

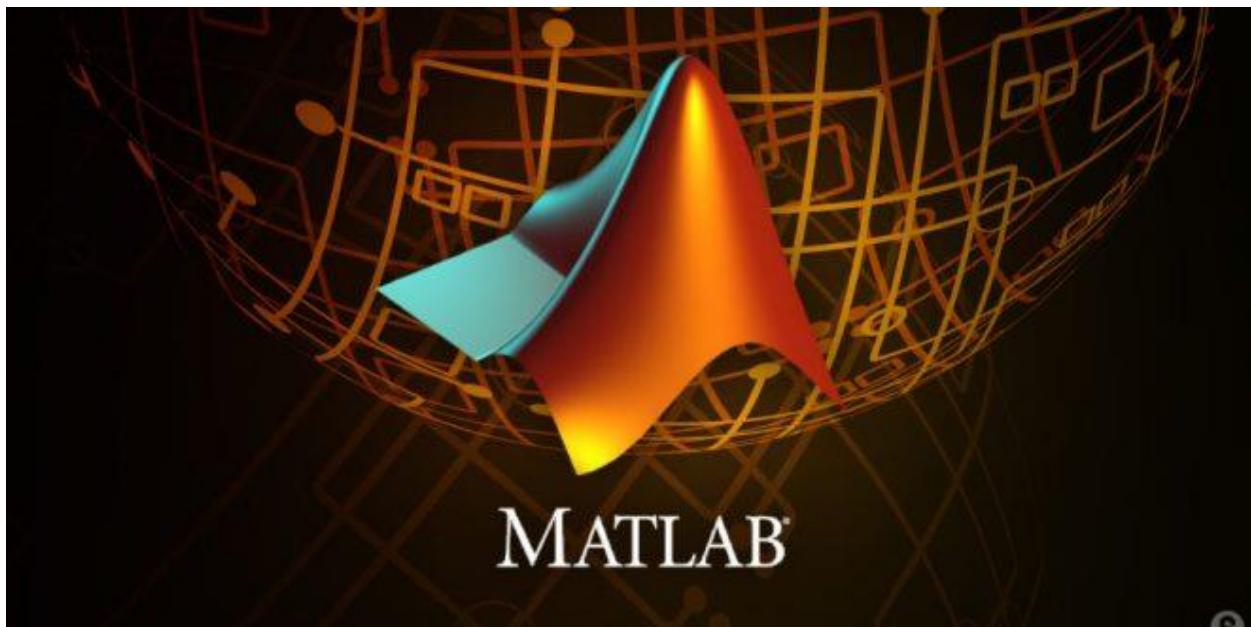


Course N°02

Vectors in

MATLAB

Cont. and Compl.



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1. Vector operations

In this section, let us discuss the following **vector operations**

Addition and subtraction of vectors

Multiplication of vector

Division of vector

Power of vector, and

Transpose of vector

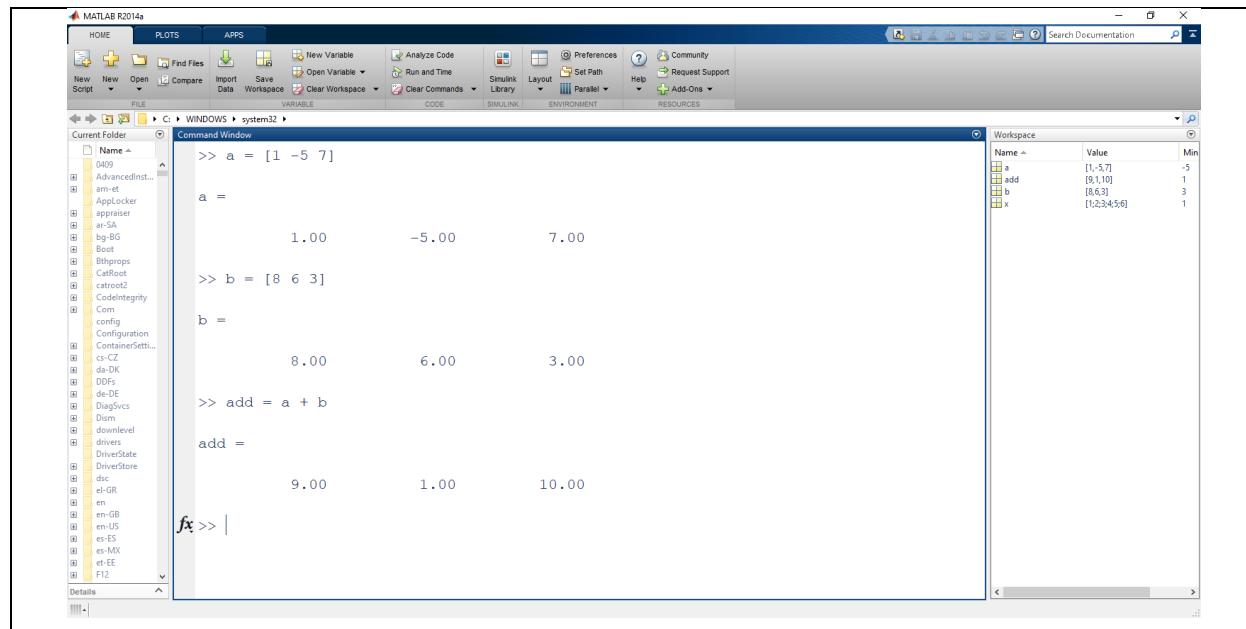
Besides the standard **vector operations**, MATLAB performs an element-by-element array operations

(**addition, subtraction, multiplication, division, and power**) among vectors of the **same dimensions**.

To illustrate this **special feature**, consider **two vectors, a and b**, of **n=3** elements.

2.1. Addition of vectors

You can **add two vectors**. Both **vectors** must have the **same number** of elements (the same dimension/size).



The screenshot shows the MATLAB interface with the Command Window and Workspace browser. In the Command Window, the following code is entered and executed:

```

>> a = [1 -5 7]
a =
    1.00    -5.00    7.00
>> b = [8 6 3]
b =
    8.00    6.00    3.00
>> add = a + b
add =
    9.00    1.00   10.00
fx >> |

```

The Workspace browser on the right shows the variables defined:

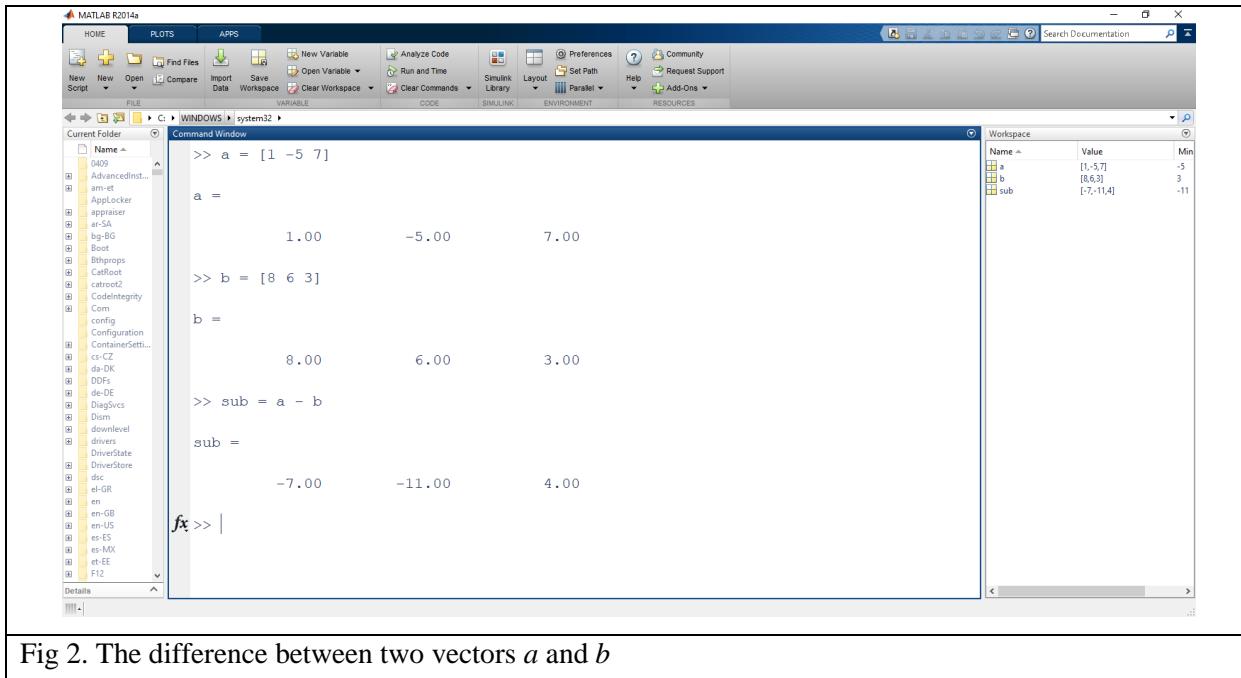
Name	Value	Min
a	[1,-5,7]	-5
b	[8,6,3]	3
add	[9,1,10]	1
x	[1;2;3;4;5;6]	1

Fig 1. The sum of two vectors *a* and *b*



2.2. Subtraction of vectors

Is the **difference between two given vectors**, whose defined in **MATLAB** by the following way



The screenshot shows the MATLAB R2014a interface. The Command Window displays the following code and results:

```

>> a = [1 -5 7]
a =
    1.00    -5.00    7.00
>> b = [8 6 3]
b =
    8.00    6.00    3.00
>> sub = a - b
sub =
   -7.00   -11.00    4.00

```

The Workspace browser on the right shows the variables defined:

Name	Value	Min
a	[1 -5 7]	-5
b	[8 6 3]	3
sub	[-7 -11 4]	-11

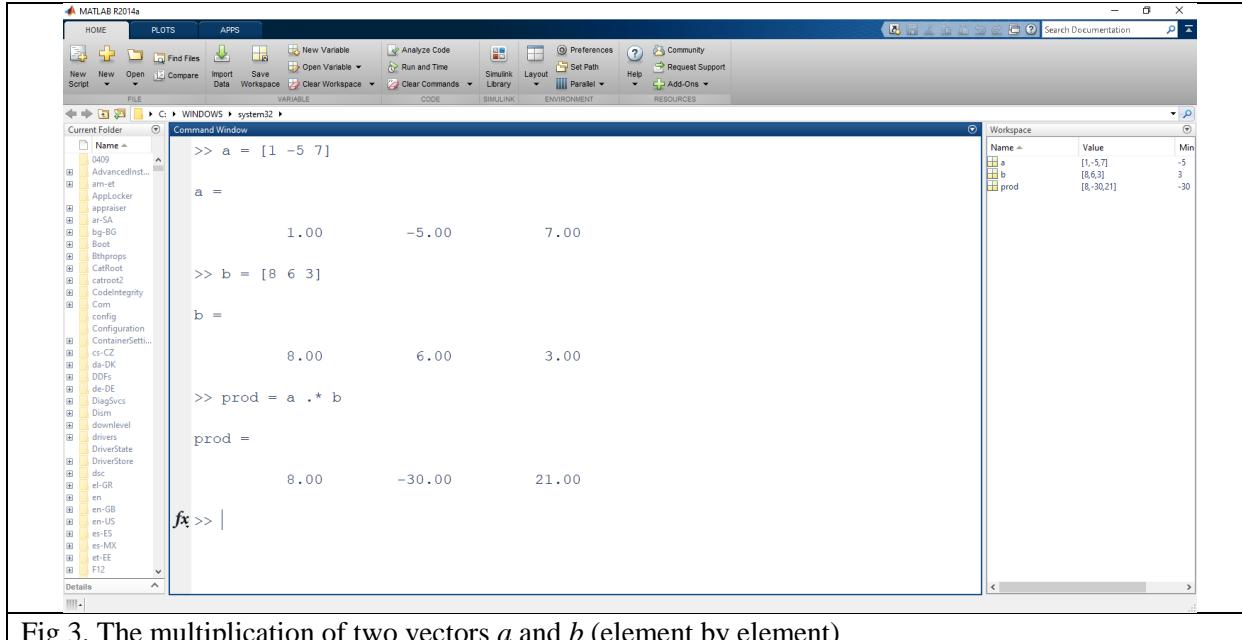
Fig 2. The difference between two vectors a and b



2.3. Multiplication of vectors

It distinguishes between **vectorial product** and **scalar product**:

Vectorial product is the **multiplying of two given vectors element-by-element** whose defined in **MATLAB** by the following way.



The screenshot shows the MATLAB R2014a interface. The Command Window displays the following code and output:

```

>> a = [1 -5 7]
a =
    1.00    -5.00    7.00
>> b = [8 6 3]
b =
    8.00    6.00    3.00
>> prod = a .* b
prod =
    8.00   -30.00    21.00

```

The Workspace browser on the right shows the variables defined:

Name	Value	Min
a	[1,-5,7]	-5
b	[8,6,3]	3
prod	[8,-30,21]	-30

Fig 3. The multiplication of two vectors a and b (element by element)



Scalar product is the **multiplying of two given vectors row-by-column** whose defined in **MATLAB** by the following way.

The screenshot shows the MATLAB R2014a interface. In the Command Window, the following code is run:

```
>> a = [1 -5 7]
a =
    1.00    -5.00    7.00
>> b = [8 6 3]
b =
    8.00    6.00    3.00
>> prod = a * b'
prod =
    -1.00
```

The Workspace pane shows the variables: a, b, and prod. The prod variable contains the scalar product of the two vectors.

Fig 4. The multiplication of two vectors a and b (row vector and column vector)

2.4. Division of vectors

Is the **division of two given vectors element-by-element**, whose defined in **MATLAB** by the following way

The screenshot shows the MATLAB R2014a interface. In the Command Window, the following code is run:

```
>> a = [1 -5 7]
a =
    1.00    -5.00    7.00
>> b = [8 6 3]
b =
    8.00    6.00    3.00
>> div = a ./ b
div =
    0.13    -0.83    2.33
```

The Workspace pane shows the variables: a, b, and div. The div variable contains the element-wise division of the two vectors.

Fig 5. The division of two vectors a and b (element by element)



3. Other useful MATLAB functions

3.1. Display single value from vector

In order to **show** or **peak** or **extract** or **display** single value from vector already written by MATLAB, we need to know the **position** or the **order** of that element in the vector

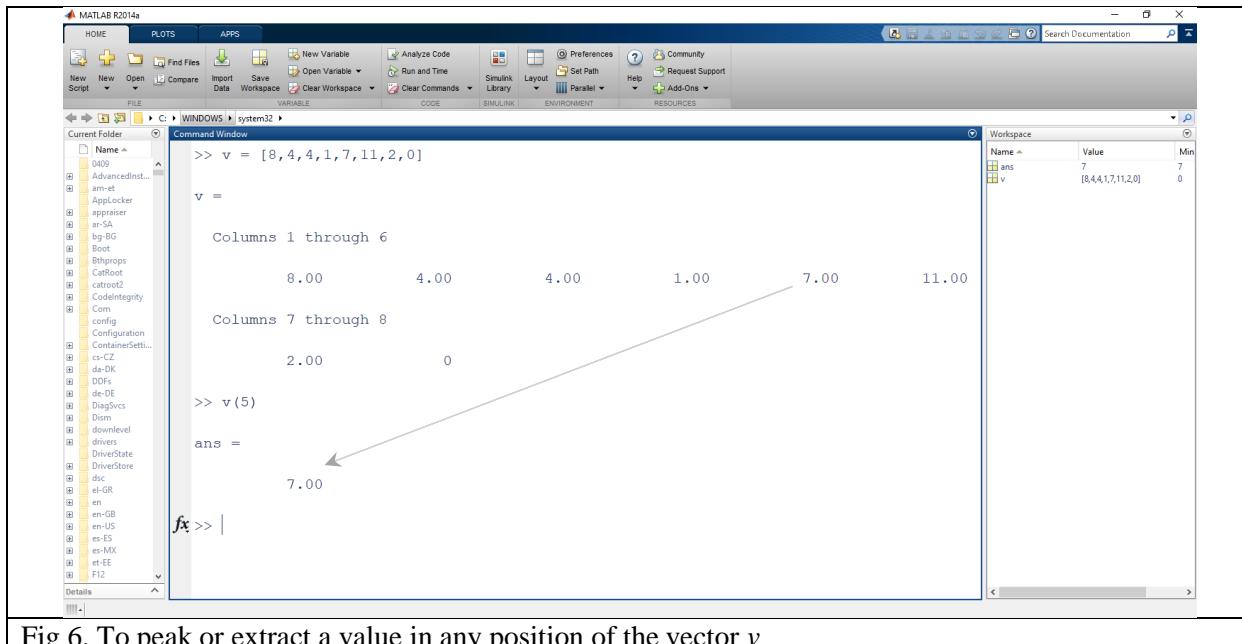


Fig 6. To peak or extract a value in any position of the vector v



3.2. Replace single value from vector

In case we want to **replace** the recent value, we peak from the vector with another value

The screenshot shows the MATLAB R2014a interface. In the Command Window, the user has defined a vector `v` as `v = [8, 4, 4, 1, 7, 11, 2, 0]`. The workspace shows `v` with a value of `[8,4,4,1,7,11,2,0]`. The user then executes the command `>> v(5)=99`, which changes the value at index 5 to 99. The workspace now shows `v` with a value of `[8,4,4,1,99,11,2,0]`.

Fig 7. To replace a value in position of the vector v

3.3. Display multiple values from vector

To **show** or **peak** or **extract** more than one value from that vector already given, we need to use **brackets** `[]` inside the **parenthesis** `()`

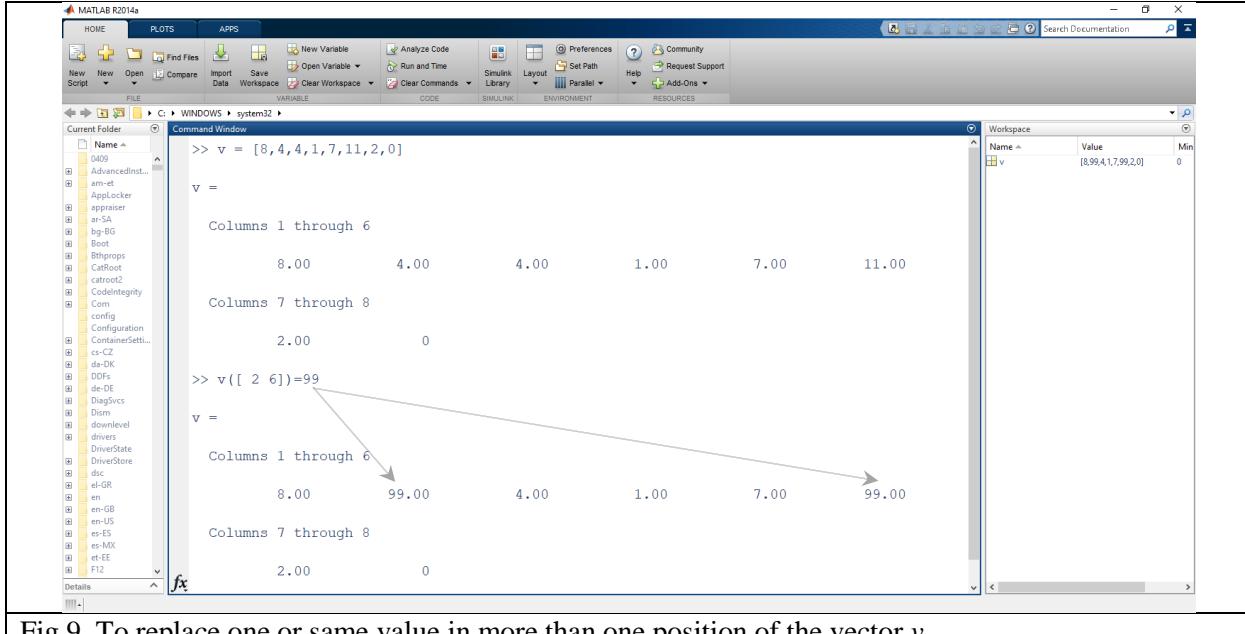
The screenshot shows the MATLAB R2014a interface. In the Command Window, the user has defined a vector `v` as `v = [8, 4, 4, 1, 7, 11, 2, 0]`. The workspace shows `v` with a value of `[8,4,4,1,7,11,2,0]`. The user then executes the command `>> v([2 6])`, which extracts the elements at indices 2 and 6. The workspace shows `ans` with a value of `[4,11]`.

Fig 8. To peak or extract multiple values in any position of the vector v



3.4. Replace multiple values from vector

In case we want to **replace** in two position different the **same value**



The screenshot shows the MATLAB R2014a interface. In the Command Window, the user has run the command `>> v = [8, 4, 4, 1, 7, 11, 2, 0]`. The resulting vector `v` is displayed as:

```

>> v = [8, 4, 4, 1, 7, 11, 2, 0]
v =
Columns 1 through 6
8.00 4.00 4.00 1.00 7.00 11.00
Columns 7 through 8
2.00 0

```

Then, the user runs the command `>> v([2 6])=99`. The resulting vector `v` is displayed as:

```

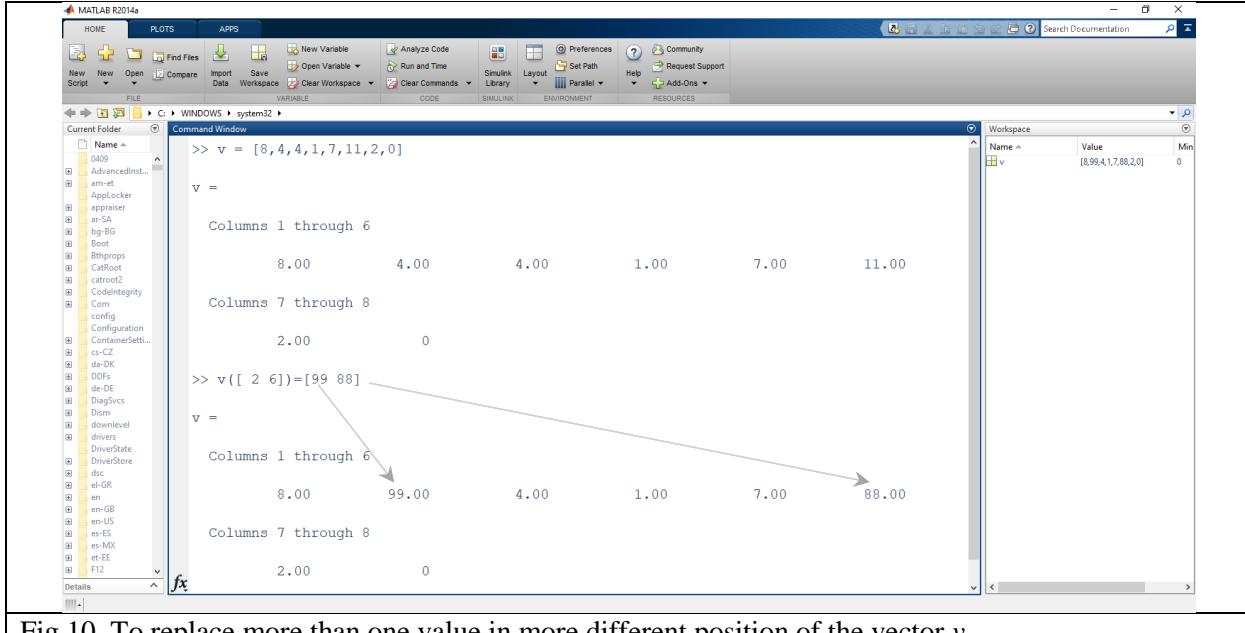
>> v([ 2 6])=99
v =
Columns 1 through 6
8.00 99.00 4.00 1.00 7.00 99.00
Columns 7 through 8
2.00 0

```

The Workspace browser on the right shows the variable `v` with the value `[8, 99, 4, 1, 7, 99, 2, 0]`.

Fig 9. To replace one or same value in more than one position of the vector v

To this end, in case we want to **replace** in two position different **two values different** of a given vector written by MATLAB



The screenshot shows the MATLAB R2014a interface. In the Command Window, the user has run the command `>> v = [8, 4, 4, 1, 7, 11, 2, 0]`. The resulting vector `v` is displayed as:

```

>> v = [8, 4, 4, 1, 7, 11, 2, 0]
v =
Columns 1 through 6
8.00 4.00 4.00 1.00 7.00 11.00
Columns 7 through 8
2.00 0

```

Then, the user runs the command `>> v([2 6])=[99 88]`. The resulting vector `v` is displayed as:

```

>> v([ 2 6])=[99 88]
v =
Columns 1 through 6
8.00 99.00 4.00 1.00 7.00 88.00
Columns 7 through 8
2.00 0

```

The Workspace browser on the right shows the variable `v` with the value `[8, 99, 4, 1, 7, 88, 2, 0]`.

Fig 10. To replace more than one value in more different position of the vector v



List of References

MATLAB A Practical Introduction to Programming and Problem Solving

MATLAB A Self-Teaching Guide

MATLAB for Beginners

