

Hands on Training on Octave: An Open Source Alternative for Matlab

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August 08 - 09, 2020

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Outline of Talk

1 What is GNU Octave?

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- 1 What is GNU Octave?
- 2 Why GNU Octave?

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- 2 Why GNU Octave?
- 3 The GNU Octave Journey

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- 5 Using Octave (Demos)

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- 5 Using Octave (Demos)
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What is GNU Octave?

- GNU Octave is software featuring a high-level programming language, primarily intended for numerical computations.
- Octave helps in solving linear and nonlinear problems numerically, and for performing other numerical experiments using a language that is mostly compatible with MATLAB.
- It may also be used as a batch-oriented language.
- Since it is part of the GNU Project, it is free software under the terms of the GNU General Public License.
- Other free alternatives to MATLAB include Scilab and FreeMat.
- Octave is more compatible with MATLAB than Scilab and FreeMat has not been updated since June 2013.

What is GNU Octave? - A community perspective.

Website

<https://www.octave.org>



IRC

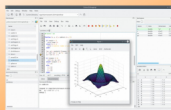
[https://freenode.net/
#octave](https://freenode.net/#octave)

Mailing-Lists



maintainers@octave.org
help@octave.org

GNU Octave



C/C++ Doxygen

<https://octave.org/doxygen>



Mediawiki

<https://wiki.octave.org>



Manual

<https://octave.org/doc/interpreter>



Octave Forge

<https://octave.sourceforge.io>



60+ Extensions for:

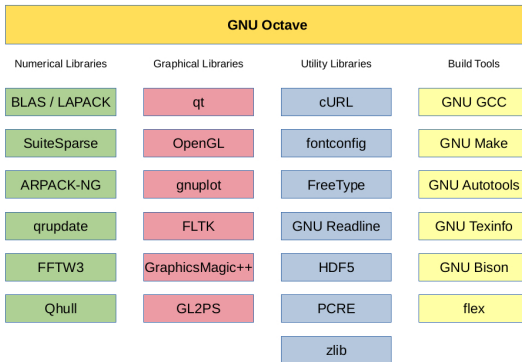
- Data I/O
- Optimization
- Symbolic comp.
- ...

Bug Tracker

<http://bugs.octave.org/>



What is GNU Octave? - A technical perspective.



"[...] If I have seen further it is by standing on the sho[u]lders of Giants. [...]"
 — Isaac Newton (1676)

Why GNU Octave?

- **GNU Octave is a free and open-source software driven by community**
- It alternates to MATLAB which shares its syntax
- It has a large (and growing) user base among scientists in academia and industry
- It has a large library of packages available for performing diverse tasks.
- It's well-documented;

The GNU Octave Journey

- Octave was originally conceived (in about 1988) to be companion software for an undergraduate-level textbook on chemical reactor design being written by James B. Rawlings of the University of Wisconsin-Madison and John G. Ekerdt of the University of Texas.
- About 1992 by John W. Eaton (jwe) of University of Wisconsin-Madison starts development
 - since then in total about 440 contributors
- Named after Octave Levenspiel (1926-2017)
 - former professor of jwe
 - famous for quick back-of-the-envelope calculations

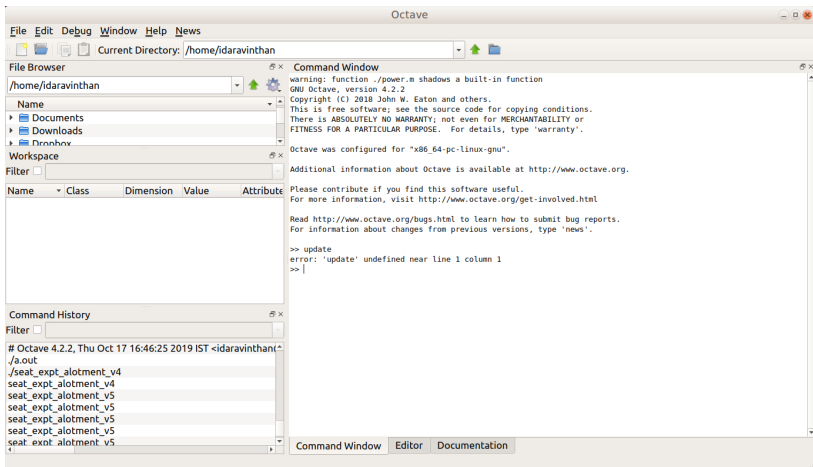
The GNU Octave Journey

- "GNU" Octave since **1997** (version 2.0.6)
- **Vision** of the GNU project¹ of the Free Software Fdn. (FSF):
*"[...] the users have the freedom to run, copy, distribute, study, change and improve the software. [...] 'free' as in 'free speech,' not as in 'free beer'. [...]"*²
- Using **infrastructure** (e.g. code hosting and bug tracking)
 - SourceForge (1999), GitHub (2008), ...
- **Sponsorship** "Working Together for Free Software Fund"

¹Recursive: "GNU's Not Unix!"

²<https://www.gnu.org/philosophy/free-sw.html>

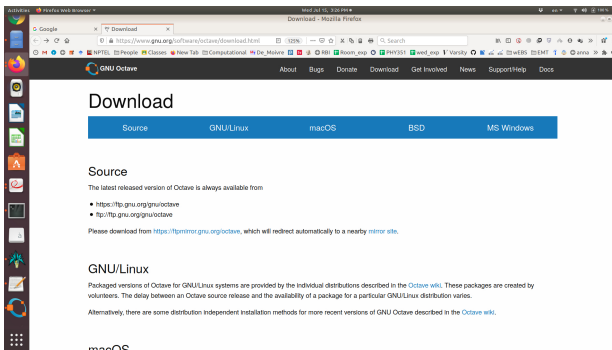
Installing GNU Octave on MS Windows 10 (1/8)



Installing GNU Octave on MS Windows 10 (2/8)

It can be download from:

<https://www.gnu.org/software/octave/download.html>



Installing GNU Octave on MS Windows 10 (3/8)

GNU Octave About Donate Download

Download

Source	GNU/Linux	macOS	BSD	Windows
<ul style="list-style-type: none"> Windows-64 (recommended) <ul style="list-style-type: none"> octave-5.1.0-w64-installer.exe (~ 286 MB) [signature] octave-5.1.0-w64.7z (~ 279 MB) [signature] octave-5.1.0-w64.zip (~ 490 MB) [signature] Windows-32 (old computers) <ul style="list-style-type: none"> octave-5.1.0-w32-installer.exe (~ 275 MB) [signature] octave-5.1.0-w32.7z (~ 258 MB) [signature] octave-5.1.0-w32.zip (~ 447 MB) [signature] Windows-64 (64-bit linear algebra for large data) <p>Unless your computer has more than ~32GB of memory and you need to solve linear algebra problems version will offer no advantage over the recommended Windows-64 version above.</p> <ul style="list-style-type: none"> octave-5.1.0-w64-64-installer.exe (~ 286 MB) [signature] octave-5.1.0-w64-64.7z (~ 279 MB) [signature] octave-5.1.0-w64-64.zip (~ 490 MB) [signature] 				

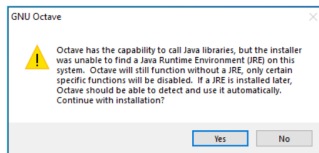
All Windows binaries with corresponding source code can be downloaded from <https://www.gnu.org/software/octave/>

- **w32:** 32-bit systems (very old or embedded devices)
- **w64:** 64-bit systems
- **w64-64:** 64-bit systems with large main memory
 $2^{32} \times 8\text{Bytes} = 32\text{GB}$
 Working with dense double matrices with
 $400,000 \times 100,000$ entries
 ($\approx 298\text{ GB}$) need this.

Installing GNU Octave on MS Windows 10 (4/8)

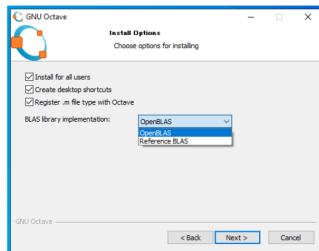
Ignore Java warning:

- Octave works perfectly without Java.
- Octave's Java interface might not work properly.



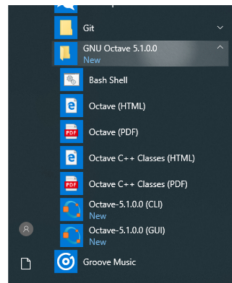
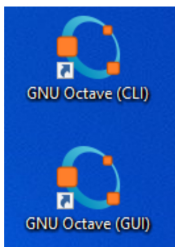
Choose:

- **OpenBLAS** (usually faster)
<https://www.openblas.net/>
- **Reference BLAS**
<https://www.netlib.org/blas/>



Installing GNU Octave on MS Windows 10 (5/8)

- As usual: desktop icons (left) and start menu entries (right).



- Start
 - command-line interface (CLI)
 - graphical user interface (GUI)

Installing GNU Octave on MS Windows 10 (6/8)

The screenshot shows the GNU Octave installation process on a Windows 10 system. The main window displays the GNU Octave version 5.1.0 installation window, which includes the GNU Octave logo (a red circle with a white 'O') and the text "GNU Octave (CLI)" and "GNU Octave (GUI)". The CLI window shows the following text:

```
C:\Octave\OCTAVE-1.0\mingw64\bin\octave-gui.exe
GNU Octave, version 5.1.0
Copyright (C) 2019 John W. Eaton and others.
This is free software; see the source code for copying conditions.
There is ABSOLUTELY NO WARRANTY; not even for MERCHANTABILITY or
FITNESS FOR A PARTICULAR PURPOSE. For details, type 'warranty'.

Octave was configured for "x86_64-mingw32".

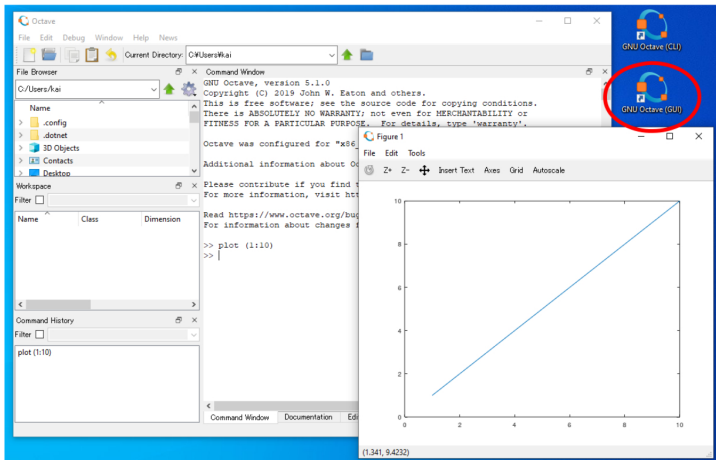
Additional information about Octave is available at https://www.octave.org.
Please contribute if you find this software useful.
For more information, visit https://www.octave.org/get-involved.html

Read https://www.octave.org/bugs.html to learn how to submit bug reports.
For information about changes from previous versions, type 'news'.

octave:1> plot (1:10)
octave:2>
```

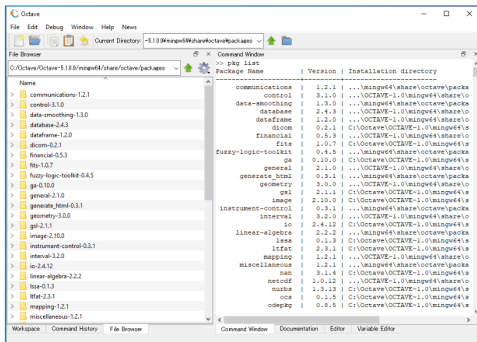
The GUI window shows a plot of a line from (0,0) to (10,10). The plot is titled "Figure 1" and has a menu bar with "File", "Edit", and "Tools". The plot area has a grid and axes ranging from 0 to 10. The status bar at the bottom of the plot window shows the coordinates (0.11982, 6.8694).

Installing GNU Octave on MS Windows 10 (7/8)



Installing GNU Octave on MS Windows 10 (8/8)

- Many **Octave Forge** packages precompiled as part of the installer.
- No need to download them, just **load** them.
 → `pkg list` → `pkg load io`

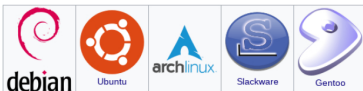


Installing GNU Octave on other systems

⇒ <https://wiki.octave.org/Installation>

GNU/Linux [edit]

• Distributions



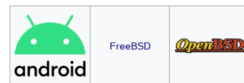
• Distribution independent



Commercial [edit]



Other Unix systems [edit]



Other [edit]



Using Octave (Demos)

Octave

File Edit Debug Window Help News

Current Directory: /home/idaravinthan/Desktop/Examples

File Browser

/home/idaravinthan/Desktop/Examples

Name

- latex
- eg1.txt
- eg2.txt
- exampl1.m

Workspace

Filter

Name	Class	Dimension	Value	Attribute
x	double	1x201	-10:0.1:10	
y	double	1x201	[0.54402, ...	

Command History

Filter

```
title ("Simple 2-D Plt");
xlabel (x);
xlabel ("x");
x = -10:0.1:10;
y = sin (x);
plot (x,y);
title ("Simple 2-D Plt");
xlabel ("x");
ylabel ("sin(x)");
exampl1
exit
```

Editor

File Edit View Debug Run Help

exampl1.m X

```
1 x = -10:0.1:10; # Create an evenly-spaced vector from -10..10
2 y = sin (x); # y is also a vector
3 plot (x, y);
4 title ("Simple 2-D Plot");
5 xlabel ("x");
6 ylabel ("sin (x)");
7
```

Figure 1

File Edit Help

Z+ Z- + Insert Text Axes Grid Autoscale

Simple 2-D Plot

sin (x)

x

line: 1 col: 1 encoding: UTF-8

Command Window Editor Documentation

(4.6175, 0.97955)

Wrapping Up

- What is GNU Octave?
 - High-level programming language, CLI/GUI Software and community.
 - A convenient interactive interface for many well-known and well-performing numerical, graphical and utility libraries written in C/C++, Fortran, Python, Java, ...
 - Free to run, copy, distribute, study, change and improve.
- What it is NOT?
 - Not a one-size-fits-all solution for numerical computations.
 - Not a compiled language, no transcompiler.

References



Octave Software:

<https://www.gnu.org/software/octave/>



Octave User Guide:

<https://octave.org/octave.pdf>



Books about Octave & Matlab:

https://wiki.octave.org/Publications_using_Octave



Octave Resources, Example Files & This Slide Deck:

<https://e2a.co.in/octave>

Thank you for your attention!



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