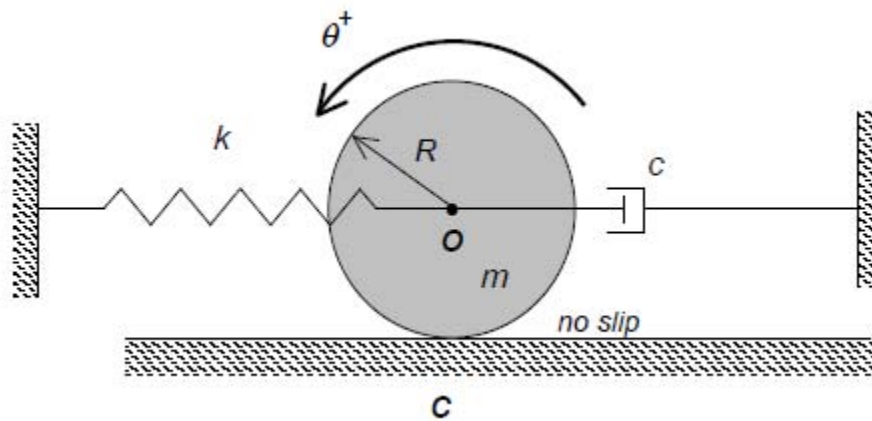


Homework H.6.F

Given: A homogeneous disk having a mass of m and outer radius 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 dashpot with damping constant c is connected between O and ground on the right side of the disk, as shown in the figure below. Let θ represent the rotation of the disk measured positive counterclockwise. When $\theta = 0$ rad, the spring is unstretched.

Find: For this problem:

- Draw a free body diagram of the disk;
- Derive the single equation of motion for the system in terms of the coordinate θ , its derivatives, and, at most, the parameters m , R , c , and k ; and
- Determine the response of the system $\theta(t)$ for $t > 0$, assuming $\theta(0) = \theta_0$ and $\dot{\theta}(0) = \dot{\theta}_0$.



Use the following parameters in your analysis: $m = 4$ kg, $k = 150$ N/m, $R = 0.1$ m, $c = 6$ kg/s, $\theta_0 = 0.2$ rad, and $\dot{\theta}_0 = -3$ rad/s.