

Lab 7 Column Buckling

Section 11 Group 4

Date: Month/Date/Year

Member: Peter Brown

Instructions:

- Replace the highlighted areas in yellow above with your own name, section and group numbers and correct dates,
- Watch lab demo video and review related materials in lecture notes, lab manual and other related documents,
- Provide your best answers to the following questions. Add pages as needed,
- Convert this Word worksheet sheet into pdf format and submit to Canvas.

1. Review Week 9 lecture and corresponding reference book materials (Peery is available online from ISU library).
2. (15 points) For the end condition of one free and one fixed (lecture note page 12), why is the effective length twice as long as the actual length? Could you come up with a simple explanation? Hint: think of "mirror" ...
3. (25 pts) Derive the formulas for critical load P and slenderness ratio L/ρ of a circular rod and a rectangular bar subjected to axial loading, in terms of π , length L , modulus of elasticity E and specimen radius R (for circular rod) or cross-sectional dimensions B and/or H (for rectangular bar).
4. (30 pts) Use the formulas from 3. to calculate the P_s and L/ρ_s for metal specimens made of stainless 304 annealed cold finish steel (elastic modulus $E = 29000$ ksi and yield strength = 35ksi) and 6061-T6 aluminum ($E=10000$ ksi and yield strength = 40 ksi) with the sizes and end conditions given in Table 1. What equivalent lengths you will use for the pivot-pivot and pivot-fixed end conditions? For the $\frac{1}{4}$ " x 1" aluminum specimen, which dimension you choose to calculate the slenderness ratio? Hint: see the workout example on pages 14-15 in lecture notes. You may want to write yourself a little computer program for these calculations. Tabulate your calculations on the P_s and L/ρ_s . Also list the effective lengths you used.

Table 1. Five column buckling test sets

specimen ID	Material	Cross section dimension (inch)	Length (inch)	End condition
I	aluminum	3/8 dia.	30	both pivot (round)
II	aluminum	1/4 x 1	30	both pivot (round)
III	steel	1/4 dia.	30	both pivot (round)
IV	steel	1/4 dia.	24	both pivot (round)
V	steel	1/4 dia.	27.5 (30 original)	one pivot, one fixed

Total 70 points

Answers:

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