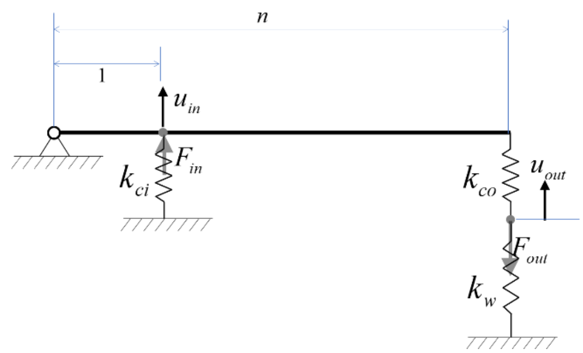
ME 254: Compliant Mechanisms		
Assigned: Mar. 11, 2025	Homework 4	Due: Mar. 18, 2025

If you use AI-agents, include your prompts just like you would cite any references that you use.

Question 1 (18 points)

(a) For the spring-lever model shown in the figure here, derive the expressions for MAr, three types of mechanical advantage, and the sensitivity w.r.t. the workpiece stiffness in the case of MA3. Derive also MA4 which is plotted against output displacement for fixed output force with the stiffness of the workpiece included. All six expressions should be in terms of k_{ci}, k_{co}, n, and other familiar terms pertaining to forces and displacements at the input and output, and stiffness at the output.



(b) Use the compliant crimping mechanism (whose four input files are sent to you by email), find k_{ci}, k_{co}, n, and plot MA1, MA2, MA3, and MA4 using your analytical expressions and linear beam finite element analysis (FEA).

(c) Extra credit if you do (b) by using the nonlinear beam FEA code.

Question 2 (6 points)

Statically balance the crimping mechanism considered in the previous problem using a single zero-free-length spring. Of course, assume that the compliant crimping mechanism too can be set up as a zero-free-length spring. Show the entire layout for static balancing including strings and supports to realize zero-free-length spring, and determine all geometric parameters and the spring constant of the balancing zero-free-length.

What you need to submit:

1. Paper copy of your results clearly written down with all details
2. Graphs and pictures of your results with proper annotation (paper copy)
3. If you build any mechanism, you get extra points.