

Unit 6 - Week 3: Structural Elements in One Dimensional FEM

| |
|---|
| Course outline |
| How does an NPTEL online course work? |
| MATLAB |
| Week 0: Prerequisite |
| Week 1: Variational Calculus and Minimization Problem |
| Week 2: One dimensional Finite Element Analysis |
| Week 3: Structural Elements in One Dimensional FEM |
| <input type="radio"/> Lec 7: Bar Element: Elemental equation; Matlab Implementation with Example |
| <input checked="" type="radio"/> Lec 8: Bar Element: Postprocessing; Comparison with Analytical Solution; Bar with linear springs |
| <input type="radio"/> Lec 9: Truss Element: Elemental equation; Matlab Implementation with Example |
| <input type="radio"/> Quiz : Assignment 3 |
| <input type="radio"/> Feedback Form |
| <input type="radio"/> Assignment Solution |
| Week 4: Structural Elements in One Dimensional FEM |
| Week 5: Structural Elements in One Dimensional FEM, and Generalized One Dimensional Finite Element Code in Computer Programming |
| Week 6: Brief Background of Tensor Calculus |
| Week 7: Two dimensional Scalar field problems |
| Week 8: Two dimensional Scalar field problems |
| Week 9: Two dimensional Scalar and Vector field problems |
| Week 10: Two dimensional Vector field and Eigen value problems |
| Week 11: Eigen value problems and Transient problem in 1D & 2D Scalar Valued Problems |
| Week 12: FEM formulation for 3D Elastic problem and challenges |
| Live session: Dr. Atanu Banerjee, Date : 16/12/2020 Time : 3:15:00 PM |

Assignment 3

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

Due on 2020-10-07, 23:59 IST.

Answer the question from "a" to "b" (i.e 1 to 14) with the help of below statement: Consider following differential equation $x^3 \frac{dy}{dx} + x^2 \frac{dy}{dx} - 4xy = 1$, in $1 \leq x \leq 5$; Given $y(1) = \frac{20}{3}$, $y'(5) = 19.33$.

(a) We can derive the variational statement as,

$$\int_1^5 \left[2x^6 \frac{dy}{dx} + x^a \left(\frac{dv}{dx} \right)^l \left(\frac{dy}{dx} \right)^m + 4xvy \right] dx = \int_1^5 bvdx + [(vx^3)y]_{x=5}$$

then answer the following:

1) What is the value of l and m ?

- A. 1 and 1
 B. 2 and 1
 C. 1 and 2
 D. 2 and 2

No, the answer is incorrect.
 Score: 0
 Accepted Answers:
 A. 1 and 1

2 points

2) What is the value of a ?

- A. 2
 B. 3
 C. -1
 D. 1

No, the answer is incorrect.
 Score: 0
 Accepted Answers:
 B. 3

1 point

3) What is the value of b ?

- A. -1
 B. 3
 C. 1
 D. -2

No, the answer is incorrect.
 Score: 0
 Accepted Answers:
 A. -1

1 point

4) What is the value of c ?

- A. 1
 B. 3
 C. 2
 D. 0

No, the answer is incorrect.
 Score: 0
 Accepted Answers:
 C. 2

1 point

5) If the variational statement is of the form $A(y, v) = L(v)$ then choose the most correct statement?

- A. A is symmetric but not bilinear
 B. A is symmetric and L is linear
 C. A is bilinear but not symmetric
 D. L is linear and A is not bilinear

No, the answer is incorrect.
 Score: 0
 Accepted Answers:
 C. A is bilinear but not symmetric

2 points

(b) If the domain of the problem is discretized with one element. Then answer the following questions: For numerical integration you can use two point Gaussian Quadrature rule. In [-1,1] domain for two point Gaussian Quadrature two gauss points and corresponding weights are

$$(\xi_1, w_1) = (-0.57735, 1);$$

$$(\xi_2, w_2) = (0.57735, 1);$$

You can use following values calculated at two gauss points

$$N|_{\xi_1} = [0.7887, 0.2113], \quad N|_{\xi_2} = [0.2113, 0.7887]$$

$$N^T N|_{\xi_1} = \begin{bmatrix} 0.622 & 0.1667 \\ 0.1667 & 0.0446 \end{bmatrix}, \quad N^T N|_{\xi_2} = \begin{bmatrix} 0.0446 & 0.1667 \\ 0.1667 & 0.622 \end{bmatrix},$$

$$N^T B|_{\xi_1} = \begin{bmatrix} -0.3944 & 0.3944 \\ -0.10565 & 0.10565 \end{bmatrix}, \quad N^T B|_{\xi_2} = \begin{bmatrix} -0.10565 & 0.10565 \\ -0.3944 & 0.3944 \end{bmatrix}.$$

and if the finite element equation is expressed as $[K]\{y\} = \{F\}$ then answer the following: then answer the following:

6) If the domain is discretized with one element, then what is the length of the element (l_e) ?

- A. 4
 B. 3.5
 C. 3
 D. 5

No, the answer is incorrect.
 Score: 0
 Accepted Answers:
 A. 4

1 point

7) what is the value of the element $K(1,1)$?

No, the answer is incorrect.
 Score: 0
 Accepted Answers:
 (Type: Range) 13,15

1 point

8) what is the value of the element $K(1,2)$?

No, the answer is incorrect.
 Score: 0
 Accepted Answers:
 (Type: Range) 4,5

1 point

9) what is the value of the element $K(2,1)$?

No, the answer is incorrect.
 Score: 0
 Accepted Answers:
 (Type: Range) -17,-15.5

1 point

10) what is the value of the element $K(2,2)$?

No, the answer is incorrect.
 Score: 0
 Accepted Answers:
 (Type: Range) 45,46

1 point

11) what is the value of the element $F(1)$?

No, the answer is incorrect.
 Score: 0
 Accepted Answers:
 (Type: Range) -2.5,-1.5

1 point

12) what is the value of the element $F(2)$?

No, the answer is incorrect.
 Score: 0
 Accepted Answers:
 (Type: Range) 2410,2420

1 point

13) Find the value of y at $x = 2$?

No, the answer is incorrect.
 Score: 0
 Accepted Answers:
 (Type: Range) 18.50,19.50

1 point

14) What is the value of y at $x = 5$?

No, the answer is incorrect.
 Score: 0
 Accepted Answers:
 (Type: Range) 50,60

1 point