

n(1)

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17/11/2015/008

Mechatronics Engineering.

$$n(n-1)y'' + (3n-1)y' + y = 0.$$

$$w_1 + w_2 + w_3 = 0.$$

w₁

$$\begin{aligned}
 v &= n(n-1) & v' &= 2n-1 & v'' &= 2 & v''' &= 0. \\
 u &= y^n & u' &= ny^{n-1} & u'' &= n(n-1)y^{n-2} & u''' &= n(n-1)(n-2)y^{n-3}, \quad u^n = y^{n+2}
 \end{aligned}$$

using Leibnitz theorem

$$\frac{dw_1}{dx} = y^{n+2} (n(n-1)) + n y^{n+1} (2n-1) + \frac{n(n-1)}{2!} y^n (2) + \frac{n(n-1)(n-2)}{3!} (y^{n-1}) (0)$$

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

$$\frac{dw_2}{dx} = \dots (3n-1)$$

$$\begin{aligned}
 v_2 &= 3n-1 & v_2' &= 3 & v_2'' &= 0 \\
 u &= y^3 & u' &= 3y^2 & u'' &= 6y, \quad \text{hence } u^n = y^{n+1}
 \end{aligned}$$

$$w_2 = y^{n+1} (3n-1) + n y^n (3) + \frac{n(n-1)}{2!} (0) y^{n-1}$$

$$w_2 = y^{n+1} (3n-1) + 3n y^n$$

$$\frac{dw_3}{dx} = \dots (y)$$

$$\begin{aligned}
 u &= y & u' &= 1 \\
 u &= y & u' &= y^0, \quad \text{hence } u^n = y^n
 \end{aligned}$$

$$w_3 = y^n (1) + n y^{n-1} (0) + \dots$$

$$w_3 = y^n$$

$$w_2 + w_2 + w_3 = 0$$

$$\therefore y^{n+2} \dots$$

$$y^{n+2}(n(n-1)) + ny^{n+1}(2n-1) + n(n-1)y^n + y^{n+1}(3n-1) + 5ny^n + y^n = 0$$

$$y^{n+2}(n(n-1)) + ny^{n+1}(2n-1) + y^{n+1}(3n-1) + n(n-1)y^n + 5ny^n + y^n = 0$$

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

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

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

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

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

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

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

$$y^{n+2}(n^2 - n) = -y^{n+1}(n(2n-1) + 3n-1) - y^n(n+1)^2 \Rightarrow \text{Returning equation}$$

when $n=0$

$$(0)y^n + (3(0) - 1)y' + y = 0$$

$$-y' = y$$

$$y'(0) = y_0$$

when $n=0, n=0$

$$y^2(0) = -y'(-1) - y^0(1)^2$$

$$y' = 1$$

when $n=0, n=1$

$$y^2(0) = -y''(1(-1) - 1) - y'(2)^2$$

$$0 = 2y'' - 4y'$$

$$y'' = 2y' \quad y' = 1 \quad \therefore y'' = 2$$

when $n=0$, $n=3$

$$y'(0) = -y_0'(-3+1) = 10y_0'$$

$$0 = 3y_0''' - 7y_0''$$

$$7y_0'' = 3y_0'''$$

$$y_0''' = 3y_0'' = 3(3y_0')$$

$$y_0'' = 27y_0'$$

when $n=0$, $n=4$

$$y'(0) = -y_0'(-4+1) = 10y_0'$$

$$0 = 4y_0^{(4)} - 16y_0'''$$

$$16y_0''' = 4y_0^{(4)}$$

$$4y_0''' = y_0^{(4)}$$

$$y_0^{(4)} = 4y_0'''$$

$$y_0^{(4)} = (4(3(2y_0')))$$

$$y_0^{(4)} = 24y_0''$$

when $n=0$, $n=4$

$$y'(0) = -y_0'(-4+1) = 25y_0^{(4)}$$

$$0 = 5y_0^{(4)} - 25y_0^{(4)}$$

$$25y_0^{(4)} = 5y_0^{(4)}$$

$$y_0^{(4)} = 5y_0^{(4)}$$

$$y_0^{(4)} = 5(4(3(2y_0')))$$

$$y_0^{(4)} = 5(24y_0'')$$

when $n=0$, $n=5$

$$y'(0) = -y_0'(-5+1) = 16y_0^{(5)}$$

$$0 = 16y_0^{(5)} - 80y_0^{(4)}$$

$$80y_0^{(4)} = 16y_0^{(5)}$$

$$y_0^{(5)} = 5y_0^{(4)}$$

$$y_0^{(5)} = 5(6(5(4(3(2y_0'))))$$

$$y_0^{(5)} = 720y_0''$$

when $n=0$, $n=6$

$$y'(0) = -y_0'(-6+1) = 25y_0^{(6)}$$

$$0 = 25y_0^{(6)} - 125y_0^{(5)}$$

$$125y_0^{(5)} = 25y_0^{(6)}$$

$$y_0^{(6)} = 5y_0^{(5)}$$

$$y_0^{(6)} = 5(720y_0'')$$

$$y_0^{(6)} = 3600y_0''$$

using the Leibniz method we find

$$y_0 + 2(y_0') + \frac{n^2}{2!}(y_0'') + \frac{n^5}{5!}(y_0''')$$

$$+ \frac{24}{4!}y_0^{(4)} + \frac{n^5}{5!}y_0^{(5)} + \frac{n^6}{6!}y_0^{(6)}$$

$$+ \frac{n^7}{7!}y_0^{(7)} + \dots$$

$$y_0 + 2y_0' + \frac{n^2}{2!}(2y_0') + \frac{n^5}{5!}(24y_0''')$$

$$+ \frac{n^4}{4!}(4!y_0'') + \frac{n^5}{5!}(5!y_0^{(5)}) + \frac{n^6}{6!}(6!y_0^{(6)})$$

$$+ \frac{n^7}{7!}(7!y_0^{(7)})$$

$$y_0 + 2y_0' + 2y_0'' + n^5(y_0''') + n^6(y_0^{(4)})$$

$$+ n^7(y_0^{(5)}) + n^6(y_0^{(6)}) + n^7(y_0^{(7)}) + \dots$$

DLS.
MATHS
FIND
PRAT

$$y + y'(n + n^2 + n^3 + n^4 + n^5 + n^6 + n^7)$$

but $y_0 = y_0$

$$y = y_0 (1 + n + n^2 + n^3 + n^4 + n^5 + n^6 + n^7)$$

i.e when $n = 5$ and when $y_0 = y_0 = 0.0005$

$$b.) y_5 = 0.0005 (1 + 5 + 5^2 + 5^3 + 5^4 + 5^5 + 5^6 + 5^7)$$

$$y_5 = 0.0005 (97,656)$$

$$y_5 = \underline{48.828}$$

$$ii) y_8 = 0.0005 (1 + 8 + 8^2 + 8^3 + 8^4 + 8^5 + 8^6 + 8^7)$$

$$y_8 = 0.0005 (2,396,745)$$

$$= 1198.3725$$

$$iii) y_{10} = 0.0005 (1 + 10 + 10^2 + 10^3 + 10^4 + 10^5 + 10^6 + 10^7)$$

$$= 0.0005 (11111111)$$

$$= 5555.5555$$

c) 1) Command window

2) clear

3) clc

4) syms n, y

5) x = (0 : 10);

6) y_0 = 0.0005

Command window

clear

clc

$$y_0 = 0.0005$$

$$n = (0:10)$$

$$y = y_0^n (1 + x + x^2 + x^3 + x^4 + x^5 + x^6 + x^7)$$

$$Y_n = \text{Sub}(n, y)$$

Plot (n, Yn)

grid on

grid minor

xLabel ('x')

yLabel ('Structural element')

~~SKETCH~~!!!!

GRAPH OF STRUCTURAL ELEMENT AGAINST X.

