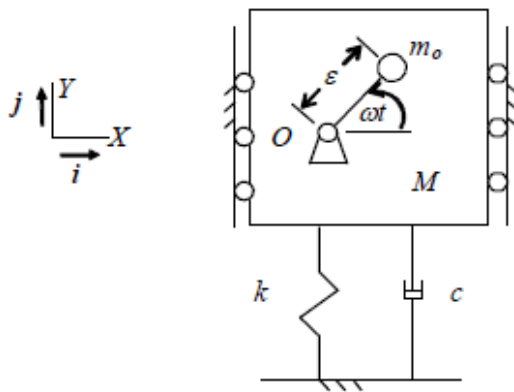


Homework # 1

Due on Tuesday, January 31 at the beginning of lecture

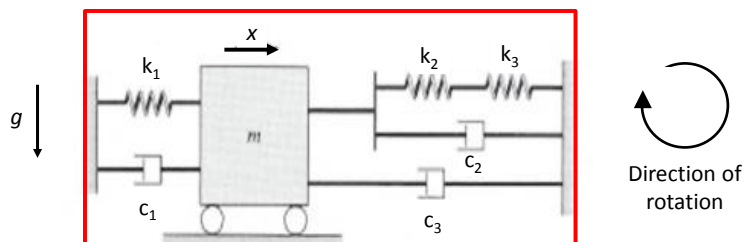
Problem # 1

Determine the equation of motion of the system shown in the figure, for motion in the Y -direction. The system consists of a washing machine resting on a spring-damper combination. Inside the washer, there is an imbalance consisting of a small mass m_o which spins with angular velocity ω in the direction shown. The radius of rotation is ε . The total mass of the system is $m_o + M$ (in other words, M does *not* include the imbalance mass). Gravity acts in the negative Y -direction.



Problem # 2

(a) Derive the equation of motion of the system shown in the figure. The mass can move only in the direction indicated as x , which is fixed with respect to the red box, but the entire red box rotates in the direction indicated with respect to the gravity vector (the gravity vector is fixed) with angular velocity ω . The initial position at time zero is as shown in the figure. (b) Provide expressions for the equivalent stiffness and equivalent damping coefficient. Neglect any centrifugal forces due to rotation.



Problem # 3

(a) Derive the equation of motion of the system shown in the figure. (b) What is the equivalent stiffness? (c) What is the natural frequency?

