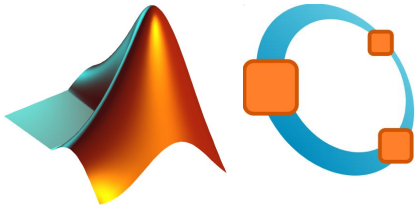
Hands-on Session with Matlab/Octave

Ikenna Ireka ***(Ph.D.)***

International Conference and Advanced Workshop on Modelling and Simulation of Complex Systems,

May 2024, Obafemi Awolowo University Ile-Ife, Nigeria



Content of this lecture.

- What is Matlab/octave?
- What can I do with it?
- The Matlab/Octave inferface,
- Scalar Mathematics,
- Arithmetic Operations,
- Number representation,
- Number formats,
- Naming variables
- Special Variables
- Command involving variables
- Basic maths functions,
- Graphing,

What's Matlab/Octave about?

- Stands for **Mat**rix **Lab**oratory
- Octave is an open source tool same as Matlab
- 4th Gen Programming language written in high level language (C, C++, Java),
- Designed to be both **interactive** and **executable**
- Used to address problems involving **Matrices**.
- Aim is to make **matrix computations** easy.

What Can I do with Matlab/Octave ?

- Numerical Simulation of equations governing real life problems
- Data analysis with relevant statistics packages
- Optimization and control,
- Curve fitting
- Signal processing ,
- Image processing,
- ….

The Matlab interface…

- Command Window (prompt >>),
- Command History,
- Workspace,
- Current Directory,
- Script Editor,
- Variable Editor or Array Editor,
- Figure Editor
- Help File…

Scalar Mathematics

- **Simple arithmetic operations**

  (like a calculator)

- **Plus** +
- **Minus** -
- **Matrix multiply** *
- **Array multiply** .*
- **Matrix power** ^
- **Array power** .^
- **Backslash or left matrix divide** \
- **Slash or right matrix divide** /

  A/B =A*inv(B) and A\B = inv(A)*B

- **Left array divide** .\
- **Right array divide** ./
- **kron - tensor product**
- **Type "help ops" on command window for all possible operations**
- **Set operations,**
- **Logical operations,**
- **Relational operators.**

Arithmetic Operations

Operation	Algebraic form	MATLAB
Addition	$a + b$	a + b
Subtraction	$a - b$	a - b
Multiplication	$a \times b$	a * b
Right division	$a \div b$	a/b
Left division	$b \div a$	a\b
Exponentiation	a^b	a ^ b

Number representation in Matlab

- Fixed point :
  - Decimals, with optional decimal point

    39.88828, -889, 0.0053

- Floating point numbers:
  - Scientific notation **A x 10^{B} (AeB)**

    0.00075 or $7.5x10^{-4}$ is written as 7.5e-4

Matlab Allows for range of values extending from 10^{-308} to 10^{308}

Displaying Numbers in Matlab

- Integers (provided the digits are < or = 9.
- Scientific notation if digits are 10 or more

FORMATS

1. format short scaled fixed point with 4 decimal digits,
2. format long scaled fixed point with 15 decimal digits,
3. format short e scaled floating point with 4 decimal digits plus exponent,
4. format long e scaled floating point with 15 decimal digits plus exponent,
5. format short g better of case 1. or 3,
6. format long g better of case 2. or 4,
7. format bank 2 decimal digits,

Variable naming rules

- Variables must start with alphabets
- May consist letters a-z (or A-Z), digits 0-9 and underscore character
- Can be as long as you like!
- Case sensitive
- Assign variables with “=”. Height=180

Special variables

- ans: whatever the last answer was
- pi: circumference/diameter of circle
- eps: smallest amount by which two machine numbers can differ
- inf or Inf: infinity e.g. 1/0
- nan or NaN: not-a-number e.g. 0/0

NEVER USE THESE AS VARIABLE NAMES!!!

Commands involving variables:

- who: lists names of defined variables
- whos: lists names and sizes of defined variables
- clear var: clears variable var
- clear: clears all variables, resets default values of special variables
- clc: clears command window but does not affect variables

Basic Mathematical Functions

Matlab	Mathematical expression
• abs(x)	$\|x\|$
• exp(x)	e^x
• log(x)	$\ln x$
• log10(x)	$\log_{10} x$
• sqrt(x)	$\sqrt{x}$
• sin(x), cos(x), tan(x) radians	same as in math but default angle is
• sind(x), cosd(x), tand(x)	default angle is degrees (**help elfun)**

Graphing

- 1 – D plots Use the matlab plot command plot(x,y)
- 2 – D plots Use the matlab command Mesh
- 3 – D plots Use the matlab surf, trisurf
- For more info on various plots and plot commands see
  - https://www.mathworks.com/help/matlab/creating_plots/types-of-matlab-plots.html
  - Type **help plot**
- It is also possible to create videos and animations with matlab too

Thank You
For Your Attention