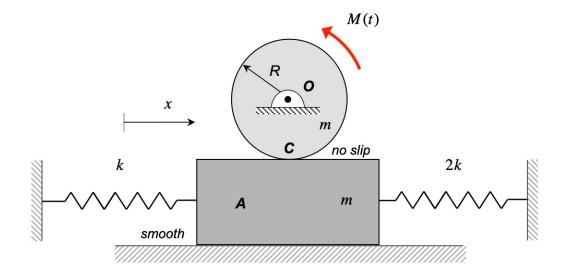**Homework H6.J**

Given: A homogeneous disk of mass m and with an outer radius of R is pinned to ground at its center O. Block A (of mass m) is connected to grounded springs of stiffnesses k and $2k$, as shown, as it slides on a smooth horizontal surface. The disk and block A are in contact as the system moves, with the disk not slipping on the surface of block A. A torque $M(\mathrm{t})$ acts on the disk. Let x measure the position of block A, with x measured positively to the right and with $x = 0$ corresponding to the springs being unstretched.

Find: For this problem:
(a) Derive the differential equation of motion (EOM) for the system in terms of the coordinate x;
(b) Determine the natural frequency of the system; and,
(c) Determine the particular solution of the EOM corresponding to an input torque of $M(\mathrm{t}) = M_0 \sin\Omega t$.