



EG413 Computer Aided Engineering

Tutorial 1: Mathcad, step-by-step

G. Mustoe

IVI S04.1



Purpose and Setup

- Demonstrate how to use MATHCAD basics in Tutorial 1
- Note, these instructions only explain the major MATHCAD commands used, not a complete description of every line of MATHCAD commands for Tutorial 1
- While performing the step-by-step MATHCAD solution have a copy of Tutorial 1 equations at hand

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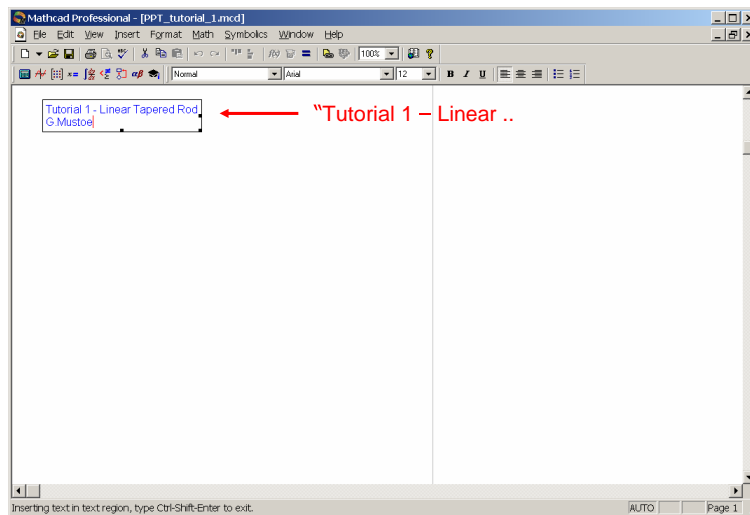
Mathcad Commands required for Tutorial 1

- Use Text mode
- Use Equation mode and <space>
- Copy and paste a picture
- Define a variable
- Evaluate a variable
- Define a function
- Evaluate a function
- Create a range variable (integers)
- Define a vector using an array subscript
- Make an x-y plot

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Mathcad – Text mode



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Mathcad – Equation mode

Tutorial 1 - Linear Tapered Rod
G.Mustoe

Define AL $AL := 0.5 * 0.55$ ← $AL:0.5*0.55$

Evaluate AL $AL = 0.275$ ← $AL=$

Press F1 for help. AUTO Page 1

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Mathcad – Copy and paste and picture

Adobe Acrobat - [Tutorial_1.pdf]

File Edit Document Tools View Window Help

145%

15.0 in

1.0 in 0.55 in Upper x-section

8000 lbf

0.5 in 0.55 in Lower x-section

Calculations:

1. Select

2. Select region To be copied

3. Select copy

1 of 3 8.5x11 in Page 1

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Mathcad – Paste picture into MCAD sheet

Select edit->Paste Special->device independent bitmap

1.0 in
0.55 in Upper x-section
15.0 in

AL = 0.5 0.55
AL = 0.275

Insert clipboard contents with options AUTO Page 1

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Mathcad – Toolbars and use of <space bar>

Click on three toolbars:
Calc., Matrix, Greek

8000 lbf
0.5 in 0.55 in Lower x-section

Matrix
Calculator
Greek

$\alpha := AL - AU$ ← Alpha:AL-AU<space>

Press F1 for help. AUTO Page 2

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Mathcad – Use of <space bar>

$\alpha = \frac{AL - AU}{AU}$ ← Alpha:AL-AU<space>/AU

NOTE: See what happens if <space> is not used in above equation!!

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Mathcad – Function definition

$\alpha = \frac{AL - AU}{AU}$

$u(x) = \frac{P \cdot L}{\alpha \cdot E \cdot AU}$ ← NOTE: Use of <space> 3 times

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Mathcad – Function evaluation and display sig figs

Mathcad Professional - [PPT_tutorial_1.mcd]

Equations:

$$\alpha := \frac{AL - AU}{AU}$$

$$u(x) := \frac{P \cdot L}{\alpha \cdot E \cdot AU} \ln \left(1 + \frac{\alpha \cdot x}{L} \right)$$

Evaluate displacements

$u(0) = 0$

$u(L) = 0.011$

Result Format dialog box:

- Number Format: **Decimal**
- Number of decimal places: **6**
- Show leading zeros:
- Strip exponents in engineering format:
- Exponential threshold: **3**

Double click #, and define 6 dec. places

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Mathcad – range variables and vectors

Mathcad Professional - [PPT_tutorial_1.mcd]

$u(L) = 0.01043$

Create two vectors containing the x-coordinate positions and displacement at 10 equal spaced points along the rod

First define a range integer variable $i := 1, 2, \dots, 10$ ← $i:1,2;10$

Define a vector of x-coord. values $X_i := (i-1) \cdot \frac{L}{9}$ ← $X[i:(i-1)*L/9$

Check

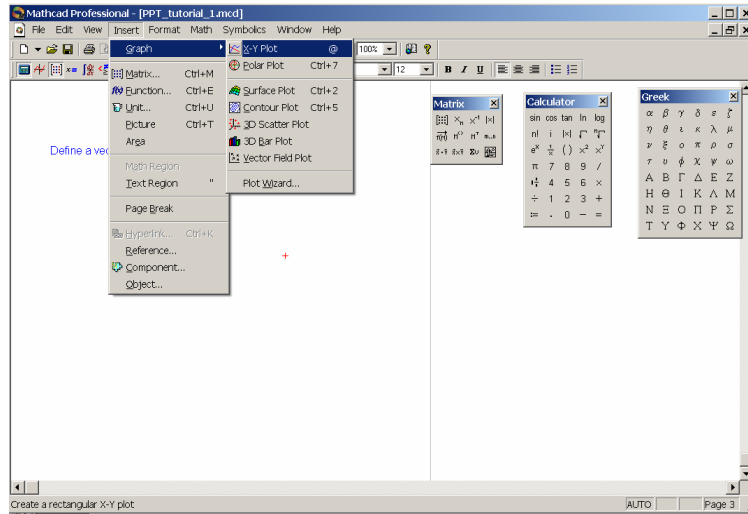
$i =$	$X_i =$
1	0
2	1.667
3	3.333
4	5
5	6.667
6	8.333
7	10
8	11.667
9	13.333
10	15

NOTE: you can use l or click here to define an array subscript

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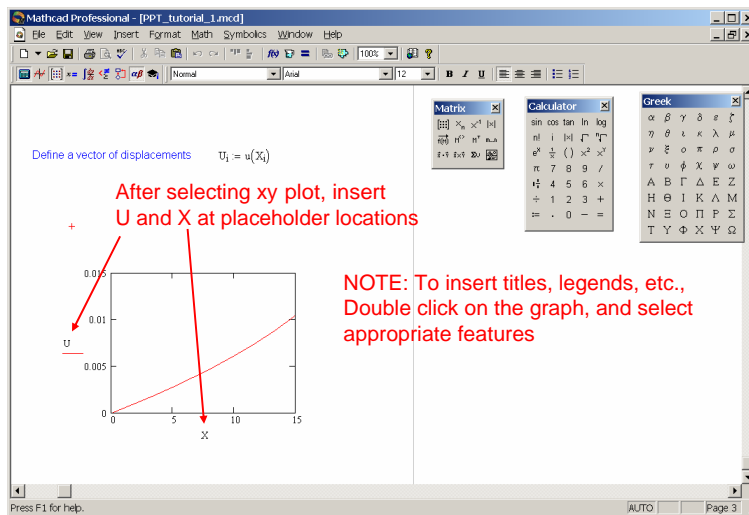
Mathcad - xy plot



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Mathcad - xy plot (continued)



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Concept Questions

1. What are MathCAD's two main modes?
2. How do you define a function in MathCAD?
3. How do you debug a MathCAD spreadsheet?
4. In what order are values calculated in MATHCAD?
5. What is a range variable and why are they used?
Give an example.
6. Explain the difference between the two different types of subscript variables in MathCAD and how you use each.

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