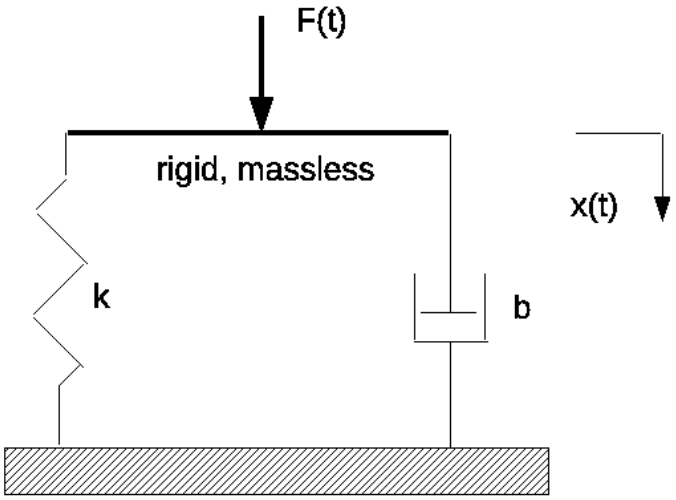
COEN 45, Spring 2010
Homework #8
Spring-damper system
Due Tues. May 25

The figure shows a spring (force proportional to extension) and a damper (force proportional to extensional velocity) connecting a rigid bar to ground.



A force $F(t)$ is applied vertically. Masses are insignificant, so the equation of motion is

$$b\dot{x} + kx = F(t)$$

subject to an initial condition $x(0) = x_0$. You are to solve this differential equation for various conditions using `ode45`. In addition to $x(t)$ you will plot the damper force $F_b = b\dot{x}$ and the spring force $F = kx$.

1. Write a function for `ode45` to use in its solution process:

```
function xdot = xdot_bk(t,x,etc)
%
%  find xdot given t,x
%  etc contaings [b k load_type period amplitude]
%  load_type is 1, 2 or 3
%  period is for load_type 2 or 3
%  amplitude of load
%
```

   Your function should be vectorized, i.e., it should work when `t` and `x` are either vectors or scalars. A template is available on the class web site.

2. A incomplete driver script `hw8.m` is available on the class web site. It uses your `xdot_bk` to generate and plot responses for various load cases:

   (a) x versus t

   (b) F_b versus t

   (c) F_k versus t

   For F_b you will need $\dot{x}(t)$. Assuming you have vectorized your `xdot_bk` you can use it.

   (a) Run the script for load case 1 (`kase = 1`).

   (b) Uncomment the line for case 2 and re-run.

   (c) Uncomment the line for case 3 and re-run.

3. Print each of the plots and on each one, write a comment about the relationship between F_k and F_b.

4. Submit three plots plus `hw8.m` and `xdot_bk.m`