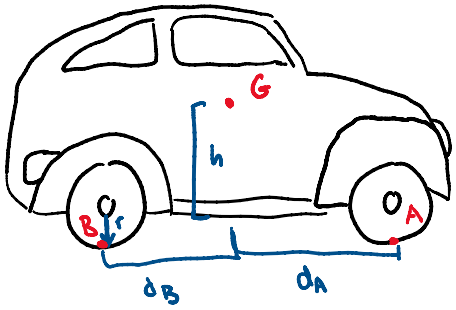
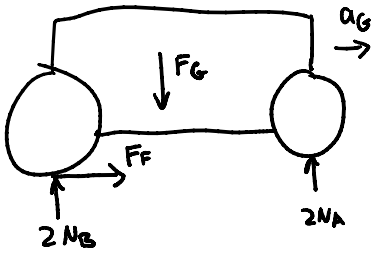
20-R-KINDK-17 Intermediate Translation (RBK) Video

Inspiration: 17-27 Hibbeler



A punch buggy is challenged to race. As it starts from rest, slamming on the accelerometer causes the rear wheels to slip. If the punch buggy has a mass of ***m = 1400kg*** with a centre of gravity at G, determine the distance it would travel in ***t = 5 seconds*** and the normal force on each of its four wheels. Assume the mass of the wheels are negligible and the coefficients of static and kinetic friction are mu_s = 0.45 and ***mu_k = 0.3***, respectively.
The radius of both wheels is ***r = 0.25 m***. G is a height of ***h = 0.5 m*** from the bottom of the frame, and ***d_A = 2 m*** and ***d_B = 1.5 m***



$\sum F_x = ma_{Gx} = F_F = \mu_k(2N_B) = 0.3(2N_B)$ ← sliding

$\sum F_y = 2N_B + 2N_A - 1400(9.81) = 0$

$\sum M_A = 1400(9.81)(2) - 2N_B(3.5) = 1400\,a_{Gx}(0.5+0.25)$

$0.6N_B = 1400\,a_{Gx}$

$N_B = \frac{7000}{3}a_{Gx}$

$2N_B + 2N_A = 13734$

$N_A = 3140.020134$

$27468 - 7N_B = 1050\,a_{Gx}$

$27468 - \frac{49000}{3}a_{Gx} = 1050\,a_{Gx}$

$N_B = 3686.979866$

$a_{Gx} = \frac{5986}{3725} = 1.580134$

$d = v_0t + \frac{1}{2}at^2 = \frac{1}{2}(1.580134)(5^2) = 19.75167785\ m$