

MATLAB Lecture Notes: Command-Based Programming

1. Basics of MATLAB

MATLAB stands for **MA**Trix **LAB**oratory. It is widely used for numerical computing, data analysis, and visualization.

File Types:

- .m - Script or function file
- .mat - Workspace data
- .fig - Figure window data

2. Command Window Tasks

```
clc           % Clears the command window
clear         % Clears variables from memory
close all     % Closes all figure windows
disp(x)       % Displays the value of x
who / whos    % Lists workspace variables
pwd           % Shows current directory
cd 'path'     % Changes directory
dir           % Lists files in directory
help / doc    % Opens help or documentation
```

3. Variables and Constants

```
x = 5;
y = [1, 2, 3];
z = [1; 2; 3];
% Constants: pi, inf, NaN
```

4. Comments in MATLAB

```
% This is a single-line comment
%{
This is a multi-line comment
%}
```

5. Scripts

Scripts are .m files with a sequence of MATLAB commands.

```
r = 5;
area = pi * r^2;
disp(['Area = ', num2str(area)]);
```

6. Built-in Math Functions

```
sqrt(16), abs(-5), log(10), log10(100)
mod(7,3), round(), floor(), ceil()
```

7. Input and Output

```
x = input('Enter a number: ');
disp(x);
fprintf('Value: %.2f\n', x);
```

8. Loops and Control Structures

If-Else

```
if x > 0
    disp('Positive');
elseif x == 0
    disp('Zero');
else
    disp('Negative');
end
```

Switch

```
switch grade
    case 'A'
        disp('Excellent');
    otherwise
        disp('Other');
end
```

For Loop

```
for i = 1:5
    disp(i);
end
```

While Loop

```
x = 1;
while x <= 5
    disp(x);
    x = x + 1;
end
```

9. User-Defined Functions

```
function output = squareNum(x)
    output = x^2;
end

function [sum, product] = addMultiply(a, b)
    sum = a + b;
    product = a * b;
end
```

10. Vectors and Matrices

```
v = [1 2 3];
A = [1 2; 3 4];
A(2,1), A(:,2)
size(A), length(v), sum(v)
```

11. Plotting Basics

```
x = 0:0.1:2*pi;
y = sin(x);
plot(x, y);
xlabel('x'); ylabel('sin(x)'); title('Sine Wave');
grid on;
```

12. File Operations

```
save file.mat;
load file.mat;
fid = fopen('data.txt','r');
line = fgets(fid);
fclose(fid);
```

13. Summary Checklist

- MATLAB Basics
- Command Tasks
- Variables
- Scripts
- Functions
- Input/Output
- Loops and Conditions
- User-Defined Functions
- Vectors and Matrices
- Plotting
- File Operations