ME EN 534
Homework #7

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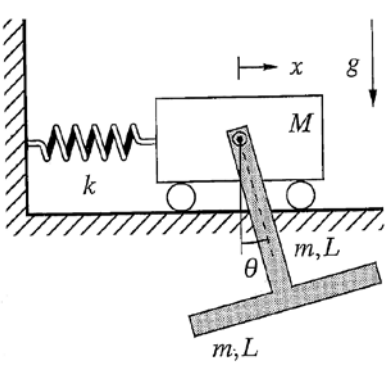
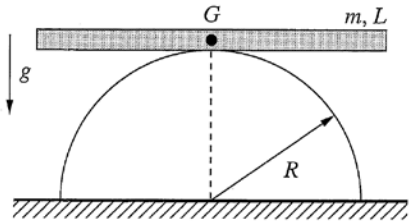
1. Complete Problem 8.24 from the text. Solve using virtual work.

2. Complete Problem 8.40 from the text.

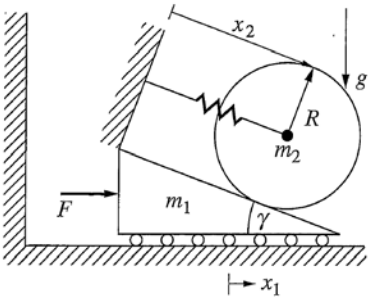
3. Find the equations of motion for the system shown, comprised of a cart and T-shaped pendulum, using Lagrange's equations. Use the variables shown in the figure as generalized coordinates.



4. A slender rod of mass m and length L is positioned over a semicircular block. Friction is sufficient to prevent slipping. Derive the equation of motion of the rod as it rocks over the semicircular block. Use θ (the angle measured clockwise from the vertical to the point of contact of the rod with the semicircular block) as the generalized coordinate. Simulate the motion of the block in response to an initial condition of $\theta(0) = 18^o$. Let m = 2.1 kg, L = 1 m, g = 9.81 m/s^2, and R = 0.5 m. Turn in a plot of the motion vs. time over an appropriate time interval.



5. A cylinder of mass m_2 and radius R rolls without slipping on a wedge of mass m_1. The wedge is moving under the influence of the force F with no friction. Obtain the equations of motion using x_1 (the position of the wedge relative to an inertial frame) and x_2 (the position of the disk relative to the wedge) as the generalized coordinates. The spring is connected between the center of the cylinder and a point that moves with the wedge.



6. A smooth tube in the form of a circle of radius r rotates in the vertical plane about point O with a constant angular velocity $\omega = \dot{\theta}$. The position of a particle of mass m that slides inside the tube is given by the relative coordinate ϕ. Find the differential equation of motion for ϕ using Lagrange's equations.