20-R-IM-DK-7

July 6, 2020 11:15 AM

Intermediate Principle of Impulse and Momentum Video

Inspiration: 19-10 Hibbeler

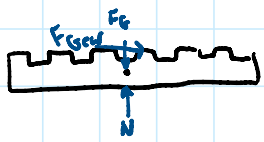
A city engineer is working on a cargo transport system utilizing gears and racks. She is considering a ***30 kg*** gear with a radius of gyration of k_G = 125 mm and a radius of ***r = 0.15 m***. The gear is in contact with a ***20 kg*** rack. If it takes the gear ***0.6125s*** to reach an angular velocity of ***omega = 20 rad/s***, starting from rest, determine the moment that the gear is subjected to. Assume there is no friction between the rack and the ground.

$v_{rack_2} = \omega_2 r = 20(0.15) = 3$

$m(v_{rack_1}) + \sum \int_{t_1}^{t_2} F\,dt = m(v_{rack_2})$

$0 + Ft = 20(3)$

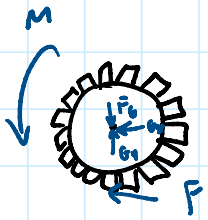
$Ft = 60 \qquad F(0.6125) = 60 \qquad F = \frac{4400}{49}$



$I_G \omega_1 + \sum \int_{t_1}^{t_2} M_c\,dt = I_G \omega_2$

$0 + Mt - Frt = I_G \omega_2 = mk_G^2 \omega_2$

$M(0.6125) - \frac{4400}{49}(0.15)(0.6125) = 30(0.125)^2(20)$



$M = 30$ Nm