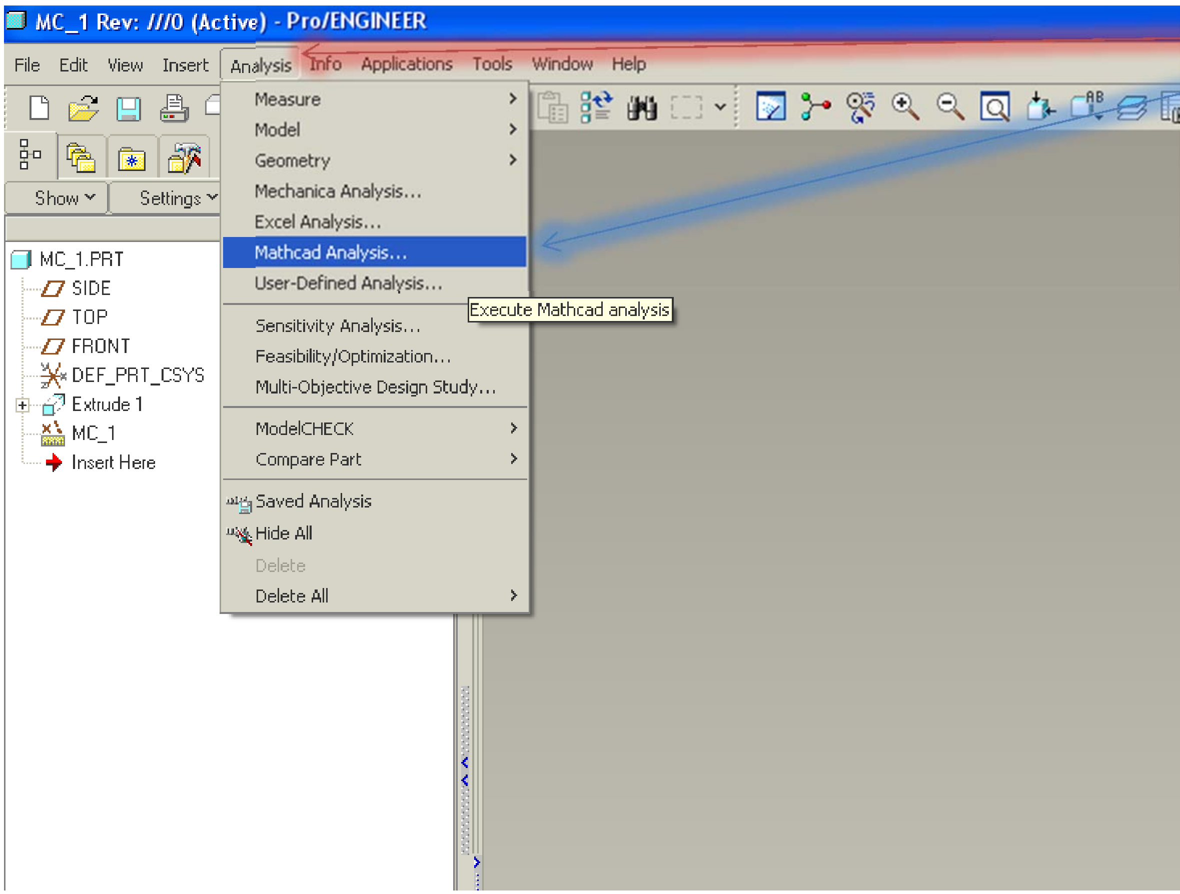
MATHCAD

SO EASY A CAVEMAN CAN DO IT

ATTACH WORKSHEET TO PRO/E

- Click Analysis
- Select Mathcad Analysis
- Select Load File, then browse to Mathcad sheet
- Associate Pro/e dimensions with Mathcad variables
- Click Compute, then add feature
- YOUR DONE!!!!!!!!! Sounds easy right……

Sometimes a pictures make things easier

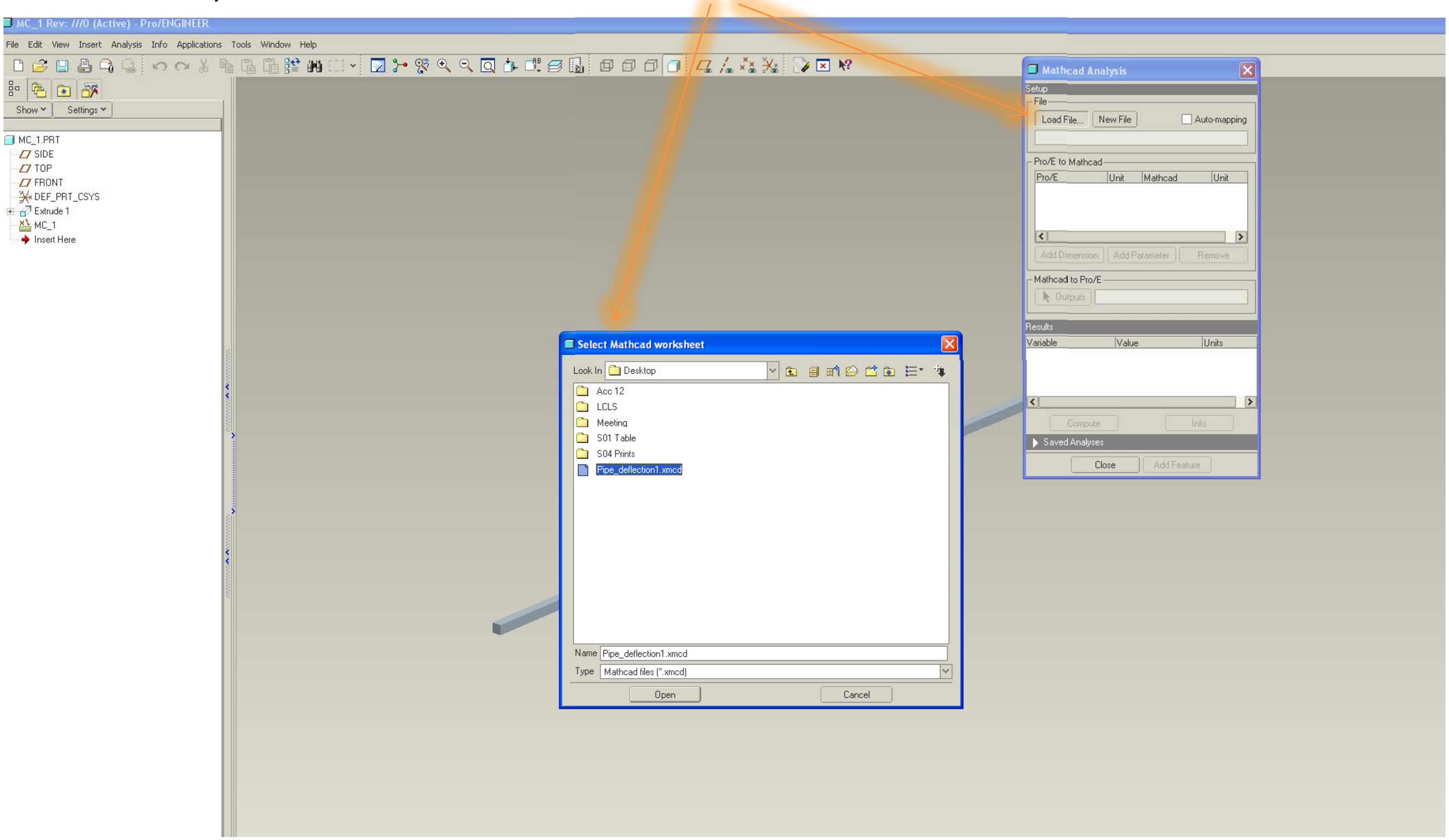


Click Analysis

Select Mathcad Analysis

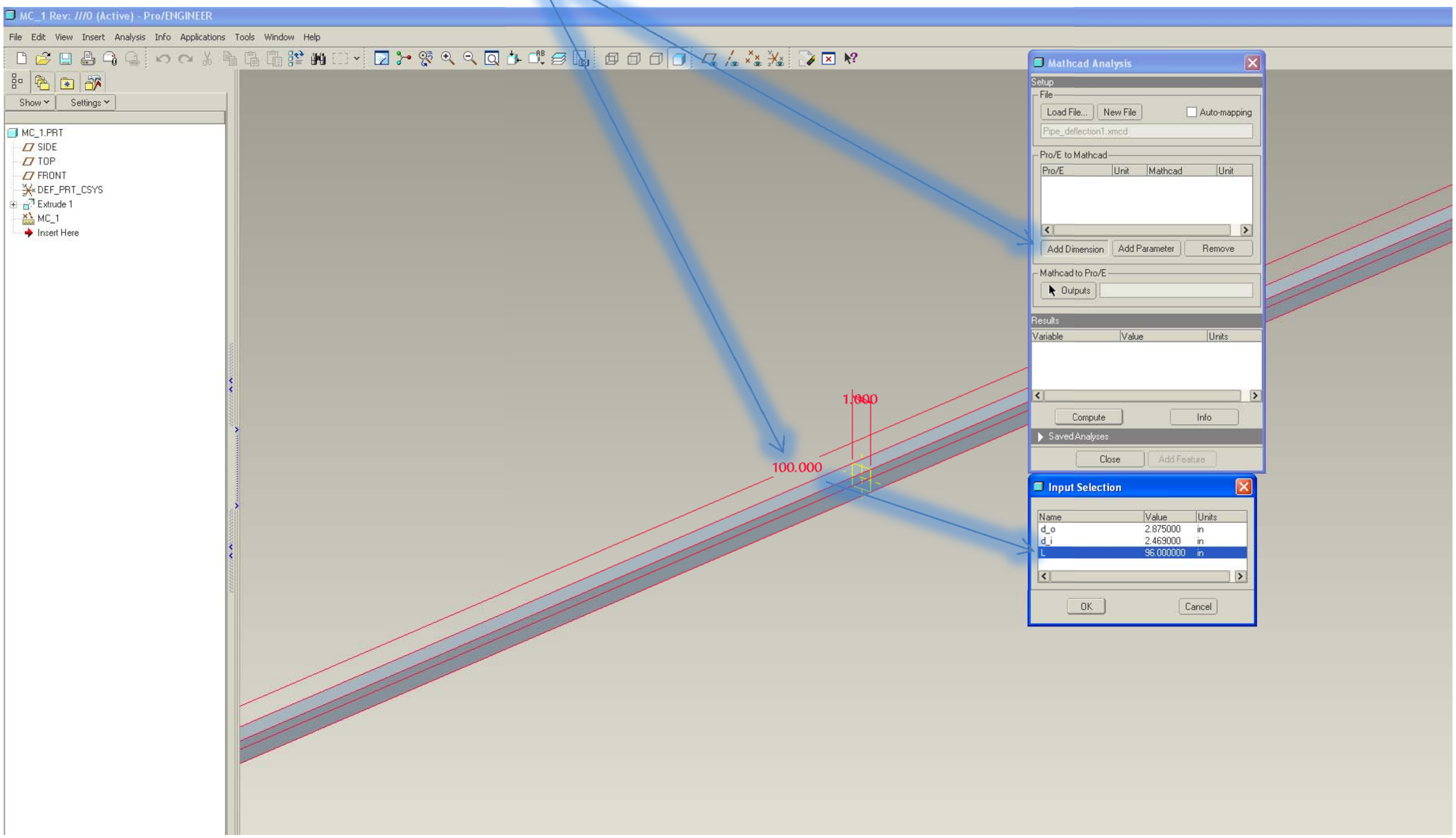
Next…..

Select Load File, then browse to Mathcad sheet



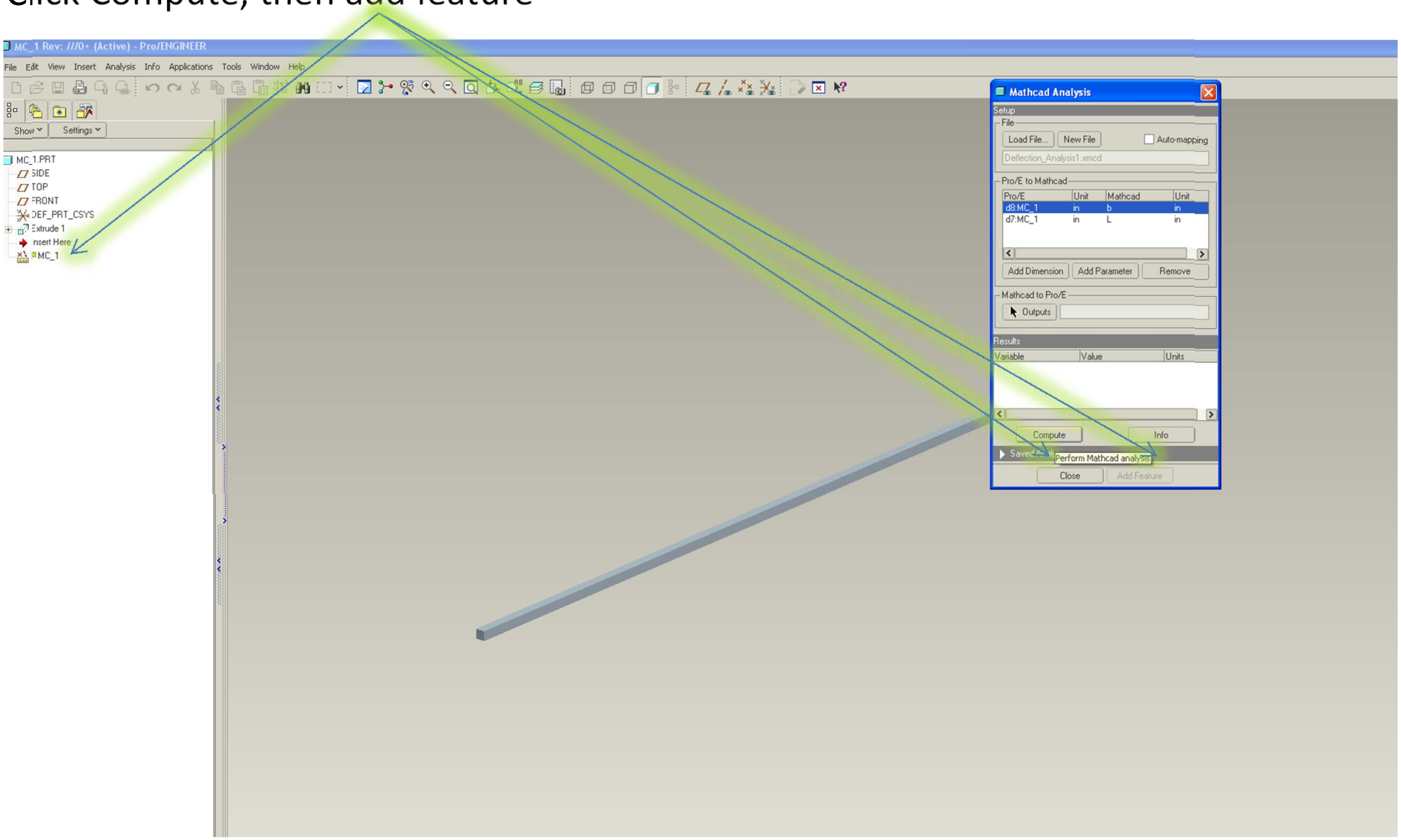
And then…..

Associate Pro/e dimensions with Mathcad variables



Finally….

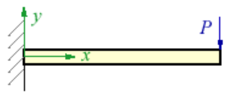
Click Compute, then add feature



Worksheet Examples

Deflection Analysis of 304SS Cantilevered Square Beam Under End Load

By: Jason Lerch



Mathcad/Pro Engineer Integration and Deflection Analysis

Calculate Second Moment of Area and Integrate with Pro/E: $b := 10in$ $\quad d8 := b$

$d8 = 10 \cdot in$ $\quad I := \frac{b^4}{12}$

$I = 833.333 \cdot in^4$

Integrate Length of Model Beam from Pro/E to Calc: $L := 10ft$ $\quad d7 := L$

$d7 = 10\,ft$

Determine your loads in pound force per foot: $P := 100lbf$

Determine Elastic Modulus by determining material type: $E := 23000ksi$

Setup range values for which you want to apply the load: $w(x) := 0in, 1in..L$ $\quad w_{max} := L$

Main Equation: a.) Displacement- $w(x) := -\frac{P \cdot x^2 (3 \cdot L - x)}{6 \cdot E \cdot I}$

$w_{max} := -\frac{P \cdot L^3}{3 \cdot E \cdot I}$ $\qquad w_{max} = -0.003 \cdot in$

b.) Slope- $\theta(x) := -\frac{P \cdot (2 \cdot L - x) \cdot x}{2 \cdot E \cdot I}$

$\theta_{max} := -\frac{P \cdot L^2}{2 \cdot E \cdot I}$ $\qquad \theta_{max} = -0.002 \cdot deg$

Conversion help

$1psi = 0.001 \cdot ksi$

$.001ksi = 1\,psi$

Symbology

L: Length of Beam (ft)

P: Load on end of Beam (lbf)

E: Elastic Modulus (ksi)

I: Second Moment of Area

θ: Slope Angle (deg)

θ_{max}: Maximum slope Angle (deg)

w: Displacement (in)

w_{max}: Maximum Displacement (in)

Second Moment of Area Formulas:

Square Cross Section: $I_x := \frac{b^4}{12}$ where b=side

Rectangular Cross Section: $I_x := \frac{(b^3 h)}{12}$ where b=width;h=height

$I_x := \frac{(bh^3)}{12}$

Circular Cross Section: $I_x := \frac{(\Pi r^4)}{4}$ where r=radius

$I_y := \frac{(\Pi r^4)}{4}$

Cylindrical Cross Section: $I_x := \frac{\Pi (d_o{}^4 - d_i{}^4)}{64}$ where d_o=cylinder outside diameter

d_i=cylinder inside diameter

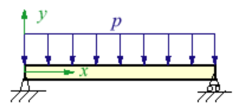
$I_y := \frac{\Pi (d_o{}^4 - d_i{}^4)}{64}$

Last Example

Go

Deflection Analysis of 304SS Standard Wall Pipe Under Uniform Load Supported at Both Ends

By: Jason Lerch



Mathcad/Pro Engineer Integration and Deflection Analysis

Main Equation: $\Delta_x(w,L,x,E,I) := \frac{(w \cdot x)}{24 \cdot E \cdot I}\left(L^3 - 2 \cdot L \cdot x^2 + x^3\right)$

Calculate Second Moment of Area and Integrate with Pro/E:

$d_o := 2.875in$ $\quad d_i := 2.469in$

$d9 := d_o$ $\quad d8 := d_i$

$d9 = 2.875 \cdot in$ $\quad d8 = 2.469 \cdot in$

$I_x := \frac{\pi \cdot \left(d_o{}^4 - d_i{}^4\right)}{64}$ $\quad I_x = 1.53 \cdot in^4$

$I_y := \frac{\pi \cdot \left(d_o{}^4 - d_i{}^4\right)}{64}$ $\quad I_y = 1.53 \cdot in^4$

$I := I_x$ $\quad I = 1.53 \cdot in^4$

Integrate Length of Model Beam from Pro/E to Calc:

$L := 96in$

$d7 := L$

$d7 = 8ft$

Determine your loads in pound force per foot: $\quad w := 10 \frac{lbf}{ft}$

Determine Elastic Modulus by determining material type: $\quad E := 27992.3ksi$

Setup range values for which you want to apply the load: $\quad x := 0ft, 1ft .. L$

Conversion help

$1psi = 0.001 \cdot ksi$

$.001ksi = 0.001 \cdot ksi$

Symbology

E:Elastic Modulus

I:Second Moment of Area (not to be mistaken with Moment of Inertia)

w:Load

L:Total Length of Beam

x:Range of applied load

$\frac{\Delta_x(w,L,x,E,I)}{in}$: Deflection Distance in inches

$\frac{x}{ft}$: x Range in feet

Second Moment of Area Formulas:

Square Cross Section: $I_x := \frac{b^4}{12}$ where b=side

Rectangular Cross Section: $I_x := \frac{\left(b^3 h\right)}{12}$ where b=width;h=height

$I_x := \frac{\left(bh^3\right)}{12}$

Circular Cross Section: $I_x := \frac{\left[(\pi r)^4\right]}{4}$ where r=radius

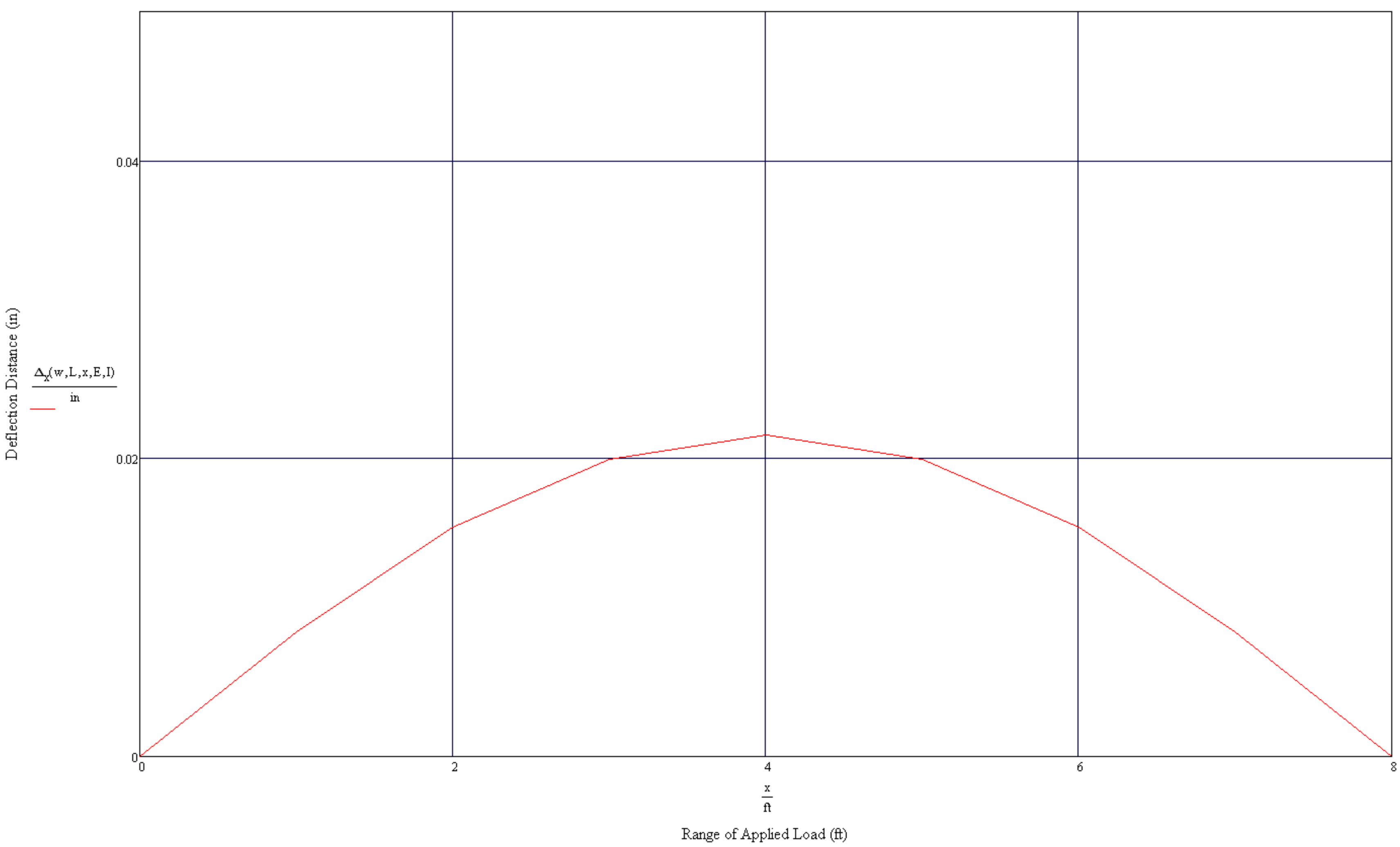
$I_y := \frac{\left[(\pi r)^4\right]}{4}$

Cylindrical Cross Section: $I_x := \frac{\pi \cdot \left(d_o{}^4 - d_i{}^4\right)}{64}$ where d_o=cylinder outside diameter

d_i=cylinder inside diameter

$I_y := \frac{\pi \cdot \left(d_o{}^4 - d_i{}^4\right)}{64}$

Plot


0.04
0.02
0
Deflection Distance (in)
Δx(w,L,x,E,I)
in
0
2
4
6
8
x
ft
Range of Applied Load (ft)

In Conclusion

- Wanted to show you the program in action but MATHCAD wasn’t loaded on this outdated computer… Apologies….
- We should be trying to integrate this into our work!!!!!!
- MATHCAD is a powerful tool
- WHY NOT USE IT????
- Constructive Questions????
- If you are interested in making a worksheet for anything, see me and I can go into further detail of how to operate mathcad and setup operations…