 UNIVERSITI TEKNIKAL MALAYSIA MELAKA	No Dokumen: MMS/BMCG3011/4	No Isu./Tarikh 1/1-03-2021
MECHANICAL ENGINEERING LABORATORY III Strut Buckling	No Semakan/Tarikh	Jumlah Mukasurat 2

OBJECTIVES

To design and conduct the experiments in order to observe the buckling behavior and determine the critical buckling load for a strut with the following end-conditions:

- Pinned for both ends
- Fixed for both ends

LEARNING OUTCOMES (N.B Students should not include these as part of their final report)

At the end of this laboratory session the students should be able to

- Apply the theoretical formulae to define critical buckling load (P_{crit}) of slender column or struts.
- Understand that the critical buckling load for struts depends on the end conditions or end supports.
- Compare between experimental and theoretical results of critical buckling loads and stresses.
- Understanding of basic laboratory practice, including design of experiments, write a clear and well-presented technical report, data acquisition, interpretation and analysis, and the relationship between experiments and theory.

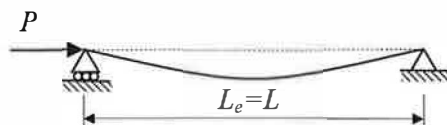
THEORETICAL BACKGROUND

The following theoretical formula to determine critical buckling load (also known as Euler's load, P_E) may be obtained from any Mechanics of Solids or Strength of Materials textbooks;

$$P_E = \frac{\pi^2 EI}{L_e^2} \quad (1)$$

with L_e is the effective length of strut and it depends on the end conditions or end supports of each strut. The effective lengths corresponding to the pinned-ends (or simple support ends) and fixed-ends are shown in Figure 1

a) Pinned-ends:



b) Fixed-ends (or clamped-ends):

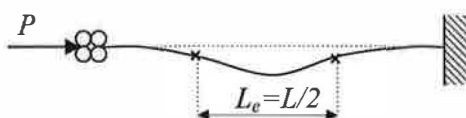


Figure 1 Effective length of strut (a) Simple supports both ends or pinned-ends (b) Fixed-ends

EQUIPMENT & SPECIMEN

- Strut apparatus Model SM105 complete with mid-span dial indicator.
- Two types of material are provided to be used as struts:
 - a) Aluminum strut (20 mm x 5 mm x 750 mm)
 - b) Brass strut (20 mm x 5 mm x 750 mm)
- Measurement tools

Precaution! Ensure that you will not overload the given struts as this will cause permanent deformation and may result in high errors of your experimental data. The strut is normally considered 'buckle' once the dial indicator unable to show any increments of deflection.

TASK

- Your experiment must be designed and conducted to investigate and determine the critical buckling load of each type of struts.
- All necessary data and results must be measured, recorded or tabulated systematically to facilitate its analysis and interpretation at the later stage of your work.
- Comparison of experimentally determined results with the theoretical results must also be presented, analyzed and discussed in your report.

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