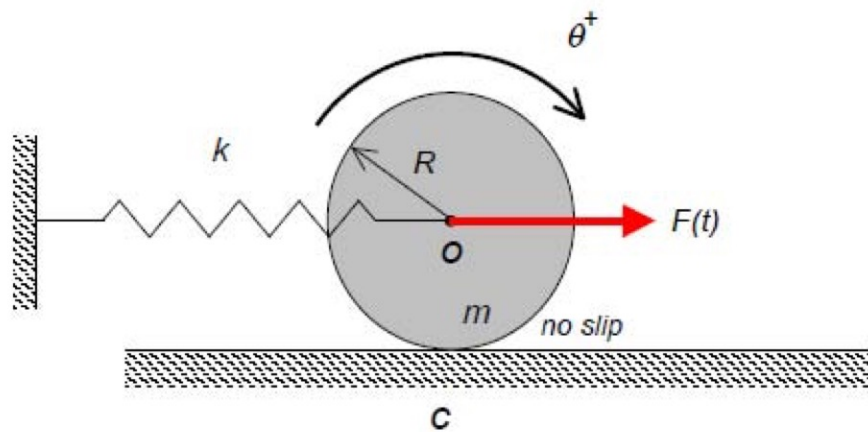


Homework 6.J

Given: A homogeneous disk, having a mass of m and outer radius of R , rolls without slipping on a rough horizontal surface. A spring of stiffness k is connected between the center O of the disk and ground on the left side of the disk. A force $F(t) = F_0 \sin \omega t$ acts horizontally at point O on the disk. Let θ represent the rotation of the disk measured positive clockwise, and let the spring be unstretched when $\theta = 0$ rad.

Find: For this problem:

- Draw a free body diagram of the disk;
- Derive the single differential equation of motion for the system in terms of the coordinate θ ; and
- Derive the particular solution $\theta_p(t)$ for the equation of motion obtained above.



Use the following parameters in your analysis: $m = 2$ kg, $k = 4800$ N/m, $R = 0.5$ m, $F_0 = 50$ N, and $\omega = 60$ rad/s.