A0B17MTB – Matlab

Introduction

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You will learn …

What is MATLAB?

Why to learn MATLAB?

First steps in MATLAB

What is MATLAB?

MATLAB is…

- high-level programming language (*4th gener. language*)
- interpreted language (not compiled, but... JIT)
  - intended mainly for numerical computing (nevertheless includes MuPAD symbolic kernel)
- philosophy: kernel + tool boxes + user-defined functions → wide application
  - wide possibilities of linking with other tools (Java, C++, Fortran, Python, .NET, Excel, physical- / multi-physical softwares)
- speed (of well written) algorithm comes near to that of C++
- excellent for „fast prototyping“
  - Matlab does not require variables declaration (not always the advantage)
- multi-license for CTU
  - Available for students as well!
  - download.cvut.cz - CTU students
  - https://matlab-lic2.feld.cvut.cz/ - FEE students

Why to learn MATLAB?

- Matlab is a worldwide standard
- used by more than 5000+ universities worldwide
- licenses used by thousands of corporations in aviation, biotechnology, electronics, cybernetics, mechanical engineering, finance, ...
- knowledge of Matlab can be used in other courses at the University as well as in professional life

Where to make use of Matlab?

- data processing and visualization during laboratory exercises
- when elaborating diploma works
- seminar exercises (signals, algorithm development, ...)
- theory verification (mathematics and physics classes, electromagnetic field, electronic circuits, ...)

- studying abroad (Erasmus, Sokrates)

$\Rightarrow$ **“everywhere“** :)

Historical development of MATLAB

- 70's
  - Cleve Moler, Matlab used instead of Fortran
  - MATrix LABoratory → matrix is the basic data structure
  - Fortran-based syntax
- 1983
  - Jack Little rewriting Matlab in C
  - new functionality and new mathematical libraries added
- 1984 (Matlab is so far for free!)
  - MathWorks founded in 1984
  - http://www.mathworks.com/
- 2004
  - Matlab used by more than 1 million of active users
- now...
  - ... R2017b is the newest version of Matlab
  - local distribution: Humusoft s.r.o.

see: http://www.mathworks.com/company/aboutus/founders/clevemoler.html

Alternatives to MATLAB

- Fortran – most of the libraries still in Fortran, used mostly by physicists
- Python – for free, fast and intuitive; Spyder provides MATLAB-like features
- Mathematica – symbolic and numerical calculations, excellent symbolic kernel, extensive applicability, mostly for mathematicians and physicists
- Maple – symbolic and numerical calculations
- MathCad –used for symbolic and numerical calculations, slightly out-of-date
- Octave – for free, syntax and functionality similar to Matlab, not so extensive, smartphone executable
- R – for free, designed particularly for statistical applications
- Scilab – Matlab-like, open documentation
- Derive – small, fast, Casio calculator executable

Alternatives to MATLAB

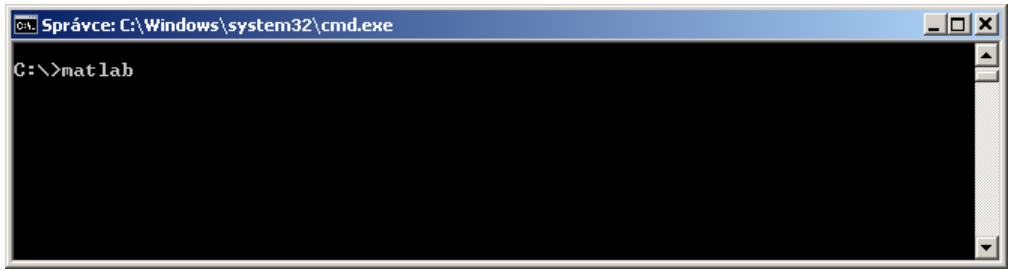
- Matlab vs. C/C++
  - optimal language strongly depends on the application
  - C/C++ faster in general, Matlab, on the other hand, provides implicit parallelism
  - general principle: Matlab more than suitable for everything except commercial compiled code (especially Matlab 6.5 and above: JIT + Real-Time Type Analysis)

- Matlab vs. Fortran
  - Matlab has wider support, more intuitive syntax
  - speed of a well written code is (usually, at least) comparable
  - utilization of Fortran is on the decline

- Matlab vs. Python
  - Matlab offers significant support thanks to MathWorks, Matlab File Exchange
  - Python entirely for free, it's becoming more and more popular

Launching Matlab

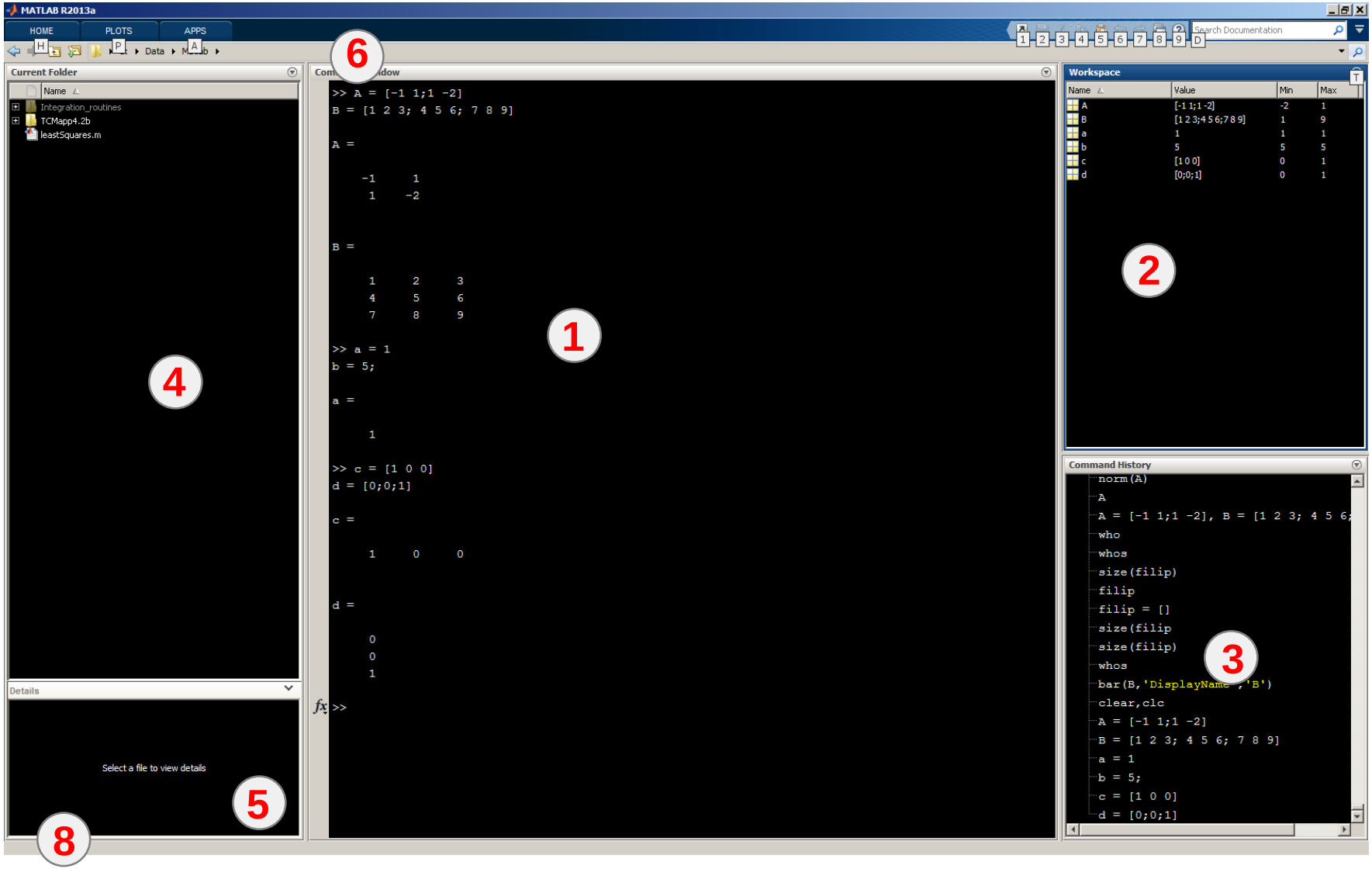
- command line
  - `matlab`



- Matlab can be launched with a set of optional parameters (see later)
  - `matlab -r "test(10)"`

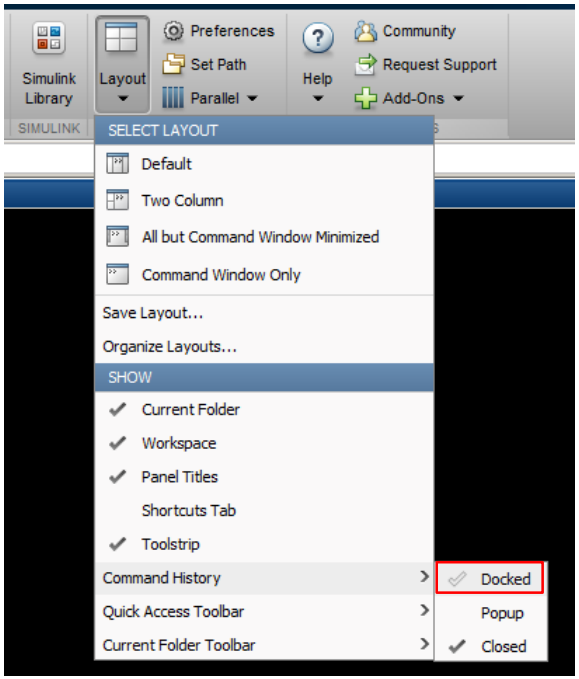
- 2017b: 2 GB RAM, 2 GB disk space (Matlab only), 4-6 GB typical installation, Win7 and newer
  - version dependent

The Matlab Environment

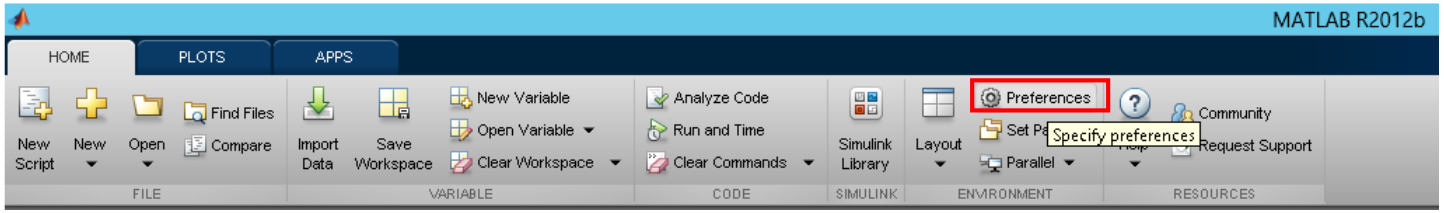


The Matlab Environment – panels

1. Command Window (CTRL+0)
2. Workspace (CTRL+3)
3. Command History (CTRL+1) – not activated in case of ≥ R2015a; to activate...
4. Current Folder (CTRL+2)
5. Current Folder – Details
6. Current Folder (with history)
7. Start (Windows like), only for ≤ Matlab R2011b
8. status

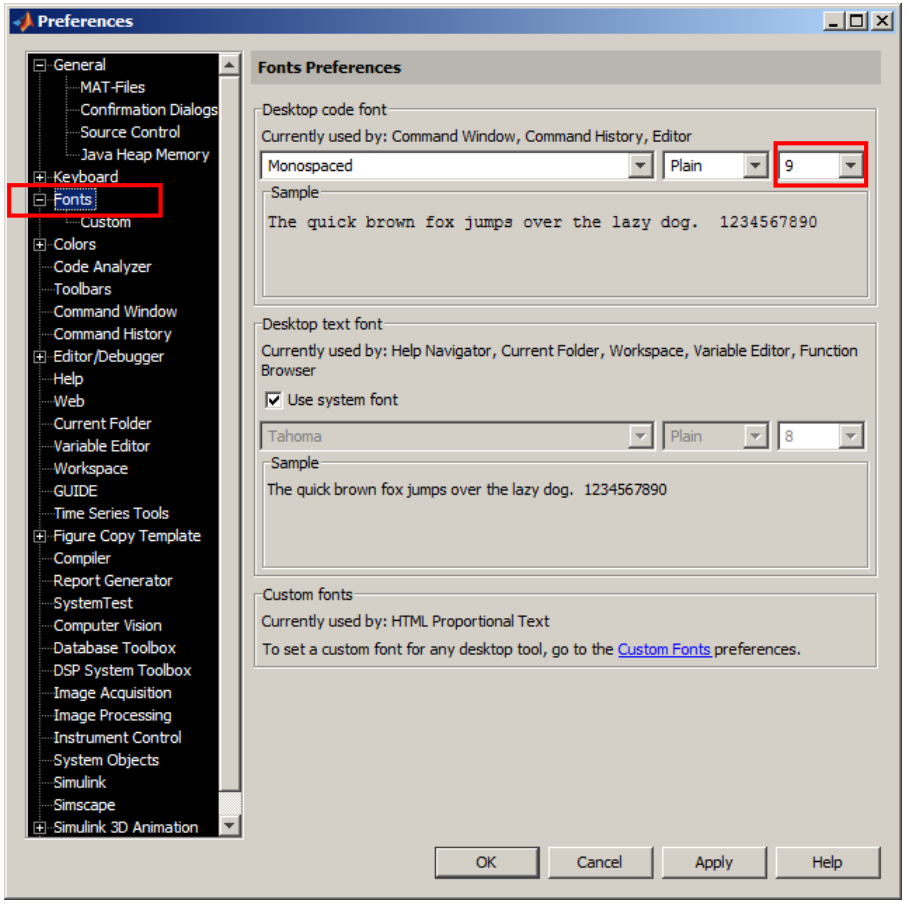


Environment setting – basics



- Matlab R2012a and later
  - ribbon menu

```
>> preferences
```



- Font size

Matlab termination

- always terminate Matlab in the command window

```
>> quit % terminates Matlab (and all windows)
>> exit %     -//-
```

- more advanced options (see documentation)

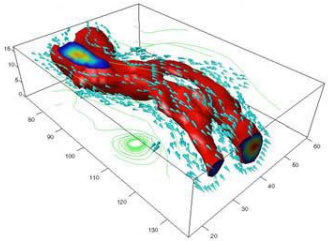
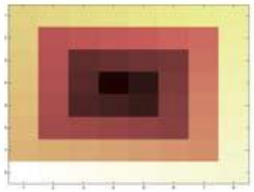
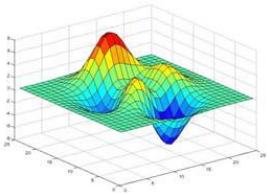
```
>> quit cancel
>> exit force
```

Command line, documentation

```
>> doc % opens documentation window
```

```
>> help % Matlab help
```

```
>> demo % tutorials
```

The Help structure

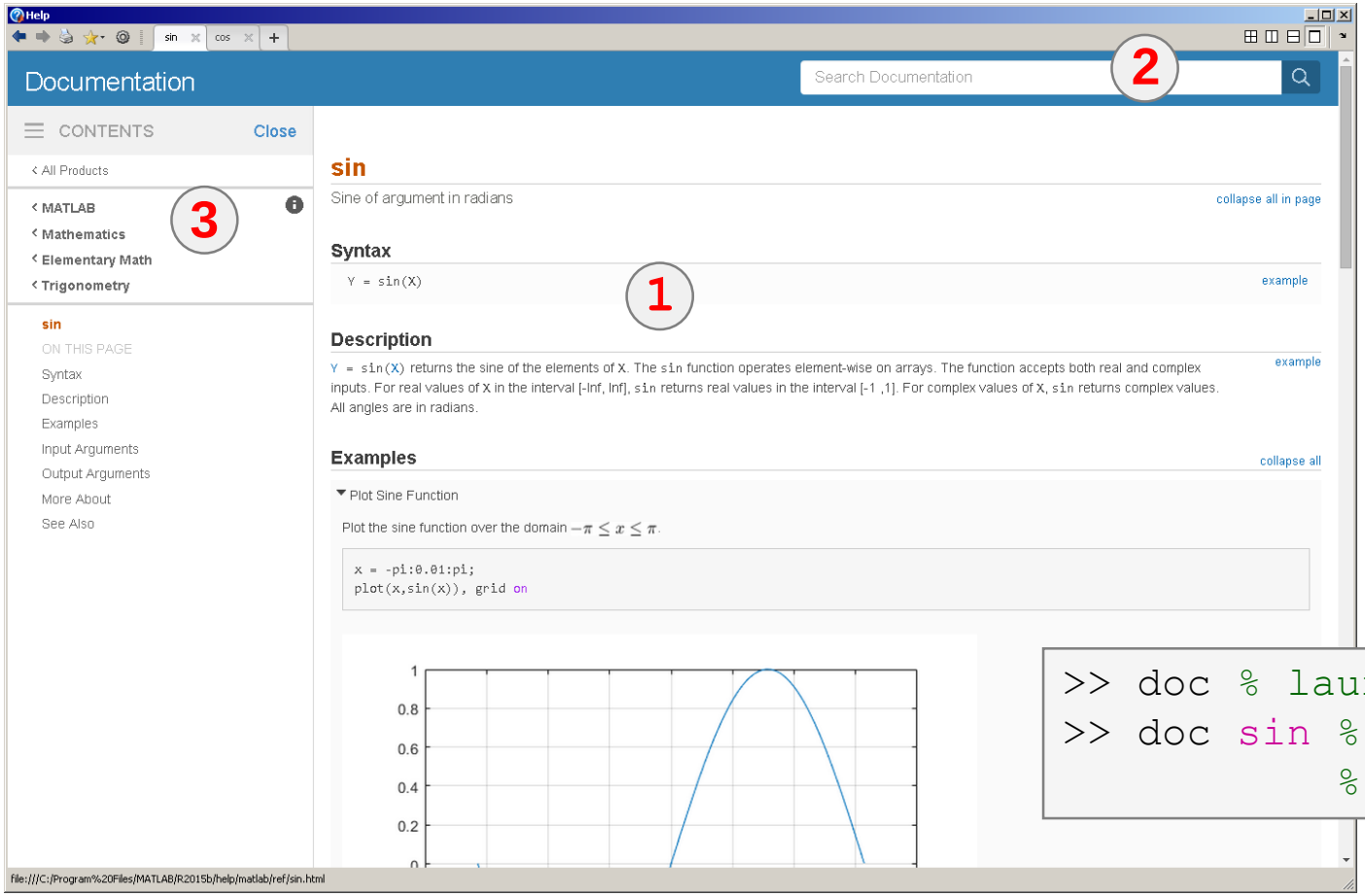
```
>> help      % displays basic help contents
>> help sin % displays help related to sine
```

```
>> help sin
 SIN    Sine of argument in radians.
    SIN(X) is the sine of the elements of X.

    See also asin, sind.

    Overloaded methods:
       codistributed/sin

    Reference page in Help browser
       doc sin
```




```
>> doc % launches help window
>> doc sin % sine function
           % related help
```

Matlab Help

240 s ↑

- start and terminate Matlab
- set the Matlab environment to your taste

- try to launch the help
- find the documentation of the following functions: `sin`, `cos`, `abs`
- browse through individual help chapters
  - pay attention to the part *Getting Started*

Shortcuts Command Window

key	meaning
ENTER	sends line for processing
ESC	deletes whole line
DEL	deletes one character (right to the cursor)
BACKSPACE	deletes one character (left to the cursor)
HOME	moves cursor to the beginning of line
END	moves cursor to the end of line
CTRL + ↑	moves cursor to the beginning of next word
CTRL + ↓	moves cursor to the beginning of previous word
SHIFT + ENTER	sends cursor to the next line
CTRL + K	deletes all to the right of cursor
CTRL + C	forces interruption of Matlab (e.g. long / erroneous calculation)
CTRL + TAB	switching between windows of Matlabu Environment
↓ a ↑	command history listing (searching is available CTRL+F)
F1	context help related to the word where the cursor is placed (Command Window, Editor)
TAB	function or variable name hint

+ usual Windows shortcuts for text processing

Searching the Help

key / command	meaning
SHIFT + F1	when pressed in command line, opens searchable function library
F9	evaluation of selected part of the code in Editor
NOT, OR, AND	it is possible to use logical operators in documentation search
*	it is possible to use wildcards in documentation search
""	to search exact phrase in documentation

```
>> docsearch "plot tools"
```

```
>> docsearch plot* tools
```

Discussed functions

`quit, exit`	terminates Matlab	•
`preferences`	opens Matlab preferences	
`doc, help, demo`	commands related to documentation and help	•
`sin, cos`	sample goniometric functions	
`abs`	absolute value	

Thank you!

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