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

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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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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.

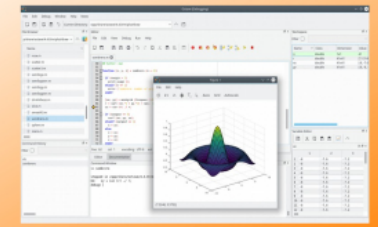
Website
https://www.octave.org

IRC
https://freenode.net/
#octave

Mailing-Lists

maintainers@octave.org
help@octave.org

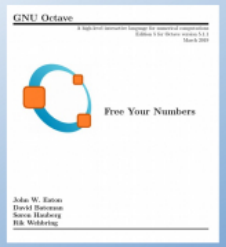
GNU Octave



C/C++ Doxygen
https://octave.org/doxygen

Mediawiki
https://wiki.octave.org

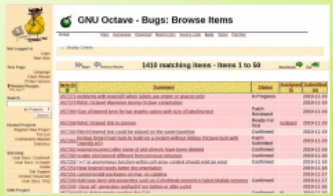
Manual
https://octave.org/doc/interpreter



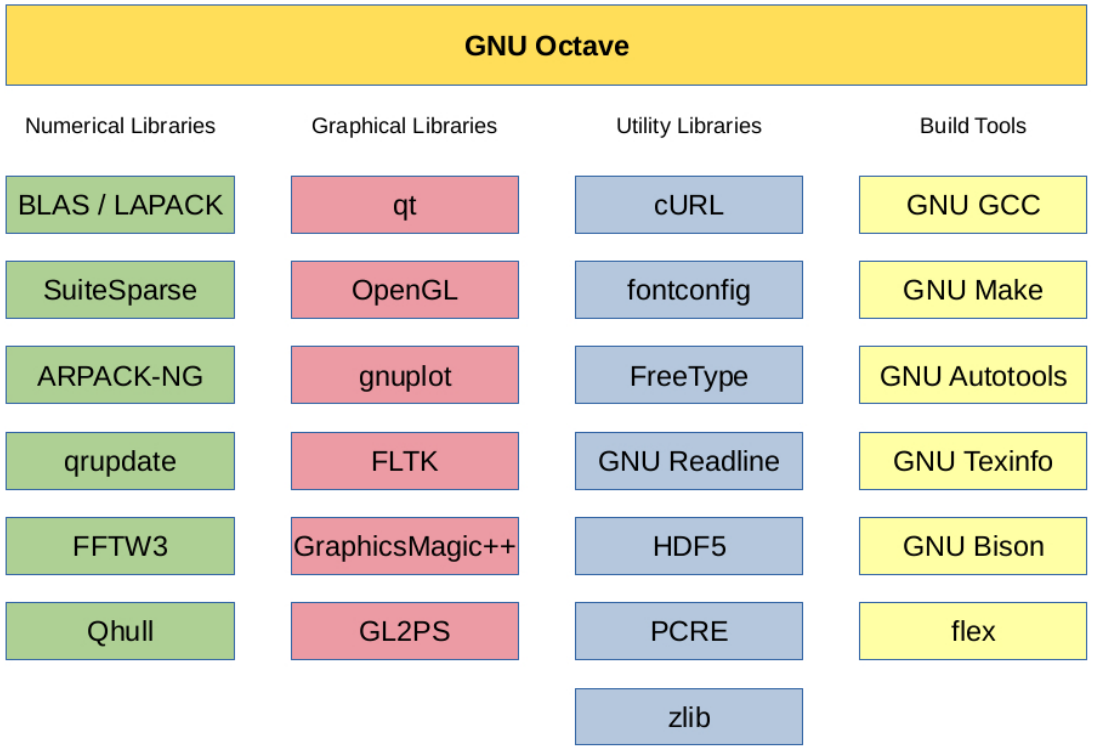
Octave Forge
https://octave.sourceforge.io

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 project[1] of the Free Software Fdn. (FSF):

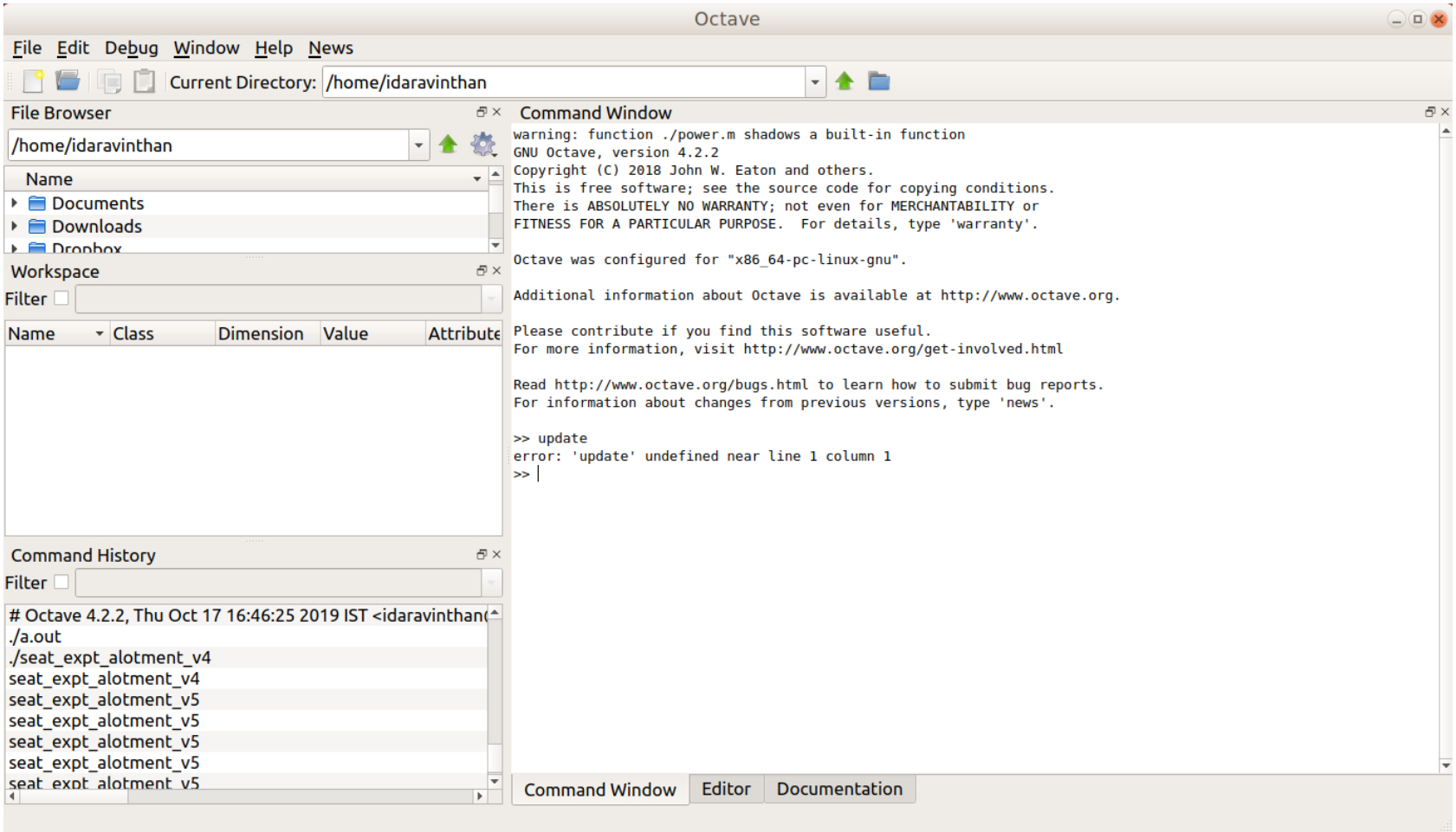
  > *"[...] the users have the freedom to run, copy, distribute, study, change and improve the software. [...] 'free' as in 'free speech,' not as in 'free beer'. [...]"* [2]

- Using **infrastructure** (e.g. code hosting and bug tracking)
  - SourceForge (1999), GitHub (2008), ...
- **Sponsorship** "Working Together for Free Software Fund"

[1] Recursive: "GNU's Not Unix!"

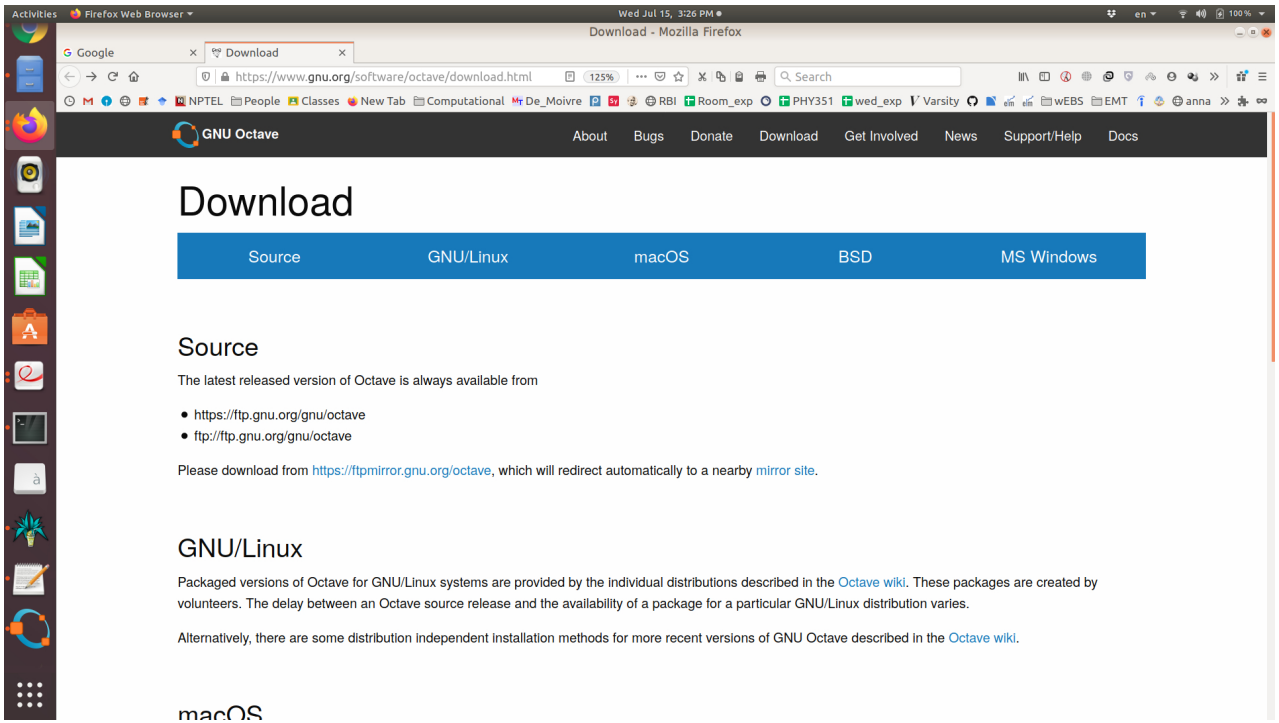
[2] https://www.gnu.org/philosophy/free-sw.html

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

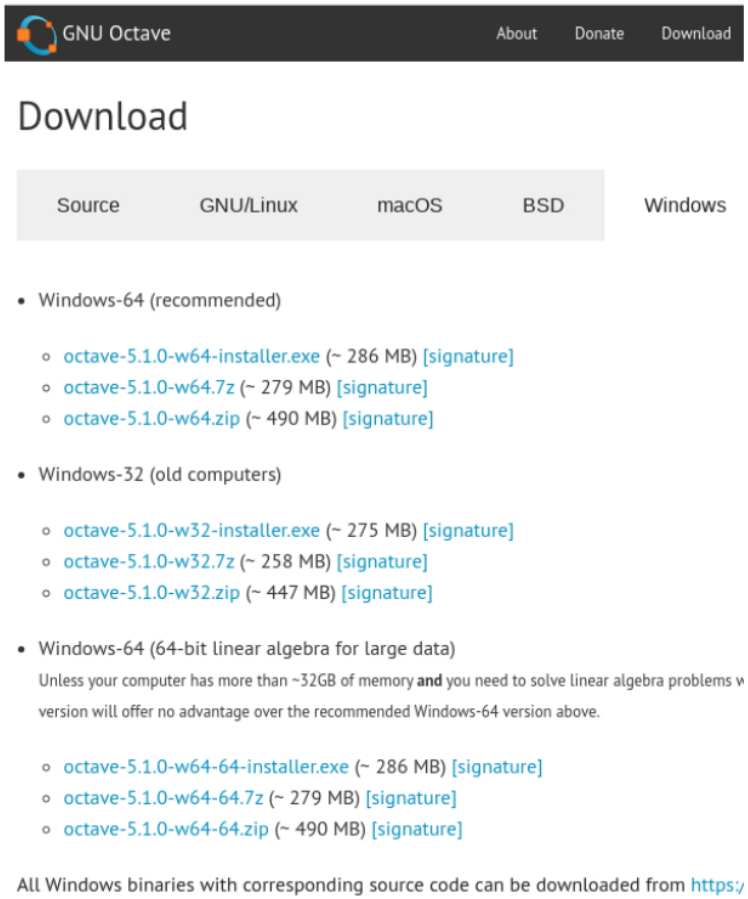


Installing GNU Octave on MS Windows 10 (2/8)

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

- Windows-64 (recommended)
  - 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)
  - 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)

  Unless your computer has more than ~32GB of memory **and** you need to solve linear algebra problems w

  version will offer no advantage over the recommended Windows-64 version above.
  - 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]

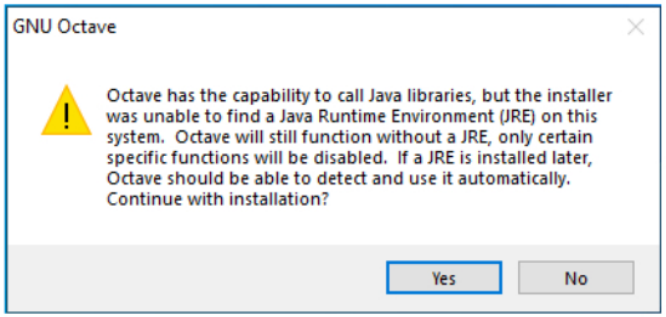
All Windows binaries with corresponding source code can be downloaded from https:/

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

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

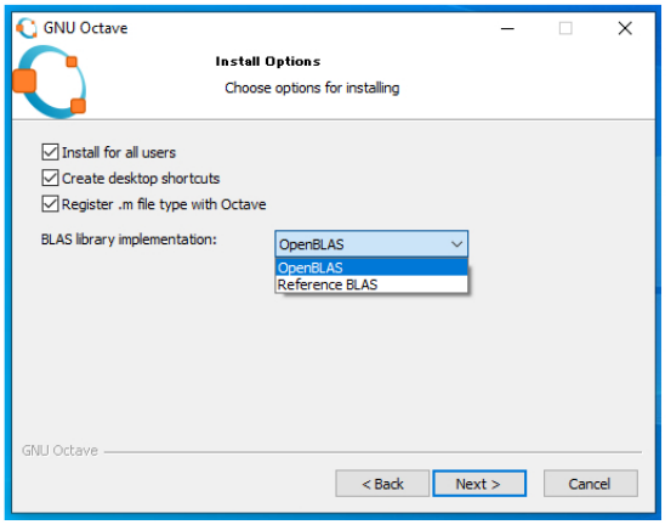
Ignore Java warning:

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



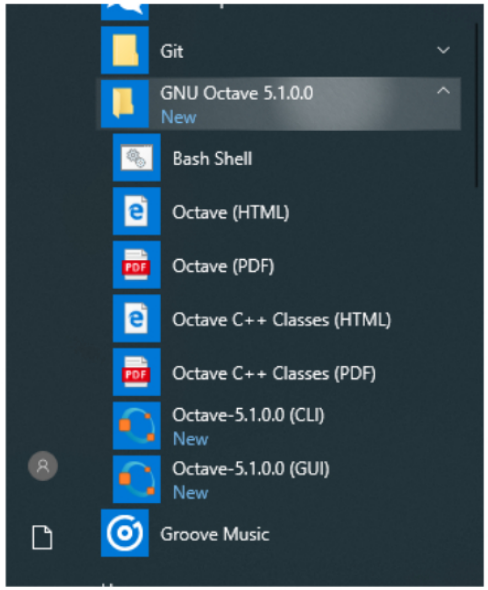
Choose:

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



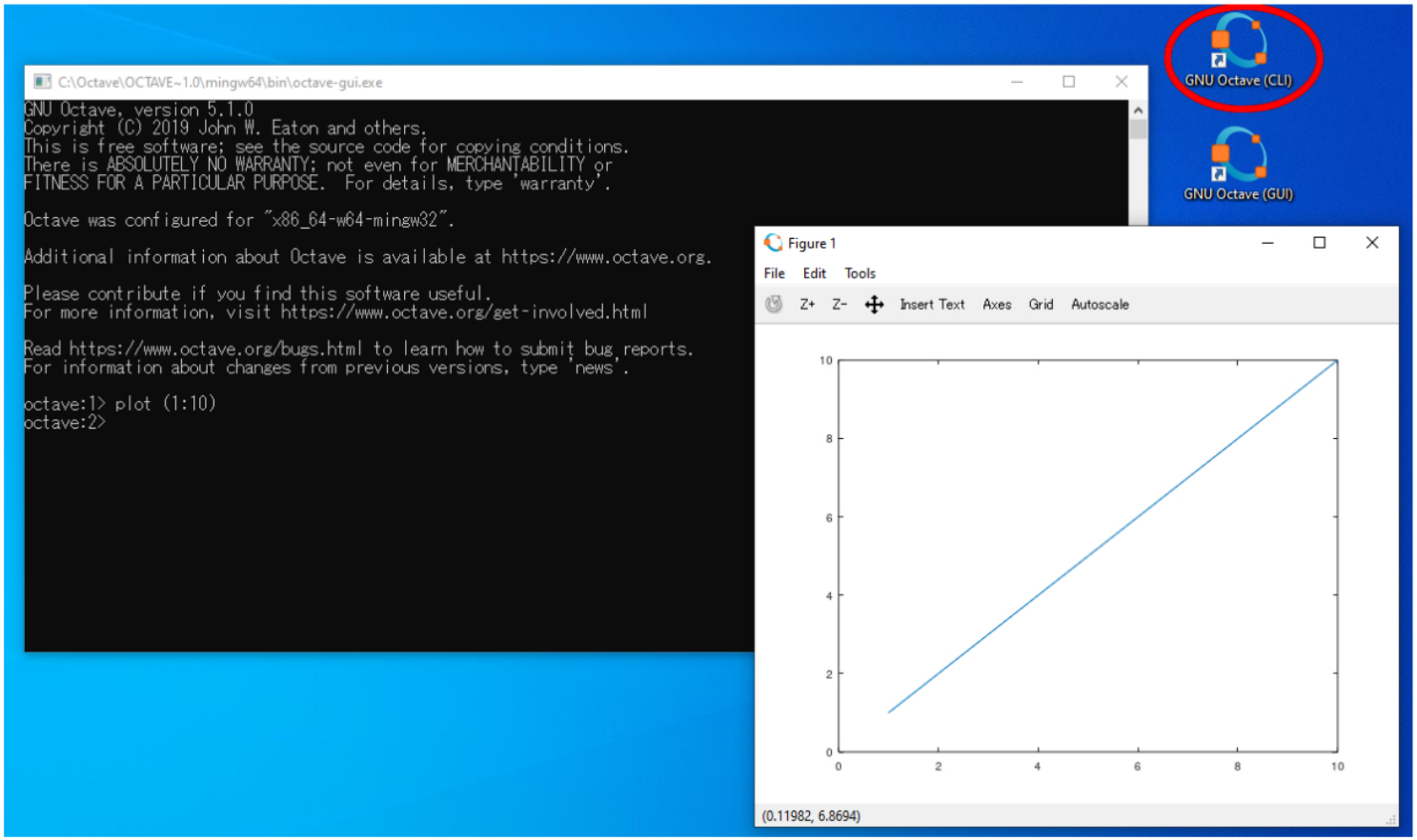
Installing GNU Octave on MS Windows 10 (5/8)

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

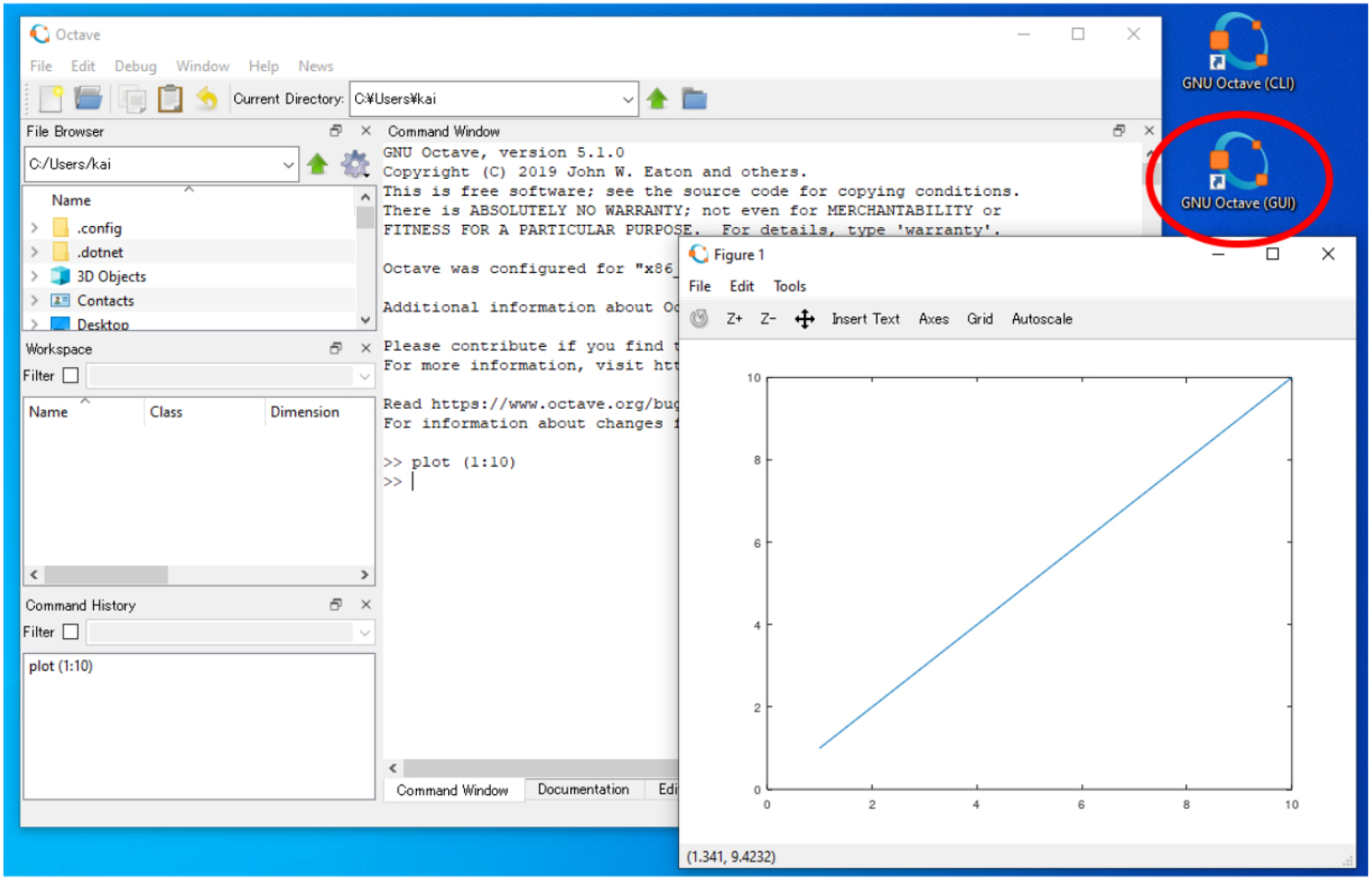


- Start
  - command-line interface (CLI)
  - graphical user interface (GUI)

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



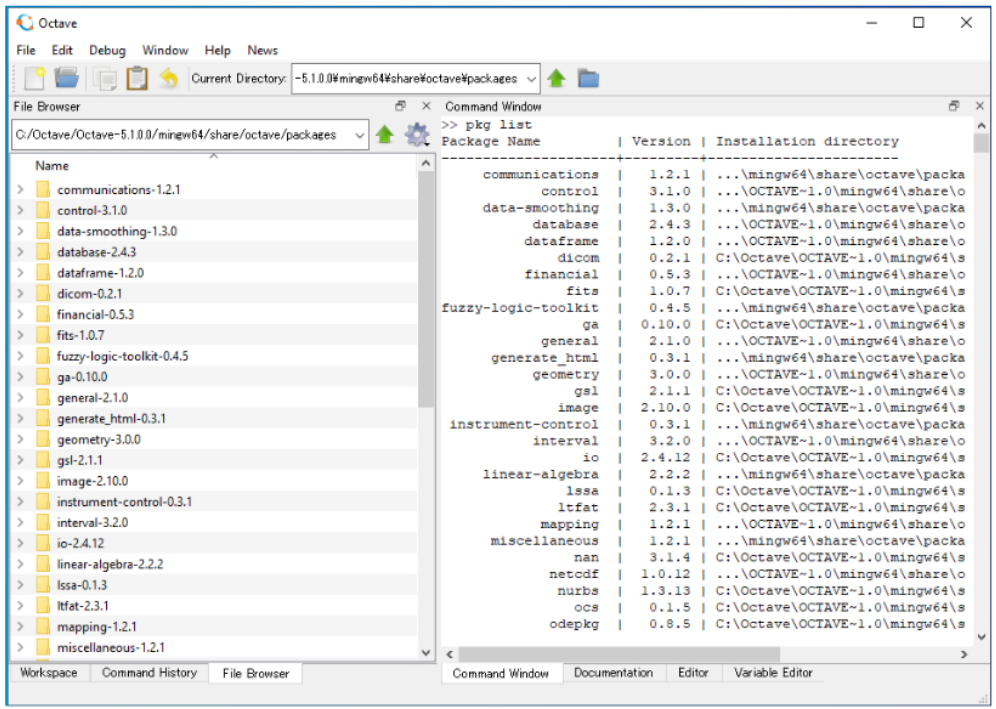
Installing GNU Octave on MS Windows 10 (7/8)



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

$\Longrightarrow$ https://wiki.octave.org/Installation

GNU/Linux [edit]

- **Distributions**

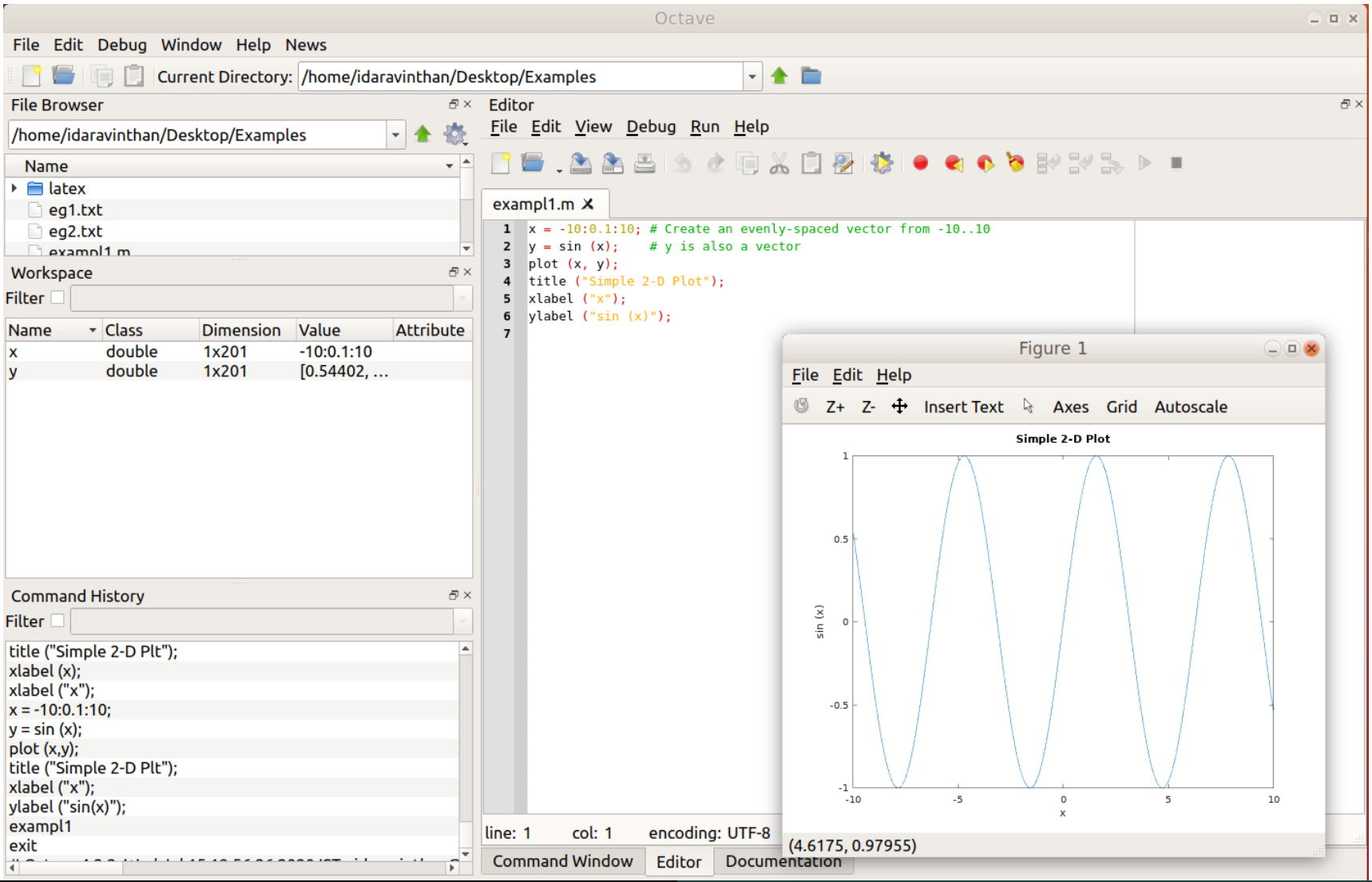
- **Distribution independent**

Commercial [edit]

Other Unix systems [edit]

Other [edit]

Using Octave (Demos)



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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