

Documenting Python Packages

Docs or it didn't happen!

Andrey Smelter

2019/04/11 (updated: 2019-04-25)

\$ whoami

Andrey (pronounced similar to André) Smelter

Postdoctoral Scholar at the University of Kentucky Markey Cancer Center

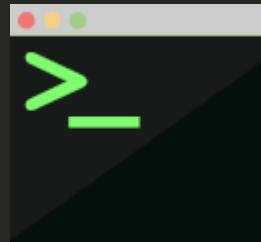
Links:

- : github.com/andreysmelter
- : linkedin.com/in/andreysmelter
- : instagram.com/andreysmelter
- : twitter.com/smelandr



A regular slide with text or code.

A transition slide or terminal output.



Why write docs?

You want people to use your code

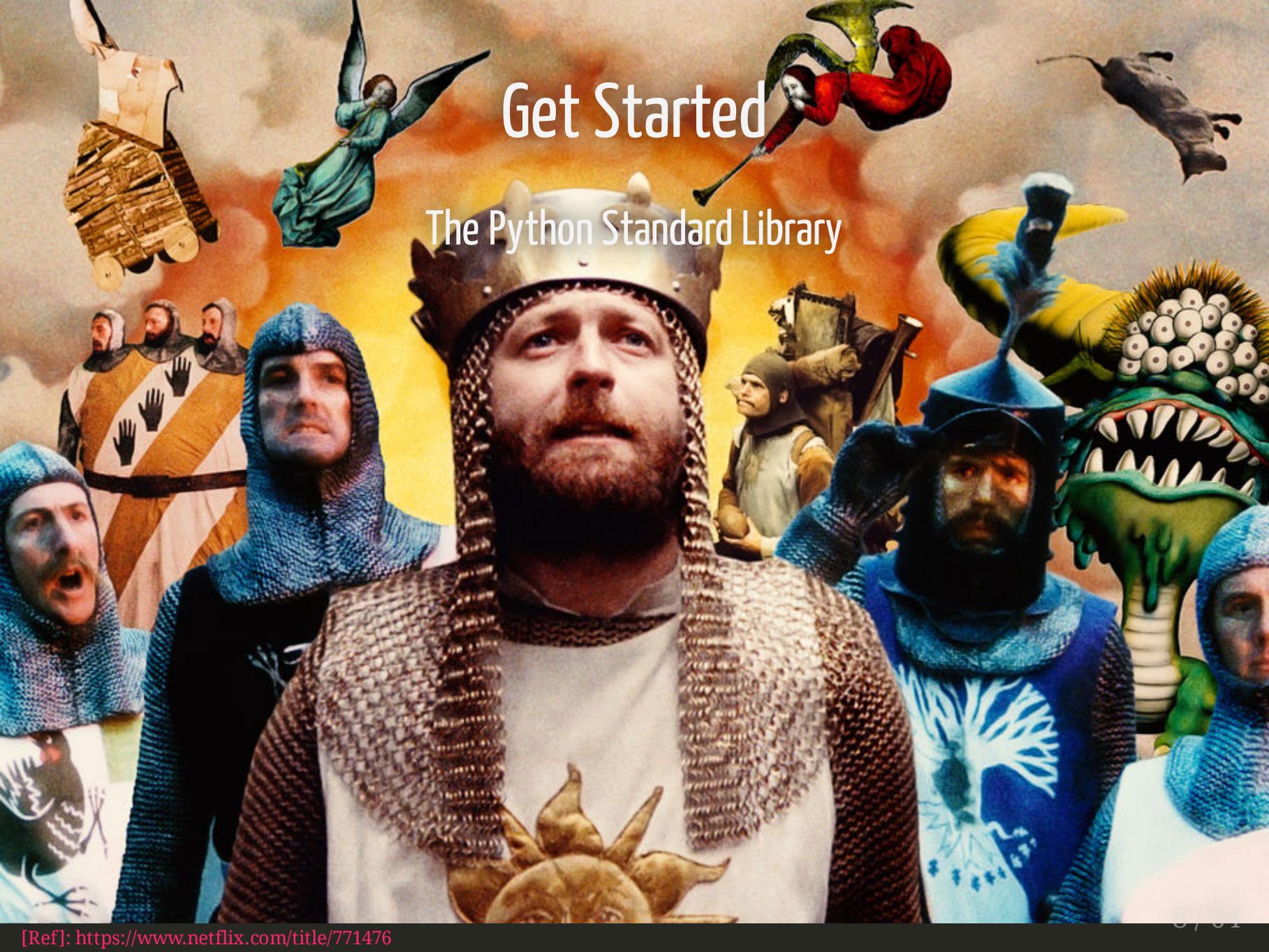
You want your code to be better

You want contributors

You will be using your code in [X] months

To document or not to document?

"There is a magical feeling that happens when you release your code. It comes in a variety of ways, but it always hits you the same. *Someone is using my code?!* A mix of terror and excitement."



Get Started

The Python Standard Library

"Batteries Included" Philosophy

Having a **rich** and **versatile** standard library

Which is **immediately available**

Without making the user **download separate packages**

`pydoc`

`built-in`

pydoc

The pydoc module **automatically** generates documentation from Python modules.

The documentation can be presented as:

- pages of **text on the console**
- served to a **web browser**
- or saved to **HTML files**

Let's use quadratic equation as an example

- The **quadratic equation** formula:

$$ax^2 + bx + c = 0$$

- The quadratic formula for the **roots**:

$$x_{1,2} = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

- The **equations/quadratic.py** module:

```
import cmath

def quadratic(a, b, c):
    discriminant = cmath.sqrt(b**2.0 - 4.0 * a * c)
    x1 = (-b + discriminant) / (2.0 * a)
    x2 = (-b - discriminant) / (2.0 * a)
    return x1, x2
```

pydoc

The pydoc module "automatically" generates documentation from Python modules

```
$ python3 -m pydoc equations.quadratic
Help on module quadratic:
```

NAME

quadratic

FUNCTIONS

quadratic(a, b, c)

FILE

equations/quadratic.py

pydoc

- Add **module-level** docstring.
- Add **function-level** docstring.

```
"""
This module contains routines for finding
roots of quadratic equations.
"""
```

```
import cmath

def quadratic(a, b, c):
    """Solve quadratic equation."""
    discriminant = cmath.sqrt(b**2.0 - 4.0 * a * c)
    x1 = (-b + discriminant) / (2.0 * a)
    x2 = (-b - discriminant) / (2.0 * a)
    return x1, x2
```

pydoc

The pydoc module automatically generates documentation from Python modules

```
$ python3 -m pydoc equations.quadratic
Help on module equations.quadratic in equations:
```

NAME

equations.quadratic

DESCRIPTION

This module contains routines for finding roots of quadratic equations.

FUNCTIONS

quadratic(a, b, c)

Solve quadratic equation.

FILE

equations/quadratic.py

pydoc

- **Package-level** docstring?

pydoc

```
$ python3 -m pydoc equations
```

```
Help on package equations:
```

```
NAME
```

```
    equations
```

```
PACKAGE CONTENTS
```

```
    quadratic
```

```
FILE
```

```
    (built-in)
```

pydoc

- Create `equations/__init__.py` file.

```
"""
This package provides routines for solving
equations.

__author__ = "Andrey Smelter"
__version__ = "0.1.0"
```

pydoc

```
$ python3 -m pydoc equations
```

```
Help on package equations:
```

NAME

equations

DESCRIPTION

This package provides routines for solving
equations.

PACKAGE CONTENTS

quadratic

VERSION

0.1.0

AUTHOR

Andrey Smelter

FILE

equations/__init__.py

pydoc

- How about **static HTML** pages?

pydoc

- How about **static HTML** pages?

```
$ python3 -m pydoc -w equations  
$ python3 -m pydoc -w equations.quadratic
```

pydoc

- **Package-level** HTML doc:

The screenshot shows a package-level documentation page for 'examples.2 example.equations' (version 0.1.0). The page has a blue header bar with the title and version information. Below the header, there is a brief description of the package. A purple sidebar on the left lists 'Package Contents' with a link to 'quadratic'. A blue sidebar on the left lists 'Author' with the name 'Andrey Smelter'. The main content area is white.

[examples.2 example.equations](#) (version 0.1.0) [index](#)
[equations/_init_.py](#)

This package provides routines for solving equations.

Package Contents

[quadratic](#)

Author

Andrey Smelter

pydoc

- **Module-level** HTML doc:

The screenshot shows a module-level HTML doc for the `example.equations.quadratic` module. The page has a blue header bar with the module name and a purple sidebar on the left.

example.2 example.equations.quadratic [index](#) [equations/quadratic.py](#)

This module contains routines for finding roots of quadratic equations.

Modules

- [math](#)

Functions

quadratic(a, b, c)
Solve quadratic equation.

pydoc

Pros:

- **Built-in** docs generator.
- Used by `>>> help()` function to pull and display docstrings from functions/methods, modules, and packages.

Cons:

- Static HTML docs are very **retro style**.



doctest

built-in

doctest

Searches for pieces of text that look like interactive Python sessions.

Then executes those sessions to verify that they work exactly as shown.

doctest

```
def quadratic(a, b, c):
    """Solve quadratic equation.

    For example:
    >>> x1, x2 = quadratic(a=2, b=-8, c=-24)
    >>> x1
    (6+0j)
    >>> x2
    (-2+0j)
    >>> 2*x1**2 - 8*x1 - 24
    0j
    >>> 2*x2**2 - 8*x2 - 24
    0j
    """
    discriminant = cmath.sqrt(b**2.0 - 4.0 * a * c)
    x1 = (-b + discriminant) / (2.0 * a)
    x2 = (-b - discriminant) / (2.0 * a)
    return x1, x2

if __name__ == "__main__":
    import doctest
    print(doctest.testmod())
```

doctest

```
$ python3 -m equations.quadratic  
TestResults(failed=0, attempted=5)
```

doctest

```
$ python3 -m equations.quadratic -v
Trying:
    x1, x2 = quadratic(a=2, b=-8, c=-24)
Expecting nothing
ok
Trying:
    x1
Expecting:
    (6+0j)
ok
Trying:
    x2
Expecting:
    (-2+0j)
ok
Trying:
    2*x1**2 - 8*x1 - 24
Expecting:
    0j
ok
Trying:
    2*x2**2 - 8*x2 - 24
Expecting:
    0j
ok
1 items had no tests:
    __main__
1 items passed all tests:
    5 tests in __main__.quadratic
5 tests in 2 items.
5 passed and 0 failed.
Test passed.
TestResults(failed=0, attempted=5)
```

doctest

```
def quadratic(a, b, c):
    """Solve quadratic equation.

    For example:
    >>> x1, x2 = quadratic(a=2, b=-8, c=-24)
    >>> x1
    (8+0j)
    >>> x2
    (-2+0j)
    >>> 2*x1**2 - 8*x1 - 24
    0j
    >>> 2*x2**2 - 8*x2 - 24
    0j
    """
    discriminant = cmath.sqrt(b**2.0 - 4.0 * a * c)
    x1 = (-b + discriminant) / (2.0 * a)
    x2 = (-b - discriminant) / (2.0 * a)
    return x1, x2

if __name__ == "__main__":
    import doctest
    print(doctest.testmod())
```

doctest

```
$ python3 -m equations.quadratic
=====
File "equations/quadratic.py", line 14, in __main__.quadratic
Failed example:
    x1
Expected:
    (8+0j)
Got:
    (6+0j)
=====
1 items had failures:
  1 of  5 in __main__.quadratic
Test Failed 1 failures.
TestResults(failed=1, attempted=5)
```

doctest

```
def quadratic(a, b, c):
    """Solve quadratic equation.

    For example:
    >>> x1, x2 = quadratic(a=0, b=-8, c=-24)
    """
    discriminant = cmath.sqrt(b**2.0 - 4.0 * a * c)
    x1 = (-b + discriminant) / (2.0 * a)
    x2 = (-b - discriminant) / (2.0 * a)
    return x1, x2

if __name__ == "__main__":
    import doctest
    print(doctest.testmod())
```

doctest

```
$ python3 -m equations.quadratic
=====
File "equations/quadratic.py", line 13, in __main__.quadratic
Failed example:
    x1, x2 = quadratic(a=0, b=-8, c=-24)
Exception raised:
Traceback (most recent call last):
  File "/usr/lib64/python3.5/doctest.py", line 1321, in __run
    compileflags, 1), test.globs)
  File "", line 1, in 
    x1, x2 = quadratic(a=0, b=-8, c=-24)
  File "equations/quadratic.py", line 16, in quadratic
    x1 = (-b + discriminant) / (2.0 * a)
ZeroDivisionError: complex division by zero
=====
1 items had failures:
  1 of  1 in __main__.quadratic
Test Failed 1 failures.
TestResults(failed=1, attempted=1)
```

doctest

```
def quadratic(a, b, c):
    """Solve quadratic equation.

    For example:
    >>> x1, x2 = quadratic(a=0, b=-8, c=-24)
    Traceback (most recent call last):
    ...
    ZeroDivisionError: complex division by zero
    """
    discriminant = cmath.sqrt(b**2.0 - 4.0 * a * c)
    x1 = (-b + discriminant) / (2.0 * a)
    x2 = (-b - discriminant) / (2.0 * a)
    return x1, x2

if __name__ == "__main__":
    import doctest
    print(doctest.testmod())
```

doctest

```
$ python3 -m equations.quadratic -v
Trying:
    x1, x2 = quadratic(a=0, b=-8, c=-24)
Expecting:
    Traceback (most recent call last):
    ...
    ZeroDivisionError: complex division by zero
ok
1 items had no tests:
    __main__
1 items passed all tests:
    1 tests in __main__.quadratic
1 tests in 2 items.
1 passed and 0 failed.
Test passed.
TestResults(failed=0, attempted=1)
```

doctest

Pros:

- **Built-in** docs string test.
- Forces you to write **high-quality examples** in your doc strings.
- Makes sure that your doc string is **up-to-date**.

Cons:

- May not be useful for more **complex cases**.



a.k.a. Python Package Index (PyPI)

Sphinx

```
python3 -m pip install Sphinx
```

Sphinx

Makes it easy to create **beautiful documentation** for Python projects.

Uses **reStructuredText** as its markup language format.

Sphinx: sphinx-quickstart

```
$ mkdir docs && cd docs  
$ sphinx-quickstart
```

```
> Separate source and build directories (y/n) [n]:
```

The project name will occur in several places in the built documentation.

```
> Project name: equations
```

```
> Author name(s): Andrey Smelter
```

```
> Project release []: 0.1.0
```

```
> Project language [en]:
```

```
Creating file ./conf.py.
```

```
Creating file ./index.rst.
```

```
Creating file ./Makefile.
```

```
Creating file ./make.bat.
```

Finished: An initial directory structure has been created.

You should now populate your master file ./index.rst and create other documentation source files. Use the Makefile to build the docs, like so:

```
make builder
```

where "builder" is one of the supported builders,
e.g. html, latex or linkcheck.

Sphinx: sphinx-quickstart

```
$ tree docs
.
└── docs
    ├── _build
    ├── conf.py
    ├── index.rst
    ├── make.bat
    ├── Makefile
    ├── _static
    └── _templates
        └── equations
            ├── __init__.py
            └── quadratic.py
```

Sphinx: conf.py

```
# import os
# import sys
# sys.path.insert(0, os.path.abspath('.'))

project = 'equations'
copyright = '2019, Andrey Smelter'
author = 'Andrey Smelter'

release = '0.1.0'

extensions = [
]

templates_path = ['_templates']

html_theme = 'alabaster'

html_static_path = ['_static']
```

Sphinx: index.rst

```
Welcome to equations's documentation!
```

```
=====
.. toctree::
   :maxdepth: 2
   :caption: Contents:
```

Sphinx: index.rst

```
Welcome to equations's documentation!
```

```
=====
```

The library for solving equations.

```
.. note::
```

```
    The ``equations`` library currently can only solve  
    quadratic equations.
```

```
.. toctree::
```

```
    :maxdepth: 2
```

```
    :caption: Contents:
```

Sphinx: Makefile

```
$ make html
Running Sphinx v2.0.1
making output directory... done
building [mo]: targets for 0 po files that are out of date
building [html]: targets for 1 source files that are out of date
updating environment: 1 added, 0 changed, 0 removed
reading sources... [100%] index
looking for now-outdated files... none found
pickling environment... done
checking consistency... done
preparing documents... done
writing output... [100%] index
generating indices... genindex
writing additional pages... search
copying static files... done
copying extra files... done
dumping search index in English (code: en) ... done
dumping object inventory... done
build succeeded.
```

The HTML pages are in _build/html.

Sphinx: html docs

[equations](#)

Navigation

Quick search

Go

Welcome to equations's documentation!

The library for solving equations.

Note:

The `equations` library currently can only solve quadratic equations.

Indices and tables

- [Index](#)
- [Module Index](#)
- [Search Page](#)

©2019, Andrey Smelter. | Powered by [Sphinx 2.0.1](#) & [Alabaster 0.7.12](#) | [Page source](#)

Sphinx: write doc string in reStructuredText format

```
def quadratic(a, b, c):
    """Solve quadratic equation.

    :param float a: a coefficient of a quadratic equation.
    :param float b: b coefficient of a quadratic equation.
    :param float c: c coefficient of a quadratic equation.
    :return: quadratic equation roots.
    :rtype: :py:class:`tuple`.

    """
    discriminant = cmath.sqrt(b**2.0 - 4.0 * a * c)
    x1 = (-b + discriminant) / (2.0 * a)
    x2 = (-b - discriminant) / (2.0 * a)
    return x1, x2
```

Sphinx: enable autodoc extension in conf.py

```
import os
import sys
sys.path.insert(0, os.path.abspath('..'))

project = 'equations'
copyright = '2019, Andrey Smelter'
author = 'Andrey Smelter'
release = '0.1.0'
extensions = [
    'sphinx.ext.autodoc',
    'sphinx.ext.viewcode',
    'sphinx.ext.intersphinx'
]

intersphinx_mapping = {'python': ('https://docs.python.org/3', None)}
templates_path = ['_templates']
html_theme = 'alabaster'
html_static_path = ['_static']
```

Sphinx: add api.rst file

The equations API Reference

```
.. automodule:: equations  
  
.. automodule:: equations.quadratic  
    :members:
```

Sphinx: add api.rst to topic tree

```
Welcome to equations's documentation!
```

```
=====
```

The library for solving equations.

```
.. note::
```

The ``equations`` library currently can only solve quadratic equations.

```
.. toctree::
```

```
:maxdepth: 2
```

```
:caption: Contents:
```

```
api
```

Sphinx: html docs

[equations](#)

Navigation

Contents:

[The equations API](#)

[Reference](#)

Quick search

Go

Welcome to equations's documentation!

The library for solving equations.

Note:

The `equations` library currently can only solve quadratic equations.

Contents:

- [The equations API Reference](#)

Indices and tables

- [Index](#)
- [Module Index](#)
- [Search Page](#)

©2019, Andrey Smelter. | Powered by [Sphinx 2.0.1](#) & [Alabaster 0.7.12](#) | [Page source](#)

Sphinx: html docs

equations

Navigation

Contents:

[The equations API Reference](#)

Quick search

 Go

The equations API Reference

This package provides routines for solving equations.

This module contains routines for finding roots of quadratic equations.

`equations.quadratic.quadratic(a, b, c)`

[\[source\]](#)

Solve quadratic equation.

Parameters:

- `a` (`float`) – a coefficient of a quadratic equation.
- `b` (`float`) – b coefficient of a quadratic equation.
- `c` (`float`) – c coefficient of a quadratic equation.

Returns:

quadratic equation roots.

Return type:

`tuple`

©2019, Andrey Smelter. | Powered by [Sphinx 2.0.1](#) & [Alabaster 0.7.12](#) | [Page source](#)

Sphinx: useful extensions

```
extensions = [  
    'sphinx.ext.autodoc',  
    'sphinx.ext.doctest',  
    'sphinx.ext.todo',  
    'sphinx.ext.coverage',  
    'sphinx.ext.mathjax',  
    'sphinx.ext.viewcode',  
    'sphinx.ext.intersphinx',  
    'nbsphinx'  
]
```

Sphinx: host on readthedocs.org

- **Register** an account on readthedocs.org.
- **Point** readthedocs to your **GitHub repo**.
- Add path to **requirements.txt** file under advanced settings.
- Push **commit** to trigger documentaion **build**.

docs

passing

docs

failing

docs

unknown

Sphinx

Pros:

- Creates **beautiful** docs.
- Provides useful **extensions**.
- **Customizable** (templates and themes).
- Uses **reStructuredText**.

Cons:

- Uses **reStructuredText** (not really cons).

MkDocs

```
python3 -m pip install mkdocs
```

MkDocs

MkDocs is a **fast, simple and beautiful** static site generator for building project documentation.

Uses **Markdown** as its markup language format.

MkDocs: quickstart

```
$ mkdocs new equations
$ tree equations
├── docs
│   └── index.md
└── equations
    ├── __init__.py
    └── quadratic.py
mkdocs.yml
```

MkDocs: mkdocs.yml

```
site_name: equations documentation!
```

MkDocs: docs/index.md

```
# Welcome to `equations` documentation!
```

The library for solving equations.

Note

The ``equations`` library currently can only solve quadratic equations.

MkDocs: html docs

```
$ mkdocs serve
INFO    - Building documentation...
INFO    - Cleaning site directory
[I 190425 02:27:22 server:298] Serving on http://127.0.0.1:8000
[I 190425 02:27:22 handlers:59] Start watching changes
[I 190425 02:27:22 handlers:61] Start detecting changes
```

MkDocs: html docs

equations documentation!

 Search

Welcome to equations documentation!

Note

Welcome to equations documentation!

The library for solving equations.

Note

The `equations` library currently can only solve quadratic equations.

Documentation built with [MkDocs](#).

MkDocs

Pros:

- **Lowers** the **barrier** for writing docs.
- Focuses on **high quality prose** docs.
- Creates **beautiful** docs.
- **Customizable** themes based on Bootstrap.
- Uses **Markdown**.

Cons:

- Cannot automatically pull **API docs**.

Conclusion: #writethedocs



Eric Holscher

@ericholscher

Following



And Sphinx for documentation. Because nobody knows how to use the code without docs :)

Akash @sky0_1

Python libraries that were used to generate Black hole image.

astropy
ephem...

4:53 AM - 15 Apr 2019

18 Retweets 51 Likes



18

51

