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Courses » Compliant Mechanisms : Principles and Design

Announcements

Course

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Unit 7 - Week 5: Structural optimization approach to “design for deflection” of compliant mechanisms

Course outline

How to access the home page?

Assignment 0

Week 1: Overview of compliant mechanisms; mobility analysis.

Week 2: Modeling of flexures and finite element analysis

Week 3: Large-displacement analysis of a cantilever beam and pseudo rigid-body modeling

Week 4: Analysis and synthesis using pseudo rigid-body models

Week 5: Structural optimization approach to “design for deflection” of compliant mechanisms

- Lec 25: Structural optimization approach
- Lec 26: Early works on design for compliance
- Lec 27: Design for deflection of trusses
- Lec 28: Design for deflection of beams and frames
- Lec 29: Design of elastic continua for desired deflection
- Lec 30: Continuum element-based topology optimization of compliant mechanisms
- Quiz : Assignment Week 5
- Solutions

Week 6: Designing compliant mechanisms using continuum topology optimization; distributed compliance

Assignment Week 5

The due date for submitting this assignment has passed.
As per our records you have not submitted this assignment.

Due on 2018-02-28, 23:59 IST.

1) A typical structural optimization problem consists of:

1 point

- an objective function.
- resource constraints.
- hierarchy in optimization.
- A and B

No, the answer is incorrect.

Score: 0

Accepted Answers:

A and B

2) Mutual strain energy is numerically equal to...

1 point

- the deflection at the point of application of applied load
- the displacement at the point of application of the unit dummy load in the direction of the dummy load
- the applied load
- the deflection at the point of application times the applied load.

No, the answer is incorrect.

Score: 0

Accepted Answers:

the displacement at the point of application of the unit dummy load in the direction of the dummy load

3) In design of a truss for desired deflection, the quantity $P_i p_i$ is always ...

1 point

- negative.
- positive.
- zero.
- None of the above

No, the answer is incorrect.

Score: 0

Accepted Answers:

None of the above

4) *Assertion:* Mutual strain energy cannot be computed for statically indeterminate trusses.

1 point

Reasoning: In statically indeterminate trusses, internal forces can be computed without knowing the areas of cross-sections.

- Assertion and reasoning are both correct statements, but the assertion does not follow from the reasoning.
- Assertion is incorrect but not the reasoning.
- Assertion and reasoning are both incorrect.
- Assertion and reasoning are correct statement and the assertion follows from the reasoning.

No, the answer is incorrect.

Score: 0

Accepted Answers:

Assertion and reasoning are both incorrect.

5) *Assertion 1:* Ralph L. Barnett observed that for certain values of deflection, $P_i p_i$ becomes negative causing difficulty in obtaining a solution. **1 point**

Assertion 2: This issue can be resolved by replacing $P_i p_i$ by $(P_i p_i)^2$ in the optimal area expression.

- Both assertions are correct.
- Assertion 1 is incorrect but not Assertion 2.
- Assertion 1 is correct but not Assertion 2.

Week 7: Spring-lever (SL) and spring-mass-lever (SML) models for compliant mechanisms, and selection maps

Week 8: Non-dimensional analysis of compliant mechanisms and kinetoelastic maps

Week 9: Instant centre and building-block methods for designing compliant mechanisms

Week 10: Bistable compliant mechanisms and static balancing of compliant mechanisms

Week 11: Compliant mechanisms and microsystems; materials and prototyping of compliant mechanisms

Week 12: Six case-studies of compliant mechanisms

MATLAB Online Access

MATLAB: Introduction to MATLAB

MATLAB: Vector and Matrix Operations

MATLAB: Advanced Topics

- Both assertions are incorrect.

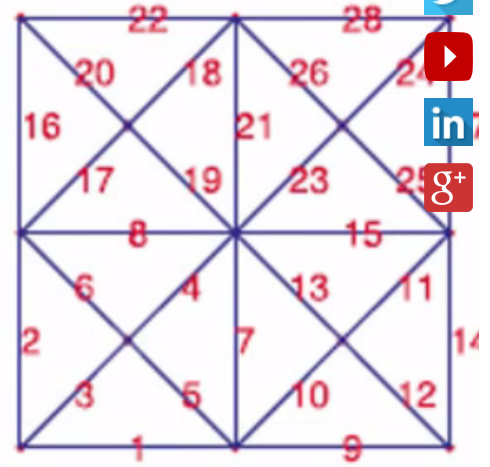
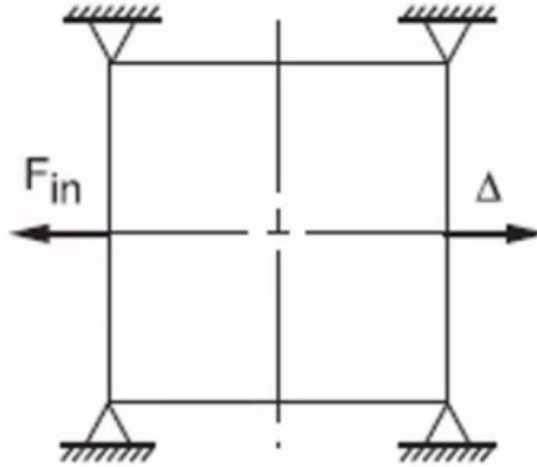
No, the answer is incorrect.

Score: 0

Accepted Answers:

Assertion 1 is correct but not Assertion 2.

6) Recall the optimal frame obtained topology obtained for the example case given below and select the frame number that is retained. 1 point



- 16
- 27
- 2
- 22

No, the answer is incorrect.

Score: 0

Accepted Answers:

22

7) The optimal area profile of a beam with desired deflection is 1 point

- $A = \sqrt{\frac{Mm}{E}}$
- $A = \sqrt{\frac{Mm}{E\alpha}}$
- $A = \sqrt{\Lambda \frac{(Mm)^2}{E\alpha}}$
- $A = \sqrt{\Lambda \frac{Mm}{E\alpha}}$

No, the answer is incorrect.

Score: 0

Accepted Answers:

$$A = \sqrt{\Lambda \frac{Mm}{E\alpha}}$$

8) Design for deflection using mutual strain energy is 1 point

- limited to trusses.
- limited to trusses and frames.
- limited by static determinacy.
- applicable to all elastic bodies.

No, the answer is incorrect.

Score: 0

Accepted Answers:

applicable to all elastic bodies.

9) Assertion 1: Density of the discretized elements are updated in the inner loop of topology optimization code in the optimality criteria method. 1 point

Assertion 2: The outer loop of the code computes the Lagrange multipliers using the equality constraints.

- Assertion 1 is correct but not Assertion 2.

- Assertion 2 is correct but not Assertion 1.
- Both the assertions are correct.
- Both the assertions are incorrect.

No, the answer is incorrect.

Score: 0

Accepted Answers:

Both the assertions are incorrect.

10) According to the Optimality property 1 concerning the flexibility-stiffness formulation, the ratio of ... is uniform throughout the continuum.

- Strain energy to mutual strain energy
- Strain energy density to mutual strain energy
- Strain energy to mutual strain energy density
- Strain energy density to mutual strain energy density

No, the answer is incorrect.

Score: 0

Accepted Answers:

Strain energy density to mutual strain energy density



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