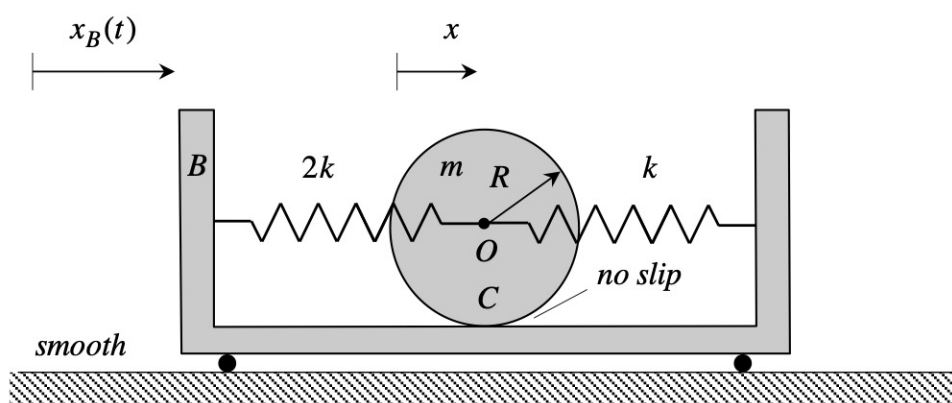


Homework 6.M

Given: A homogeneous disk of mass m and with an outer radius of R rolls without slipping on a rough horizontal surface on cart B. The disk is connected at its center O with two springs (of stiffnesses $2k$ and k) to B, as shown in the figure. The base B is given a prescribed motion of $x_B(t) = b \sin \Omega t$. Let x measure the position of O from its position when the springs are unstretched.

Find: For this problem:

- Derive the differential equation of motion (EOM) for the system in terms of the coordinate x ;
- Determine the natural frequency ω_n of the system;
- Determine the amplitude of the motion described by particular solution of the EOM; and,
- For the motion found in (c) above, does O move in phase or out of phase with B?



Use the following parameters in your analysis: $m = 200$ kg, $k = 10,000$ N/m, $b = 0.1$ m, and $\Omega = 15$ rad/s.