

Fall, 2022

ME 323 – Mechanics of Materials

Lecture 9 – Axial deformation (cont.)

Reading assignment: Ch.6-Ch.7 lecturebook



Mechanical Engineering

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Structural health monitoring could have picked it up sooner

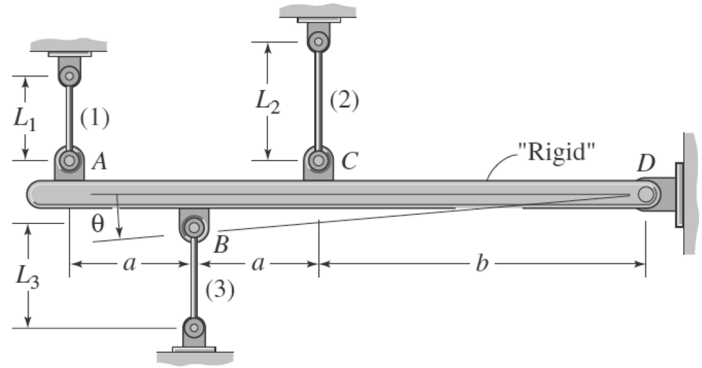
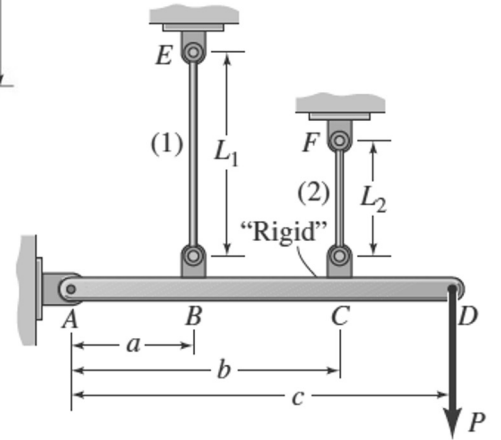
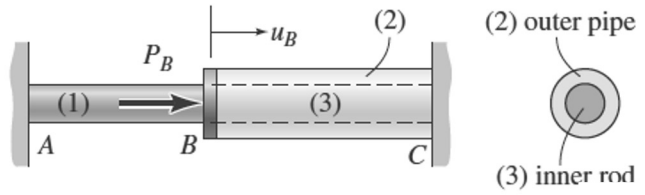
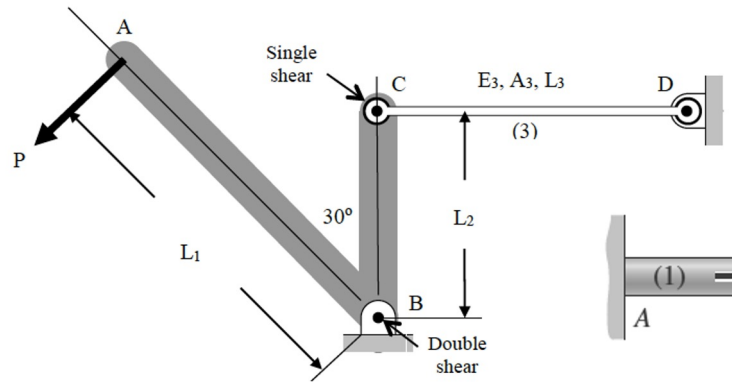
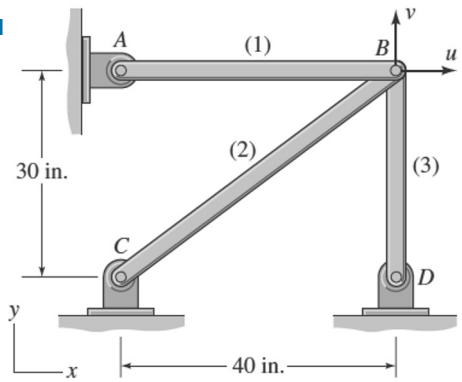
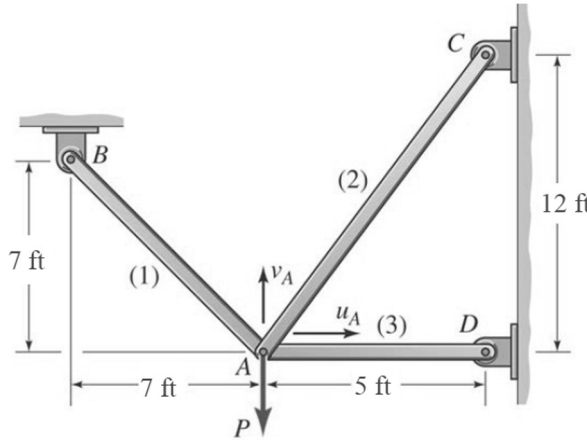
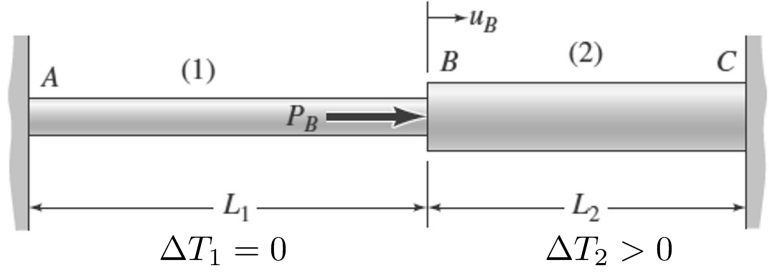
The Forth Road Bridge is a suspension bridge in east central Scotland. It opened in 1964 and, at the time, was the longest suspension bridge in the world outside the United States. In 2015, the bridge shut down for almost three weeks due to a crack caused by a seized pin. Russell (operations manager of the bridge) said: *“My opinion would be if we have structural health monitoring on the bridge, that would be the way forward. If we had had that, it perhaps may have been picked up – perhaps.”*

[Video](#)



Axial deformation – Statically indeterminate

Examples 7-13:



statically indeterminate structures

- 1) Free body diagram
- 2) Equilibrium equations
- 3) Force-displacement behavior
- 4) Compatibility conditions, Geometry of deformations
- 5) Solve for unknowns

Axial deformation – Statically indeterminate

Example 12

Member (2) is incorrectly manufactured and its length is 49.9 in. (as opposed to 50 in.)

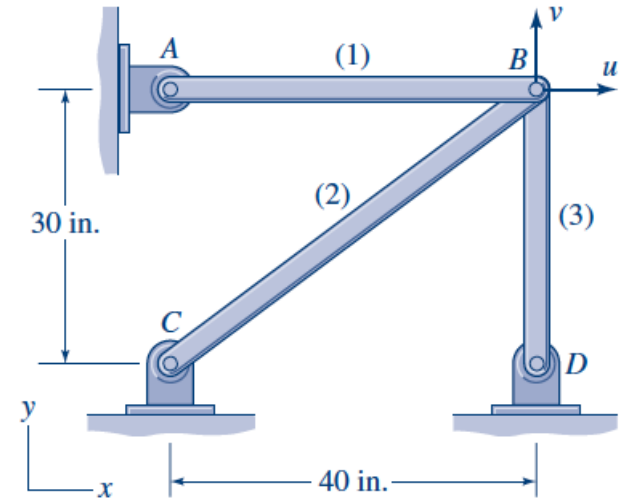
(a) Determine the displacement at B.

(b) Determine the resulting stresses.

$$\theta_1 = 0$$

$$\theta_2 = \arctan(3/4)$$

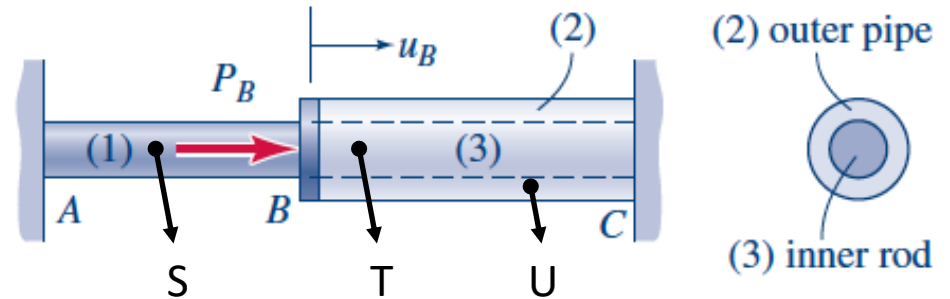
$$\theta_3 = \pi/2$$



Axial deformation – Statically indeterminate

Example 13

- Determine the reactions at ends A and C.
- Determine the state of stress and strain at points S, T and U; and represent them in stress elements.



Axial deformation – Statically indeterminate

Any questions?