Homework #5

Readings
Segui: Chapter 4.1 – 4.9

Problem 1
As a good ENCE455 student, you are curious about the wide range of performance that you can get out of a single steel shape in compression. You choose a W14×82 section for your study. You are interested in looking at the effects of steel type, boundary conditions, and length on flexural buckling. Plot the following four curves on the **same axis**:

a) F_{cr} versus L for pinned-pinned boundary conditions and A36 steel.
b) F_{cr} versus L for pinned-pinned boundary conditions and A992 Gr. 50 steel.
c) F_{cr} versus L for fixed-pinned boundary conditions and A36 steel.
d) F_{cr} versus L for fixed-pinned boundary conditions and A992 Gr. 50 steel.

For the plot, use a range of L from 0 to 70 feet. You are encouraged to use a program such as Excel, but write out the equations that you are using. Print out all of your spreadsheets and plots. Comment on the effect of steel type and boundary conditions for different length columns based on your plot.

Problem 2
For the following columns, determine the design compressive strength considering flexural buckling. Include checks for local buckling. Include a check for member slenderness. Do not use the column design tables.

a) W12×40, fixed-pinned boundary conditions, length 25 ft, F_y = 50 ksi.
b) HSS12×8×½, fixed-fixed boundary conditions, length 15 ft, F_y = 36 ksi.
c) Round HSS6.000×0.375, pinned-pinned boundary conditions, length 20 ft, F_y = 36 ksi.

Problem 3
Compute the design compressive strength of the W12×40 from Problem 2(c) using the column design tables in your AISC Manual (starting on page 4-12). You may interpolate values from the table if necessary.

Problem 4
Select the lightest W18 section to support a factored compressive load of 1300 kips. Consider flexural buckling only. The member is 20 feet tall and can be assumed pinned-pinned connected. Use A992 Grade 50 steel. You may use any design table that applies. Show a final check for the column strength, including slenderness and a hand calculation check of local buckling.

Problem 5
Repeat Problem 4 assuming that the weak axis is completely braced and buckling can only occur in the strong axis.