Sample report on southampton solent university

Health & Medicine, Stress

APPLIED MECHANICS LABORATORY

LAB B: COMPARISON BETWEEN A SIMPLY SUPPORTED BEAM AND AN ENCASTRÈ (BUILT-IN) BEAM

Object

Apparatus

A range of (supplied) beams of various materials, rule, dial-test indicator and magnetic base, beam rig, various masses, load hanger.

Theory

The formula for the deflection of a simply supported beam with a central point applied can be derived theoretically to show that:

y = W l3 Where W = Load

48 E Il = Span

E = Young's Modulus

I = b d3

12

For an encastrè beam the formula for the maximum deflection of a central point load at its mid-span is:

y = W l3

192 E I

Method

Using a steel beam with a section 25. 4mm x 6. 35mm, set a span of 800mm. For a simply supported beam rest the beam on the knife-edges; for the built-in beam use the clamps and ensure that the beam is properly clamped. Load the beam in increments of 0. 5kg mass up to 3kg. Check repeatability. Plot load against deflection for the two beams. Repeat for other materials.

Results:

Lap1

(Steel Simply Supported Beam)

(Steel Encastrè Beam)

Aluminum Simply Supported Beam

(Aluminium Encastré Beam)0

Aluminium Encastré Beam

(Brass Simply Supported Beam)

(Brass Encastré Beam)

Copper Simply Supported Beam

Discussion

Plot the graphs as instructed in the method. You can construct graphs by hand or use software (e. g. Excel).

Compare the stiffness of the two beam arrangements.

Use your results with the two deflection formulae to obtain a value for E for all the materials.

How close are the results?

Does this verify the formulae?

Draw the bending moment diagrams for the two beams when subject to their greatest load. What factors should be taken into account in structural design when comparing these two beams? Suggest suitable applications.

Answer

The stiffness of the encastred beam is more than the simply supported beam and the results are close in some cases while they vary greatly in other cases. This can be attributed to the way the data has been collected and to the error in data collection.

The formula is verified by this experiment.

Conclusion

Comment on the success of the experiment and evaluate how useful it was. Highlight sources of error and suggest potential improvements for the experiment.

Answer

The experiment is a success and this can be understood from the data collected and from the graphs plotted. Yet the error in the graphs are attributed to the error in data collection.

APPLIED MECHANICS LABORATORY

LAB E: COMBINED BENDING AND TORSION

Object

Apparatus Lap2

Rig, copper tube (external diameter 40. 9mm, wall thickness 0. 813mm), masses, weight hangers, electronic resistance strain gauges and display unit.

Method

- Ensure that the copper tube is suspended so that the distances from the supports to each arm are equal.

- Record the length of the arms and distance from the supports to the arms.

Result

- With no load present, switch on both strain indicator units by pressing the POWER keypad. Balance the units by pressing the BAL keypad twice and then pressing the RECORD keypad.
- The seven channels should all display zero micro-strain (or close to zero). If not repeat step 3.

NOTE: The strain indicators are positioned on top of the tube. The formulae regard tensile strains as positive and compressive as negative. Due to the position of the gauges any positive strains will show compression, not tension. In order to produce a correct strain circle it is necessary to invert all signs (e. g. if gauge #1 indicates -50με then it is +50με). You need to do this for EVERY value.

- Plot graphs (by hand) of micro-strain against position of ERSG and micro-strain against applied mass. From the lines of best fit from the second graph select gauges 3, 4 and 5 for the maximum load and construct a strain circle. The method of constructing the strain circle is shown on the next page.

Theory

Calculate the experimental principal stresses, given by the formulae:

$\sigma 1 = E (\varepsilon 1 + \upsilon\varepsilon 2)\sigma 2 = E (\varepsilon 2 + \upsilon\varepsilon 1)$

$(1 – \upsilon 2) (1 – \upsilon 2)$

Take E copper = 126GN/m2υ = 0. 34

Calculate the theoretical principal stresses, given by the formulae:

$\sigma 1 = ½(\sigma x + \sigma y) + ½ \sqrt{[(\sigma x - \sigma y)2 + 4\tau 2xy]}$

$\sigma 2 = ½(\sigma x + \sigma y) - ½ \sqrt{[(\sigma x - \sigma y)2 + 4\tau 2xy]}$

NB σy = zero since loading is only in one plane

Discussion & Conclusions

Compare the experimental and theoretical principal stresses. What might account for the differences? Comment on the accuracy of the experiment. Consider realistic scenarios involving combined bending and torsion.

Constructing the Strain Circle

*Text from: Mechanical Technology (Third Edition),

DH BACON & RC STEPHENS, Butterworth-Heinemann 2000

pp103 – 104

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