

ME 254: Compliant Mechanisms

Assigned: Feb. 18, 2025

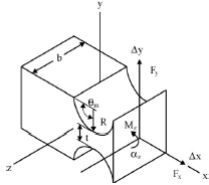
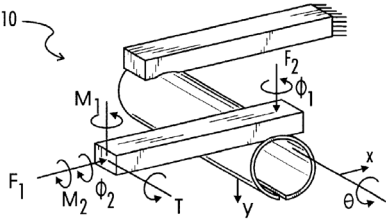
Project Assignment 1

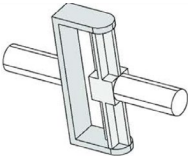
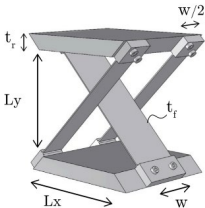
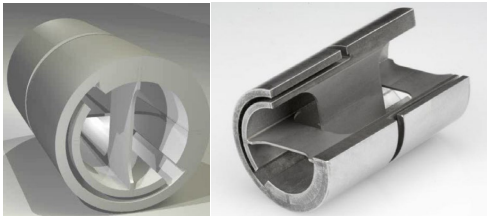
Due: Mar. 4, 2025

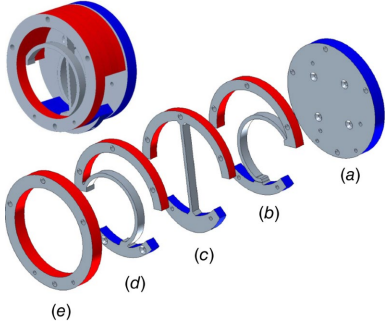
If you use AI-agents, include your prompts just like you would cite any references that you use.

Detailed analysis of elastic pairs (8 points)

An elastic revolute pair is assigned to each of you individually. Model it in 3D finite element analysis and obtain the intended axis stiffness, full-axis stiffness matrix, range of rotation before it fails due to stress exceeding the strength or buckling, axis drift, and the extent of linearity. For the last three, it is important to do geometrically nonlinear analysis. We will arrange separate sessions to help you with using COMSOL or Abaqus. We will collectively try to get the initial rotational stiffness of all of them to be nearly the same and try to make all of them 3D printable to approximately the same size.

<i>Name of the elastic revolute pair</i>	<i>Picture and/or reference</i>	<i>Your name</i>
Planar X pivot	 Generic	ROHIT KUMAR DESHMUKH
Circular notch flexure	 Generic	LAKHINANA HARSHAVARDHAN
Split-tube flexure	 US Patent US6585445B1; Inventors: Michael Goldfarb John E. Speich	RAGHAVENDRA KATRAGADDA

Cruciform flexure	 Trease, B., Moon, Y. -M., and Kota, S., "Design of Large-displacement Compliant Joints," ASME Journal of Mechanical Design, Vol. 127, JULY 2005.	LUBAID NISAR
Cross-flexure pivot	 Rommers, J., van der Wijk, V., Aragón, A. M., Herder, J. L., "The STAGE method for simultaneous design of the stress and geometry of flexure mechanisms," Precision Engineering 89 (2024) 103–112.	PATIL PRAJYOT PRADEEPKUMAR
Bendix cross-strip flexure	 Full and cut-away views Commercial	SHIYAM SANKAR S
Near-zero-stiffness flexural pivot	Zhao, H., Zhao, C., Ren, S., and Bi, S., 2019, "Analysis and Evaluation of a Near-Zero Stiffness Rotational Flexural Pivot," <i>Mech. Mach. Theory</i>, 135, pp. 115–129.	GAURAV NAVNATH SHINDE

Triple-axis cross pivot	Serafino, S., Bruzzone, L., Fanghella, P., and Verotti, M., "Design of High-Performance Triple-Axis Cross Pivots," <i>J. Mechanisms Robotics</i>. Feb 2025, 17(2): 021004 (12 pages) 	R VISHWANATH
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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.