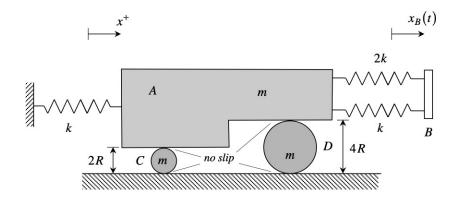## Homework H6.K

Given: Cart A (of mass m) is supported by two rollers C and D (each of mass m, and having outer radii of R and $2R$, respectively). The rollers are known to roll without slipping with respect to both the ground and cart A. A spring of stiffness k is attached between the left side of the cart and ground. Two additional springs, of stiffnesses k and $2k$, are attached between the right side of cart A and a moveable base B. The base B is given a prescribed motion of $x_B(t) = b\,cos\Omega t$. Let x represent the motion of cart A, where $x = x_B = 0$ when all three of the springs are unstretched.

Find: For this problem:
(a) Derive the differential equation of motion (EOM) for the structure in terms of the coordinate x;
(b) Identify the natural frequency ω_n of oscillations for the system;
(c) Derive the particular solution for the EOM, $x_P(t)$; and,
(d) What is the amplitude of the motion for the cart when $\Omega = 2\omega_n$? Is the cart moving in-phase or out-of-phase with the base B at this frequency of excitation?