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Courses » Computational Fluid Dynamics

Announcements

Course

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Unit 4 - Week 3



Course outline

How to access the portal

Week 1

Week 2

Week 3

- Cecture 11 : Point Collocation method, the Galerkin's method & the 'M' form
- Lecture 12 : Finite element method (FEM) of discretization
- Lecture 13 : Finite element method of discretization (contd.)
- Lecture 14 : Finite difference method (FDM) of discretization
- Lecture 15 : Well posed boundary value problem
- Quiz : Week 3 : Assignment
- Feedback for Week 3

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Week 3: Assignment

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

Due on 2018-09-05, 23:59 IS



1 point

The governing equation for velocity in a non-dimensional form for one-dimensional steady fully developed fluid is given by

$$\frac{d^2u}{dx^2} + u + x = 0$$

with the boundary conditions u(0) = u(1) = 0.

Considering a trial function of $u = a \sin \pi x$, the value of the parameter a by following the Least Square Method is

(a)
$$a = \frac{1}{(\pi^2 - 1)^2}$$

(b)
$$a = \frac{1}{\pi(\pi^2 - 1)}$$

(c)
$$a = \frac{2}{\pi(\pi^2 - 1)}$$

(d)
$$a = \frac{2}{(\pi^2 - 1)}$$

No, the answer is incorrect. Score: 0

Accepted Answers:

(c)
$$a = \frac{2}{\pi (\pi^2 - 1)}$$

2) 0 points

The governing equation for velocity in a non-dimensional form for one-dimensional steady fully developed fluid is given by

$$\frac{d^2u}{dx^2} + u + x = 0$$

with the boundary conditions u(0) = u(1) = 0.

Considering a trial function of $u = a \sin \pi x$, u can be expressed following the Point collocation Method is



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Assianment Solution

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- (c) $u = \frac{2}{\pi^2 1} \sin \pi x$
 - (d) $u = \frac{1}{\pi^2 1} \sin \pi x$



No, the answer is incorrect.

Score: 0

Accepted Answers:

(d)
$$u = \frac{1}{\pi^2 - 1} \sin \pi x$$



The governing equation for velocity in a non-dimensional form for one-dimensional steady fully developed fluid is given by



$$\frac{d^2u}{dx^2} + u + x = 0$$

with the boundary conditions u(0) = u(1) = 0.

Considering a trial function of $u = a \sin \pi x$, the value of the parameter a by following the Galerkin's Method is

(a)
$$a = \frac{1}{(\pi^2 - 1)}$$

(b)
$$a = \frac{1}{\pi(\pi^2 - 1)}$$

(c)
$$a = \frac{2}{\pi (\pi^2 - 1)}$$

(d)
$$a = \frac{2}{(\pi^2 - 1)}$$

No, the answer is incorrect.

Score: 0

Accepted Answers:

(c)
$$a = \frac{2}{\pi(\pi^2 - 1)}$$

1 point

The governing equation for velocity in a non-dimensional form for one-dimensional steady fully developed fluid is given by

$$\frac{d^2u}{dx^2} + u + x = 0$$

with the boundary conditions u(0) = u(1) = 0.

Considering a trial function of $u = a \sin \pi x$, u can be expressed following the Rayleigh -Ritz Method is

(a) $u = \sin \pi x$

(b)
$$u = \frac{2}{\pi(\pi^2 - 1)} \sin \pi x$$

(c)
$$u = \frac{1}{\pi(\pi^2 - 1)} \sin \pi x$$

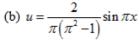
(d)
$$u = \frac{1}{\pi^2 - 1} \sin \pi x$$

No, the answer is incorrect.

Score: 0

5)

Accepted Answers:

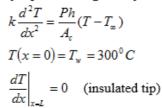


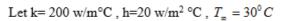




Consider a 1 mm diameter, 50 mm long aluminium pin-fin used to enhance heat for the surface wall maintained at 300° C. The governing differential equation are given by:







What is the temperature distribution in the fin using the Galerkin weighed residual method? Assume trial solution is : $T(x) \approx c_0 + c_1 x + c_2 x^2 = \hat{T}(x)$

(a)
$$\hat{T}(x) = 300 + 38751.43(x^2 - 2Lx)$$

(b)
$$\hat{T}(x) = 300 + 18751.43(x^2 - 2Lx)$$

(c)
$$\hat{T}(x) = 150 + 38751.43(x^2 - 2Lx)$$

(d)
$$\hat{T}(x) = 150 + 18751.43(x^2 - 2Lx)$$

No, the answer is incorrect.

Score: 0

Accepted Answers:

(a)
$$\hat{T}(x) = 300 + 38751.43(x^2 - 2Lx)$$

6) 1 point

For one dimensional steady heat conduction with heat generation, the governing equation is $\frac{d}{dx}\left(k\frac{dT}{dx}\right) + s = 0$

Assume boundary condition $\frac{dT}{dx}\Big|_{x=0} = 0$ and $T\Big|_{x=L} = \widetilde{T}$

Discretize the domain using F.E.M (finite element method) for temperature distribution using the Galerkin weighted residual method, a trial solution is $T(x) \approx \hat{T}(x) = a + bx$

This trial solution valid over:

- (a) Valid over individual nodes
- (b) Valid over individual element
- (c) Valid over all domain nodes
- (d) Valid over all domain elements

No, the answer is incorrect.

Score: 0

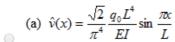
Accepted Answers:

(b) Valid over individual element
In order to discretize the term $\frac{\partial u}{\partial y}$, the order of accuracy in forward, backward and 1 point
central difference scheme is respectively regarding finite difference method
(a) 1, 2 and 1
(b) 2, 1 and 2 (c) 1, 1 and 2
(d) 1, 1 and 1
No, the answer is incorrect. Score: 0
Accepted Answers: (c) 1, 1 and 2
1 pc
For one dimensional heat conduction governing equation is $k \frac{d^2T}{dx^2} = 0$, for domain x
to x=10 cm. The boundary conditions are:
Boundary condition I: at x=0 cm, heat flux = $1W/m^2$ and at x= 10 cm, heat flux = $1W/m^2$
Boundary condition II: at $x=0$ cm, $T=310$ K, and at $x=10$ cm, heat flux $=1$ W/m ²
Which of the following statements are correct?
 (a) Solution is inconsistent for both the boundary conditions (b) Solution is consistent for both the boundary conditions and for BC I, solution is unique. (c) Solution is consistent for both the boundary conditions and for BC II, solution is unique. (d) Solution is consistent and unique for both the boundary conditions.
No, the answer is incorrect. Score: 0
Accepted Answers: (c) Solution is consistent for both the boundary conditions and for BC II, solution is unique.
9) 0 points
For free tip of a fin, the boundary condition at tip is given by:
$-k \frac{dT}{dx}\Big _{x=L} = h(T_L - T_{\infty})$, here all terms have usual meaning. Regarding this consider following
statements:
Statement I: This is valid only for steady case.
Statement II: Valid for transient case at any instant of time.
Statement III: Not valid for transient case at any instant. Select the correct option regarding these statements
select the correct option regarding these statements
(a) Statement I and II are correct. (b) Statement I and III are correct.
(c) Only I is correct.
(d) Only II is correct
No, the answer is incorrect. Score: 0
Accepted Answers: (a) Statement I and II are correct.
10) 1 point

Consider the example of simply supported bean under uniformly distributed load. The governing equation is $EI\frac{d^4v}{dv^4} - q_0 = 0$ for x = 0 to x = L. Boundary condition are:

v(0) = 0, $\frac{d^2v}{dx^2}(0) = 0$ and v(L) = 0, $\frac{d^2v}{dx^2}(L) = 0$. Assume trial solution as $v(x) \approx \hat{v}(x) = a \sin(\pi x/L)$ for weighted residual approach set residual at L/4 is equal to zero. The solution is:







(b)
$$\hat{v}(x) = \frac{\sqrt{2}}{\pi^4} \frac{q_0 L^3}{EI} \sin \frac{\pi x}{L}$$



(c)
$$\hat{v}(x) = \frac{\sqrt{2}}{\pi^4} \frac{q_0 L^2}{EI} \sin \frac{\pi x}{L}$$



(d)
$$\hat{v}(x) = \frac{\sqrt{2}}{\pi^4} \frac{q_0 L}{EI} \sin \frac{\pi x}{L}$$



No, the answer is incorrect. Score: 0

Accepted Answers:

(a)
$$\hat{v}(x) = \frac{\sqrt{2}}{\pi^4} \frac{q_0 L^4}{EI} \sin \frac{\pi x}{L}$$

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