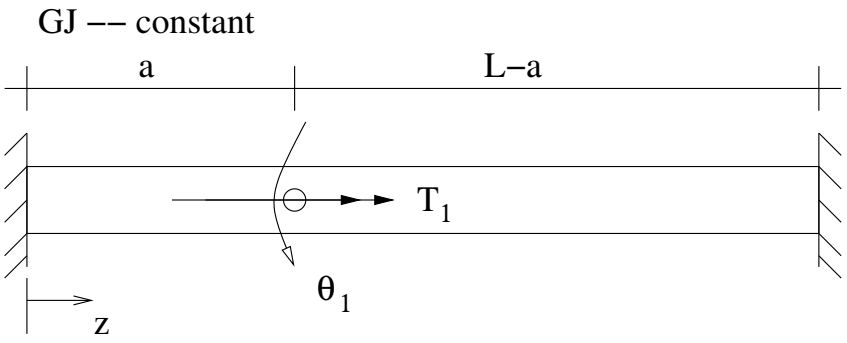
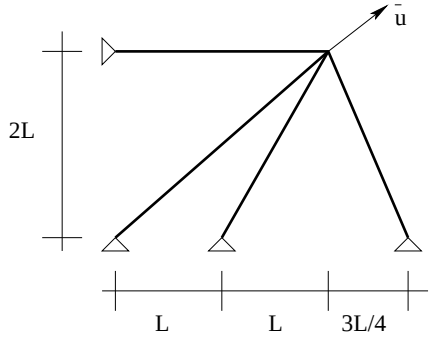
HW 5: Due Feb. 24

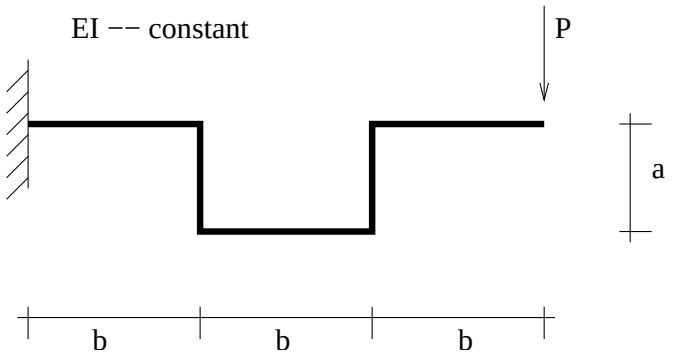
1. Find the relation between the point torque T_1 and the corresponding rotation $\theta_1 = \phi(a)$ using conservation of energy. Use the kinematic expressions for the stored energy.



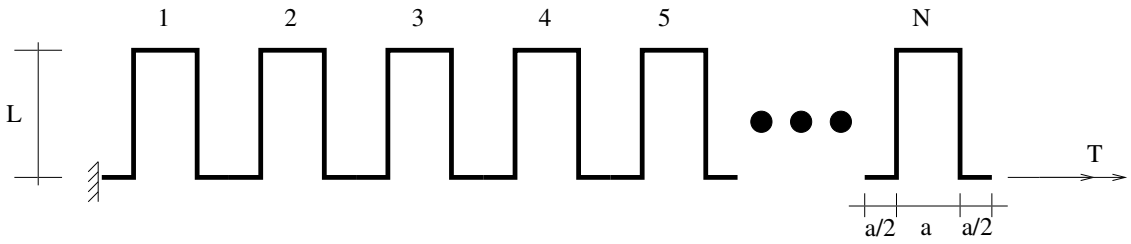
2. For the truss shown below, use conservation of energy to find the load component in the direction of the given displacement at the corner node. Use the kinematic expressions for the stored energy. [Hint: you can exploit the compatibility matrix to help you solve this problem.] Let $L = 24$ in, $AE = 15 \times 10^6$ lb, and $\bar{\boldsymbol{u}} = 10^{-3}(\boldsymbol{e}_x + \boldsymbol{e}_y)$ in. [Hint: Use the kinematic form of the stored energy.]



3. Find the vertical deflection at the tip of the structure shown below using a conservation of energy method. Assume all sections are slender. [Hint: use the force expressions for the stored energy.]



4. Shown is a serpentine spring. The spring is composed of N "hairpin" segments of a round wire with dimensions as shown. Determine an expression for the torsional stiffness of the spring. Express your answer in terms of E, I, J, G, a, L, N. Use conservation of energy to solve; use the force expressions for the stored energy.



5. For the system shown below, use conservation of energy (force version) to determine the deflection in the direction of the load at the point where the load is applied. You may assume that GJ, EI, AE, and $\frac{1}{\alpha}AG$ are all given and constant.