X

Unit 9 - Week 7: Spring-lever (SL) and spring-mass-lever (SML) models for compliant mechanisms, and selection maps

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: 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 7

The due date for submitting this assignment has passed. Due on 2018-03-14, 23:59 IST.
As per our records you have not submitted this assignment.

1) The minimum number of static FEA runs required to obtain the five parameters k_{ci}, $k_{co}, m_{ci}, m_{co}, n$ in SML model is: *1 point*

- One
- Two
- Three
- Four

No, the answer is incorrect.
Score: 0

Accepted Answers:
Two

2) Identify the false statement among the following regarding selection and re-design of compliant mechanisms using SL/SML model. *1 point*

- A database of compliant mechanisms is required.
- Feasibility map can computed for the given design specification
- Can be utilized for synthesis problem involving function generation.
- Dynamics of compliant mechanism can be captured.

No, the answer is incorrect.
Score: 0

Accepted Answers:
Can be utilized for synthesis problem involving function generation.

3) Which of the following statement is true about SL/SML model? *1 point*

- k_{ext} is connected in parallel with k_{co} .
- k_a is connected in series with k_{ci}.
- k_a is connected in parallel with k_{ci}.
- None of these.

No, the answer is incorrect.
Score: 0

Accepted Answers:
k_a is connected in parallel with k_{ci}.

optimization; distributed compliance

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

- Lec 37: SL model for compliant mechanisms
- Lec 38: Feasibility maps for compliant mechanisms
- Lec 39: Selection of compliant mechanisms for given user-specifications
- Lec 40: Two case-studies using feasibility maps technique
- Lec 41: SML model for compliant mechanisms for dynamic response
- Lec 42: Re-design of compliant mechanisms; Matlab and Java codes
- Quiz : Assignment Week 7
- Solutions

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

4) Assertion: Kinetic energy equivalence method is preferred over natural frequency equivalence method for redesign. ***1 point***

Reasoning: Modal analysis of compliant mechanism is computationally expensive.

- 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 and reasoning are both correct.

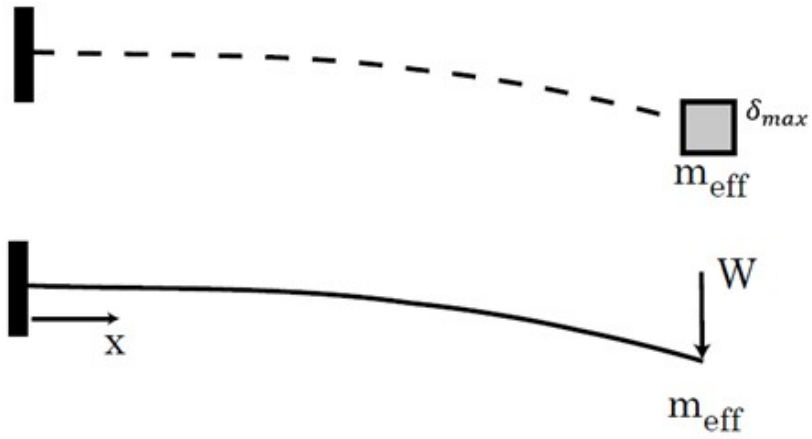
5) Choose the INCORRECT statement- ***1 po***

- The points inside the stiffness and inertia maps are independent of each other.
- In SL/SML model, compliant mechanisms are uniquely defined using five parameters.
- The feasibility map cannot have holes in it.
- None of these.

No, the answer is incorrect.
Score: 0

Accepted Answers:
The points inside the stiffness and inertia maps are independent of each other.

6) Find the effective mass m_{eff} (located at free end) for a cantilevered beam (see fig.) having uniform mass distribution by using kinetic energy equivalence *(density = 7800 kg/m3, length = 5 cm, in-plane thickness = 0.5 mm, width = 1 cm).* ***1 point***



- 0.23 g
- 0.46 g
- 2.3 g
- 4.6 g

No, the answer is incorrect.
Score: 0

Accepted Answers:
0.46 g

7) Find the parameter values of the SL model of the compliant mechanism shown in figure. Two independent static FE analysis were performed and their results are tabulated as follows: ***1 point***

Analysis I	$F_{in} = 1$ N	$x_{in} = 3$ mm	$x_{out} = 15$ mm
Analysis II	$F_{out} = 0.5$ N	$x_{in} = 0.4$ mm	$x_{out} = 4$ mm

of compliant mechanisms

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

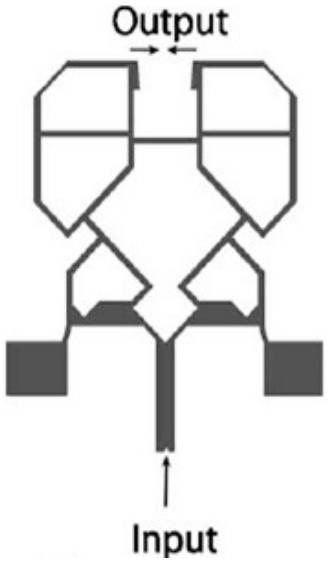
Week 12: Six case-studies of compliant mechanisms

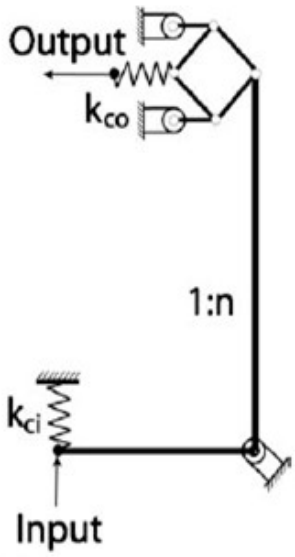
MATLAB Online Access

MATLAB: Introduction to MATLAB

MATLAB: Vector and Matrix Operations

MATLAB: Advanced Topics





Calculate k_{ci} for the given model

- 3570 N/m
- 667 N/m
- 632 N/m
- 333 N/m

No, the answer is incorrect.
Score: 0

Accepted Answers:
333 N/m

8) For the model given in Q7 calculate k_{co} ***1 point***

- 750 N/m
- 400 N/m
- 250 N/m
- 50 N/m

No, the answer is incorrect.
Score: 0

Accepted Answers:
250 N/m

9) For the model given in Q7 calculate n ***1 point***

- 1
- 3
- 4
- 5

No, the answer is incorrect.
Score: 0

Accepted Answers:
5

10)Find the modal amplitude ratio x_{out}/x_{in} corresponding to first natural frequency for the mechanism in Q.7. Assume the values of m_{ci} as 20e-3 kg and m_{co} as 5e-3 kg respectively. ***1 point***

- 5.264
- 0.736
- 133.0
- 33.23

No, the answer is incorrect.
Score: 0

Accepted Answers:
5.264

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