Exp. # 3

Stability Of Columns

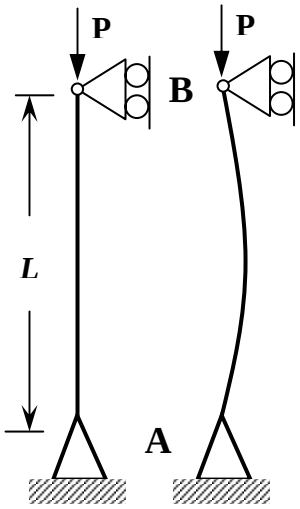
Objective:

The objective of this experiment is to study the behavior of axially loaded columns, determine experimentally the critical buckling load, and to compare results with Euler's formula.

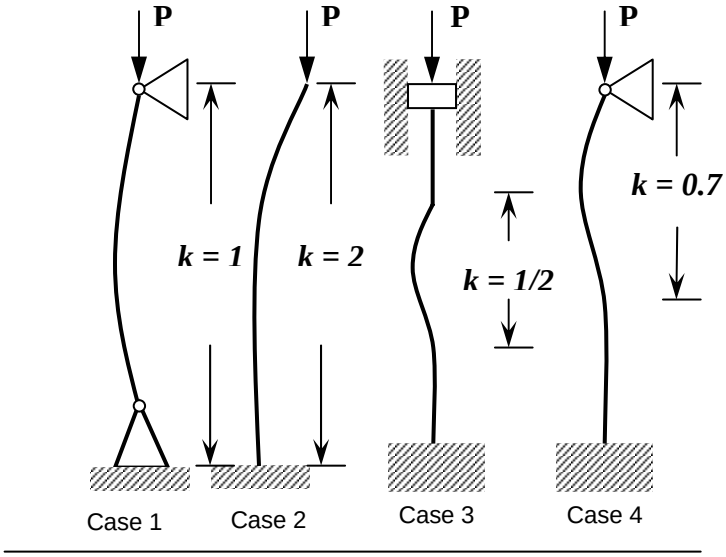
Theory:

Euler's formula:

Figure 1. shows a column of length L supporting and axial load P, increased until it reaches a critical value Pcr and the column don't yield, and then the column will fail due to buckling. The critical load is given by Euler formula:



Buckling of a column due to an axial compressive load P



Euler cases of buckling

Apparatus & Equipment Needed:

The table unit consists of a strong aluminum section frame. Beam specimens of varying thickness made of different materials. Loading is applied using sets of weights and the beam deformation measured

Procedure:

1. Set up the test device in vertical and horizontal position. The force gauge can be turned 90 for this purpose.
2. Inert thrust piece with with V notch into attachment socket and fasten with clamping screw.
3. Insert long thrust piece with V notch into the guide bush of the load cross-bar and hold it firmly.
4. Insert the S2 rod specimen with edges in the V notch.

5. The load cross-bar must be clamped on the guide column in such manner that there is still approx. 5 mm for the top thrust pieces to move.
6. Align the rod specimen in such manner that its buckling direction points in the direction of the lateral guide columns. Here, the edges must be perpendicular to the load cross-bar.
7. Pretighten the rod specimen with low, nonmeasurable force.
8. Align the measuring gauge to the middle of the of the rod specimen using the support clamps. The measuring gauge must be set at right angle to the direction of buckling.
9. Pretighten the measuring gauge to 10mm deflection with adjustable support.
10. Slowly subject the rod specimen load using the load nut.
11. Read the deflection from the measuring gauge. Read the record the deflection every 0.25 mm up to 1mm.
12. Above 1 mm deflection, it suffices to record the deflection and force every 0.5 mm.
13. Repeat the experiment for the (Pin-Fixed) end condition column.

Results and analysis:

1. Fill the experimental results at tables 1, 2 & 3.
2. Calculate the reaction forces and compare with experimental values (table 1).
3. Calculate the theoretical deflection and compare with the experimental values of simply supported beam (table 2).
4. Calculate the theoretical deflection and compare with the experimental values of cantilever beam (table 3).
5. Find percentage of error in each case compared to the theoretical ones.
6. Comment on your results and state specifically the source of error in each case.

Distance **x** from support **A** (mm)	Experimental		Theoretical		Percentage Error (%)	
	Reaction force **A** (N)	Reaction force **B** (N)	Reaction force **A** (N)	Reaction force **B** (N)	Reaction force **A**	Reaction force **B**
100						

200						
300						
400						
500 (Center)						

Table 1: Part 1, *Reaction forces.*

Distance **x** from support **A** (mm)	Deflection **W** (Experimental) (mm)	Deflection **W** (Theoretical) (mm)	Percentage Error (%)
100			
200			
300			
400			
500 (Center)			

Table 2: Part 2, simply supported beam deflection.

Length **L** from clamp (mm)	Deflection **W** (Experimental) (mm)	Deflection **W** (Theoretical) (mm)	Percentage Error (%)
200			
300			
400			

Table 3: Part 3, cantilever beam deflection.