# MATH 3341: Introduction to Scientific Computing Lab

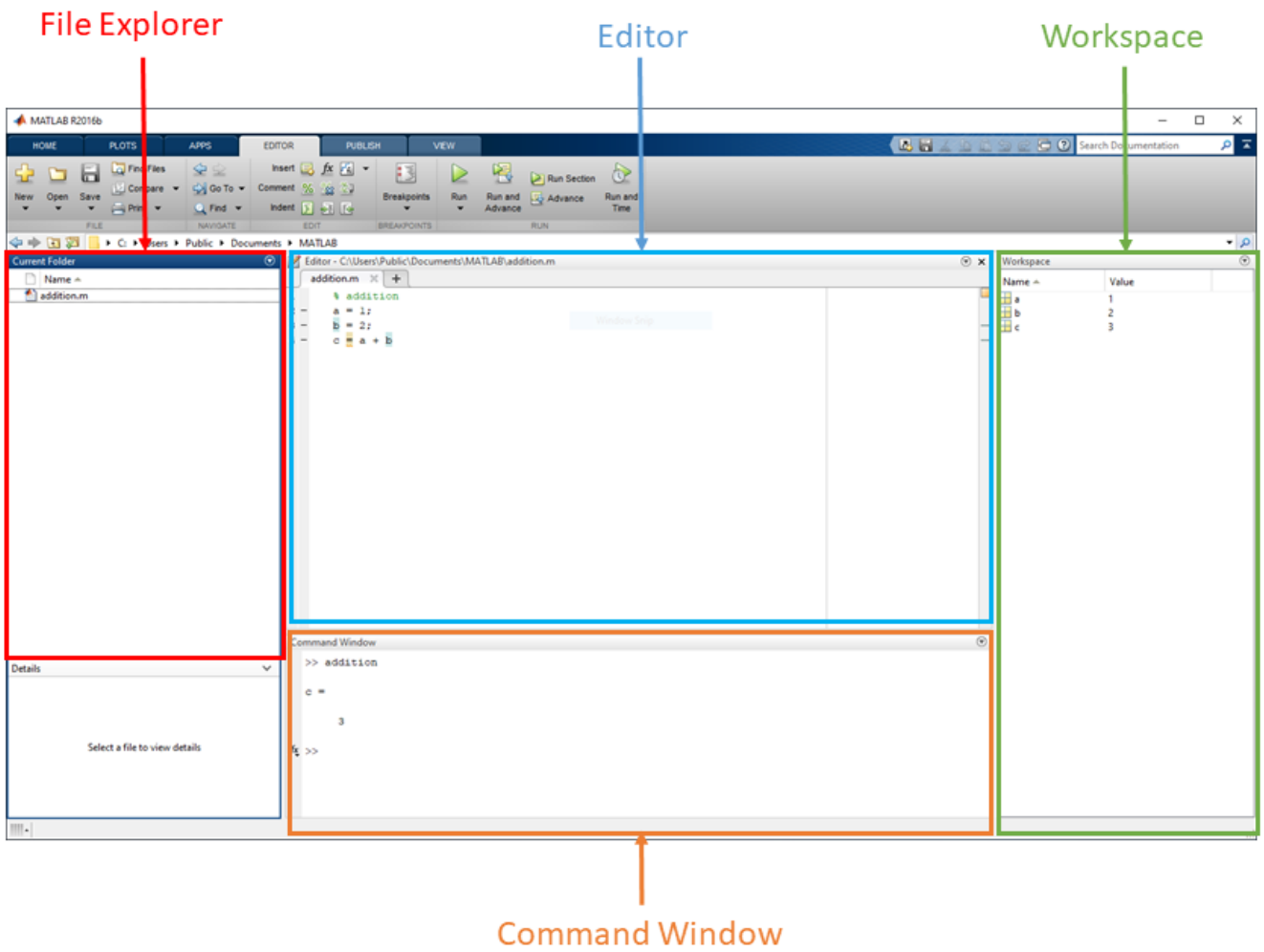
Libao Jin

University of Wyoming

January 27, 2021

# Lab 01: Introduction to MATLAB and LaTeX

# MATLAB Interface



# Basic Math Operations

- Addition: e.g. `3 + 3` or `plus(3, 3)`
- Subtraction: e.g. `7 - 9` or `minus(7, 9)`
- Multiplication: e.g. `4 * 6` or `times(4, 6)`
- Division: e.g. `6 / 3` or `rdivide(6, 3)`
- Exponentiation: e.g. `2 ^ 3` or `power(2, 3)`

# Exponential and Natural Logarithm Functions

- $e^x$: `exp(x)`
- $\ln y$: `log(y)`
- $\log_2 a$: `log2(a)`
- $\log_{10} b$: `log10(b)`

# Trigonometric Functions

- $\sin x$: `sin(x)`
- $\cos x$: `cos(x)`
- $\tan x$: `tan(x)`
- $\arcsin x$ or $\sin^{-1} x$: `asin(x)`
- $\arccos x$ or $\cos^{-1} x$: `acos(x)`
- $\arctan x$ or $\tan^{-1} x$: `atan(x)`

# Functions Commonly Used

- `help`: Display help text in Command Window
- `doc`: Reference page in Help browser
- `pwd`: Show (print) current working directory
- `cd`: Change current working directory
- `ls`: List directory
- `clc`: Clear command window
- `clear`: Clear variables and functions from memory
- `clf`: Clear current figure
- `beep off/on`: turns off/on noise produced by error messages
- `diary`: Save text of MATLAB session
- `realmin`: Smallest positive normalized floating point number
- `realmax`: Largest finite floating point number
- `intmin`: Smallest integer value
- `intmax`: Largest positive integer value
- `eps`: Spacing of floating point numbers
- `class`: Return class name of object

# LaTeX Primer

# Basic structure

```
\documentclass{article}
\usepackage{amssmb, amsmath}
\author{firstName lastName}
\title{The Title}
\date{\today}
\begin{document}
\maketitle
\section{Demo of Section}
\subsection{Demo of Subsection}
Here is the body.
\end{document}
```

# Math Environment/Mode

```
\begin{equation}
% Put equation here
\end{equation}

$$
% Put equation here
$$

$Put inline equation here$
```

# Multi-line equations

```
\begin{align}
% Put multiline equation here
\end{align}
```

# Examples

```
\begin{equation*}
E = mc^2.
\end{equation*}
```

or

```
$$
E = mc^2.
$$
```

generates

$$E = mc^2.$$

# Examples

```
\begin{align}
    \frac{d}{dx} f(g(x))
        & = \frac{d f(g(x))}{d g(x)} \frac{d g(x)}{dx}
    \\ & = f'(g(x)) g'(x).
\end{align}
```

generates

$$\frac{d}{dx} f(g(x)) = \frac{df(g(x))}{dg(x)} \frac{dg(x)}{dx} \tag{1}$$

$$= f'(g(x))g'(x). \tag{2}$$

# Subscripts and Supscripts

- $a_1$: `$a_{1}$`
- $a^2$: `$a^{2}$`
- $a_3^4$: `$a_{3}^{4}$`
- $a_{\text{sub}}^{\text{sup}}$: `$a_{\text{sub}}^{\text{sup}}$`

# Fractions

- $\frac{\text{numerator}}{\text{denominator}}$: `$\frac{numerator}{denominator}$`
- $\frac{3}{5}$: `$\frac{3}{5}$`

# Matrices

```
$$
\begin{matrix}
a_{11} & a_{12} \\
a_{21} & a_{22} \\
\end{matrix}
$$
```

Replace `matrix` with `bmatrix`, `pmatrix`, `vmatrix`, `Vmatrix`, repectively.

# matrix environment

```
$$
\begin{matrix}
a_{11} & a_{12} \\
a_{21} & a_{22} \\
\end{matrix}
$$
```

generates

$$\begin{matrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{matrix}$$

# bmatrix environment

```
$$
\begin{bmatrix}
a_{11} & a_{12} \\
a_{21} & a_{22} \\
\end{bmatrix}
$$
```

generates

$$\begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix}$$

# pmatrix environment

```
$$
\begin{pmatrix}
a_{11} & a_{12} \\
a_{21} & a_{22} \\
\end{pmatrix}
$$
```

generates

$$\begin{pmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{pmatrix}$$

# vmatrix environment

```
$$
\begin{vmatrix}
a_{11} & a_{12} \\
a_{21} & a_{22} \\
\end{vmatrix}
$$
```

generates

$$\begin{vmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{vmatrix}$$

# Vmatrix environment

```
$$
\begin{Vmatrix}
a_{11} & a_{12} \\
a_{21} & a_{22} \\
\end{Vmatrix}
$$
```

generates

$$\begin{Vmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{Vmatrix}$$

# enumerate Environment

```
\begin{enumerate}[1.]
    \item Monday
    \item Tuesday
    \item Wednesday
\end{enumerate}
```

generates

1. Monday
2. Tuesday
3. Wednesday

# itemize Environment

```
\begin{itemize}
    \item Monday
    \item Tuesday
    \item Wednesday
\end{itemize}
```

generates

- Monday
- Tuesday
- Wednesday

# lstlisting Environment

```
\begin{lstlisting}[style=MATLAB]
clear; clc;
x = linspace(0, 2 * pi, 100);
y = sin(x);
figure
plot(x, y)
xlabel('$x$')
ylabel('$y$')
title('$y = \sin{x}$')
\end{lstlisting}
```

# lstlisting Environment

```
\lstinputlisting[style=MATLAB]{script.m}
```

# Greek Letters

- \alpha: $\alpha$
- \beta: $\beta$
- \gamma: $\gamma$
- \rho: $\rho$
- \phi: $\phi$
- \varphi: $\varphi$
- $\vdots$

# Standard Function Names

- `\cos`: $\cos$
- `\arccos`: $\arccos$
- `\dim`: $\dim$
- `\log`: $\log$
- `\ln`: $\ln$
- `\limsup`: $\limsup$
- `\min`: $\min$
- `\deg`: $\deg$
- `\operatorname{span}`: $\operatorname{span}$

# Binary Operation/Relation Symbols

- \pm: $\pm$
- \oplus: $\oplus$
- \perp: $\perp$
- \subset: $\subset$
- \in: $\in$
- \leq: $\leq$
- \geq: $\geq$
- \neq: $\neq$

# Arrow Symbols

- \leftarrow: $\leftarrow$
- \Leftarrow: $\Leftarrow$
- \rightarrow: $\rightarrow$
- \Rightarrow: $\Rightarrow$
- \leftrightarrow: $\leftrightarrow$
- \Leftrightarrow: $\Leftrightarrow$
- \mapsto: $\mapsto$
- \leadsto: $\leadsto$
- \implies: $\implies$
- \impliedby: $\impliedby$
- \iff: $\iff$

# Miscellaneous Symbols

- \infty: $\infty$
- \nabla: $\nabla$
- \partial: $\partial$
- \cdots: $\cdots$
- \ldots: $\ldots$
- \vdots: $\vdots$
- \ddots: $\ddots$
- \forall: $\forall$
- \exists: $\exists$
- \emptyset: $\emptyset$
- \int: $\int$
- \iint: $\iint$

# Styles

- \mathcal{A}: $\mathcal{A}$
- \mathbb{A}: $\mathbb{A}$
- \mathfrak{A}: $\mathfrak{A}$
- \mathsf{A}: $\mathsf{A}$
- \mathbf{A}: $\mathbf{A}$

# Text Mode: Accents and Symbols

- \'{o}: ó
- \.{o}: ȯ
- \b{o}: o̲
- \o: ø
- \ae: æ
- \"{o}: ö
- \copyright: ©
- \S: §

# Text formatting

- `\textit{Italic}`: *Italic*
- `\textsc{Small Caps}`: Small Caps
- `\textsl{Slanted}`: *Slanted*
- `\textup{Upright}`: Upright
- `\textbf{Boldface}`: **Boldface**
- `\textmd{Medium}`: Medium
- `\texttt{TypeWriter}`: `TypeWriter`
- `\textsf{Sans Serif}`: Sans Serif
- `\textrm{Roman}`: Roman