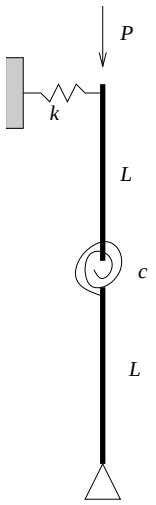
HW 8: Due Thursday March 31

1. (20 pts) Shown below is a structure that may be idealized as being composed of two rigid links of length L that are joined by a torsional spring with spring constant c. The top of the structure is supported by a flexible support with spring constant k.



   (a) Find the total potential energy Π without making a small angle approximation.

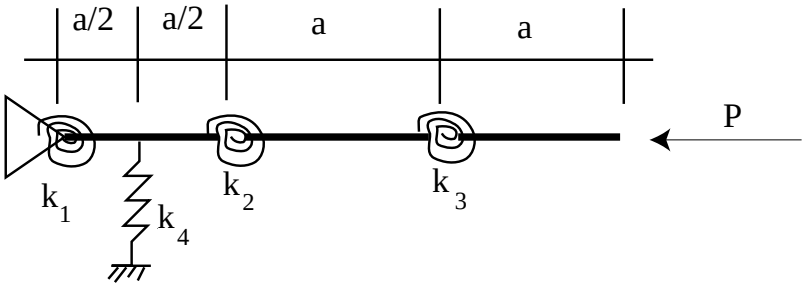
   (b) Reduce your expression in part (a) to one appropriate for small angles.

   (c) Determine the critical load using your expression from part (b) and *accurately sketch/plot* the deflected shape just after collapse. As degrees of freedom, choose the rotations of the bars with respect to the vertical.

2. (10 pts) The linkage shown below is made of three rigid bars, three torsional springs, and one extensional spring.

   (a) Set up the potential energy expression for the system assuming small motions.

   (b) Find the governing system of equilibrium equations that one would have to solve in order to determine the critical load; write your answer in matrix form and indicate in words the remaining steps that would be needed to solve the problem. **Do not solve the equations.**

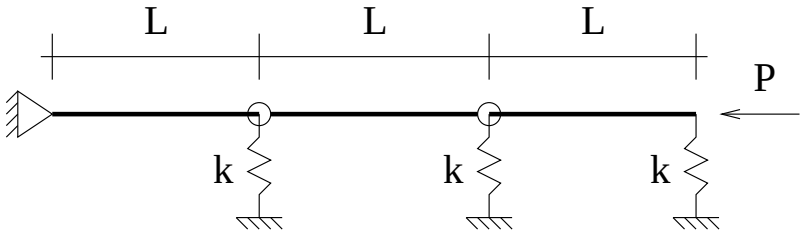


3. (20 pts) Consider the three (rigid) bar system shown where $k = 100$ kN/m and $L = 0.3$ m.

   (a) Find the three buckling loads and their associated buckling modes/shapes. *Accurately sketch/plot* the buckling modes.

   (b) Which of the three is the critical mode shape?

   (c) If the spring constant nearest the support is quadrupled in value, what is the new critical load and mode shape? *Accurately sketch/plot* the critical mode.



4. (10 pts: Extra Credit) What the video at
   `http://www.youtube.com/user/RoyalSociety#p/u/0/EKngs1vvcJU`
   Then set up the equations for the tensile buckling problem with rigid bars that is described and solve for the critical 'buckling' load.