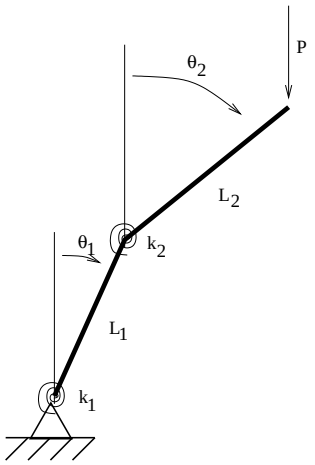
HW 7: Due Wednesday April 7

1. For the two-degree-of-freedom system made up of rigid bars and torsional springs, as shown,

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

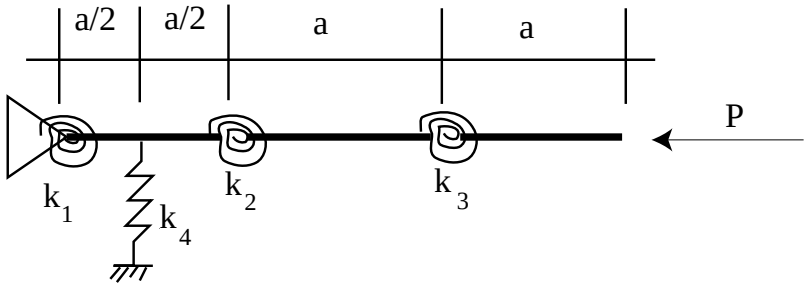
   (b) Reduce your expression in part (a) to one appropriate for small angles.



2. 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.

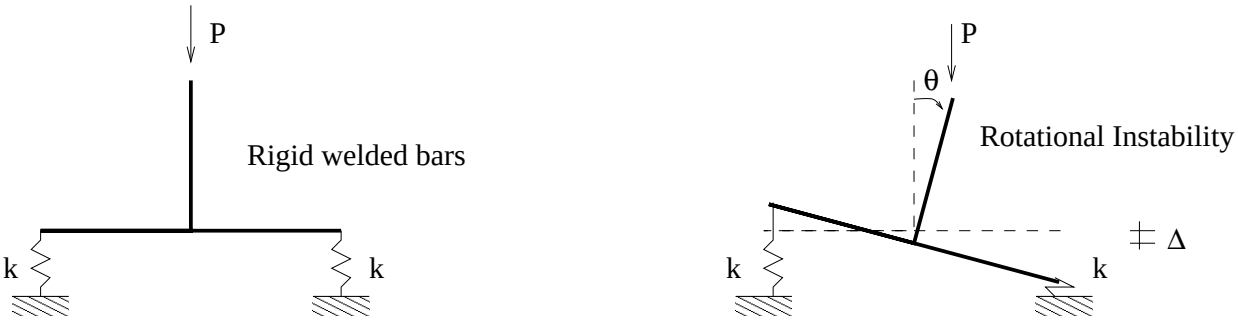
   (b) Find the governing system of equilibrium equations that one would have to solve in order to determine the critical load; write your answer in matrix form and indicate in words the remaining steps that would be needed to solve the problem. **Do not solve the equations.**



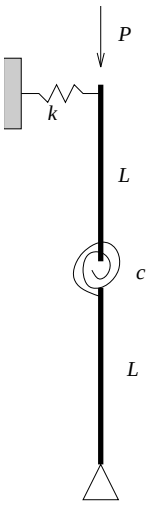
3. As the load P is increased on the structure shown, the rigid inverted-T will displace uniformly downwards. At a certain load P the structure will experience a rotational instability.

   (a) Assuming, small motions, write an expressions for the system's potential energy.

   (b) Find the equilibrium equations and determine the critical load.



4. Shown below is a structure that may be idealized as being composed of two rigid links of length $L = 2$ (m) that are joined by a torsional spring with spring constant $c = 2$ (kN-m/rad). The top of the structure is supported by a flexible support with spring constant $k = 1$ (kN/m). Determine the critical load of the structure and sketch the deflected shape just after collapse.


P
k
L
c
L