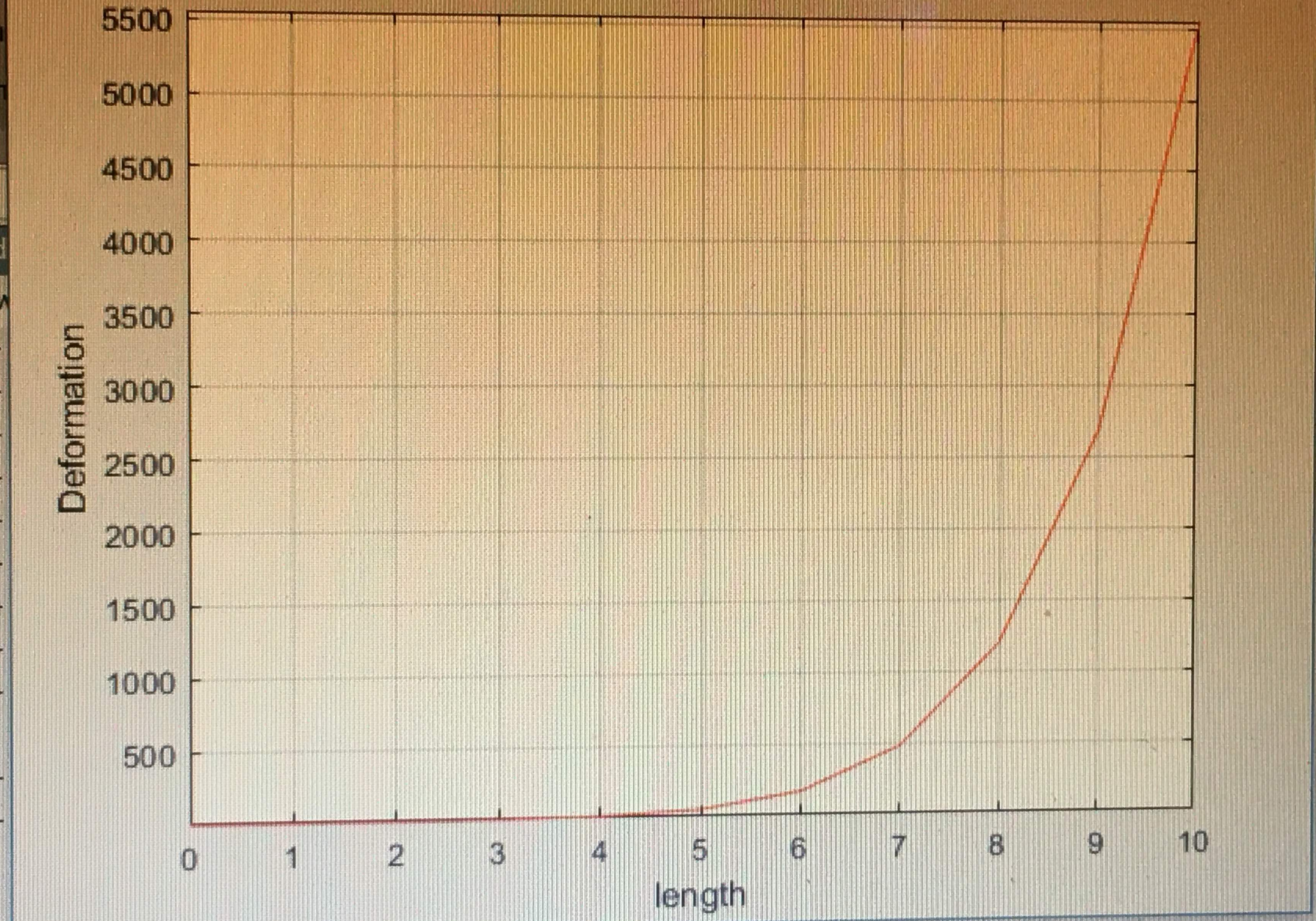
File Edit View Insert Tools Desktop Window Help



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$x(x-1)y''' + (3x-1)y' + y = 0$

$x(x-1)y''$

expand

$(x^2-x)y''$ $\quad w = uv$

$= y^{(n+2)}(x^2-x) + ny^{(n+1)}(2x-1) + \frac{n(n-1)(-2)}{2!}$

2) $(3x-1)y$

$v = 3x-1$

$u = y$

Using Leibnitz theorem,

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

3) $y(1)$

$u = y$

$v = 1$

Using Leibnitz theorem

$y^{(n)}(1)$

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

$y^{(n+1)} + 3xy^{(n)} + y^{(n)}$

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

$$(y^{n+1})_0 = -\frac{(n(n-1) + 3n + 1)}{-(n+1)} (y^{(n)})_0$$

$$(y^{(n+1)})_0 = \frac{(n+1)(n+1)}{(n+1)} (y^{(n)})_0$$

$$(y^{(n+1)})_0 = n+1 (y^{(n)})_0$$

When $n = 1$

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

When $n = 2$

$$(y^{(3)})_0 = 3(y^{(2)})_0 = 3(2(y^{(1)})_0)$$

When n is 3

$$(y^{(4)} \pm 4(y^{(3)})_0 = 4 \cdot 3 \cdot 2 (y^{(1)})_0$$

When n is 4

$$(y^{(5)}) = 5(y^{(4)})_0 = 5 \cdot 4 \cdot 3 \cdot 2 (y^{(1)})_0$$

When n is 5

$$(y^{(6)} = 6(y^{(5)})_0 = 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 (y^{(1)})_0$$

When n is 6

$$(y^{(7)} = 7(y^{(6)})_0 = 7 \cdot 6 \cdot 5 \cdot 4 \cdot 5 \cdot 2 (y^{(1)})_0$$

When n is 8

$(y^{(9)})_0 = 8(y^{(8)})_0 = 9 \cdot 8 \cdot 7 \cdot 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 (y^{(1)})_0$

Using Maclaurin series

$y = (y)_0 + x(y^{(1)})_0 + x^2(y^{(1)})_0 + x^3(y^{(1)})_0 + x^4(y^{(1)})_0 + x^5(y^{(1)})_0 + x^6(y^{(1)})_0 + x^7(y^{(1)})_0$

$y = (y)_0 + (y^{(1)})_0 \{x + x^2 + x^3 + x^4 + x^5 + x^6 + x^7\}$

$y(0) = 0.0005m$ and $y'(0) = 0.0005$

$x = 5$

$y = 0.0005 + 0.0005\{5 + 5^2 + 5^3 + 5^4 + 5^5 + 5^6 + x^7\}$

$y = 48.828$

≈ 49

$x = 8$

$y = 0.0005 + 0.0005\{8 + 8^2 + 8^3 + 8^4 + 8^5 + 8^6 + 8^7\}$

$y = 1,98337205 \simeq 1,198$

$x = 10$

$y = 0.0005 + 0.0005\{8 + 8^2 + 8^3 + 8^4 + 8^5 + 8^6 + 8^7\}$

$y = 1.98372$

$= 1,198$

```
Command window
clear
clc
close all
x=0:1:10j
y=0.0005+(0.0005*(x+x.^2+x.^3+x.^4
+x.^5+x.^6+x.^7));
plot(x,y)
xlabel('Length')
ylabel('Deformation')
title('Length-Deformation')
grid on
grid minor
axis equal
axis tight
```