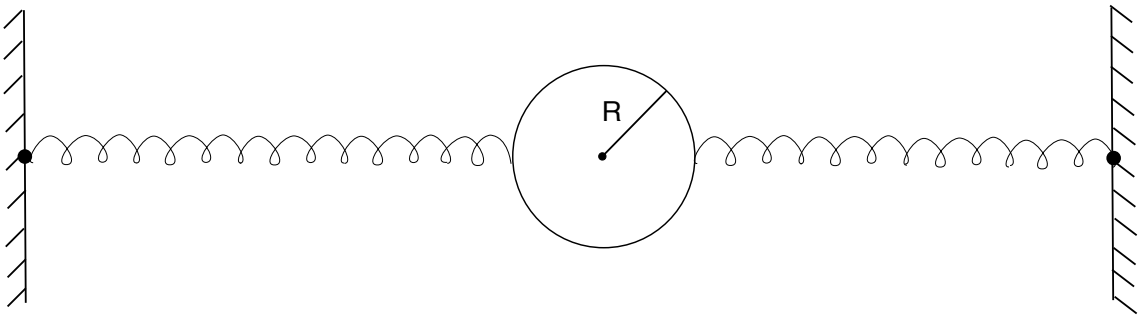
2. **Disc on Springs**

A thin uniform disk of mass M and radius R is connected by two springs of spring constant K to two fixed points on a frictionless table top. The springs are attached to the disc at opposite ends of a diameter and the disk is free to translate and rotate in the plane. Each spring has an unstretched length l_0, and when the disc sits at rest in the equilibrium position (as in the figure), both springs are stretched to the same length $l > l_0$. The motion of the disc in the plane has three degrees of freedom which we can take to be the coordinates (x, y) of the center of the disc and the angle ϕ of rotation of the disc with respect to its orientation when at rest.



What are frequencies of the normal modes of oscillation for small motions about this equilibrium position?