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Courses » Compliant Mechanisms : Principles and Design

Announcements

Course

Ask a Question

Due on 2018-02-14, 23:59 IS

Progress



Unit 5 - Week 3: Large-displacement analysis of a cantilever beam and pseudo rigid-body modeling



1 point

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: Largedisplacement analysis of a cantilever beam and pseudo rigid-body modeling

- Lec 13: Deformation of a cantilever under a tip-load, using elliptic integrals
- Lec 14: Elliptic integrals and their use in elastica analysis
- Lec 15: Frisch-Fay's approach to large deformation of beam
- Crossley's kinematic
- Lec 17: Howell-Midha's elastic model
- Lec 18: Putting together the pseudo rigid-body model
- Quiz : Assignment Week 3
- Solutions

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 optimization; distributed compliance

Assignment Week 3

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

- 1) A Pseudo Rigid Body (PRB) model of a compliant parallel-stage mechanism...
 - is similar to that of a cantilever beam.
 - is similar to that of a fixed-fixed beam.
 - ontains two half-PRBs.
 - ontains four half-PRBs.

No, the answer is incorrect.

Score: 0

Accepted Answers:

contains four half-PRBs.

- 2) The complete elliptical integrals F(k) are special cases of the incomplete elliptical integrals $F(\phi,k)$, when ϕ is **1 point**

 - $\pi/4$
 - $\pi/2$
 - _
 - n
 - $2/\pi$

No, the answer is incorrect.

Score: 0

Accepted Answers:

 $\pi/2$

Assertion: The large-displacement behavior of a cantilever beam with end load can be obtained as an elliptical integral solution.

Reasoning: The beam equation can be converted to a single-variable equation for linearly elastic, inextensible, rigid-in-shear, and of constant-cross-section conditions.

- Assertion is correct but not the reasoning
- Assertion is incorrect but the reasoning is correct.
- Neither assertion nor reasoning is correct.
- Both assertion and reasoning are correct.

No, the answer is incorrect

Score: 0

Accepted Answers:

Both assertion and reasoning are correct.

4) A complete integral of I kind is given by:

1 point

$$F(p,\phi) = \int_{0}^{\phi} \frac{d\phi}{\sqrt{1 - p^2 \sin^2 \phi}}$$

 $F(p, \pi/2) = \int_{0}^{\pi/2} \frac{d\phi}{\sqrt{1 - p^2 \sin^2 \phi}}$

 $E(p,\phi) = \int_{0}^{\phi} \sqrt{1 - p^2 \sin^2 \phi} d\phi$

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

Week 8: Nondimensional 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

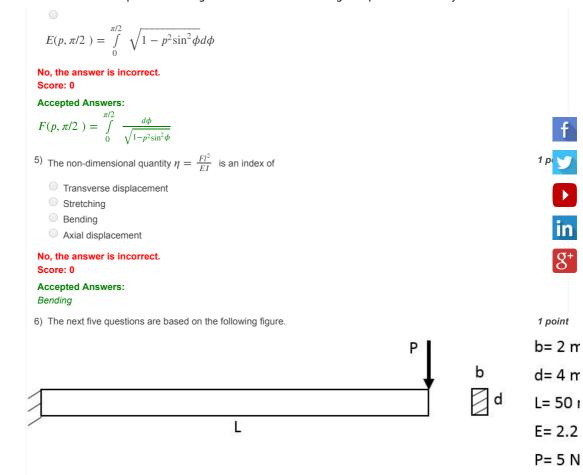
Week 12: Six casestudies of compliant mechanisms

MATLAB Online Access

MATLAB: Introduction to MATLAB

MATLAB: Vector and Matrix Operations

MATLAB: Advanced Topics



For a cantilever beam as shown in the figure, the index of bending is

- 0.2837
- 0.5326
- 0.7298
- 0 1

No, the answer is incorrect.

Score: 0

Accepted Answers:

0.5326

7) In a pseudo rigid body model of a cantilever beam, the torsion spring is attached at what distance(mm) from the fixed 1 point end of the beam

- 8.33
- 12.40
- 41.67
- 37.50

No, the answer is incorrect.

Score: 0

Accepted Answers:

8.33

8) The torsion stiffness κ at the joint in Nm is given by

1 point

- 0 1.056
- 3.168
- 0 10.56
- 31.68

No, the answer is incorrect.

Score: 0

Accepted Answers:

1.056

9) The equation of the locus of the loaded tip of the cantilever in a rectangular coordinate system is Note: Take the origin (0,0) at the fixed end of the cantilever beam.

1 point

$$x^2 + y^2 = 50^2$$

$$\frac{1}{x^2} + \frac{1}{y^2} = 50^2$$

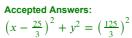
$$x^2 + y^2 = \left(\frac{125}{3}\right)^2$$

$$\left(x - \frac{25}{3}\right)^2 + y^2 = \left(\frac{125}{3}\right)^2$$

No, the answer is incorrect.

Score: 0









B. Elastostatic approximation: The resistance to deflection of the beam is captured with a torsion spring whose stiffness is constant over a small range only.

- Only A is correct.
- Only B is correct.
- Both A and B are correct.
- Both A and B are incorrect.

No, the answer is incorrect.

Score: 0

Accepted Answers:

Both A and B are incorrect.

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