

ME 5339
HOMEWORK SET NO. 9

Due Apr. 10, 2008
(Two problems will be graded.)

Problem 9-1

A uniform steel column, with fixed- and hinge-connected ends, is subjected to a vertical load $P = 450$ kN. The cross section of the column is 0.05 by 0.075m and the length is 3.6m. Taking $\sigma_{yp} = 280$ MPa and $E = 210$ GPa, calculate

- a) the critical load and critical Euler stress, assuming a factor of safety of 1.5,
- b) the critical load if the length is reduced to 1.2m.

Problem 9-2

A hollow circular steel column with $E=30 \times 10^3$ Ksi is simply supported over a length 20 ft. The inner and outer diameters of the cross-section are 3 in and 4 in. respectively. Determine:

- a) The slenderness ratio
- b) The critical buckling load
- c) The axial stress at the critical buckling load.
- d) If a roller supports are added at the midpoint, what would be the new critical buckling load?

Problem 9-3

Determine the smallest diameter rod of a steel alloy that can be used to support a compression load, $P=60$ kN without buckling if

- a) the length is 750mm
- b) the length is 300mm.

Assume $\sigma_Y=252$ MPa and $E=210$ GPa.