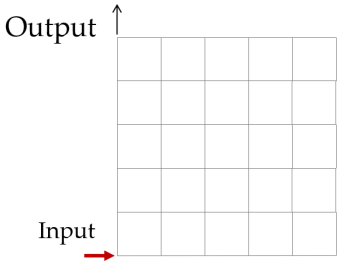
ME 254: Compliant Mechanisms		
Assigned: Feb. 18, 2025	Homework 3	Due: Feb. 27, 2025

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

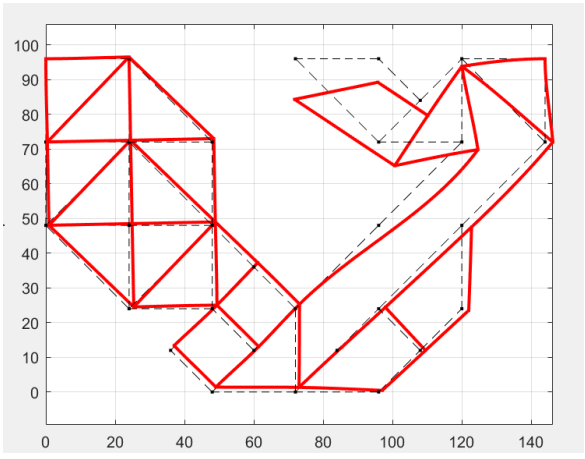
Question 1 (10 points)

Use the instant centre method to design a compliant mechanism that provides as large a geometric advantage (i.e., output displacement divided by input displacement) as possible for the following input-output specification. The entire mechanism must lie within the square domain of 50 cm × 50 cm. Verify your solution using the Matlab beam code for linear and nonlinear finite element analysis. Assume 1 cm × 1 cm cross-section for the beams and an Young's modulus of 1 GPa. Draw the geometric advantage as a function of the input force for the linear and nonlinear cases up to the point where the analysis fails to converge or the mechanism undergoes self-contact.



Question 2 (10 points)

Obtain the CM parameters, k_{ci}, k_{co}, and n as well as the equivalent k_{ii}, k_{io}, and k_{oo} for the compliant mechanism shown here. Its four input files are sent by email. Note that the nodal coordinates and cross-section dimensions are in μm, forces in μN, and Young's modulus in $\mu N / \mu m^2$. Trace all six CM parameter values in separate graphs for a suitable range of input force by using the Matlab beam code for nonlinear analysis.



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 10 extra points.