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Courses » Compliant Mechanisms : Principles and Design

Announcements Course Ask a Question Progress



Unit 12 - Week 10: Bistable compliant mechanisms and static balancing 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

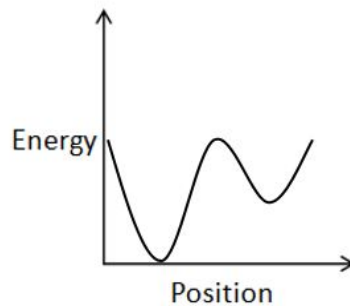
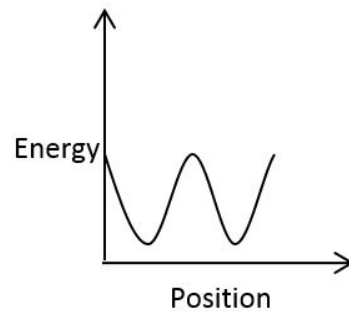
Week 5: Structural optimization approach to "design for deflection" of compliant mechanisms

Week 6: Designing compliant mechanisms using continuum topology

Assignment Week 10

The due date for submitting this assignment has passed. **Due on 2018-04-04, 23:59 IST.** As per our records you have not submitted this assignment.

1) Which of the following represents the strain energy curve of a bistable element? 1 point

 Both of the above Neither of the above

No, the answer is incorrect.

Score: 0

Accepted Answers:

Both of the above

2) Consider a flexure-based lever attached to a zero-free length spring of stiffness k_1 as shown in the figure. What is the stiffness K of the balancing spring at the given instant? 1 point

optimization;
distributed
compliance

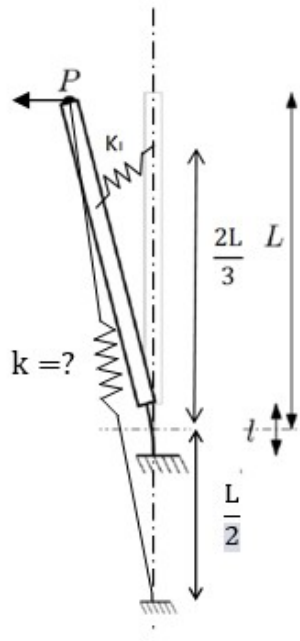
Week 7: Spring-lever (SL) and spring-mass-lever (SML) models for compliant mechanisms, and selection maps

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

- Lec 55: Bistability in elastic systems
- Lec 56: Analysis of bistable arches
- Lec 57: Compliant mechanisms with bistable arches
- Lec 58: Static balancing and zero-free-length springs
- Lec 59: Static balance of a compliant mechanism using a linkage.
- Lec 60: Static balancing method for compliant mechanisms
- Quiz : Assignment Week 10
- Solutions



- $3\left(\frac{EI}{1L^2} + \frac{4}{9}k_1\right)$
- $2\left(\frac{EI}{1L^2} + \frac{4}{9}k_1\right)$
- $\left(\frac{EI}{31L^2} + \frac{4}{27}k_1\right)$
- None of the above

No, the answer is incorrect.

Score: 0

Accepted Answers:

$$2\left(\frac{EI}{1L^2} + \frac{4}{9}k_1\right)$$

3) A symmetric shape of bistable arch cannot be obtained by linear combination of

1 point

- First and third buckling mode shapes
- Second and fourth buckling mode shapes
- Both of the above
- None of the above

No, the answer is incorrect.

Score: 0

Accepted Answers:

Second and fourth buckling mode shapes

4) Assertion: The Critical point method used to find the force-displacement characteristics of bistable element gives approximate results. **1 point**

Reasoning: The critical point uses only two points namely switching force point and switch-back point to predict the entire Force-displacement curve.

- The statements in the assertion and reasoning are both correct and the reasoning is correct for the assertion.
- The statements in the assertion and reasoning are both correct but the reasoning is not correct for the assertion.
- The assertion is correct but not the reasoning.
- The statements in assertion and reasoning are both incorrect.



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

No, the answer is incorrect.

Score: 0

Accepted Answers:

The assertion is correct but not the reasoning.

5) Mark the following statement as A if true and B if false.

It is impossible to statically balance a mechanism without auxiliary bodies.

- A
 B

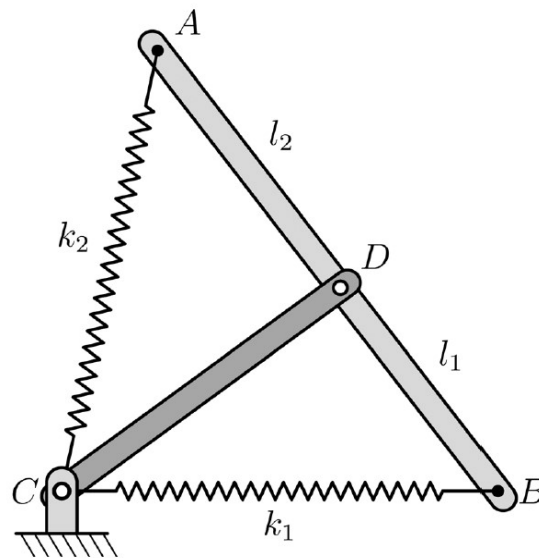
No, the answer is incorrect.

Score: 0

Accepted Answers:

B

6) Consider the statically balanced linkage shown in the figure



The condition for perfect static balancing of the given linkage is...

- $k_1 l_2 = k_2 l_1$
 $k_1 l_1 = k_2 l_2$
 $k_1 = k_2 (l_1 + l_1)$
 $k_1 = k_2 (l_1 - l_2)$

No, the answer is incorrect.

Score: 0

Accepted Answers:

$k_1 l_1 = k_2 l_2$

7) In question 6, will the linkage be in equilibrium if the pivot at C is detached from the fixed frame?

- No
 Yes
 May be
 Insufficient information to conclude

No, the answer is incorrect.

Score: 0

Accepted Answers:

1 point



1 point



Yes

8) In question 6, is there a restriction on the length of CD for perfect static balance of the linkage?

1 point

- It cannot be larger than DA and DB.
- It cannot be smaller than DA and DB.
- It depends on DA, DB, and the two spring constants.
- There is no restriction.

No, the answer is incorrect.

Score: 0

Accepted Answers:

There is no restriction.

9) Assertion: Perfect static balancing of a compliant mechanism can be achieved over its complete range of motion with a linear balancing spring.

1 point

Reasoning: A compliant mechanism can be modelled as a linear translational spring over its complete range of motion.

- The statements in the assertion and reasoning are both correct and the reasoning is correct for the assertion.
- The statements in the assertion and reasoning are both correct but the reasoning is not correct for the assertion.
- The assertion is correct but not the reasoning.
- The statements in assertion and reasoning are both incorrect.

No, the answer is incorrect.

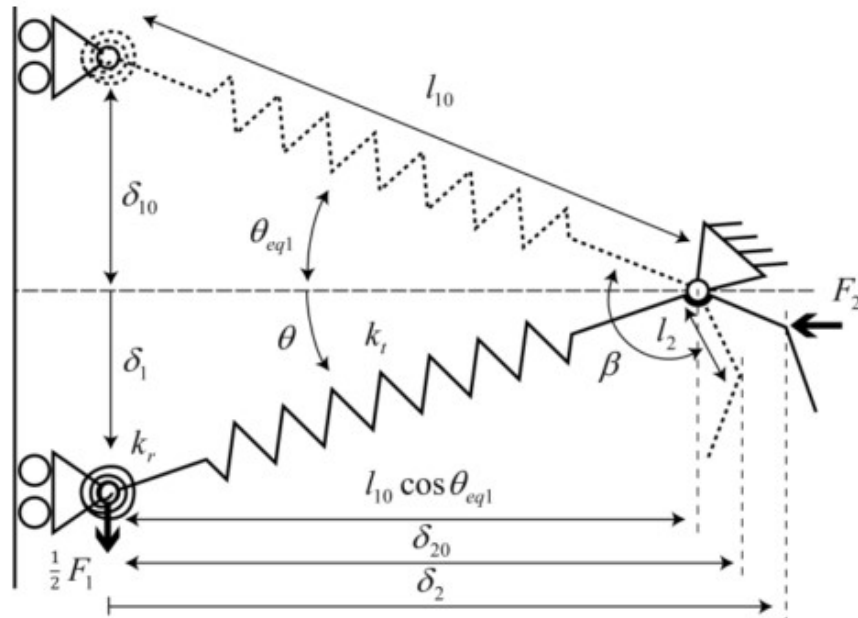
Score: 0

Accepted Answers:

The statements in assertion and reasoning are both incorrect.

10) Consider the kinetoelastic model of a bistable element shown in the figure.

1 point



If stiffness of torsional spring is zero, what is the value of θ ?

- $\frac{l_{10} \cos \theta_{eq1} - l_{10}}{l_{10}}$
- θ_{eq1}
- $\pi \theta_{eq1}$
- None of the above

No, the answer is incorrect.

Score: 0

Accepted Answers:

θ_{eq1}

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