

Homework H.6.D

Given: A homogeneous disk of mass m and outer radius R is able to roll without slipping on a rough, inclined surface. The center of the disk O is attached to ground with two springs of stiffnesses k and $2k$, as shown in the figure. Let x represent the motion of O along the incline as the disk rolls, where $x = 0$ when the springs are unstretched.

Find: For this problem:

- Derive the dynamical equation of motion (EOM) of the system in terms of the coordinate x ;
- From the EOM, determine the static displacement of O , x_{st} ;
- Rewrite the EOM of the system in terms of the variable $z = x - x_{st}$, where z represents the position of O relative to its static equilibrium position; and,
- Determine the natural frequency of the system in terms of, at most, the given parameters of the problem: m , k and R .

