ELEMENT BY ELEMENT MATH OPERATIONS w/ ARRAYS

Lecture Date : 14 SEP 16

MATLAB is designed to carry out advanced array operations that have many applications in sci and engineering

Quick review on syntax

3 uses for ( )

(1) Order of precedence
(2) Specifying parameters for functions
(3) Addressing arrays

1 use for [ ]

(1) defining arrays

IMPORTANT NOTE: MATRIX OPERATIONS (i.e. linear algebra) AND ELEMENT BY ELEMENT OPERATIONS ARE INDEPENDENT!

Matrix Addition and Subtraction

Just like you think. Need to be identical size

$$A = \begin{bmatrix} A_{11} & A_{12} & A_{13} \\ A_{21} & A_{22} & A_{23} \end{bmatrix} \qquad B = \begin{bmatrix} B_{11} & B_{12} & B_{13} \\ B_{21} & B_{22} & B_{23} \end{bmatrix}$$

$$A + B = \begin{bmatrix} (A_{11}+B_{11}) & (A_{12}+B_{12}) & (A_{13}+B_{13}) \\ (A_{21}+B_{21}) & (A_{22}+B_{22}) & (A_{23}+B_{23}) \end{bmatrix}$$

If scalar is added or subtracted from array, it is added or subtracted TO ALL ELEMENTS

$$c = C \qquad A - C = \begin{bmatrix} (A_{11}-C) & (A_{12}-C) & (A_{13}-C) \\ (A_{21}-C) & (A_{22}-C) & (A_{23}-C) \end{bmatrix}$$

Element by Element Math Operations

SYMBOL	DESCRIPTION
.*	Multiplication
.^	Exponentiation
./	Right Division
.\	Left Division

$$A .* B = \begin{bmatrix} (A_{11} * B_{11}) & (A_{12} * B_{12}) & (A_{13} * B_{13}) \\ (A_{21} * B_{21}) & (A_{22} * B_{22}) & (A_{23} * B_{23}) \end{bmatrix}$$

$$A .\wedge \cancel{B}^{n} = \begin{bmatrix} (A_{11})^n & (A_{12})^n & (A_{13})^n \\ (A_{21})^n & (A_{22})^n & (A_{23})^n \end{bmatrix}$$

$$A ./ B = \begin{bmatrix} (A_{11}/B_{11}) & (A_{12}/B_{12}) & (A_{13}/B_{13}) \\ (A_{21}/B_{21}) & (A_{22}/B_{22}) & (A_{23}/B_{23}) \end{bmatrix}$$

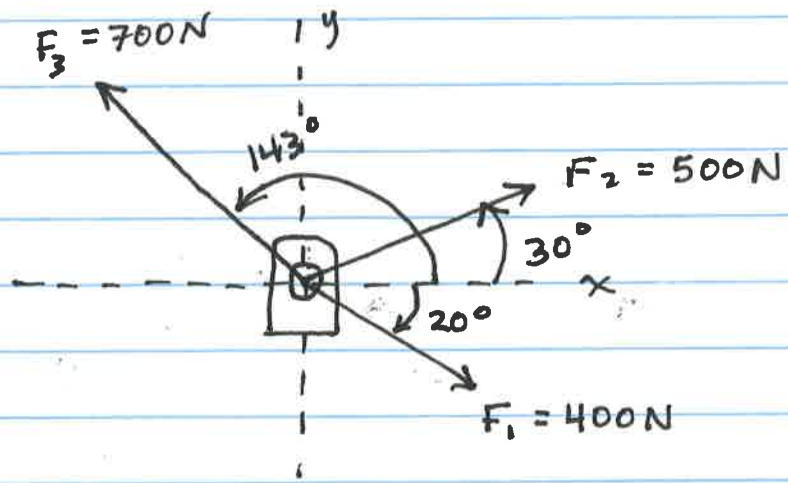
Element by element useful for calculating value of a function at many values of its argument

```
x = [1:8]
y = x.^2-4*x
```

Built in MATLAB functions can accept arrays as inputs

```
x = [0:pi/6:pi]
y = cos(x)
```

Example problem



Determine the equivalent force applied to the bracket

Recall

$$F = F_x \hat{i} + F_y \hat{j} = F\cos\theta\,\hat{i} + F\sin\theta\,\hat{j}$$

$$\Rightarrow \hat{F} = F\,(\cos\theta\,\hat{i} + \sin\theta\,\hat{j})$$

where F is the magnitude of the force and θ is the angle relative to the x axis

$$\Rightarrow F = \sqrt{F_x^2 + F_y^2} \quad \text{and} \quad \tan\theta = \frac{F_y}{F_x}$$

```
[1] clear
[2] F1M = 400 ; F2M = 500; F3M = 700 ;
[3] Th1 = -20 ; Th2= 30; Th3 = 143;
[4] F1 = F1M * [cosd(Th1)  sind(Th1)]
[5] F2 = F2M * [cosd(Th2)  sind(Th2)]
[6] F3 = F3M * [cosd(Th3)  sind(Th3)]
```

```
[7]  Ftot = F1 + F2 + F3
[8]  FtotM = sqrt( Ftot(1)^2 + Ftot(2)^2)
[9]  Th = atand (Ftot(2)/Ftot(1))
```