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Courses » Compliant Mechanisms : Principles and Design

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Unit 3 - Week 1: Overview of compliant mechanisms; mobility analysis.

Course outline

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Assignment 0

**Week 1:
Overview of compliant mechanisms; mobility analysis.**

- Lec 1: Overview
- Lec 2: Spirit of compliant design.
- Lec 3: A glimpse of applications
- Lec 4: Mobility and degrees of freedom in compliant mechanisms
- Lec 5: Grübler's formula and its case studies
- Lec 6: Maxwell's rule, compatibility and force equilibrium matrices
- Quiz : Assignment Week 1
- Solutions

**Week 2:
Modeling of flexures and finite element analysis**

Assignment Week 1

The due date for submitting this assignment has passed. **Due on 2018-02-05, 23:59 IST.** As per our records you have not submitted this assignment.

1) In a 6×6 compliance matrix, how many entries would be zero for an ideal spherical ball joint? **1 point**

- 33
- 32
- 31
- 30

No, the answer is incorrect.

Score: 0

Accepted Answers:

33

2) Can a helical spring be called a compliant mechanism? If so, what is it best used for? **1 point**

- No
- Yes; to transmit motion
- Yes; to transform energy
- Yes; to transmit motion and to transform energy

No, the answer is incorrect.

Score: 0

Accepted Answers:

Yes; to transmit motion and to transform energy

3) Mark the following statements as A if true and B if false. If flexibility is a matter of design, then one can build a compliant mechanism with granite. **1 point**

- A
- B

No, the answer is incorrect.

Score: 0

Accepted Answers:

A

4) In which one of the following does a rigid-body mechanism fare better than a compliant mechanism, in general? **1 point**

- Simplified assembly
- Mechanical advantage
- Minimizing backlash
- Economy of material

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 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

Week 11: Compliant mechanisms and microsystems; materials and

No, the answer is incorrect.

Score: 0

Accepted Answers:

Mechanical advantage

5) Assertion: Extended Grübler's formula predicts the upper limit of the degrees of freedom. Reasoning: Number of degrees of freedom of a compliant mechanism is always uncertain.

1 point

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

No, the answer is incorrect.

Score: 0

Accepted Answers:

Assertion is correct but not the reasoning.

6) What is the state of self-stress of the following truss?

1 point



- 0
- 1
- 2
- 3

No, the answer is incorrect.

Score: 0

Accepted Answers:

1

7) Which one of the following identifies the difference between Grübler's formula (A) and extended Grübler's formula (B)?

1 point

- A never gives negative DoF whereas B does.
- A correctly predicts DoF of symmetric/special linkages whereas B doesn't.
- A predicts the upper limit of DoF whereas B predicts the lower limit of DoF.
- None of the above.

No, the answer is incorrect.

Score: 0

Accepted Answers:

None of the above.

8) Match the following

1 point

I	Null space of the compliance matrix indicates	A	a) DoF
II	Null space of the equilibrium matrix indicates	B	b) Self-stress modes
III	Rank-deficiency of the compliance matrix indicates	C	c) Rigid-body modes

- I-A, II-C, II-B

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

- I-C, II-B, III-A
- I-C, II-A, III-B
- I-A, II-B, III-C

No, the answer is incorrect.

Score: 0

Accepted Answers:

I-C, II-B, III-A

9) What kind of applications usually prefer rigid-body mechanisms over compliant mechanisms? **1 point**

- MEMS applications
- Applications requiring minimal backlash error
- Applications demanding high mechanical efficiency
- None of the above

No, the answer is incorrect.

Score: 0

Accepted Answers:

Applications demanding high mechanical efficiency

10) Why should one prefer distributed compliance over discrete compliance? **1 point**

- Better material utilization
- No localized stress concentrations
- Both A and B
- Neither A nor B

No, the answer is incorrect.

Score: 0

Accepted Answers:

Both A and B



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