

ME 254: Compliant Mechanisms		
Assigned: Jan. 9, 2024	Homework 1	Due: Jan. 16, 2024

Question 1 (10 points)

Choose any compliant mechanism from the M2D2 collection available at <https://mecheng.iisc.ac.in/m2d2/CMcollection/> and inform everyone else in the class what you have chosen by emailing the number of the mechanism to me254_2024@iisc.ac.in. This will ensure that each student in the class works with a different compliant mechanism.

- Download the CAD file from the website (DXF file) or COMSOL file and have your model ready in COMSOL. Perform deformation and stress analysis of the compliant mechanism in COMSOL. Use Young's modulus of 1.2 GPa and Poisson's ratio of 0.45 corresponding to polypropylene. Dimensions are as per the real model available in the M2D2 laboratory (take TA's help for this).
- Compare the COMSOL simulation results by hand-testing the real compliant mechanism available in the M2D2 laboratory (take TA's help for this). Does it work the way simulation results show? Record your observations.
- Extra 10 points if you 3D-print the mechanism (in small size so that you do not waste material of the 3D printer) (take TA's help for this) and see where it might break if you apply excessive load. Again, compare with COMSOL simulation results to see where the stress is excessive.

Question 2 (10 points)

Create a beam model of the compliant mechanism you have shown. For this, you need to create four data files (node.dat, elem.dat, forces.dat, and dispbc.dat) as per the Matlab files downloadable at <https://mecheng.iisc.ac.in/suresh/me254/notes.html> in the Week 2 row in the table.

- Analyze using the linear beam finite elements in Matlab.
- Analyze using the nonlinear beam finite elements in Matlab.
- Compare Matlab beam FEA results with COMSOL's continuum-element FEA result, both linear and nonlinear. Record your observations.

What you need to submit for Questions 1 and 2:

- Paper copy of your results clearly written down with all details
- Graphs and pictures of your results with proper annotation (paper copy)
- Four data files for FEA beam code in Matlab of your chosen compliant mechanism.
- Your 3D-printed compliant mechanism (optional for extra points)