



# UL HPC School 2017

## PS8a: MATLAB (interactive, passive and sequential jobs)

---

UL High Performance Computing (HPC) Team

V. Plugaru

University of Luxembourg (UL), Luxembourg

<http://hpc.uni.lu>

## Latest versions available on Github:



UL HPC tutorials:

<https://github.com/ULHPC/tutorials>

UL HPC School:

<http://hpc.uni.lu/hpc-school/>

PS8a tutorial sources:

<https://github.com/ULHPC/tutorials/tree/devel/advanced/MATLAB1>





# Summary

- 1 **Pre-requisites**
- 2 Objectives
- 3 Example 1
- 4 Example 2
- 5 Practical session
- 6 Conclusion



## Tutorial files

### Sample MATLAB scripts used in the tutorial

- download only the scripts:

```
(frontend)$> mkdir $HOME/matlab-tutorial
(frontend)$> cd $HOME/matlab-tutorial
(frontend)$> wget
https://raw.githubusercontent.com/ULHPC/tutorials/devel/advanced/MATLAB1/code/example1.m
(frontend)$> wget
https://raw.githubusercontent.com/ULHPC/tutorials/devel/advanced/MATLAB1/code/example2.m
(frontend)$> wget
https://raw.githubusercontent.com/ULHPC/tutorials/devel/advanced/MATLAB1/code/google_finance_data.m
```

- *or* download the full repository and link to the MATLAB tutorial:

```
(frontend)$> git clone https://github.com/ULHPC/tutorials.git
(frontend)$> ln -s tutorials/advanced/MATLAB1/ $HOME/matlab-tutorial
```



## X Window System

In order to see locally the MATLAB graphical interface, a package providing the X Window System is required:

- on OS X: **XQuartz** <http://xquartz.macosforge.org/landing/>
- on Windows: **VcXsrv** <http://sourceforge.net/projects/vcxsrv/>

Now you will be able to connect with X11 forwarding enabled:

- on Linux & OS X:  

```
$> ssh access-gaia.uni.lu -X
```
- on Windows, with Putty  
Connection → SSH → X11 → **Enable X11 forwarding**



# Summary

- 1 Pre-requisites
- 2 Objectives**
- 3 Example 1
- 4 Example 2
- 5 Practical session
- 6 Conclusion



# Objectives of this PS

Better understand the usage of MATLAB on the **UL HPC Platform**

- running in interactive mode
  - ↪ with either the full graphical or the text-mode interface
  - ↪ using the XCS portal ([xcs.uni.lu](https://xcs.uni.lu))



# Objectives of this PS

Better understand the usage of MATLAB on the UL HPC Platform

- running in interactive mode
  - ↪ with either the full graphical or the text-mode interface
  - ↪ using the XCS portal ([xcs.uni.lu](https://xcs.uni.lu))
- running in passive mode
  - ↪ several ways of submitting MATLAB jobs





# Objectives of this PS

Better understand the usage of MATLAB on the **UL HPC Platform**

- running in interactive mode
  - ↪ with either the full graphical or the text-mode interface
  - ↪ using the XCS portal ([xcs.uni.lu](https://xcs.uni.lu))
- running in passive mode
  - ↪ several ways of submitting MATLAB jobs
- checking available toolboxes & licenses status



# Objectives of this PS

Better understand the usage of MATLAB on the **UL HPC Platform**

- running in interactive mode
  - ↪ with either the full graphical or the text-mode interface
  - ↪ using the XCS portal ([xcs.uni.lu](https://xcs.uni.lu))
- running in passive mode
  - ↪ several ways of submitting MATLAB jobs
- checking available toolboxes & licenses status
- using script (.m) files



# Objectives of this PS

Better understand the usage of MATLAB on the **UL HPC Platform**

- running in interactive mode
  - ↪ with either the full graphical or the text-mode interface
  - ↪ using the XCS portal ([xcs.uni.lu](https://xcs.uni.lu))
- running in passive mode
  - ↪ several ways of submitting MATLAB jobs
- checking available toolboxes & licenses status
- using script (.m) files
- plotting data, saving the plots to file



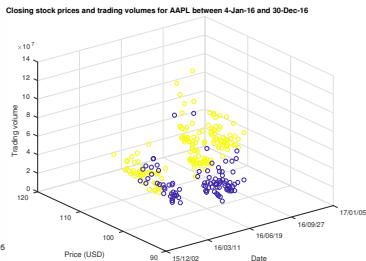
# Summary

- 1 Pre-requisites
- 2 Objectives
- 3 Example 1**
- 4 Example 2
- 5 Practical session
- 6 Conclusion

## Scripts and plots

**example1.m:** non-interactive script that shows:

- the use of a stopwatch timer
- how to use an external function (financial data retrieval)
- how to use different plotting methods
- how to export the plots in different graphic formats





# Summary

- 1 Pre-requisites
- 2 Objectives
- 3 Example 1
- 4 Example 2**
- 5 Practical session
- 6 Conclusion



## Parallelization

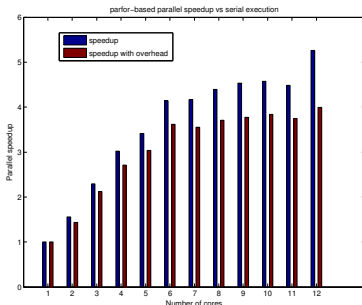
**example2.m:** non-interactive script that shows:

- the serial execution of time consuming operations

# Parallelization

**example2.m:** non-interactive script that shows:

- the serial execution of time consuming operations
- Revisited in MATLAB2 tutorial:
  - ↪ the parallel execution and relative speedup vs serial execution
  - ↪ setting the # of parallel threads through environment variables
  - ↪ GPU-based parallel execution







# Summary

- 1 Pre-requisites
- 2 Objectives
- 3 Example 1
- 4 Example 2
- 5 Practical session**
- 6 Conclusion



## Exercises

- Read and understand the MATLAB tutorial

<https://github.com/ULHPC/tutorials/tree/devel/advanced/MATLAB1>

↪ all provided scripts are fully commented

- Run all the examples

↪ launching interactive/passive mode MATLAB

↪ plotting script

↪ parallel execution script



## Useful links

- Parallel Computing Toolbox <http://www.mathworks.nl/help/distcomp/index.html>
- Parallel for-Loops (parfor)  
<http://www.mathworks.nl/help/distcomp/getting-started-with-parfor.html>
- GPU Computing <http://www.mathworks.nl/discovery/matlab-gpu.html>



# Summary

- 1 Pre-requisites
- 2 Objectives
- 3 Example 1
- 4 Example 2
- 5 Practical session
- 6 Conclusion**



# What we've seen so far

- MATLAB execution modes on the [UL HPC Platform](#)
- Checking for available toolboxes and licenses
- Plotting

## Perspectives

- Personalize the UL HPC launchers with the MATLAB commands
- Check the second example M-file for insight into basic parallel execution
- Parallelize your own tasks using `parfor`/GPU-enabled instructions



Thank you for your attention...

## Questions?

<http://hpc.uni.lu>

### The UL High Performance Computing (HPC) Team

University of Luxembourg, Belval Campus:

Maison du Nombre, 4th floor

2, avenue de l'Université

L-4365 Esch-sur-Alzette

mail: [hpc@uni.lu](mailto:hpc@uni.lu)



- 1 Pre-requisites
- 2 Objectives
- 3 Example 1
- 4 Example 2
- 5 Practical session
- 6 Conclusion