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#### Courses » Compliant Mechanisms : Principles and Design

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## Unit 8 - Week 6:

# Designing compliant mechanisms using continuum topology optimization; distributed compliance

Announcements



# in

# Course outline

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**Assignment 0** 

Week 1: Overview of compliant mechanisms; mobility analysis.

Week 2: Modeling of flexures and finite element analysis

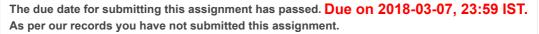
Week 3: Largedisplacement analysis of a cantilever beam and pseudo rigid-body modeling

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 6**



Course

1) Which of the following formulations does not need an output force or a load?

1 point

- MSE/SE formulation
- Efficiency formulation
- Mechanical advantage formulation
- None of the above

#### No, the answer is incorrect.

Score: 0

#### **Accepted Answers:**

None of the above

- 2) The appearance of point-flexures can be mitigated in topology solutions to obtain distributed *1 point* compliant mechanism by...
  - constraining the distortion energy of elements.
  - modifying the objective function to minimize the relative rotation of elements around a node.
  - erosion-dilation method.
  - all of the above

#### No, the answer is incorrect.

Score: 0

#### **Accepted Answers:**

all of the above

3) Assertion 1: Skeletal shape optimization can be used to obtain true distributed compliant **1 point** mechanisms.

Assertion 2: Skeletal shape optimization assumes uniform cross sections for beam segments.

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

#### No, the answer is incorrect.

Score: 0

#### **Accepted Answers:**

Assertion 1 is incorrect but not Assertion 2.

4) Answer questions 4-10 based on YinSyn topology optimization code available at <a href="http://www.mecheng.iisc.ernet.in/~suresh/YinSyn/">http://www.mecheng.iisc.ernet.in/~suresh/YinSyn/</a>

#### optimization; distributed compliance

- Lec 31: YinSyn; synthesis of nonlinear responses with compliant mechanisms
- Lec 32: Five different formulations for compliant mechanism design and some benchmark problems
- Lec 33:Distributed compliance
- Lec 34: How to achieve distributed compliance
- Lec 35: Shape optimization
- Lec 36: Camflexure clampcase-study
- Quiz : Assignment Week 6
- Solutions

Week 7: Springlever (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 Run the file 'yinsyn.m' without changing the given input files and find the ratio of the final value to the initial value of the objective function.

#### No, the answer is incorrect.

Score: 0

#### **Accepted Answers:**

(Type: Range) 85,88



5) Run the 'yinsyn.m' file without changing the boundary conditions to solve the stiff-structure problem. The value of objective function changes from ...



- -3.74E-002 to -9.37E-002
- -3.74E-002 to -6.74E-002
- -3.45E-002 to -9.37E-002
- 104691.19 to 328.28



#### No, the answer is incorrect.

Score: 0

#### **Accepted Answers:**

104691.19 to 328.28

- 6) Assertion 1: Objective function of the optimization problem implemented in the YinSYn code *1 point* is -MSE/SE. Assertion 2: YinSyn code does not use a volume constraint.
  - Both assertions are correct.
  - Assertion 1 is incorrect but not Assertion 2.
  - Assertion 1 is correct but not Assertion 2.
  - Both assertions are incorrect.

#### No, the answer is incorrect.

Score: 0

#### **Accepted Answers:**

Assertion 1 is correct but not Assertion 2.

- 7) Match the following lines of code to their role after going through the input file 'gripper.yin'. 1 point
  - 1. Line no 6
- a. No of holes in the domain
- 2. Line no 58
- b. Tolerance
- 3. Line no 18
- c. Problem type
- 4. Line no 67
- d. Poisson's ratio
- 1-b, 2-d, 3-a, 4-c.
- 1-c, 2-b, 3-a, 4-d.
- 1-a, 2-d, 3-c, 4-b.
- 1-c, 2-d, 3-a, 4-b.

#### No, the answer is incorrect.

Score: 0

#### **Accepted Answers:**

1-c, 2-d, 3-a, 4-b.

- 8) Run the given code after changing the volume fraction to 0.3 from 0.1. Final value of the **1 point** objective function changes from ...
  - -3.74E-002 to -9.37E-002
  - -3.74E-002 to -1.55E-001
  - -3.45E-002 to -9.37E-001
  - -9.74E-001 to -3.37E-002

#### No, the answer is incorrect.

Score: 0

#### 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

#### **Accepted Answers:**

- -3.74E-002 to -1.55E-001
- 9) To modify the domain to include a non-design domain, which line of 'gripper.yin' has to be changed?
  - 1 point

- Line no 18
- Line no 24
- Line no 15
- Line no 21



No, the answer is incorrect.

Score: 0

#### **Accepted Answers:**

Line no 24



10)To include an additional input force in 'gripper.yin', ....

1 pc

- Line no 39 must be changed from 1 to 2.
- A new line specifying force direction and magnitude must be added after Line no 45.
- Both A and B.
- None of the above.

No, the answer is incorrect.

Score: 0

**Accepted Answers:** 

Both A and B.

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