

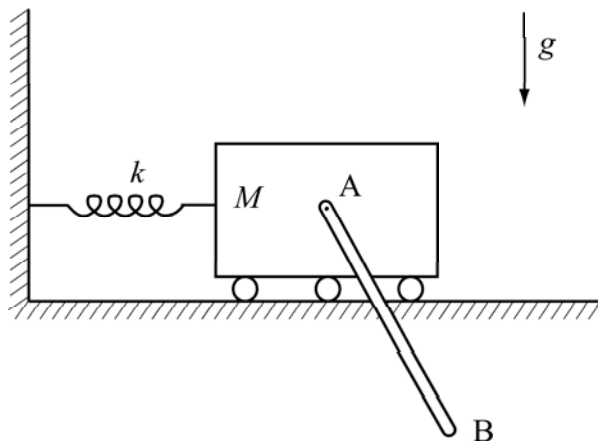
Quiz No. 1

Tuesday, October 13th, 2009

This is a *closed-book* quiz. Each student may bring one 8 1/2 x 11 inch sheet of self-prepared notes only.

Problem 1 (10 points)

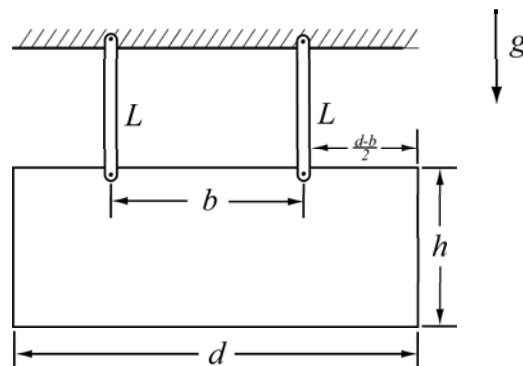
In the system sketched below, the block of mass M is connected to the vertical wall via a spring of stiffness k , and moves horizontally on small, massless rollers. The rigid, uniform link AB of mass m and length L can swing freely about A . Neglecting friction, derive the equation(s) of motion for this system.



Problem 2 (10 points)

A rectangular, uniform, rigid plate of mass m is suspended from the ceiling via two identical rigid links of length L and negligible mass, as shown in the sketch below.

- (a) Derive the equation(s) governing the motion of the plate in its own plane
- (b) Determine the forces exerted by the links on the plate



Problem 3. (10 points)

A uniform, circular, rigid disk is mounted on a vertical shaft such that the normal to the disk makes an angle α to the shaft. (See the sketch below.) The mass of the disk is M and its radius is R . (The axial and diametral moments of inertia of the disk are $\frac{1}{2}MR^2$ and $\frac{1}{4}MR^2$, respectively.) The shaft has relatively negligible mass and rotates with constant angular speed ω .

- (a) Calculate the angular momentum of the disk about its center C
- (b) Determine the reaction forces at the bearings (ignore the effect of gravity)

