

# MATLAB Tutorial I

**EEE116 Experimental, Computer Skills and Sustainability**  
**For Group B on Mar. 27th, 2018, HS102 and HS103**  
**For Group A on Apr. 3rd, 2018, HS102 and HS103**

## 1 Entering Expressions in MATLAB Command Window

**Problem 1.1.** Suppose that  $u = 2$  and  $v = 3$ . Evaluate the following expressions using MATLAB

a)  $\frac{4u}{3v},$

b)  $\frac{2v^{-2}}{(u+v)^2},$

c)  $\frac{u^3v^2}{u^3 - v^2},$

d)  $\frac{4}{3}\pi v^2.$

**Problem 1.2.** The distance travelled by a ball falling in the air is given by the equation

$$x = x_0 + v_0t + \frac{1}{2}at^2$$

Use MATLAB to calculate the position of the ball at time  $t = 5$  s if  $x_0 = 10$  m,  $v_0 = 15$  m/s, and  $a = -9.81$  m/s<sup>2</sup>.

**Problem 1.3.** Given  $x = -5 + 9i$  and  $y = 6 - 2i$ , use MATLAB to calculate  $x + y$ ,  $xy$  and  $x/y$ .

## 2 MATLAB Workspace

**Problem 2.1.** What is a workspace and where is it? (Provide your answer in a text file and save it in the required folder.)

**Problem 2.2.** Use commands `who` and `whos` to see the variables in the workspace.

**Problem 2.3.** Clear variables  $x$ ,  $u$  and  $v$ . Clear the other variables in the workspace.

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### 3 Getting Help

**Problem 3.1.** Get help on the MATLAB function `exp` using: (a) The “`help exp`” command typed in the Command Window, (b) The MATLAB Help Window, (c) Summarise your observation of the difference between these two methods in a text file).

**Problem 3.2.** Use the `lookfor` command to determine how to take the base-10 logarithm of a number in MATLAB. Calculate  $\log_{10}(2)$ .

### 4 Arrays in MATLAB

**Problem 4.1.** Type this matrix in MATLAB and use MATLAB to answer the following questions:

$$A = \begin{bmatrix} 3 & 7 & -4 & 2 \\ -5 & 9 & 10 & 2 \\ 6 & 13 & 8 & 11 \\ 15 & 5 & 4 & 1 \end{bmatrix}$$

- a) Find transpose of  $A$  denoted as  $A^T$ ,  $B = A + i * A$ , transpose of  $B$  denoted as  $B^T$  and hermitian transpose of  $B$  denoted as  $B^H$ .
- b) Create a vector  $v$  consisting of the elements in the second column of  $A$ .
- c) Create a vector  $w$  consisting of the elements in the second row of  $A$ .
- d) Create a  $4 \times 3$  array  $B$  consisting of all elements in the second through fourth columns of  $A$ .
- e) Create a  $3 \times 4$  array  $C$  consisting of all elements in the second through fourth rows of  $A$ .
- f) Create a  $2 \times 3$  array  $D$  consisting of all elements in the first two rows and the last three columns of  $A$ .
- g) Use MATLAB to get the lengths of  $v$  and  $w$ . Get the sizes of  $A$ ,  $B$ ,  $C$  and  $D$ .

### 5 Array Operations

**Problem 5.1.** Given the matrices

$$A = \begin{bmatrix} -7 & 16 \\ 4 & 9 \end{bmatrix}, B = \begin{bmatrix} 6 & -5 \\ 12 & -2 \end{bmatrix}, C = \begin{bmatrix} -3 & -9 \\ 6 & 8 \end{bmatrix}$$

Use MATLAB to

- a) Find  $A + B - C$ .
- b) Verify the associative law  $(A + B) + C = A + (B + C)$ .
- c) Find the result of  $A$  times  $B$  using the array product (element by element).

- d) Find the result of  $A$  divided by  $B$  using the array right division (element by element).
- e) Find  $B$  raised to the third power element by element.

**Problem 5.2.** The potential energy stored in a spring is  $kx^2/2$ , where  $k$  is the spring constant and  $x$  is the compression in the spring. The force required to compress the spring is  $F = kx$ . Use the data in the following table to find a) the compression  $x$  in each spring and b) the potential energy stored in each spring.

	1	2	3	4	5
$F$ (N)	11	7	8	10	9
$k$ (N/m)	1000	800	900	1200	700

## 6 Matrix Operations

**Problem 6.1.** Given the matrices:

$$A = \begin{bmatrix} 3 & -6 & 2 \\ 2 & 8 & 3 \\ 1 & -2 & 5 \end{bmatrix}, B = \begin{bmatrix} 6 & 9 & -1 \\ 7 & 5 & 1 \\ -5 & 9 & 10 \end{bmatrix}, C = \begin{bmatrix} -7 & -5 & 2 \\ 10 & 6 & 1 \\ 3 & -9 & 8 \end{bmatrix}$$

- a) Use MATLAB to find the products  $AB$  and  $BA$ .
- b) Verify the distributive property  $(AB)C = A(BC)$ .
- c) Find  $A^3$ .