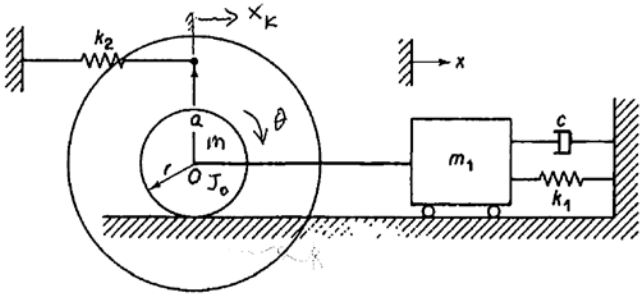
ME 370.1 Fall 2018 Name(s)

Homework 6

Due: *In class*, Friday, Oct. 5

1. (15 pts) Examine the geometric model shown below. The wheel rolls without slip making the model SDOF. The spring k_2 is connected to the wheel at a location "*a*" above the center of the wheel.



(1) (4 pts) Draw the *FBD* for the wheel and write the two *ele eqs*, one for m and the other for J_o.

(2) (2 pts) The motion relation between x_k and x is

a) $x_k = x$ b) $x_k = (a/r)x$

c) $x_k = (r/a)x$ d) $x_k = \big((a+r)/r\big)x$

e) $x_k = \big((a+r)/a\big)x$

(3) (9 pts) The math model of the system in x is

a) $(m + m_1 + J_o/r^2)\ddot{x} + c\dot{x} + (k_1 + k_2(a+r)^2/r^2)x = 0$

b) $(m + m_1 + J_o/r^2)\ddot{x} + c\dot{x} + (k_1 + k_2(a+r)/r)x = 0$

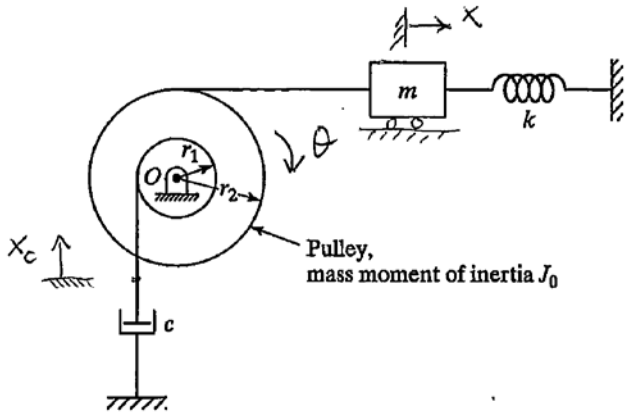
c) $((a/r)m + m_1 + J_o/r^2)\ddot{x} + c\dot{x} + (k_1 + (a+r)^2/r^2)x = 0$

d) $((a/r)m + m_1 + J_o/r^2)\ddot{x} + c\dot{x} + (k_1 + k_2(a+r)/r)x = 0$

e) $(m + (a/r)m_1 + J_o/r^2)\ddot{x} + c\dot{x} + (k_1 + (a+r)^2/r^2)x = 0$

f) $(m + (a/r)m_1 + J_o/r^2)\ddot{x} + c\dot{x} + (k_1 + k_2(a+r)/r)x = 0$

2. (12 pts) Refer to the geometric model below.



(1) (2 pts) The motion relation between x_c and x is

a) $x_c = x$

b) $x_c = \dfrac{r_1}{r_2} x$

c) $x_c = \dfrac{r_2}{r_1} x$

d) $x_c = \dfrac{r_1 + r_2}{r_2} x$

e) $x_c = \dfrac{r_2}{r_1 + r_2} x$

(2) (10 pts) Let $m = 9\,\text{kg}$, $J_o = 4\,\text{kg-m}^2$, $r_1 = 0.1\,\text{m}$ and $r_2 = 0.25\,\text{m}$. The math model of the system in θ is

a) $656.25\ddot{\theta} + 2c\dot{\theta} + 16.74k\theta = 0$

b) $656.25\ddot{\theta} + c\dot{\theta} + 16.74k\theta = 0$

c) $456.25\ddot{\theta} + c\dot{\theta} + 6.25k\theta = 0$

d) $456.25\ddot{\theta} + 4c\dot{\theta} + 26.83k\theta = 0$

e) $352.74\ddot{\theta} + 2c\dot{\theta} + 6.25k\theta = 0$

f) $352.74\ddot{\theta} + 4c\dot{\theta} + 26.83k\theta = 0$