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17/ENG0/057

EIECTRİCAL / ELECTRONİCS ENGİNEERİNG

ENGİNEERİNG MATH ASSİGNMENT

Solution:

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17/ENG04/057
ELECTRICAL ELECTRONICS ENGINEERING
MATH (381) ; ENGINEERING MATH

∴ Given the equation 1:

$$\underbrace{x(x-1)y''}_{w_1} + \underbrace{(3x-1)y'}_{w_2} + \underbrace{y}_{w_3} = \underbrace{0}_{w_4}$$

Where; $w_1 = x(x-1)y''$

$w_2 = (3x-1)y$

$w_3 = y$

$w_4 = 0$

∴ w_1 ;

$u = y''$ $\qquad v = x(x-1) = x^2 - x$

$u^n = y^{n+2}$ $\qquad v' = 2x - 1$

$u^{n-1} = y^{n+1}$ $\qquad v^2 = 2$

$u^{n-2} = y^n$ $\qquad v^3 = 0$

∴

w_2 :

$u = y'$ $\qquad v = 3x - 1$

$u^n = y^{n+1}$ $\qquad v' = 3$

$u^{n-1} = y^n$ $\qquad v'' = 0$

w_3

$u = y$ $\qquad v = 1$

$u^n = y^n$ $\qquad v' = 0$

∴ using; Leibitonz Formula;

∴ $u^n v + n u^{n-1} v' + \frac{n(n-1)}{2!} u^{n-2} v^2 + \frac{n(n-1)(n-2)}{3!} u^{n-3} v^3$

∴ $w_1 = y^{(n+2)} \cdot (x^2 - x) + n(y^{n+1}) \cdot (2x-1) + \frac{n(n-1)}{2!} y^n \cdot 2 \cdot 0$

$w_1 = y^{(n+2)} \cdot (x^2 - x) + n(y^{n+1}) \cdot (2x-1)$

$W_3 = y^n$.

$\therefore W_1 + W_2 + W_3 = W_4$

$\Rightarrow y^{(n+2)}(x^2-x) + (2nx-n)y^{(n+1)} + y^n(n^2-n) + y^{(n+1)}(3x-1) + 3ny^n + y^n = 0$

$\therefore$ Assume $x = 0$

$(-n)y^{(n+1)} + y^n(n^2-n) + 3ny^n + y^n = 0$

$\therefore y^{(n+1)}(-n-1) + y^n(n^2-n+3n+1) = 0$

$y^{(n+1)}(-n-1) + y^n(n^2+2n+1) = 0$

$\therefore -y^{(n+1)}(n+1) + y^{(n)}(n^2+2n+1) = 0$

$y^{(n+1)}(n+1) = y^{(n)}(n+1)(n+1)$.

$y^{(n+1)} = y^{(n)}(n+1)$.

$(y^{(n+1)})_0 = (y^n)_0(n+1)$ [Recurrent Relation]

Assume $n = 0$.

$\therefore [y^{(1)}]_0 = (y^{(0)})_0(1)$

$0.005 = 0.005(1)$.

$\therefore$ at $n = 1$

$(y^2)_0 = 2(y^{(1)})_0$

at $n = 2$

$(y^{(3)})_0 = 3y^{(2)} \Rightarrow 3(2(y^{(1)})_0) = 6(y^{(1)})_0$.

$n = 3$

$(y^{(4)})_0 = 4(y^{(3)})_0 \Rightarrow 4(3(2(y^{(1)})_0)) = 24(y^{(1)})_0$

$n = 4$

$(y^{(5)})_0 = 5(y^{(4)})_0 \Rightarrow 5(4(3(2(y^{(1)})_0))) = 120(y^{(1)})_0$.

$n = 5$.

$(y^{(6)})_0 = 6(y^{(5)})_0 \Rightarrow 6(120y^{(1)}) = 720(y^{(1)})_0$

$n = 6$

$(y^7)_0 = 7(y^{(6)})_0 \Rightarrow 7(720y^{(1)})_0 = 5040(y^{(1)})_0$.

using Maclaurin Series:

$$y = (y^{(0)})_0 + (y^{(1)})_0 x + \frac{(y^{(2)})_0}{2!} x^2 + \frac{x^3}{3!} (y^{(3)})_0 + \frac{x^4}{4!} (y^4)_0 + \frac{x^5}{5!} (y^5)_0$$

$$+ \frac{x^6}{6!} (y^{(6)})_0 + \frac{x^7}{7!} (y^{(7)})_0$$

$$\Rightarrow y = 0.0005 + 0.0005x + \frac{2x^2}{2} (y^{(2)})_0 + \frac{6x^3}{3!} (y^{(3)})_0 + \frac{24}{4!} x^4 (y^{(4)})_0 +$$

$$\frac{120x^5}{5!} (y^{(5)})_0 + \frac{720x^6}{6!} (y^{(6)})_0 + \frac{5040}{7!} x^7 (y^{(7)})_0$$

$$\therefore y = (y^{(0)})_0 + x(y^{(0)}) + x^2 (y^{(0)})_0 + x^3 (y^{(0)})_0 + x^4 (y^{(0)})_0 + x^5 (y^0)_0 + x^6 (y^{(0)})_0$$

$$+ x^7 (y^{(0)})_0 + \ldots$$

$\therefore$ Power Series $\Rightarrow y = (y^{(0)})_0 (1 + x + x^2 + x^3 + x^4 + x^5 + x^6 + x^7)$

Since $(y^{(0)})_0 = 0.0005\,m$ and $(y^{(1)})_0 = 0.0005$.

$\therefore$ Power Series: $y = 0.0005(1 + x + x^2 + x^3 + x^4 + x^5 + x^6 + x^7 + \ldots$

$\therefore$ When $x = 5m$.

$$y = 0.0005(1 + 5 + 5^2 + 5^3 + 5^4 + 5^5 + 5^6 + 5^7)$$

$$y \Rightarrow 48.83\,m.$$

When $x = 8m$

$$y = 0.0005(1 + 8 + 8^2 + 8^3 + 8^4 + 8^5 + 8^6 + 8^7)$$

$$y = 1198.3725\,m.$$

$\therefore$ When $x = 10$.

$$y = 0.0005(1 + 10 + 10^2 + 10^3 + 10^4 + 10^5 + 10^6 + 10^7)$$

$$y = 5555.556\,m$$

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Solution:

```
commandwindow
clear
clc
close all
syms x
x = 0:0.01:10
y = 0.0005*(1+x+x^2+x^3+x^4+x^5+xv6+x^7)
t= subs(y)
plot(x,t)
xlabel=('meters')
ylabel('deformation')
grid on
grid minor
axis tight
```

graph: