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NPTEL

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Courses » Mechanics Of Materials

Announcements

Course

Ask a Question

Progress

Mentor

Unit 6 - Week 4-Concept of strain

Course outline

Week 0

How to access the portal

Week 1

Week 2

Week 3

Week 4-Concept of strain

- 3D Equilibrium equations
- Stretch ratio and strain
- Curves and arc Length
- Gradient
- Deformation and displacement Gradient
- Right Cauchy Green Deformation tensor
- Homogeneous deformation
- Engineering strain
- Change in Angle
- Quiz : Assignment 4
- Week 4 Feedback
- Solution for Assignment - 4

Week 5-Constitutive

Assignment 4

The due date for submitting this assignment has passed. **Due on 2018-02-21, 23:59 IST.**

Submitted assignment

Based on the data given in question 1 , answer question 2

- 1) 5 points
 Determine whether the following stress fields are possible in some body currently at rest, but subjected to an elastic deformation from a stress free configuration. Assume that there are no body forces or couples or surface moments acting on the body. Here (x,y,z) denote the coordinates of a typical material particle in the current configuration and c_i some constants.

i.
$$\begin{bmatrix} c_1x + c_2y & c_5x - c_1y & 0 \\ c_1y - c_4x & c_3x + c_4y & 0 \\ 0 & 0 & 0 \end{bmatrix}$$

- Yes
 No

No, the answer is incorrect.

Score: 0

Accepted Answers:

No

- 2) 5 points

ii.
$$\begin{bmatrix} c_1y^2 & c_4x^2 & c_5y^2 \\ c_4x^2 & c_2xy & c_6x^2 \\ c_5y^2 & c_6x^2 & c_3xy \end{bmatrix}$$

- Yes
 No

No, the answer is incorrect.

Score: 0

Accepted Answers:

Yes

Based on the data given in question 3 , answer the following questions up to 17

- 3)

relation, strain energy and potential

Week 6- Displacement due to uniaxial loading, temperature and bending

Week 7 -Stresses and deflection in homogeneous beams loaded about one principal axis

Week 8 - Stresses and deflection in beams loaded about one principal axis

week 9: Stresses and deflection in beams not loaded about principal axis

Week 10: Stresses and displacement due to torsion or inflation

Week 11

Week 12 - Buckling of columns

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Notes

A body in the form of a cube, $B = \{(X, Y, Z) | -1\text{cm} \leq X \leq 1\text{cm}, -1\text{cm} \leq Y \leq 1\text{cm}, -1\text{cm} \leq Z \leq 1\text{cm}\}$ in the reference configuration, is subjected to the following deformation field:

$$x = X, y = Y + 0.1 Z, z = 1.1Z,$$

where, (X, Y, Z) are the Cartesian coordinates of a material point before deformation and (x, y, z) are the Cartesian coordinates of the same material point after deformation. Both the reference and current configuration is described using the same coordinate system with basis $\{\mathbf{e}_x, \mathbf{e}_y, \mathbf{e}_z\}$.

The C_{yy} component of the right Cauchy-Green deformation tensor is: _____

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Numeric) 1

3 points

4) The C_{yz} component of the right Cauchy-Green deformation tensor is: _____

Hint

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Numeric) 0.1

3 points

5) The C_{zz} component of the right Cauchy-Green deformation tensor is: _____

Hint

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Numeric) 1.22

3 points

6) The ϵ_{yz} component of the linearized strain tensor is: _____

Hint

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Numeric) 0.05

3 points

7) The ϵ_{zz} component of the linearized strain tensor is: _____

Hint

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Numeric) 0.1

3 points

8)

The stretch ratio of a line initially oriented along \mathbf{e}_z direction of length 1 mm located at (0,0.5 cm ,0.5 cm) computed exactly using the right Cauchy-Green deformation tensor is: _____

Hint

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Range) 1.1035,1.1055

3 points

9)

The engineering strain of a line initially oriented along \mathbf{e}_z direction of length 1 mm located at (0,0.5 cm ,0.5 cm) computed using the linearized strain tensor is: _____

Hint

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Numeric) 0.1

3 points

10)

The stretch ratio of a line initially oriented along $(\mathbf{e}_y + \mathbf{e}_z)/\sqrt{2}$ direction of length 1 mm located at (0,0.5 cm ,0.5 cm) computed exactly using the right Cauchy-Green deformation tensor is: _____

Hint

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Numeric) 1.1

3 points

11)

The engineering strain of a line initially oriented along $(\mathbf{e}_y + \mathbf{e}_z)/\sqrt{2}$ direction of length 1 mm located at (0,0.5 cm,0.5 cm) computed using the linearized strain tensor is:

Hint

No, the answer is incorrect.**Score: 0****Accepted Answers:***(Type: Numeric) 0.1*

3 points

12)

The deformed angle between two line elements initially oriented along \mathbf{e}_y and \mathbf{e}_z directions at (0,0.5 cm ,0.5 cm) computed exactly using right Cauchy-Green deformation tensor is: _____ degrees

Hint

No, the answer is incorrect.**Score: 0****Accepted Answers:***(Type: Range) 84.805,84.807*

3 points

13)

The change in angle between two line elements initially oriented along \mathbf{e}_y and \mathbf{e}_z directions at (0,0.5 cm ,0.5 cm) computed using linearized strain tensor is: _____ degrees

No, the answer is incorrect.**Score: 0****Accepted Answers:***(Type: Range) 5.72,5.74*

3 points

14)

The deformed angle between two line elements initially oriented along \mathbf{e}_y and $(\mathbf{e}_y + \mathbf{e}_z)/\sqrt{2}$ directions at (0,0.5 cm ,0.5 cm) computed exactly using right Cauchy-Green deformation tensor is: _____ degrees

No, the answer is incorrect.**Score: 0****Accepted Answers:***(Type: Numeric) 45*

3 points

15)

The change in angle between two line elements initially oriented along \mathbf{e}_y and $(\mathbf{e}_y + \mathbf{e}_z)/\sqrt{2}$ directions at (0,0.5 cm ,0.5 cm) computed using linearized strain tensor is: _____ degrees

No, the answer is incorrect.**Score: 0****Accepted Answers:***(Type: Range) 5.72,5.74*

3 points

16 Can the given deformation be classified as small deformation?

3 points

- Yes
 No

No, the answer is incorrect.**Score: 0****Accepted Answers:**

No

17)

3 points

The deformed shape of the circle defined by: $X = 0, Y^2 + Z^2 = 0.01$ would be which of the following?

- Circle
 Ellipse
 Parabola
 Hyperbola

No, the answer is incorrect.**Score: 0****Accepted Answers:**

Ellipse

Based on the data given in question 18, answer the following questions up to 32

18)

A body in the form of a cube, $B = \{(X, Y, Z) | -1\text{cm} \leq X \leq 1\text{cm}, -1\text{cm} \leq Y \leq 1\text{cm}, -1\text{cm} \leq Z \leq 1\text{cm}\}$ in the reference configuration, is subjected to the following displacement field:

$$u_x = 0, u_y = (Y+Z)10^{-4}, u_z = -10^{-4}Z,$$

where, (X, Y, Z) are the Cartesian coordinates of a material point before deformation. Both the reference and current configuration is described using the same coordinate system with basis $\{\mathbf{e}_x, \mathbf{e}_y, \mathbf{e}_z\}$. For the specified displacement field compute the following accurately up to first decimal place:

The C_{yy} component of the right Cauchy-Green deformation tensor is: $1 + \underline{\hspace{2cm}} \times 10^{-4}$

No, the answer is incorrect.**Score: 0****Accepted Answers:**

(Type: Numeric) 2

3 points

19)

No, the answer is incorrect.**Score: 0****Accepted Answers:**

(Type: Numeric) 1

3 points

20)

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Numeric) -2

3 points

21 The ϵ_{yy} component of the linearized strain tensor is: _____ $\times 10^{-4}$

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Numeric) 1

3 points

22 The ϵ_{yz} component of the linearized strain tensor is: _____ $\times 10^{-4}$

Hint

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Numeric) 0.5

3 points

23)

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Numeric) -1

3 points

24)

The stretch ratio of a line initially oriented along \mathbf{e}_z direction of length 1 mm located at (0,0.5 cm ,0.5 cm) computed exactly using the right Cauchy-Green deformation tensor is: $1 + \text{_____} \times 10^{-4}$

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Numeric) -1

3 points

25)

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Numeric) -1

3 points

26)

The stretch ratio of a line initially oriented along $(\mathbf{e}_y + \mathbf{e}_z)/\sqrt{2}$ direction of length 1 mm located at (0,0.5 cm ,0.5 cm) computed exactly using the right Cauchy-Green deformation tensor is: $1 + \underline{\hspace{2cm}} \times 10^{-4}$

Hint

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Numeric) 0.5

3 points

27)

The engineering strain of a line initially oriented along $(\mathbf{e}_y + \mathbf{e}_z)/\sqrt{2}$ direction of length 1 mm located at (0,0.5 cm,0.5 cm) computed using the linearized strain tensor is: $\underline{\hspace{2cm}} \times 10^{-4}$

Hint

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Numeric) 0.5

3 points

28)

The deformed angle between two line elements initially oriented along \mathbf{e}_y and \mathbf{e}_z directions at (0,0.5 cm ,0.5 cm) computed exactly using right Cauchy-Green deformation tensor is: $90 + \underline{\hspace{2cm}} \times 10^{-4}$ degrees

Hint

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Range) -57.4,-57.2

3 points

29)

The change in angle between two line elements initially oriented along \mathbf{e}_y and \mathbf{e}_z directions at (0,0.5 cm ,0.5 cm) computed using linearized strain tensor is: $\underline{\hspace{2cm}} \times 10^{-4}$ degrees

Hint

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Range) 57.2,57.4

3 points

30)

The change in angle between two line elements initially oriented along e_y and $(e_y + e_z)/\sqrt{2}$ directions at $(0, 0.5 \text{ cm}, 0.5 \text{ cm})$ computed using linearized strain tensor is: _____ $\times 10^{-4}$ degrees

Hint

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Range) 171.7,171.9

3 points

31 Can the given deformation be classified as small deformation?

3 points

Yes

No

No, the answer is incorrect.

Score: 0

Accepted Answers:

Yes

3 points

32)

Circle

Ellipse

Parabola

Hyperbola

No, the answer is incorrect.

Score: 0

Accepted Answers:

Ellipse

Previous Page

End

