

ME 4733: Deformation and Fracture of Engineering Materials

Spring 2002

Problem Set 1

Problems are due at the beginning of the class, Wednesday, January 30.

1) Hertzberg, 1.3

A 200-mm-long rod with a diameter of 2.5mm is loaded with a 2000-N weight. If the diameter decreases to 2.2 mm, compute the following:

- (a) The final length of the rod.
- (b) The *true* stress and *true* strain at this load.
- (c) The *engineering* stress and strain at this load.

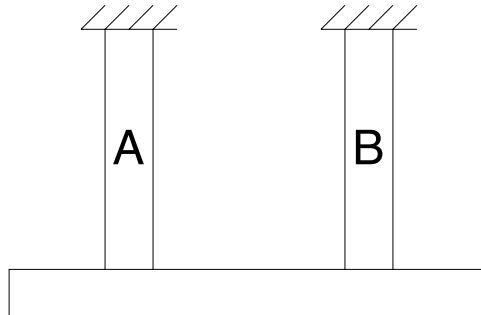
2) Hertzberg, 1.8

A 5-cm-long circular rod of 1080 as-rolled steel (diameter=1.28cm) is loaded to failure in tension. What was the load necessary to break the sample? If 80% of the total elongation was uniform in character prior to the onset of localized deformation, computer the true stress at the point of incipient necking. (refer to table 1.6a in Hertzburg textbook)

3) Hertzberg, 1.11

A platform is suspended by two parallel rods, as shown in the sketch, with each rod being 1.28cm in diameter. Rod A is manufactured from 4340 steel [$Q + T(650^\circ)$] ($E = 210\text{GPa}$, $\sigma_{ys} = 855\text{MPa}$); rod B is made from 7075-T6 aluminum alloy ($E = 70\text{GPa}$, $\sigma_{ys} = 505\text{MPa}$).

- a) What uniform load can be applied to the platform before yielding will occur?
- b) Which rod will be the first to yield? (*Hint*: Both rods experience the same elastic strain)



4) Hertzberg, 1.12

A 100-mm-long rod of 1340 steel [$Q + T(205^\circ)$] is subjected to a load of 50,000N. If the diameter of the rod is 10 mm, what strain would the rod experience? What strain would remain is the load were removed?