البرمجة الإجرائية

Lecture No. 3

Vectors

ميكاترونيكس - سنة أولى

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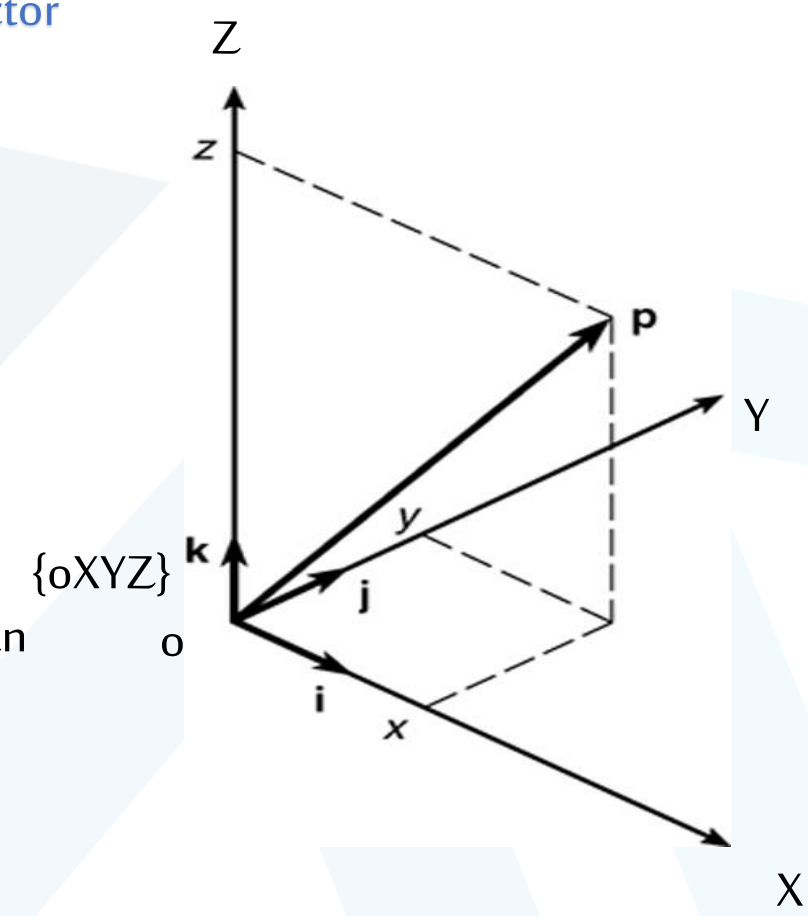
Specification of a position vector

The vector p can be specified using Cartesian coordinates by three components: x, y, and z, and can be written as:

>> p = [x, y, z].



However, MATLAB or MATH in general can use vectors having more than three elements.

>>pn=[x1, x2, x3, ...xn]

Create a Vector

To create a *row* vector, separate the elements by comma. For example,

```
>>p = [3,7,9]
p =
  3   7   9
```

You can create a *column* vector by using the *transpose* notation ('). single quotation mark

```
>>p = [3,7,9]'
p =
  3
  7
  9
```

You can also create a column vector by separating the elements by **semicolons**.

For example,

```
>>g = [3;7;9]
g =
   3
   7
   9
```

Vectors

قد يكون الشعاع مكون من عمود واحد و عدة أسطر

نكتب عناصر الشعاع بين قوسين متوسطين، و نفصل بين كل عنصرين متتاليين منه بفراغ أو بفاصلة

```
>> x = [1i ;2j; 3 ;-4*pi ;5 ;-6 ]

x =

  0.0000 + 1.0000i
  0.0000 + 2.0000i
  3.0000 + 0.0000i
 -12.5664 + 0.0000i
  5.0000 + 0.0000i
 -6.0000 + 0.0000i
```

- أو بإيجاد منقول شعاع عادي (منقول x هو x')

```
>> x=[1 ,2 ,3 ,4 ,5, 6 ,7 ,8, -9,-12.3]'

x =

   1.0000
   2.0000
   3.0000
   4.0000
   5.0000
   6.0000
   7.0000
   8.0000
  -9.0000
 -12.3000
```

Vectors

الصيغة (s:step:e) تولد شعاع قيمة أول عنصر منه هو s، و الفاصل بين كل عنصر و الذي يليه هو step، و آخر عنصر هو أكبر عدد ينتمي إلى السلسلة و قيمته أصغر أو تساوي e

الأشعة: هي مصفوفات وحيدة البعد، أي مكونة من سطر واحد و عدة أعمدة

توليد الأشعة

```
>> x=1:.5:5
x =
   1.0000   1.5000   2.0000   2.5000   3.0000   3.5000   4.0000   4.5000   5.0000
```

```
>> x=5:-.5:1
x =
   5.0000   4.5000   4.0000   3.5000   3.0000   2.5000   2.0000   1.5000   1.0000
```

```
>> x=5:-.7:1
x =
   5.0000   4.3000   3.6000   2.9000   2.2000   1.5000
```

```
>> z=1:6
z =
     1     2     3     4     5     6
```

```
>> z=-1:3
z =
    -1     0     1     2     3
```

The linspace command also creates a linearly spaced row vector, but instead you specify the number of values rather than the increment.

The syntax is linspace(x1,x2,n), where x1 and x2 are the lower and upper limits and n is the number of points.

linspace(X1, X2, n) generates n points between X1 and X2.

- If n is omitted, n=100.
- For n = 1, linspace returns X2.

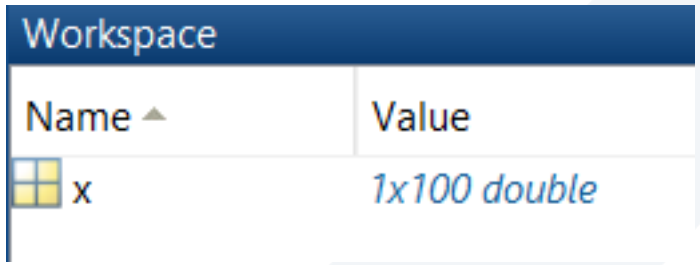
```
>> y=linspace(1,6,10)

y =

   1.0000   1.5556   2.1111   2.6667   3.2222   3.7778   4.3333   4.8889   5.4444   6.0000
```

الصيغة linspace(a,b,n) تولد شعاع أول عنصر منه هو a و آخر عنصر هو b، و يقسم المجال بحيث يكون عدد العناصر الكلي هو n

```
>> linspace(5,8,1)

ans =

     8
```

```
>> A=linspace(0,10,5)

A =

         0    2.5000    5.0000    7.5000   10.0000
```

```
>> x=linspace(5,8);
```



For example, linspace(5,8,31) is equivalent to [5:0.1:8].

```
>> isequal([5:0.1:8],linspace(5,8,31))

ans =

  logical

     1
```

step=(b-a)/(n-1)

(8-5)/(31-1)=3/30=0.1

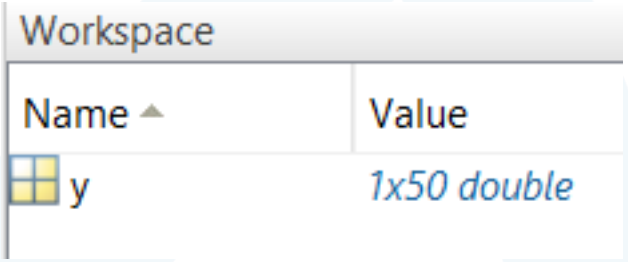
The logspace command creates an array of *logarithmically* spaced elements.

Its syntax is logspace(a,b,n), where n is the number of points between 10^a and 10^b.

For example, x = logspace(-1,1,4) produces the vector
x = [0.1000, 0.4642, 2.1544, 10.000].

If n is omitted, the number of points defaults to 50.

```
>> y=logspace(-1,1);
```



Vectors

توليد الأشعة:

```
>> y=logspace(1,6,10)

y =

  1.0e+06 *

  0.0000   0.0000   0.0001   0.0005   0.0017   0.0060   0.0215   0.0774   0.2783   1.0000
```

الصيغة logspace(a,b,n) تشبه الصيغة السابقة، إلا أن المجال يكون مقسم وفق تدريجة لوغارتمية و طرفي المجال هما 10^a و 10^b

Vectors

```
format long
>> y=logspace(1,6,10)

y =

   1.0e+06 *

  Columns 1 through 5

   0.000010000000000   0.000035938136638   0.000129154966501   0.000464158883361   0.001668100537200

  Columns 6 through 10

   0.005994842503189   0.021544346900319   0.077426368268113   0.278255940220713   1.000000000000000
```

Magnitude, Length, and Absolute Value of a Vector

Keep in mind the precise meaning of these terms when using MATLAB.

The length command gives the *number of elements* in the vector.

The *magnitude* of a vector **x** having elements $x_1, x_2, \ldots, x_n$ is a scalar, given by $\sqrt{(x_1^2 + x_2^2 + \ldots + x_n^2)}$, and is the same as the vector's geometric length.

The *absolute value* of a vector **x** is a vector whose elements are the absolute values of the elements of **x**.

Magnitude, Length, and Absolute Value of a Vector

For example, if x = [2,-4,5],

- its length is 3; (computed from length(x))

its magnitude is $\sqrt{[2^2 + (-4)^2 + 5^2]} = 6.7082$;
(computed from:

```
>> sqrt(x*x')

ans =

   6.7082
```

$$[2 \quad -4 \quad 5]\begin{bmatrix} 2 \\ -4 \\ 5 \end{bmatrix} =$$

4+16+25

- its absolute value is [2,4,5] (computed from abs(x)).

vector

```
Row=[1  2  3  4];

Row=[1,2,3,4];

Col=[1;2;3;4];

size(Row),size(Col)

length(Row),length(Col)
```

```
ans =
   1    4

ans =
   4    1

ans =
   4

ans =
   4
```

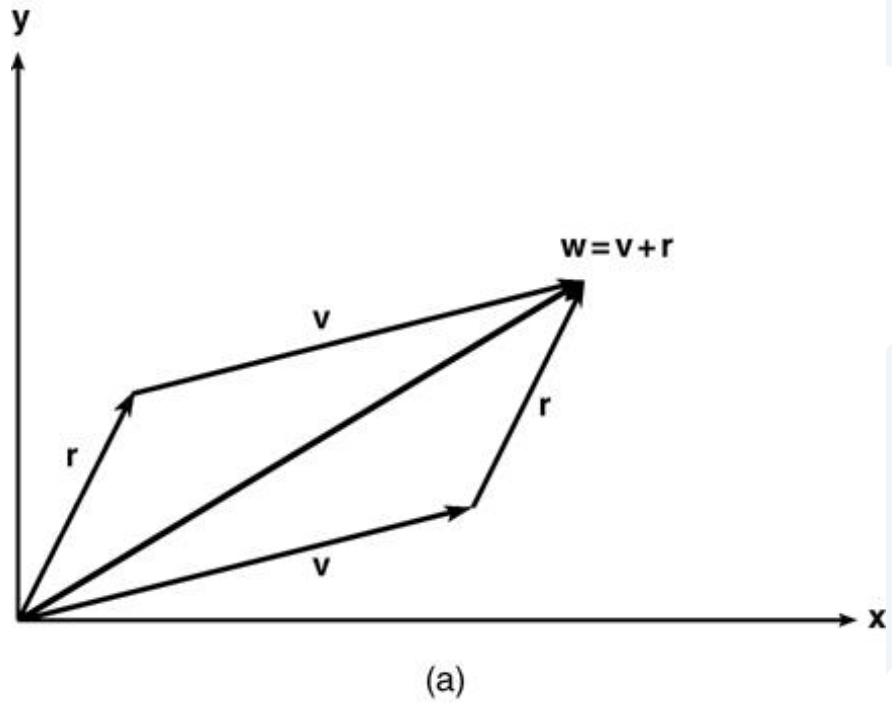
Vectors Index

```
>> x=[27 88 66 9 11 5 0 1];
>> x(2)

ans =

   88

>> x(11)
Index exceeds the number of array elements (8).

>> x(8)

ans =

    1
```

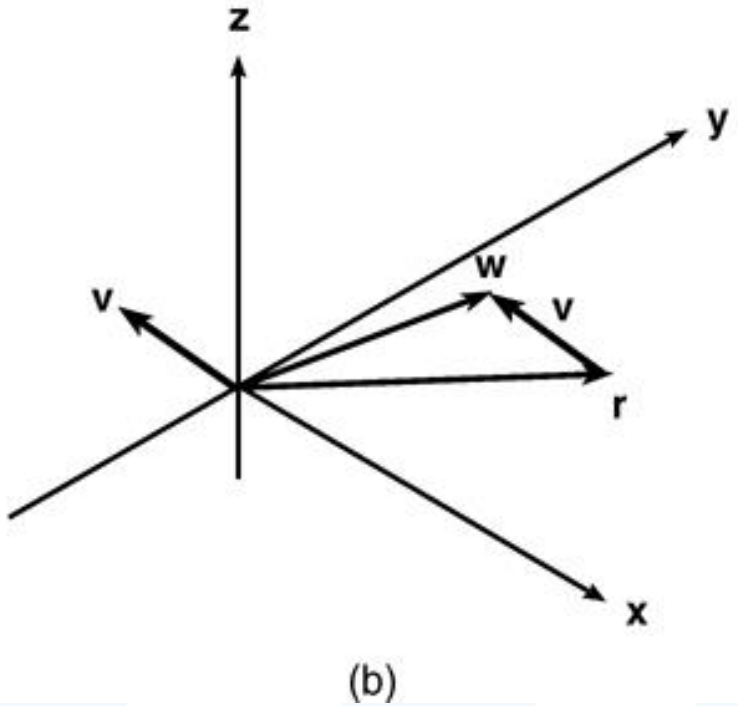
```
>> x(2:6)

ans =

   88   66    9   11    5

>> x(2:10)
Index exceeds the number of array elements (8).
```

- اقتطاع عنصر من شعاع او شعاع جزئي من شعاع
- أول عنصر دليله 1

Vector addition by geometry.



(a) The parallelogram law.



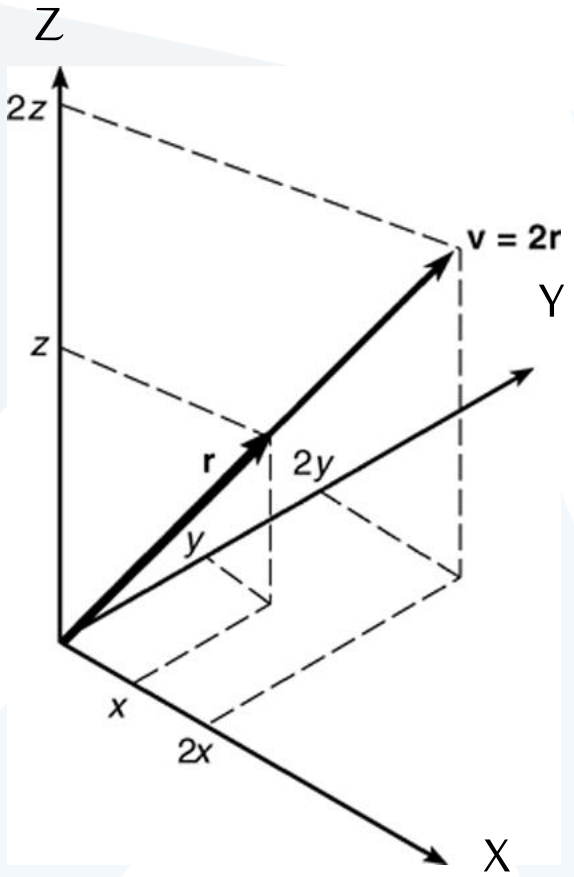
(b) Addition of vectors in three dimensions.

Geometric interpretation of scalar multiplication of a vector

If r = [x, y, z],

then

v = 2r =2[x, y, z] = [2x, 2y, 2z].



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Thanks .