

Python for Signal & Control

an overview

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Outline

- Python usage, comparison with Matlab
- The new curriculum in “classes prépas”
- Ecosystem: packages and environments
- *Live demos*

Software in Engineering/Control

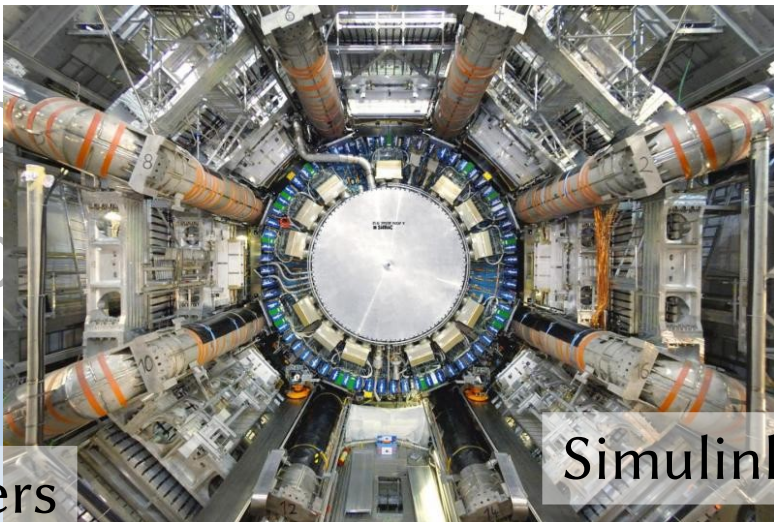
- Domination of Matlab-Simulink
 - Easy-to-learn programming
 - Nice Integrated Development Environment
 - but **proprietary, limited code reusability**
- Looking for alternatives
 - Open source “**equivalents**”: Scilab-Xcos, Octave
 - Open source **alternatives**: Modelica, R, **Python**, Julia
 - Better code reusability: an educational issue?



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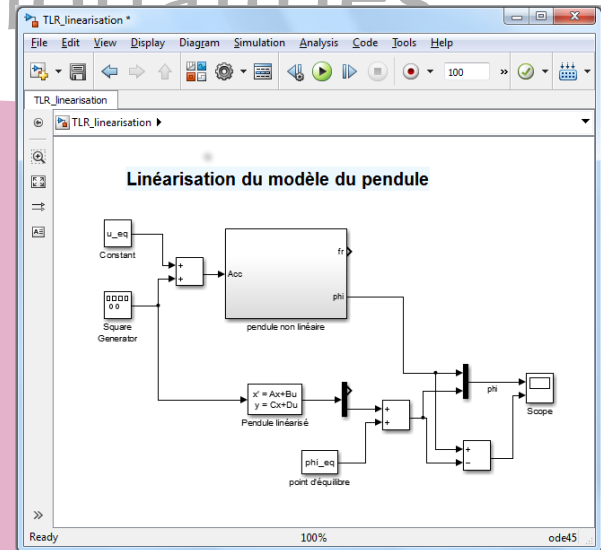


Small computers
(ex: Raspberry Pi)



Simulink

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tionalities



Web services & Cloud computing



Controlling experiments

Scripting engine
(ex: dSPACE ControlDesk)

- Scientific computing
- Dynamical simulation
- Data analysis
- Plotting

Matlab

Advanced User Interfaces

Simulink code generation for real-time targets



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Interpreted languages



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The new curriculum for “classes préparas”

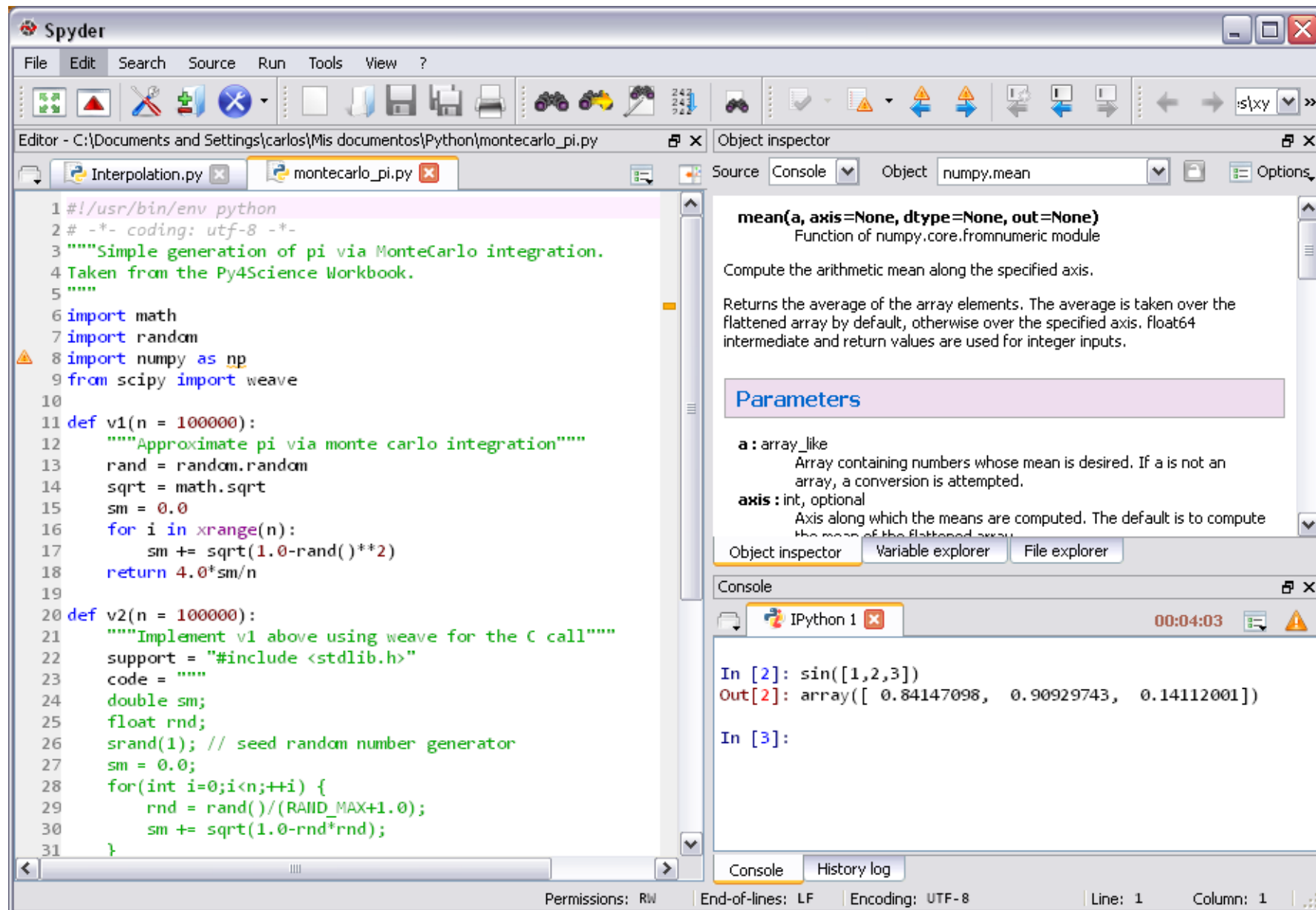
- Python for learning Algorithmics
- Python or Scilab for scientific computing, and system simulation

Educated students coming soon... (?)

Python Ecosystem

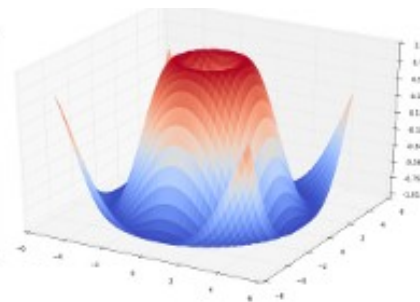
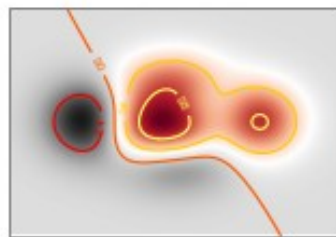
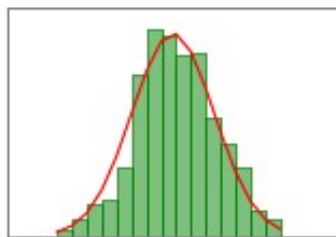
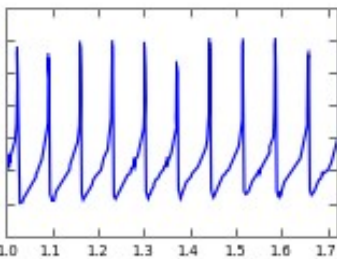
- Many available packages
<https://pypi.python.org/pypi>
 - for science
 - and beyond!
- No “**standard/official**” development environment, but (too?) many options available:
 - Light weight: text editor + console
 - Integrated Development Environment (e.g. for Matlab users: **Spyder**, next slide)
 - Interactive **IPython Notebook** (cf. demos)

Spyder IDE, for Scientific Python



Major Python packages for science & engineering

- NumPy:
N-dimensional array package
- SciPy library: <http://scipy.org/>
toolboxes for integration, optimization, signal, ...
- Matplotlib: <http://matplotlib.org/>
plotting, *with Matlab inspired API*
- And symbolic mathematics (SymPy),
Machine Learning (Scikit-learn), ...



Examples for Control & Signal

- Signal processing: IIR filter design
 - Numerical arrays manipulation (numpy)
 - Signal filtering (scipy.signal)
 - Plots (matplotlib)
 - Interactivity with IPython widgets
- Optimal Control: Linear Quadratic regulator
 - Symbolic math (sympy)
 - Numerical LQ synthesis (python-control, slycot)

Demo time!