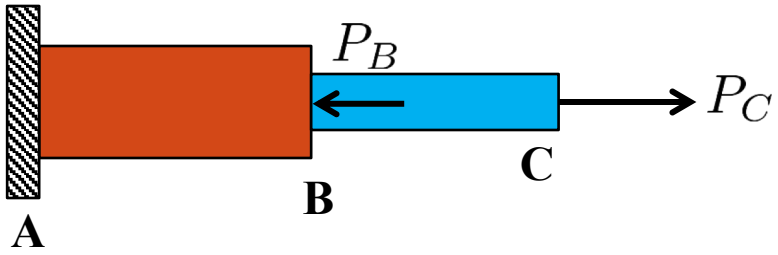
Chapter 4: Axial Load

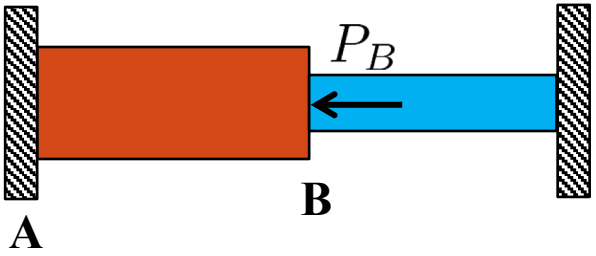
Chapter Objectives

- ✓ Determine the elastic deformation of axially loaded members
- ✓ Apply the principle of superposition for total effect of different loading cases
- ✓ Deal with compatibility conditions
- ✓ Deal with thermal stresses
- ✓ Misfit problems

Static **Determinate** Problems

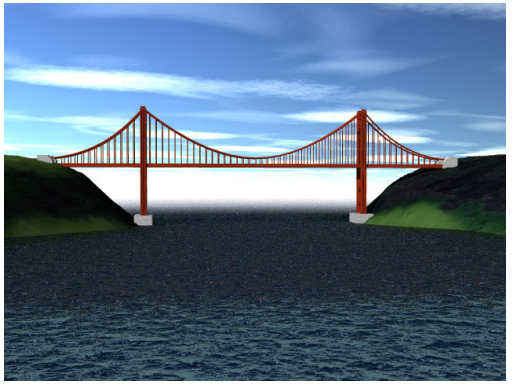


Static Indeterminate Problems



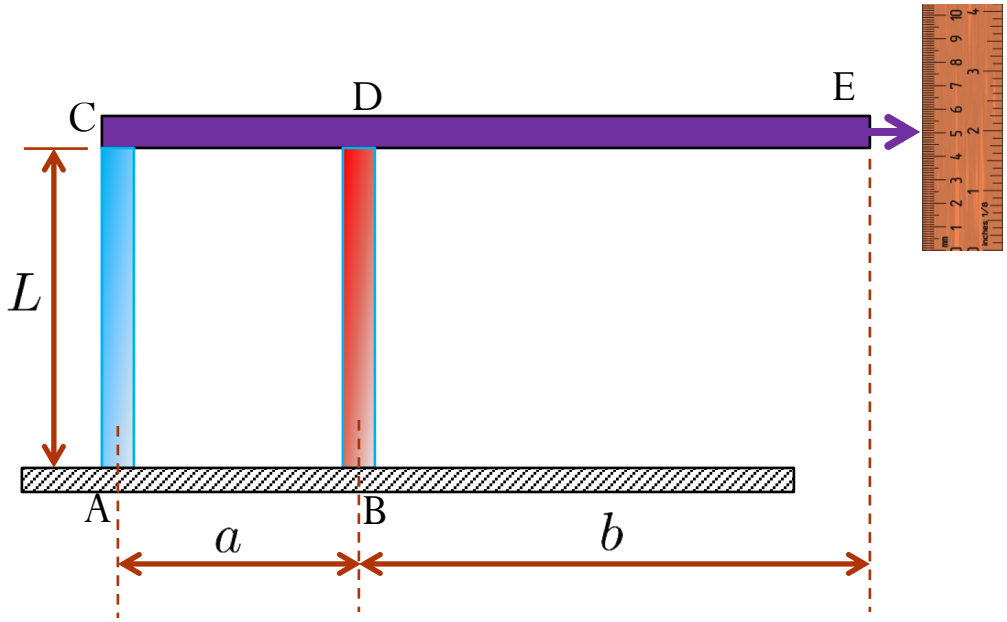
Problems involving temperature changes





Verrazano-Narrows Bridge: Because of thermal expansion of the steel cables, the bridge roadway is 12 feet (3.66 m) lower in summer than in winter

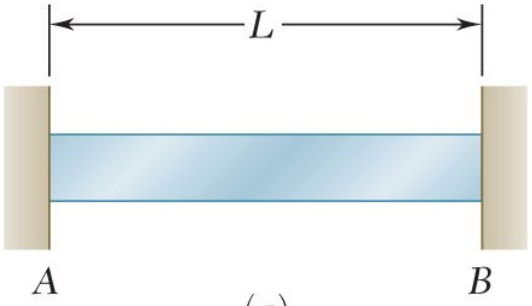
The device is used to measure a change in temperature. Rod AC and BD are made of Tungsten and Magnesium respectively. At a given temperature T_o, the rigid bar CDE is in the horizontal position. Determine an expression for the temperature T as a function of the vertical displacement of point E, δ_E.

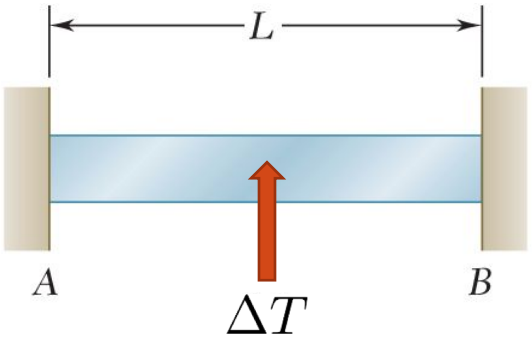


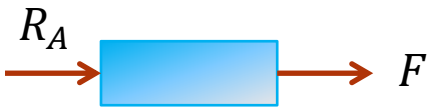
- Rod AC: Tungsten α_t
- Rod BD: Magnesium α_m

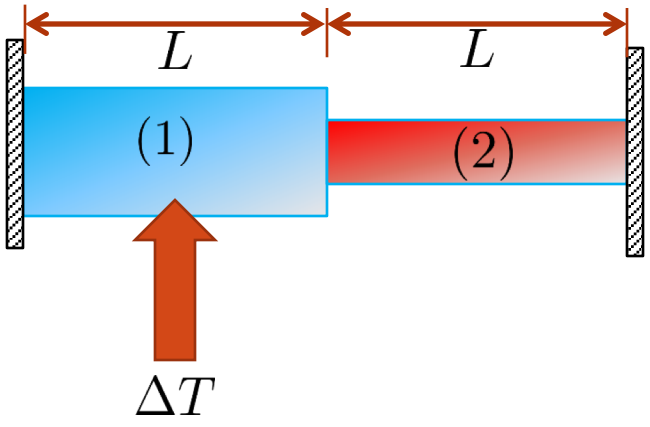
$$\alpha_m > \alpha_t$$

Statically indeterminate problems









$$E_1 = E_2 = E$$

$$\alpha_1 = \alpha_2 = \alpha$$

$$A_1,\ A_2$$