# **Documentation System**

Release 10.3

**The Sage Development Team** 

# **CONTENTS**

1	Sage Doc Builders	1
2	Sphinx Extensions	13
Pyt	hon Module Index	27
Ind	ex	29

**CHAPTER** 

ONE

### SAGE DOC BUILDERS

# 1.1 Sage docbuild main

This module defines the Sage documentation build command:

```
sage --docbuild [OPTIONS] DOCUMENT (FORMAT | COMMAND)
```

If FORMAT is given, it builds DOCUMENT in FORMAT. If COMMAND is given, it returns information about DOCUMENT.

Run sage --docbuild to get detailed explanations about arguments and options.

### Positional arguments:

### Standard options:

```
-h, --help
                       show a help message and exit
-H, --help-all
                         show an extended help message and exit
-D, --documents
                        list all available DOCUMENTs
-F, --formats
                         list all output FORMATs
                      list all COMMANDs for DOCUMENT DOC; use 'all' to list all
-C DOC, --commands DOC
-i, --inherited
                         include inherited members in reference manual; may be slow, __
→may fail for PDF output
                         include variables prefixed with '_' in reference
-u, --underscore
                         manual; may be slow, may fail for PDF output
-j, --mathjax, --jsmath
                         ignored for backwards compatibility
--no-plot
                         do not include graphics auto-generated using the '.. plot'
→markup
--include-tests-blocks
                         include TESTS blocks in the reference manual
                         do not include PDF links in DOCUMENT 'website';
--no-pdf-links
                         FORMATs: html, json, pickle, web
--warn-links
                         issue a warning whenever a link is not properly
                         resolved; equivalent to '--sphinx-opts -n' (sphinx option:
→nitpicky)
--check-nested
                         check picklability of nested classes in DOCUMENT 'reference'
--no-prune-empty-dirs
                         do not prune empty directories in the documentation sources
-N, --no-colors
                         do not color output; does not affect children
-q, --quiet
                         work quietly; same as --verbose=0
-v LEVEL, --verbose LEVEL report progress at LEVEL=0 (quiet), 1 (normal), 2
```

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```
(info), or 3 (debug); does not affect children

-o DIR, --output DIR if DOCUMENT is a single file ('file=...'), write output to→

→this directory
```

### Advanced options:

```
-S OPTS, --sphinx-opts OPTS pass comma-separated OPTS to sphinx-build; must precede OPTS with '=', as in '-S=-q,-aE' or '-S="-q,-aE"'

-U, --update-mtimes before building reference manual, update modification times for auto-generated reST files

-k, --keep-going do not abort on errors but continue as much as possible after an error

--all-documents ARG if ARG is 'reference', list all subdocuments of en/reference. If ARG is 'all', list all main documents
```

### class sage\_docbuild.\_\_main\_\_.IntersphinxCache

Bases: object

Replace sphinx.ext.intersphinx.fetch\_inventory by an in-memory cached version.

### fetch\_inventory (app, uri, inv)

Return the result of sphinx.ext.intersphinx.fetch\_inventory() from a cache if possible. Otherwise, call sphinx.ext.intersphinx.fetch\_inventory() and cache the result.

```
sage_docbuild.__main__.format_columns (lst, align='<', cols=None, indent=4, pad=3, width=80)</pre>
```

Utility function that formats a list as a simple table and returns a Unicode string representation.

The number of columns is computed from the other options, unless it's passed as a keyword argument. For help on Python's string formatter, see

https://docs.python.org/library/string.html#format-string-syntax

```
sage_docbuild.__main__.get_formats()
```

Return a list of output formats the Sage documentation builder will accept on the command-line.

```
sage_docbuild.__main__.help_commands (name='all')
```

Append and return a tabular list of commands, if any, the Sage documentation builder can run on the indicated document. The default is to list all commands for all documents.

```
sage_docbuild.__main__.help_description(s=", compact=False)
```

Append and return a brief description of the Sage documentation builder.

If 'compact' is False, the function adds a final newline character.

```
sage_docbuild.__main__.help_documents()
```

Append and return a tabular list of documents, including a shortcut 'all' for all documents, available to the Sage documentation builder.

```
sage_docbuild.__main__.help_examples(s=")
```

Append and return some usage examples for the Sage documentation builder.

```
sage_docbuild.__main__.help_formats()
```

Append and return a tabular list of output formats available to the Sage documentation builder.

Bases: Action

Print an extended help message for the Sage documentation builder and exits.

Bases: Action

Print a help message for the Sage documentation builder.

The message includes command-line usage and a list of options. The message is printed only on the first call. If error is True during this call, the message is printed only if the user hasn't requested a list (e.g., documents, formats, commands).

```
sage_docbuild.__main__.help_usage(s=", compact=False)
```

Append and return a brief usage message for the Sage documentation builder.

If 'compact' is False, the function adds a final newline character.

Bases: Action

A helper wrapper for command-line options to the Sage documentation builder that print lists, such as document names, formats, and document-specific commands.

```
sage_docbuild.__main__.main()
sage_docbuild.__main__.setup_logger(verbose=1, color=True)
```

Set up a Python Logger instance for the Sage documentation builder.

The optional argument sets logger's level and message format.

**EXAMPLES:** 

```
sage: from sage_docbuild.__main__ import setup_logger, logger
sage: setup_logger()
sage: type(logger)
<class 'logging.Logger'>
```

```
sage_docbuild.__main__.setup_parser()
```

Set up and return a command-line ArgumentParser instance for the Sage documentation builder.

### 1.2 Documentation builders

This module is the starting point for building documentation, and is responsible to figure out what to build and with which options. The actual documentation build for each individual document is then done in a subprocess call to Sphinx, see <code>builder\_helper()</code>. Note that

- The builders are configured with build\_options.py;
- The Sphinx subprocesses are configured in conf.py.

DocBuilder is the base class of all Builders. It has builder helpers html(), latex(), pdf(), inventory(), etc, which are invoked depending on the output type. Each type corresponds with the Sphinx builder format, except that pdf is Sphinx latex builder plus compiling latex to pdf. Note that Sphinx inventory builder is not native to Sphinx

but provided by Sage. See sage\_docbuild/ext/inventory\_builder.py. The Sphinx inventory builder is a dummy builder with no actual output but produces doctree files in local/share/doctree and inventory.inv inventory files in local/share/inventory.

The reference manual is built in two passes, first by <code>ReferenceBuilder</code> with inventory output type and secondly with "html" output type. The <code>ReferenceBuilder</code> itself uses <code>ReferenceTopBuilder</code> and <code>ReferenceSubBuilder</code> and <code>ReferenceSubBuilder</code> to build subcomponents of the reference manual. The <code>ReferenceSubBuilder</code> examines the modules included in the subcomponent by comparing the modification times of the module files with the times saved in <code>local/share/doctree/reference.pickle</code> from the previous build. Then new rst files are generated for new and updated modules. See <code>get\_new\_and\_updated\_modules()</code>.

After github issue #31948, when Sage is built, ReferenceBuilder is not used and its responsibility is now taken by the Makefile in \$SAGE\_ROOT/src/doc.

### class sage\_docbuild.builders.AllBuilder

Bases: object

A class used to build all of the documentation.

```
get_all_documents()
```

Return a list of all of the documents.

A document is a directory within one of the language subdirectories of SAGE\_DOC\_SRC specified by the global LANGUAGES variable.

### **EXAMPLES:**

```
sage: from sage_docbuild.builders import AllBuilder
sage: documents = AllBuilder().get_all_documents()
sage: 'en/tutorial' in documents # optional - sage_spkg
True
sage: documents[0] == 'en/reference'
True
```

### class sage\_docbuild.builders.DocBuilder(name, lang='en')

Bases: object

### INPUT:

- name the name of a subdirectory in SAGE\_DOC\_SRC, such as 'tutorial' or 'bordeaux\_2008'
- lang (default "en") the language of the document.

```
changes (*args, **kwds)
clean (*args)
html (*args, **kwds)
htmlhelp (*args, **kwds)
inventory (*args, **kwds)
json (*args, **kwds)
latex (*args, **kwds)
```

### pdf()

Build the PDF files for this document.

This is done by first (re)-building the LaTeX output, going into that LaTeX directory, and running 'make all-pdf' there.

### **EXAMPLES:**

```
sage: from sage_docbuild.builders import DocBuilder
sage: b = DocBuilder('tutorial')
sage: b.pdf() #not tested
```

```
pickle (*args, **kwds)
web (*args, **kwds)
```

class sage\_docbuild.builders.ReferenceBuilder(name, lang='en')

Bases: AllBuilder

This class builds the reference manual. It uses DocBuilder to build the top-level page and ReferenceSubBuilder for each sub-component.

### get\_all\_documents(refdir)

Return a list of all reference manual components to build.

We add a component name if it's a subdirectory of the manual's directory and contains a file named 'index.rst'.

We return the largest component (most subdirectory entries) first since they will take the longest to build.

### **EXAMPLES:**

### class sage\_docbuild.builders.ReferenceSubBuilder(\*args, \*\*kwds)

Bases: DocBuilder

This class builds sub-components of the reference manual. It is responsible for making sure that the auto generated reST files for the Sage library are up to date.

When building any output, we must first go through and check to see if we need to update any of the autogenerated reST files. There are two cases where this would happen:

- 1. A new module gets added to one of the toctrees.
- 2. The actual module gets updated and possibly contains a new title.

### auto\_rest\_filename (module\_name)

Return the name of the file associated to a given module

**EXAMPLES:** 

### cache\_filename()

Return the filename where the pickle of the reference cache is stored.

### clean\_auto()

Remove all autogenerated reST files.

### get\_all\_included\_modules()

Return an iterator for all modules which are included in the reference manual.

```
get_all_rst_files (exclude_sage=True)
```

Return an iterator for all rst files which are not autogenerated.

```
get_cache()
```

Retrieve the reference cache which contains the options previously used by the reference builder.

If it doesn't exist, then we just return an empty dictionary. If it is corrupted, return an empty dictionary.

```
get_modified_modules()
```

Return an iterator for all the modules that have been modified since the documentation was last built.

### get\_module\_docstring\_title(module\_name)

Return the title of the module from its docstring.

### get\_modules (filename)

Given a filename for a reST file, return an iterator for all of the autogenerated reST files that it includes.

```
get_new_and_updated_modules()
```

Return an iterator for all new and updated modules that appear in the toctrees, and remove obsolete old modules.

### get\_sphinx\_environment()

Return the Sphinx environment for this project.

```
get_unincluded_modules()
```

Return an iterator for all the modules in the Sage library which are not included in the reference manual.

```
print_included_modules()
```

Print all of the modules that are included in the Sage reference manual.

```
print_modified_modules()
```

Print a list of all the modules that have been modified since the documentation was last built.

```
print_new_and_updated_modules()
```

Print all the modules that appear in the toctrees that are newly included or updated.

```
print_unincluded_modules()
```

Print all of the modules which are not included in the Sage reference manual.

```
save_cache()
```

Pickle the current reference cache for later retrieval.

### update\_mtimes()

Update the modification times for reST files in the Sphinx environment for this project.

```
write_auto_rest_file (module_name)
```

Write the autogenerated reST file for module\_name.

```
class sage_docbuild.builders.ReferenceTopBuilder(*args, **kwds)
```

Bases: DocBuilder

This class builds the top-level page of the reference manual.

html()

Build the top-level document.

```
class sage_docbuild.builders.SingleFileBuilder(path)
```

Bases: DocBuilder

This is the class used to build the documentation for a single user-specified file. If the file is called 'foo.py', then the documentation is built in DIR/foo/ if the user passes the command line option "-o DIR", or in  $DOT\_SAGE/docbuild/foo/$  otherwise.

```
class sage_docbuild.builders.WebsiteBuilder(name, lang='en')
```

Bases: DocBuilder

clean()

When we clean the output for the website index, we need to remove all of the HTML that were placed in the parent directory.

In addition, remove the index file installed into the root doc directory.

#### html()

After we have finished building the website index page, we copy everything one directory up, that is, to the base diectory html/en.

In addition, an index file is installed into the root doc directory.

Thus we have three index.html files:

html/en/website/index.html (not used) html/en/index.html (base directory) index.html (root doc directory)

pdf()

Build the website hosting pdf docs.

```
sage_docbuild.builders.build_many (target, args, processes=None)
```

Thin wrapper around  $sage_docbuild.utils.build_many$  which uses the docbuild settings NUM\_THREADS and ABORT\_ON\_ERROR.

```
sage_docbuild.builders.build_other_doc(args)
```

```
sage_docbuild.builders.build_ref_doc(args)
```

```
sage_docbuild.builders.builder_helper(type)
```

Return a function which builds the documentation for output type type.

```
sage_docbuild.builders.get_builder(name)
```

Return an appropriate Builder object for the document name.

DocBuilder and its subclasses do all the real work in building the documentation.

```
sage_docbuild.builders.get_documents()
```

Return a list of document names the Sage documentation builder will accept as command-line arguments.

# 1.3 Build options

This module defines options for building Sage documentation.

# 1.4 Sphinx build script

This is Sage's version of the sphinx-build script. We redirect stdout and stderr to our own logger, and remove some unwanted chatter.

```
class sage_docbuild.sphinxbuild.SageSphinxLogger(stream, prefix)
    Bases: object
    This implements the file object interface to serve as sys.stdout/sys.stderr replacement.
    ansi_escape_sequence = re.compile('\n \\x1b # ESC\n \\[ # CSI sequence
    starts\n [0-?]* # parameter bytes\n [ -/]* # intermediate bytes\n [@-~] #
    final byte\n ', re.VERBOSE)
    ansi_escape_sequence_color = re.compile('\n \\x1b # ESC\n \\[ # CSI
    sequence starts\n [0-9;]* # parameter bytes\n # intermediate bytes\n m #
    final byte\n ', re.VERBOSE)
    close()
    closed = False
    encoding = None
    flush()
    isatty()
    mode = 'w'
    name = '<log>'
    newlines = None
    prefix_len = 9
    raise_errors()
        Raise an exceptions if any errors have been found while parsing the Sphinx output.
        EXAMPLES:
```

```
sage: from sys import stdout
sage: from sage_docbuild.sphinxbuild import SageSphinxLogger
sage: logger = SageSphinxLogger(stdout, "doctesting")
sage: logger._log_line("This is a SEVERE error\n")
[doctestin] This is a SEVERE error
sage: logger.raise_errors()
Traceback (most recent call last):
...
OSError: This is a SEVERE error
```

```
softspace = 0
```

```
write(str)
writelines(sequence)
sage_docbuild.sphinxbuild.runsphinx()
sage_docbuild.sphinxbuild.term_width_line(text)
```

# 1.5 Sphinx build configuration

This file contains configuration needed to customize Sphinx input and output behavior.

```
class sage_docbuild.conf.SagecodeTransform(document, startnode=None)
    Bases: SphinxTransform
```

Transform a code block to a live code block enabled by jupyter-sphinx.

Effectively a code block like:

```
EXAMPLE::

sage: 1 + 1
2
```

is transformed into:

```
EXAMPLE::

sage: 1 + 1
2

.. ONLY:: html

.. JUPYTER-EXECUTE::
:hide-code:
:hide-output:
:raises:
:stderr:

1 + 1
```

enabling live execution of the code.

```
sage_docbuild.conf.call_intersphinx(app, env, node, contnode)
     Call intersphinx and make links between Sage manuals relative.
```

```
sage_docbuild.conf.check_nested_class_picklability(app, what, name, obj, skip, options)
```

Print a warning if pickling is broken for nested classes.

```
sage docbuild.conf.debug inf(app, message)
```

```
sage_docbuild.conf.find_sage_dangling_links (app, env, node, contnode)
```

Try to find dangling link in local module imports or all.py.

```
sage_docbuild.conf.nitpick_patch_config(app)
```

Patch the default config for nitpicky

Calling path\_config ensure that nitpicky is not considered as a Sphinx environment variable but rather as a Sage environment variable. As a consequence, changing it doesn't force the recompilation of the entire documentation.

```
sage_docbuild.conf.set_intersphinx_mappings(app, config)
```

Add precompiled inventory (the objects.inv)

```
sage_docbuild.conf.setup(app)
```

```
sage_docbuild.conf.skip_member(app, what, name, obj, skip, options)
```

To suppress Sphinx warnings / errors, we

- Don't include [aliases of] builtins.
- Don't include the docstring for any nested class which has been inserted into its module by sage.misc. NestedClassMetaclass only for pickling. The class will be properly documented inside its surrounding class.
- Optionally, check whether pickling is broken for nested classes.
- Optionally, include objects whose name begins with an underscore ('\_'), i.e., "private" or "hidden" attributes, methods, etc.

Otherwise, we abide by Sphinx's decision. Note: The object obj is excluded (included) if this handler returns True (False).

### 1.6 Utilities

```
exception sage_docbuild.utils.RemoteException(tb: str)
```

Bases: Exception

Raised if an exception occurred in one of the child processes.

tb: str

```
class sage_docbuild.utils.RemoteExceptionWrapper(exc: BaseException)
```

Bases: object

Used by child processes to capture exceptions thrown during execution and report them to the main process, including the correct traceback.

exc: BaseException

tb: str

**exception** sage\_docbuild.utils.WorkerDiedException (message: str | None, original\_exception:

BaseException | None = None)

Bases: RuntimeError

Raised if a worker process dies unexpected.

```
original_exception: BaseException | None
```

```
sage_docbuild.utils.build_many (target, args, processes=None)
```

Map a list of arguments in args to a single-argument target function target in parallel using multiprocessing.cpu count() (or processes if given) simultaneous processes.

This is a simplified version of multiprocessing.Pool.map from the Python standard library which avoids a couple of its pitfalls. In particular, it can abort (with a RuntimeError) without hanging if one of the worker processes unexpectedly dies. It also has semantics equivalent to maxtasksperchild=1; that is, one process is started per argument. As such, this is inefficient for processing large numbers of fast tasks, but appropriate for running longer tasks (such as doc builds) which may also require significant cleanup.

It also avoids starting new processes from a pthread, which results in at least one known issue:

• When PARI is built with multi-threading support, forking a Sage process from a thread leaves the main Pari interface instance broken (see github issue #26608#comment:38).

In the future this may be replaced by a generalized version of the more robust parallel processing implementation from sage.doctest.forker.

#### **EXAMPLES:**

```
sage: from sage_docbuild.utils import build_many
sage: def target(N):
...:    import time
...:    time.sleep(float(0.1))
...:    print('Processed task %s' % N)
sage: _ = build_many(target, range(8), processes=8)
Processed task ...
```

This version can also return a result, and thus can be used as a replacement for multiprocessing. Pool.map (i.e. it still blocks until the result is ready):

```
sage: def square(N):
    return N * N
sage: build_many(square, range(100))
[0, 1, 4, 9, ..., 9604, 9801]
```

If the target function raises an exception in any of the workers, build\_many raises that exception and all other results are discarded. Any in-progress tasks may still be allowed to complete gracefully before the exception is raised:

```
sage: def target(N):
....: import time, os, signal
....: if N == 4:
....: # Task 4 is a poison pill
(continues on next page)
```

1.6. Utilities 11

(continued from previous page)

```
1 / 0
...: else:
...: time.sleep(float(0.5))
...: print('Processed task %s' % N)
```

Note: In practice this test might still show output from the other worker processes before the poison-pill is executed. It may also display the traceback from the failing process on stderr. However, due to how the doctest runner works, the doctest will only expect the final exception:

```
sage: build_many(target, range(8), processes=8)
Traceback (most recent call last):
...
    raise ZeroDivisionError("rational division by zero")
ZeroDivisionError: rational division by zero
...
    raise worker_exc.original_exception
ZeroDivisionError: rational division by zero
```

Similarly, if one of the worker processes dies unexpectedly otherwise exits non-zero (e.g. killed by a signal) any in-progress tasks will be completed gracefully, but then a RuntimeError is raised and pending tasks are not started:

```
sage: def target(N):
....: import time, os, signal
....: if N == 4:
....: # Task 4 is a poison pill
....: os.kill(os.getpid(), signal.SIGKILL)
....: else:
....: time.sleep(float(0.5))
....: print('Processed task %s' % N)
sage: build_many(target, range(8), processes=8)
Traceback (most recent call last):
...
WorkerDiedException: worker for 4 died with non-zero exit code -9
```

**CHAPTER** 

**TWO** 

### SPHINX EXTENSIONS

# 2.1 Inventory builder

A customized builder which only generates intersphinx "object.inv" inventory files. The documentation files are not written.

Bases: DummyBuilder

A customized builder which only generates intersphinx "object.inv" inventory files. The documentation files are not written.

```
epilog = 'The inventory file is in %(outdir)s.'
```

The message emitted upon successful build completion. This can be a printf-style template string with the following keys: outdir, project

### finish()

Only write the inventory files.

### format = 'inventory'

The builder's output format, or "if no document output is produced.

```
get_outdated_docs()
```

Return an iterable of output files that are outdated.

```
get_target_uri (docname, typ=None)
```

Return the target URI for a document name.

```
name = 'inventory'
```

The builder's name, for the -b command line option.

sage\_docbuild.ext.inventory\_builder.setup(app)

### 2.2 Sage autodoc extension

This is sphinx.ext.autodoc extension modified for Sage objects.

The original header of sphinx.ext.autodoc:

Extension to create automatic documentation from code docstrings.

Automatically insert docstrings for functions, classes or whole modules into the doctree, thus avoiding duplication between docstrings and documentation for those who like elaborate docstrings.

This module is currently based on sphinx.ext.autodoc from Sphinx version 7.2.6. Compare (do diff) with the upstream source file sphinx/ext/autodoc/\_\_init\_\_.py.

In the source file of this module, major modifications are delimited by a pair of comment dividers. To lessen maintenance burden, we aim at reducing the modifications.

### **AUTHORS:**

- ? (before 2011): initial version derived from sphinx.ext.autodoc
- Johan S. R. Nielsen: support for \_sage\_argspec\_
- Simon King (2011-04): use sageinspect; include public cython attributes only in the documentation if they have a
  docstring
- Kwankyu Lee (2018-12-26, 2022-11-08): rebased on the latest sphinx.ext.autodoc
- Kwankyu Lee (2024-02-14): rebased on Sphinx 7.2.6

Bases: GenericAliasMixin, SlotsMixin, RuntimeInstanceAttributeMixin, UninitializedInstanceAttributeMixin, NonDataDescriptorMixin, DocstringStripSignatureMixin, ClassLevelDocumenter

Specialized Documenter subclass for attributes.

```
add_content (more_content)
add_directive_header (sig)

classmethod can_document_member (member, membername, isattr, parent)

document_members (all_members=False)

get_attribute_comment (parent, attrname)

get_doc()

get_real_modname()

import_object (raiseerror=False)

static is_function_or_method(obj)

member_order = 60
    order if autodoc_member_order is set to 'groupwise'

objtype = 'attribute'
    name by which the directive is called (auto...) and the default generated directive name
```

```
option_spec: OptionSpec = {'annotation': <function annotation_option>,
    'no-index': <function bool_option>, 'no-value': <function bool_option>,
    'noindex': <function bool option>}
    priority = 10
        priority if multiple documenters return True from can document member
    should_suppress_value_header()
    update_annotations (parent)
        Update __annotations__ to support type_comment and so on.
class sage docbuild.ext.sage autodoc.ClassDocumenter(*args: Any)
    Bases: DocstringSignatureMixin, ModuleLevelDocumenter
    Specialized Documenter subclass for classes.
    add_content (more_content)
    add_directive_header(sig)
    classmethod can_document_member(member, membername, isattr, parent)
    document_members (all_members=False)
    format_args (**kwargs)
    format_signature(**kwargs)
    generate (more content=None, real modname=None, check module=False, all members=False)
    get canonical fullname()
    get_doc()
    get_object_members(want_all)
    get_overloaded_signatures()
    get_variable_comment()
    import_object (raiseerror=False)
    member_order = 20
        order if autodoc_member_order is set to 'groupwise'
    objtype = 'class'
        name by which the directive is called (auto...) and the default generated directive name
    option_spec: OptionSpec = {'class-doc-from': <function</pre>
    class_doc_from_option>, 'exclude-members': <function</pre>
    exclude_members_option>, 'inherited-members': <function</pre>
    inherited members option>, 'member-order': <function
    member_order_option>, 'members': <function members_option>, 'no-index':
    <function bool_option>, 'noindex': <function bool_option>,
    'private-members': <function members_option>, 'show-inheritance':
    <function bool_option>, 'special-members': <function members_option>,
    'undoc-members': <function bool_option>}
```

```
priority = 15
         priority if multiple documenters return True from can_document_member
class sage_docbuild.ext.sage_autodoc.ClassLevelDocumenter (directive: DocumenterBridge,
                                                                      name: str, indent: str = ")
     Bases: Documenter
     Specialized Documenter subclass for objects on class level (methods, attributes).
     resolve_name (modname, parents, path, base)
class sage_docbuild.ext.sage_autodoc.DataDocumenter(directive: DocumenterBridge, name: str,
                                                              indent: str = ")
     Bases: GenericAliasMixin, UninitializedGlobalVariableMixin, ModuleLevelDocu-
     menter
     Specialized Documenter subclass for data items.
     add_content (more_content)
     add_directive_header(sig)
     classmethod can_document_member (member, membername, isattr, parent)
     document_members (all_members=False)
     get_doc()
     get_module_comment (attrname)
     get_real_modname()
     import_object (raiseerror=False)
     member_order = 40
         order if autodoc_member_order is set to 'groupwise'
     objtype = 'data'
         name by which the directive is called (auto...) and the default generated directive name
     option_spec: OptionSpec = {'annotation': <function annotation_option>,
     'no-index': <function bool_option>, 'no-value': <function bool_option>,
     'noindex': <function bool_option>}
     priority = -10
         priority if multiple documenters return True from can_document_member
     should_suppress_value_header()
     update_annotations (parent)
         Update __annotations__ to support type_comment and so on.
class sage_docbuild.ext.sage_autodoc.DataDocumenterMixinBase
     Bases: object
     config: Config
     env: BuildEnvironment
```

```
modname: str
     object: Any
     objpath: list[str]
     parent: Any
     should_suppress_directive_header()
         Check directive header should be suppressed.
     should_suppress_value_header()
         Check :value: header should be suppressed.
     update_content (more_content)
         Update docstring, for example with TypeVar variance.
class sage_docbuild.ext.sage_autodoc.DecoratorDocumenter(directive: DocumenterBridge,
                                                                       name: str, indent: str = ")
     Bases: FunctionDocumenter
     Specialized Documenter subclass for decorator functions.
     format_args (**kwargs)
     objtype = 'decorator'
         name by which the directive is called (auto...) and the default generated directive name
     priority = -1
         priority if multiple documenters return True from can document member
class sage_docbuild.ext.sage_autodoc.DocstringSignatureMixin
     Bases: object
     Mixin for FunctionDocumenter and MethodDocumenter to provide the feature of reading the signature from the
     format_signature (**kwargs)
     get_doc()
class sage_docbuild.ext.sage_autodoc.DocstringStripSignatureMixin
     Bases: DocstringSignatureMixin
     Mixin for AttributeDocumenter to provide the feature of stripping any function signature from the docstring.
     format_signature (**kwargs)
class sage_docbuild.ext.sage_autodoc.Documenter(directive: DocumenterBridge, name: str,
                                                            indent: str = ")
     Bases: object
```

A Documenter knows how to autodocument a single object type. When registered with the AutoDirective, it will be used to document objects of that type when needed by autodoc.

Its *objtype* attribute selects what auto directive it is assigned to (the directive name is 'auto' + objtype), and what directive it generates by default, though that can be overridden by an attribute called *directivetype*.

A Documenter has an *option\_spec* that works like a docutils directive's; in fact, it will be used to parse an auto directive's options that matches the Documenter.

### add\_content (more\_content)

Add content from docstrings, attribute documentation and user.

### add\_directive\_header(sig)

Add the directive header and options to the generated content.

```
add_line (line, source, *lineno)
```

Append one line of generated reST to the output.

### classmethod can\_document\_member (member, membername, isattr, parent)

Called to see if a member can be documented by this Documenter.

### check\_module()

Check if *self.object* is really defined in the module given by *self.modname*.

### content\_indent = ' '

indentation by which to indent the directive content

### document\_members (all\_members=False)

Generate reST for member documentation.

If *all\_members* is True, document all members, else those given by *self.options.members*.

### property documenters: dict[str, type[Documenter]]

Returns registered Documenter classes

### filter\_members (members, want\_all)

Filter the given member list.

Members are skipped if

- they are private (except if given explicitly or the private-members option is set)
- they are special methods (except if given explicitly or the special-members option is set)
- they are undocumented (except if the undoc-members option is set)

The user can override the skipping decision by connecting to the autodoc-skip-member event.

### format\_args (\*\*kwargs)

Format the argument signature of self.object.

Should return None if the object does not have a signature.

### format name()

Format the name of self.object.

This normally should be something that can be parsed by the generated directive, but doesn't need to be (Sphinx will display it unparsed then).

### format\_signature(\*\*kwargs)

Format the signature (arguments and return annotation) of the object.

Let the user process it via the autodoc-process-signature event.

### **generate** (more\_content=None, real\_modname=None, check\_module=False, all\_members=False)

Generate reST for the object given by *self.name*, and possibly for its members.

If *more\_content* is given, include that content. If *real\_modname* is given, use that module name to find attribute docs. If *check\_module* is True, only generate if the object is defined in the module name it is imported from. If *all\_members* is True, document all members.

```
get_attr(obj, name, *defargs)
```

getattr() override for types such as Zope interfaces.

### get\_doc()

Decode and return lines of the docstring(s) for the object.

When it returns None, autodoc-process-docstring will not be called for this object.

```
get_object_members(want_all)
```

Return  $(members_check_module, members)$  where members is a list of (membername, member) pairs of the members of self.object.

If want\_all is True, return all members. Else, only return those members given by self.options.members (which may also be None).

### get\_real\_modname()

Get the real module name of an object to document.

It can differ from the name of the module through which the object was imported.

```
get_sourcename()
```

```
import_object (raiseerror=False)
```

Import the object given by self.modname and self.objpath and set it as self.object.

Returns True if successful, False if an error occurred.

### member order = 0

order if autodoc\_member\_order is set to 'groupwise'

### objtype = 'object'

name by which the directive is called (auto...) and the default generated directive name

```
option_spec: OptionSpec = {'no-index': <function bool_option>, 'noindex':
<function bool_option>}
```

```
parse_name()
```

Determine what module to import and what attribute to document.

Returns True and sets self.modname, self.objpath, self.fullname, self.args and self.retann if parsing and resolving was successful.

### priority = 0

priority if multiple documenters return True from can\_document\_member

### process\_doc (docstrings)

Let the user process the docstrings before adding them.

```
resolve_name (modname, parents, path, base)
```

Resolve the module and name of the object to document given by the arguments and the current module/class.

Must return a pair of the module name and a chain of attributes; for example, it would return ('zipfile', ['ZipFile', 'open']) for the zipfile.ZipFile.open method.

### sort members (documenters, order)

Sort the given member list.

### titles\_allowed = True

true if the generated content may contain titles

```
class sage_docbuild.ext.sage_autodoc.ExceptionDocumenter(*args: Any)
     Bases: ClassDocumenter
     Specialized ClassDocumenter subclass for exceptions.
     classmethod can_document_member (member, membername, isattr, parent)
     member order = 10
          order if autodoc_member_order is set to 'groupwise'
     objtype = 'exception'
          name by which the directive is called (auto...) and the default generated directive name
     priority = 20
          priority if multiple documenters return True from can_document_member
class sage_docbuild.ext.sage_autodoc.FunctionDocumenter (directive: Documenter Bridge,
                                                                       name: str, indent: str = ")
     Bases: DocstringSignatureMixin, ModuleLevelDocumenter
     Specialized Documenter subclass for functions.
     add_directive_header(sig)
     annotate_to_first_argument (func, typ)
          Annotate type hint to the first argument of function if needed.
     classmethod can_document_member (member, membername, isattr, parent)
     document members (all members=False)
     format args (**kwargs)
     format_signature (**kwargs)
     member_order = 30
          order if autodoc_member_order is set to 'groupwise'
     merge_default_value(actual, overload)
          Merge default values of actual implementation to the overload variants.
     objtype = 'function'
          name by which the directive is called (auto...) and the default generated directive name
class sage_docbuild.ext.sage_autodoc.GenericAliasMixin
     Bases: DataDocumenterMixinBase
     Mixin for DataDocumenter and AttributeDocumenter to provide the feature for supporting GenericAliases.
     should_suppress_directive_header()
     update_content (more_content)
sage_docbuild.ext.sage_autodoc.INSTANCEATTR = <object object>
     The base class of the class hierarchy.
     When called, it accepts no arguments and returns a new featureless instance that has no instance attributes and
```

cannot be given any.

```
class sage_docbuild.ext.sage_autodoc.MethodDocumenter(directive: DocumenterBridge, name:
                                                                     str. indent: str = "
     Bases: DocstringSignatureMixin, ClassLevelDocumenter
     Specialized Documenter subclass for methods (normal, static and class).
     add_directive_header(sig)
     annotate_to_first_argument(func, typ)
          Annotate type hint to the first argument of function if needed.
     classmethod can_document_member (member, membername, isattr, parent)
     directivetype = 'method'
     document_members (all_members=False)
     format_args (**kwargs)
     get_doc()
     import_object (raiseerror=False)
     member order = 50
          order if autodoc_member_order is set to 'groupwise'
     merge_default_value(actual, overload)
          Merge default values of actual implementation to the overload variants.
     objtype = 'method'
          name by which the directive is called (auto...) and the default generated directive name
     priority = 1
          priority if multiple documenters return True from can document member
class sage_docbuild.ext.sage_autodoc.ModuleDocumenter(*args: Any)
     Bases: Documenter
     Specialized Documenter subclass for modules.
     add_content (more_content)
     add_directive_header(sig)
     classmethod can document_member (member, membername, isattr, parent)
     content_indent = ''
          indentation by which to indent the directive content
     get_module_members()
          Get members of target module.
     get_object_members(want_all)
     import_object (raiseerror=False)
     objtype = 'module'
          name by which the directive is called (auto...) and the default generated directive name
```

```
option_spec: OptionSpec = {'deprecated': <function bool_option>,
    'exclude-members': <function exclude_members_option>, 'ignore-module-all':
    <function bool option>, 'imported-members': <function bool option>,
    'inherited_members': <function inherited_members_option>, 'member-order':
    <function member_order_option>, 'members': <function members_option>,
    'no-index': <function bool_option>, 'no-value': <function bool_option>,
    'noindex': <function bool option>, 'platform': <function identity>,
     'private-members': <function members_option>, 'show-inheritance':
    <function bool_option>, 'special-members': <function members_option>,
    'synopsis': <function identity>, 'undoc-members': <function bool_option>}
    parse_name()
    resolve name (modname, parents, path, base)
    sort members (documenters, order)
class sage_docbuild.ext.sage_autodoc.ModuleLevelDocumenter(directive: DocumenterBridge,
                                                                 name: str, indent: str = ")
    Bases: Documenter
    Specialized Documenter subclass for objects on module level (functions, classes, data/constants).
    resolve_name (modname, parents, path, base)
class sage_docbuild.ext.sage_autodoc.NonDataDescriptorMixin
    Bases: DataDocumenterMixinBase
    Mixin for AttributeDocumenter to provide the feature for supporting non data-descriptors.
```

**Note:** This mix-in must be inherited after other mix-ins. Otherwise, docstring and :value: header will be suppressed unexpectedly.

```
get_doc()
     import_object (raiseerror=False)
     should_suppress_value_header()
class sage_docbuild.ext.sage_autodoc.ObjectMember (name: str, obj: Any, *, docstring: str | None
                                                              = None, class_: Any | None = None,
                                                              skipped: bool = False)
     Bases: object
```

A member of object.

This is used for the result of  $Documenter.get_module_members()$  to represent each member of the object.

Note: An instance of this class behaves as a tuple of (name, object) for compatibility to old Sphinx. The behavior will be dropped in the future. Therefore extensions should not use the tuple interface.

```
class sage_docbuild.ext.sage_autodoc.Options
    Bases: dict
```

A dict/attribute hybrid that returns None on nonexisting keys.

```
copy()
class sage_docbuild.ext.sage_autodoc.PropertyDocumenter(directive: DocumenterBridge,
                                                                         name: str. indent: str = "
     Bases: DocstringStripSignatureMixin, ClassLevelDocumenter
     Specialized Documenter subclass for properties.
     add_directive_header(sig)
     classmethod can document member (member, membername, isattr, parent)
     document members (all members=False)
     format args (**kwargs)
     get_real_modname()
     import_object (raiseerror=False)
          Check the exisitence of uninitialized instance attribute when failed to import the attribute.
     member_order = 60
          order if autodoc_member_order is set to 'groupwise'
     objtype = 'property'
          name by which the directive is called (auto...) and the default generated directive name
     priority = 11
          priority if multiple documenters return True from can_document_member
class sage_docbuild.ext.sage_autodoc.RuntimeInstanceAttributeMixin
     Bases: DataDocumenterMixinBase
     Mixin for AttributeDocumenter to provide the feature for supporting runtime instance attributes (that are defined
     in __init__() methods with doc-comments).
     Example:
          class Foo:
              def __init__(self):
                  self.attr = None #: This is a target of this mix-in.
     RUNTIME_INSTANCE_ATTRIBUTE
     get_doc()
     import object (raiseerror=False)
          Check the existence of runtime instance attribute after failing to import the attribute.
     is_runtime_instance_attribute(parent)
          Check the subject is an attribute defined in init ().
     is runtime instance attribute not commented (parent)
          Check the subject is an attribute defined in __init__() without comment.
     should_suppress_value_header()
```

```
class sage_docbuild.ext.sage_autodoc.SlotsMixin
     Bases: DataDocumenterMixinBase
     Mixin for AttributeDocumenter to provide the feature for supporting slots .
     get_doc()
     import_object (raiseerror=False)
     isslotsattribute()
          Check the subject is an attribute in __slots__.
     should_suppress_value_header()
class sage_docbuild.ext.sage_autodoc.UninitializedGlobalVariableMixin
     Bases: DataDocumenterMixinBase
     Mixin for DataDocumenter to provide the feature for supporting uninitialized (type annotation only) global vari-
     ables.
     get_doc()
     import_object (raiseerror=False)
     should_suppress_value_header()
class sage_docbuild.ext.sage_autodoc.UninitializedInstanceAttributeMixin
     Bases: DataDocumenterMixinBase
     Mixin for AttributeDocumenter to provide the feature for supporting uninitialized instance attributes (PEP-526
     styled, annotation only attributes).
     Example:
          class Foo:
              attr: int #: This is a target of this mix-in.
     get_doc()
     import object (raiseerror=False)
          Check the exisitence of uninitialized instance attribute when failed to import the attribute.
     is_uninitialized_instance_attribute(parent)
          Check the subject is an annotation only attribute.
     should_suppress_value_header()
sage_docbuild.ext.sage_autodoc.annotation_option(arg)
sage_docbuild.ext.sage_autodoc.autodoc_attrgetter(app, obj, name, *defargs)
     Alternative getattr() for types
sage_docbuild.ext.sage_autodoc.between (marker, what=None, keepempty=False, exclude=False)
     Return a listener that either keeps, or if exclude is True excludes, lines between lines that match the marker regular
     expression. If no line matches, the resulting docstring would be empty, so no change will be made unless keepempty
     is true.
     If what is a sequence of strings, only docstrings of a type in what will be processed.
sage_docbuild.ext.sage_autodoc.bool_option(arg)
     Used to convert flag options to auto directives. (Instead of directives.flag(), which returns None).
```

```
Used to convert the :class-doc-from: option to autoclass directives.
sage_docbuild.ext.sage_autodoc.cut_lines(pre, post=0, what=None)
     Return a listener that removes the first pre and last post lines of every docstring. If what is a sequence of strings,
     only docstrings of a type in what will be processed.
     Use like this (e.g. in the setup () function of conf.py):
     from sphinx.ext.autodoc import cut_lines
     app.connect('autodoc-process-docstring', cut_lines(4, what=['module']))
     This can (and should) be used in place of automodule_skip_lines.
sage_docbuild.ext.sage_autodoc.exclude_members_option(arg)
     Used to convert the :exclude-members: option.
sage_docbuild.ext.sage_autodoc.getdoc(obj, *args, **kwargs)
sage_docbuild.ext.sage_autodoc.identity(x)
sage_docbuild.ext.sage_autodoc.inherited_members_option(arg)
     Used to convert the :inherited-members: option to auto directives.
sage_docbuild.ext.sage_autodoc.member_order_option(arg)
     Used to convert the :member-order: option to auto directives.
sage_docbuild.ext.sage_autodoc.members_option(arg)
     Used to convert the :members: option to auto directives.
sage docbuild.ext.sage autodoc.merge members option(options)
     Merge :private-members: and :special-members: options to the :members: option.
sage_docbuild.ext.sage_autodoc.py_ext_sig_re = re.compile('^ ([\\w.]+::)? #
explicit module name\n ([\w.]+\.)? \# module and/or class name(s)\n (\w+)
\  # thing name\n (?: \\[\\s*(.*)\\s*])? , re.VERBOSE)
     extended signature RE: with explicit module name separated by "::"
sage_docbuild.ext.sage_autodoc.setup(app)
```

sage\_docbuild.ext.sage\_autodoc.class\_doc\_from\_option(arg)

# 2.3 Sage multidocs extension

The goal of this extension is to manage a multi-documentation in Sphinx. To be able to compile Sage's huge documentation in parallel, the documentation is cut into a bunch of independent documentations called "sub-docs", which are compiled separately. There is a master document which points to all the sub-docs. The intersphinx extension ensures that the cross-link between the sub-docs are correctly resolved. However some work is needed to build a global index. This is the goal of the multidocs extension.

More precisely this extension ensures the correct merging of

- · the todo list if this extension is activated
- the python indexes
- the list of python modules
- · the javascript index

```
· the citations
```

```
sage_docbuild.ext.multidocs.citation_dir(app)
```

 $\verb|sage_docbuild.ext.multidocs.fetch_citation| (app, env)$ 

Fetch the global citation index from the refman to allow for cross references.

sage\_docbuild.ext.multidocs.fix\_path\_html(app, pagename, templatename, ctx, event\_arg)

Fix the context so that the files

- search.html
- genindex.html
- py-modindex.html

point to the right place, that is in reference/instead of reference/subdocument.

```
sage_docbuild.ext.multidocs.get_env(app, curdoc)
```

Get the environment of a sub-doc from the pickle

```
sage_docbuild.ext.multidocs.get_js_index(app, curdoc)
```

Get the JS index of a sub-doc from the file

```
sage_docbuild.ext.multidocs.init_subdoc(app)
```

Init the merger depending on if we are compiling a sub-doc or the master doc itself.

```
sage_docbuild.ext.multidocs.merge_environment(app, env)
```

Merge the following attributes of the sub-docs environment into the main environment:

- titles Titles
- $\bullet$  todo\_all\_todos todo's
- indexentries global python index
- all\_docs needed by the is index
- citations citations
- domaindata['py']['modules'] list of python modules

```
sage_docbuild.ext.multidocs.merge_js_index(app)
```

Merge the JS indexes of the sub-docs into the main JS index

```
\verb|sage_docbuild.ext.multidocs.setup| (app)
```

```
sage_docbuild.ext.multidocs.write_citations(app, citations)
```

Pickle the citation in a file.

# **PYTHON MODULE INDEX**

### S

```
sage_docbuild.__main__,1
sage_docbuild.build_options,8
sage_docbuild.builders,3
sage_docbuild.conf,9
sage_docbuild.ext.inventory_builder,13
sage_docbuild.ext.multidocs,25
sage_docbuild.ext.sage_autodoc,14
sage_docbuild.sphinxbuild,8
sage_docbuild.utils,10
```

28 Python Module Index

# **INDEX**

A	Documenter method), 20			
add_content() (sage_docbuild.ext.sage_autodoc.At- tributeDocumenter method), 14	<pre>annotate_to_first_argument()     (sage_docbuild.ext.sage_autodoc.Method-</pre>			
add_content() (sage_docbuild.ext.sage_autodoc.Class-	Documenter method), 21 annotation_option() (in module			
Documenter method), 15	sage_docbuild.ext.sage_autodoc), 24			
add_content() (sage_docbuild.ext.sage_autodoc.Data-	ansi_escape_sequence			
Documenter method), 16	(sage_docbuild.sphinxbuild.SageSphinxLog-			
add_content() (sage_docbuild.ext.sage_autodoc.Doc-umenter method), 17	ger attribute), 8			
add_content() (sage_docbuild.ext.sage_autodoc.Mod-	ansi_escape_sequence_color			
uleDocumenter method), 21	(sage_docbuild.sphinxbuild.SageSphinxLog-			
add_directive_header()	<pre>ger attribute), 8 apply() (sage_docbuild.conf.SagecodeTransform</pre>			
(sage_docbuild.ext.sage_autodoc.Attribute-	method), 9			
Documenter method), 14	AttributeDocumenter (class in			
add_directive_header()	sage_docbuild.ext.sage_autodoc), 14			
(sage_docbuild.ext.sage_autodoc.ClassDocu-	<pre>auto_rest_filename()</pre>			
menter method), 15	(sage_docbuild.builders.ReferenceSubBuilder			
add_directive_header() (sage_docbuild.ext.sage_autodoc.DataDocu-	method), 5			
menter method), 16	<pre>autodoc_attrgetter()</pre>			
add_directive_header()	sage_docbuild.ext.sage_autodoc), 24			
(sage_docbuild.ext.sage_autodoc.Documenter				
method), 18	В			
add_directive_header()	between() (in module sage_docbuild.ext.sage_autodoc),			
(sage_docbuild.ext.sage_autodoc.Function-	24			
Documenter method), 20	bool_option() (in module			
add_directive_header()	sage_docbuild.ext.sage_autodoc), 24			
(sage_docbuild.ext.sage_autodoc.Method-	<pre>build_many() (in module sage_docbuild.builders), 7</pre>			
Documenter method), 21	build_many() (in module sage_docbuild.utils), 11			
add_directive_header()	build_other_doc() (in module			
(sage_docbuild.ext.sage_autodoc.Module-	sage_docbuild.builders), 7			
Documenter method), 21	<pre>build_ref_doc() (in module sage_docbuild.builders),</pre>			
add_directive_header()	7			
(sage_docbuild.ext.sage_autodoc.Property-	builder_helper() (in module			
Documenter method), 23	sage_docbuild.builders), 7			
add_line() (sage_docbuild.ext.sage_autodoc.Docu- menter method), 18	С			
add_page_context() (in module	<pre>cache_filename() (sage_docbuild.builders.Refer-</pre>			
sage_docbuild.conf), 9	enceSubBuilder method), 6			
AllBuilder (class in sage_docbuild.builders), 4	call_intersphinx() (in module			
annotate_to_first_argument()	sage_docbuild.conf), 9			
(sage_docbuild.ext.sage_autodoc.Function-				

can_document_member()	content_indent(sage_docbuild.ext.sage_autodoc.Mod-			
(sage_docbuild.ext.sage_autodoc.Attribute- Documenter class method), 14	uleDocumenter attribute), 21 copy () (sage_docbuild.ext.sage_autodoc.Options			
can_document_member()	method), 22			
(sage_docbuild.ext.sage_autodoc.ClassDocu-	cut_lines() (in module			
menter class method), 15	sage_docbuild.ext.sage_autodoc), 25			
can_document_member()	0 - 0 - //			
(sage_docbuild.ext.sage_autodoc.DataDocu-	D			
menter class method), 16	DataDocumenter (class in			
can_document_member()	sage_docbuild.ext.sage_autodoc), 16			
(sage_docbuild.ext.sage_autodoc.Documenter	DataDocumenterMixinBase (class in			
class method), 18	sage_docbuild.ext.sage_autodoc), 16			
can_document_member()	debug_inf() (in module sage_docbuild.conf), 10			
(sage_docbuild.ext.sage_autodoc.Exception-	DecoratorDocumenter (class in			
Documenter class method), 20	sage_docbuild.ext.sage_autodoc), 17			
can_document_member()	default_priority (sage_docbuild.conf.Sagecode-			
(sage_docbuild.ext.sage_autodoc.Function-	Transform attribute), 9			
Documenter class method), 20	directivetype(sage_docbuild.ext.sage_autodoc.Method-			
can_document_member()	Documenter attribute), 21			
(sage_docbuild.ext.sage_autodoc.Method-	DocBuilder (class in sage_docbuild.builders), 4			
Documenter class method), 21	DocstringSignatureMixin (class in			
can_document_member()	sage_docbuild.ext.sage_autodoc), 17			
(sage_docbuild.ext.sage_autodoc.Module-	DocstringStripSignatureMixin (class in			
Documenter class method), 21	sage_docbuild.ext.sage_autodoc), 17			
can_document_member()	document_members()			
(sage_docbuild.ext.sage_autodoc.Property-	(sage_docbuild.ext.sage_autodoc.Attribute-			
Documenter class method), 23	Documenter method), 14			
changes () (sage_docbuild.builders.DocBuilder	document_members()			
method), 4	(sage_docbuild.ext.sage_autodoc.ClassDocu-			
check_module()(sage_docbuild.ext.sage_autodoc.Doc-	menter method), 15			
umenter method), 18	document_members()			
<pre>check_nested_class_picklability() (in</pre>	(sage_docbuild.ext.sage_autodoc.DataDocu-			
module sage_docbuild.conf), 10	menter method), 16			
<pre>citation_dir() (in module sage_docbuild.ext.multi-</pre>	document_members()			
docs), 26	(sage_docbuild.ext.sage_autodoc.Documenter			
<pre>class_doc_from_option()</pre>	method), 18			
sage_docbuild.ext.sage_autodoc), 24	document_members()			
ClassDocumenter (class in				
sage_docbuild.ext.sage_autodoc), 15	Documenter method), 20			
ClassLevelDocumenter (class in	document_members()			
sage_docbuild.ext.sage_autodoc), 16	(sage_docbuild.ext.sage_autodoc.Method-			
clean() (sage_docbuild.builders.DocBuilder method), 4	Documenter method), 21			
clean() (sage_docbuild.builders.WebsiteBuilder	document_members()			
method), 7	(sage_docbuild.ext.sage_autodoc.Property-			
<pre>clean_auto() (sage_docbuild.builders.ReferenceSub-</pre>	Documenter method), 23			
Builder method), 6	Documenter (class in sage_docbuild.ext.sage_autodoc),			
<pre>close() (sage_docbuild.sphinxbuild.SageSphinxLogger</pre>	17			
method), $8$	documenters (sage_docbuild.ext.sage_autodoc.Docu-			
<pre>closed (sage_docbuild.sphinxbuild.SageSphinxLogger at-</pre>	menter property), 18			
tribute), 8				
config (sage_docbuild.ext.sage_autodoc.DataDocu-	E			
menterMixinBase attribute), 16	encoding (sage_docbuild.sphinxbuild.SageSphinxLogger			
content_indent (sage_docbuild.ext.sage_autodoc.Doc-umenter attribute), 18	attribute), 8			

env (sage_docbuild.ext.sage_autodoc.DataDocumenter- MixinBase attribute), 16	(sage_docbuild.ext.sage_autodoc.Documenter method), 18
epilog (sage_docbuild.ext.inventory_builder.Inventory-	<pre>format_signature()</pre>
Builder attribute), 13	(sage_docbuild.ext.sage_autodoc.Function-
exc (sage_docbuild.utils.RemoteExceptionWrapper at-	Documenter method), 20
tribute), 10	FunctionDocumenter (class in
ExceptionDocumenter (class in	sage_docbuild.ext.sage_autodoc), 20
sage_docbuild.ext.sage_autodoc), 19	G
exclude_members_option() (in module	
sage_docbuild.ext.sage_autodoc), 25	generate() (sage_docbuild.ext.sage_autodoc.Class- Documenter method), 15
	<pre>generate() (sage_docbuild.ext.sage_autodoc.Docu-</pre>
fetch_citation() (in module sage_docbuild.ext.multidocs), 26	menter method), 18 GenericAliasMixin (class in
<pre>fetch_inventory() (sage_docbuildmainInter-</pre>	sage_docbuild.ext.sage_autodoc), 20
sphinxCache method), 2	<pre>get_all_documents() (sage_docbuild.builders.All-</pre>
filter_members()(sage_docbuild.ext.sage_autodoc.Do	
umenter method), 18	get_all_documents() (sage_docbuild.builders.Ref-
find_sage_dangling_links() (in module	erenceBuilder method), 5
sage_docbuild.conf), 10	<pre>get_all_included_modules()</pre>
finish() (sage_docbuild.ext.inventory_builder.Invento-ryBuilder method), 13	(sage_docbuild.builders.ReferenceSubBuilder method), 6
fix_path_html() (in module sage_docbuild.ext.multi-	<pre>get_all_rst_files() (sage_docbuild.builders.Ref-</pre>
docs), 26	erenceSubBuilder method), 6
flush() (sage_docbuild.sphinxbuild.SageSphinxLogger	<pre>get_attr() (sage_docbuild.ext.sage_autodoc.Docu-</pre>
method), 8	menter method), 18
format (sage_docbuild.ext.inventory_builder.Inventory-	<pre>get_attribute_comment()</pre>
Builder attribute), 13	(sage_docbuild.ext.sage_autodoc.Attribute-
format_args() (sage_docbuild.ext.sage_autodoc.Class-	Documenter method), 14
Documenter method), 15 format_args() (sage_docbuild.ext.sage_autodoc.Dec-	get_builder() (in module sage_docbuild.builders), 7
oratorDocumenter method), 17	<pre>get_cache() (sage_docbuild.builders.ReferenceSub- Builder method), 6</pre>
format_args() (sage_docbuild.ext.sage_autodoc.Doc-	get_canonical_fullname()
umenter method), 18	(sage_docbuild.ext.sage_autodoc.ClassDocu-
format_args() (sage_docbuild.ext.sage_autodoc.Func-	menter method), 15
tionDocumenter method), 20	get_doc() (sage_docbuild.ext.sage_autodoc.Attribute-
format_args()(sage_docbuild.ext.sage_autodoc.Method	
Documenter method), 21	get_doc() (sage_docbuild.ext.sage_autodoc.ClassDocu-
format_args()(sage_docbuild.ext.sage_autodoc.Prop-	menter method), 15
ertyDocumenter method), 23	<pre>get_doc() (sage_docbuild.ext.sage_autodoc.DataDocu-</pre>
format_columns() (in module	menter method), 16
sage_docbuildmain), 2	<pre>get_doc() (sage_docbuild.ext.sage_autodoc.Doc-</pre>
<pre>format_name() (sage_docbuild.ext.sage_autodoc.Doc-</pre>	stringSignatureMixin method), 17
umenter method), 18	<pre>get_doc() (sage_docbuild.ext.sage_autodoc.Docu-</pre>
<pre>format_signature()</pre>	menter method), 19
(sage_docbuild.ext.sage_autodoc.ClassDocu-	<pre>get_doc() (sage_docbuild.ext.sage_autodoc.Method-</pre>
menter method), 15	Documenter method), 21
<pre>format_signature()</pre>	<pre>get_doc() (sage_docbuild.ext.sage_autodoc.Non-</pre>
(sage_docbuild.ext.sage_autodoc.DocstringSig-	DataDescriptorMixin method), 22
natureMixin method), 17	<pre>get_doc() (sage_docbuild.ext.sage_autodoc.RuntimeIn-</pre>
<pre>format_signature()</pre>	stanceAttributeMixin method), 23
(sage_docbuild.ext.sage_autodoc.Doc-	<pre>get_doc() (sage_docbuild.ext.sage_autodoc.SlotsMixin</pre>
stringStripSignatureMixin method), 17	method), 24
<pre>format_signature()</pre>	

get_doc() (sage_docbuild.ext.sage_autodoc.Uninitial- izedGlobalVariableMixin method), 24	<pre>get_sourcename() (sage_docbuild.ext.sage_autodoc.Doc umenter method), 19</pre>
get_doc() (sage_docbuild.ext.sage_autodoc.Uninitial- izedInstanceAttributeMixin method), 24	<pre>get_sphinx_environment()     (sage_docbuild.builders.ReferenceSubBuilder</pre>
get_documents() (in module sage_docbuild.builders),	method), 6
7	<pre>get_target_uri()</pre>
get_env() (in module sage_docbuild.ext.multidocs), 26	tory_builder.InventoryBuilder method), 13
<pre>get_formats() (in module sage_docbuildmain),</pre>	<pre>get_unincluded_modules()</pre>
2	(sage_docbuild.builders.ReferenceSubBuilder
<pre>get_js_index() (in module sage_docbuild.ext.multi-</pre>	method), 6
docs), 26	<pre>get_variable_comment()</pre>
get_modified_modules()	(sage_docbuild.ext.sage_autodoc.ClassDocu-
(sage_docbuild.builders.ReferenceSubBuilder	menter method), 15
method), 6	getdoc() (in module sage_docbuild.ext.sage_autodoc),
get_module_comment()	25
(sage_docbuild.ext.sage_autodoc.DataDocu- menter method), 16	Н
get_module_docstring_title()	has () (sage_docbuild.conf.Tags method), 9
(sage_docbuild.builders.ReferenceSubBuilder	help_commands() (in module
method), 6	sage_docbuildmain), 2
get_module_members()	help_description() (in module
(sage_docbuild.ext.sage_autodoc.Module-	sage_docbuildmain), 2
Documenter method), 21	help_documents() (in module
get_modules() (sage_docbuild.builders.ReferenceSub-	sage_docbuildmain), 2
Builder method), 6	help_examples() (in module
get_new_and_updated_modules()	sage_docbuildmain), 2
(sage_docbuild.builders.ReferenceSubBuilder	help_formats() (in module
method), 6	sage_docbuildmain), 2
<pre>get_object_members()</pre>	help_message_long (class in
(sage_docbuild.ext.sage_autodoc.ClassDocu-	sage_docbuildmain), 2
menter method), 15	help_message_short (class in
get_object_members()	sage_docbuildmain), 3
(sage_docbuild.ext.sage_autodoc.Documenter method), 19	help_usage() (in module sage_docbuildmain), 3
get_object_members()	help_wrapper (class in sage_docbuildmain), 3 html() (sage_docbuild.builders.DocBuilder method), 4
(sage_docbuild.ext.sage_autodoc.Module-	html() (sage_docbuild.builders.ReferenceTopBuilder
Documenter method), 21	method), 7
· ·	html() (sage_docbuild.builders.WebsiteBuilder method),
tory_builder.InventoryBuilder method), 13	7
get_overloaded_signatures()	htmlhelp() (sage_docbuild.builders.DocBuilder
(sage_docbuild.ext.sage_autodoc.ClassDocu-	method), 4
menter method), 15	
get_real_modname()	I
(sage_docbuild.ext.sage_autodoc.Attribute-	identity() (in module
Documenter method), 14	sage_docbuild.ext.sage_autodoc), 25
get_real_modname()	<pre>import_object() (sage_docbuild.ext.sage_autodoc.At-</pre>
(sage_docbuild.ext.sage_autodoc.DataDocu-	tributeDocumenter method), 14
menter method), 16	<pre>import_object() (sage_docbuild.ext.sage_autodoc.Class-</pre>
<pre>get_real_modname()</pre>	Documenter method), 15
method), 19	import_object() (sage_docbuild.ext.sage_autodoc.Data-
get_real_modname()	Documenter method), 16
(sage_docbuild.ext.sage_autodoc.Property-	import_object() (sage_docbuild.ext.sage_autodoc.Doc- umenter method), 19
Documenter method), 23	umenici memou j, 17

<pre>import_object() (sage_docbuild.ext.sage_autodoc.Met</pre>	
<pre>import_object() (sage_docbuild.ext.sage_autodoc.Mod uleDocumenter method), 21</pre>	main() (in module sage_docbuildmain), 3  dimember_order (sage_docbuild.ext.sage_autodoc.At- tributeDocumenter attribute), 14
<pre>import_object() (sage_docbuild.ext.sage_autodoc.Nor.</pre>	member_order (sage_docbuild.ext.sage_autodoc.Class-
<pre>import_object() (sage_docbuild.ext.sage_autodoc.ProjectyDocumenter method), 23</pre>	Pmember_order (sage_docbuild.ext.sage_autodoc.Data-
<pre>import_object() (sage_docbuild.ext.sage_autodoc.Run</pre>	menter attribute) 10
<pre>import_object() (sage_docbuild.ext.sage_autodoc.Slot</pre>	tion Documenter attribute) 20
<pre>import_object() (sage_docbuild.ext.sage_autodoc.Uni</pre>	tion Documenter attribute) 20
<pre>import_object() (sage_docbuild.ext.sage_autodoc.Uni</pre>	Documenter attribute), 21
<pre>inherited_members_option() (in module</pre>	member_order (sage_docbuild.ext.sage_autodoc.Prop- ertyDocumenter attribute), 23
<pre>init_subdoc() (in module sage_docbuild.ext.multi- docs), 26</pre>	<pre>member_order_option() (in module</pre>
INSTANCEATTR (in module sage_docbuild.ext.sage_autodoc), 20	members_option() (in module sage_docbuild.ext.sage_autodoc), 25
<pre>IntersphinxCache</pre>	merge_default_value() (sage_docbuild.ext.sage_autodoc.Function-
inventory() (sage_docbuild.builders.DocBuilder method), 4	Documenter method), 20
InventoryBuilder (class in sage_docbuild.ext.inven- tory_builder), 13	merge_default_value() (sage_docbuild.ext.sage_autodoc.Method- Documenter method), 21
is_function_or_method()     (sage_docbuild.ext.sage_autodoc.Attribute-	merge_environment() (in module sage_docbuild.ext.multidocs), 26
Documenter static method), 14 is_runtime_instance_attribute()	merge_js_index() (in module sage_docbuild.ext.mul-tidocs), 26
(sage_docbuild.ext.sage_autodoc.RuntimeIn- stanceAttributeMixin method), 23	merge_members_option() (in module sage_docbuild.ext.sage_autodoc), 25
<pre>is_runtime_instance_at-</pre>	MethodDocumenter (class in sage_docbuild.ext.sage_autodoc), 20
(sage_docbuild.ext.sage_autodoc.RuntimeIn-stanceAttributeMixin method), 23	mode (sage_docbuild.sphinxbuild.SageSphinxLogger attribute), 8
is_uninitialized_instance_attribute()	modname (sage_docbuild.ext.sage_autodoc.DataDocu- menterMixinBase attribute), 16
isatty() (sage_docbuild.sphinxbuild.SageSphinxLogger method), 8	<pre>module    sage_docbuildmain,1    sage_docbuild.build_options,8</pre>
isslotsattribute() (sage_docbuild.ext.sage_autodoc.SlotsMixin method), 24	<pre>sage_docbuild.builders,3 sage_docbuild.conf,9 sage_docbuild.ext.inven-</pre>
J	<pre>tory_builder, 13 sage_docbuild.ext.multidocs, 25</pre>
json() (sage_docbuild.builders.DocBuilder method), 4	<pre>sage_docbuild.ext.sage_autodoc, 14 sage_docbuild.sphinxbuild, 8</pre>
	<pre>sage_docbuild.utils, 10</pre>
<pre>latex() (sage_docbuild.builders.DocBuilder method), 4 linkcheck() (sage_docbuild.builders.DocBuilder</pre>	ModuleDocumenter (class in sage_docbuild.ext.sage_autodoc), 21
method) 4	ModuleLevelDocumenter (class in

sage_docbuild.ext.sage_autodoc), 22	P
N	parent (sage_docbuild.ext.sage_autodoc.DataDocu- menterMixinBase attribute), 17
name (sage_docbuild.ext.inventory_builder.Inventory- Builder attribute), 13	parse_name() (sage_docbuild.ext.sage_autodoc.Docu- menter method), 19
name (sage_docbuild.sphinxbuild.SageSphinxLogger attribute), 8	parse_name() (sage_docbuild.ext.sage_autodoc.Mod-uleDocumenter method), 22
newlines (sage_docbuild.sphinxbuild.SageSphinxLogger attribute), 8	pdf() (sage_docbuild.builders.DocBuilder method), 4 pdf() (sage_docbuild.builders.WebsiteBuilder method), 7
nitpick_patch_config() (in module sage_docbuild.conf), 10	<pre>pickle() (sage_docbuild.builders.DocBuilder method), 5</pre>
NonDataDescriptorMixin (class in sage_docbuild.ext.sage_autodoc), 22	<pre>prefix_len</pre>
0	print_included_modules() (sage_docbuild.builders.ReferenceSubBuilder
object (sage_docbuild.ext.sage_autodoc.DataDocu- menterMixinBase attribute), 17	<pre>method), 6 print_modified_modules()</pre>
ObjectMember (class in sage_docbuild.ext.sage_autodoc), 22	(sage_docbuild.builders.ReferenceSubBuilder method), 6
objpath (sage_docbuild.ext.sage_autodoc.DataDocu- menterMixinBase attribute), 17	print_new_and_updated_modules() (sage_docbuild.builders.ReferenceSubBuilder
objtype (sage_docbuild.ext.sage_autodoc.AttributeDocu-	method), 6
menter attribute), 14	print_unincluded_modules()
objtype (sage_docbuild.ext.sage_autodoc.ClassDocu- menter attribute), 15	(sage_docbuild.builders.ReferenceSubBuilder method), 6
objtype (sage_docbuild.ext.sage_autodoc.DataDocu-	priority (sage_docbuild.ext.sage_autodoc.Attribute-
menter attribute), 16	Documenter attribute), 15
objtype (sage_docbuild.ext.sage_autodoc.Decorator- Documenter attribute), 17	priority (sage_docbuild.ext.sage_autodoc.ClassDocu- menter attribute), 15
objtype (sage_docbuild.ext.sage_autodoc.Documenter attribute), 19	priority (sage_docbuild.ext.sage_autodoc.DataDocu- menter attribute), 16
objtype (sage_docbuild.ext.sage_autodoc.ExceptionDoc-umenter attribute), 20	priority (sage_docbuild.ext.sage_autodoc.Decorator- Documenter attribute), 17
objtype (sage_docbuild.ext.sage_autodoc.FunctionDoc-umenter attribute), 20	priority (sage_docbuild.ext.sage_autodoc.Documenter attribute), 19
objtype (sage_docbuild.ext.sage_autodoc.MethodDocu- menter attribute), 21	priority (sage_docbuild.ext.sage_autodoc.Exception- Documenter attribute), 20
	priority (sage_docbuild.ext.sage_autodoc.MethodDoc-umenter attribute), 21
objtype (sage_docbuild.ext.sage_autodoc.PropertyDocu- menter attribute), 23	priority (sage_docbuild.ext.sage_autodoc.Property- Documenter attribute), 23
option_spec (sage_docbuild.ext.sage_autodoc.At- tributeDocumenter attribute), 14	process_doc() (sage_docbuild.ext.sage_autodoc.Doc-umenter method), 19
option_spec (sage_docbuild.ext.sage_autodoc.Class- Documenter attribute), 15	PropertyDocumenter (class in sage_docbuild.ext.sage_autodoc), 23
option_spec (sage_docbuild.ext.sage_autodoc.Data- Documenter attribute), 16	py_ext_sig_re (in module sage_docbuild.ext.sage_autodoc), 25
option_spec (sage_docbuild.ext.sage_autodoc.Docu- menter attribute), 19	R
option_spec (sage_docbuild.ext.sage_autodoc.Module- Documenter attribute), 21	raise_errors() (sage_docbuild.sphinxbuild.Sage- SphinxLogger method), 8
Options (class in sage_docbuild.ext.sage_autodoc), 22 original_exception (sage_docbuild.utils.Work-erDiedException attribute), 11	ReferenceBuilder (class in sage_docbuild.builders), 5

ReferenceSubBuilder  sage_docbuild.builders), 5	(class	in	setup_	logger() <i>sage_docbuild</i>	(in main ), 3	module
ReferenceTopBuilder  sage_docbuild.builders), 7	(class	in	setup_	parser() sage_docbuild	(in	module
RemoteException, 10			ehould		_mam),5 irective_hea	der()
RemoteException, 10 RemoteExceptionWrapper	(class	in	SHOULU		ext.sage_autodoc.D	
sage_docbuild.utils), 10	·			menterMixinBas	se method), 17	
resolve_name()( <i>sage_docbuild.e</i>	xt.sage_autodoc	.Class	<b>Leheb</b> uld			
Documenter method), 16					ext.sage_autodoc.G	enericAlias-
resolve_name()( <i>sage_docbuild.e</i>	xt.sage_autodoc	.Doc-		<i>Mixin method</i> ),		
umenter method), 19	•				alue_header(	
resolve_name()(sage_docbuild.e	xt.sage_autodoc	.Mod-		-	ext.sage_autodoc.A	ttribute-
uleDocumenter method), 22		14 1	, , ,	Documenter met		
resolve_name()( <i>sage_docbuild.e</i> uleLevelDocumenter method	-	.Mod-	should		alue_header( <i>ext.sage_autodoc.D</i>	
runsphinx() (in module sage_doci	build.sphinxbuild	d), 9		menter method).	, 16	
RUNTIME_INSTANCE_ATTRIBUT	E		should	_suppress_v	alue_header(	)
(sage_docbuild.ext.sage_auto stanceAttributeMixin attribut					ext.sage_autodoc.D	
RuntimeInstanceAttributeM		in	should		alue_header(	)
sage_docbuild.ext.sage_auto			DITO GEG.		ext.sage_autodoc.N	
S			ahauld	-	alue_header(	\
			SHOUTU		ext.sage_autodoc.R	
sage_docbuildmain					exi.sage_auioaoc.K Iixin method), 23	unumem-
module, 1			ahauld		alue_header(	\
sage_docbuild.build_optio	ns		SHOULG		ext.sage_autodoc.Si	
module, 8				method), 24	zni.suge_umouoc.si	Oismiani
sage_docbuild.builders			chould		alue_header(	\
module, 3			SHOUTU		ext.sage_autodoc.U	
<pre>sage_docbuild.conf module,9</pre>				izedGlobalVaria	ıbleMixin method),	24
sage_docbuild.ext.invento	ry_builder		should		alue_header(	
module, 13					ext.sage_autodoc.U	
sage_docbuild.ext.multido	CS				ibuteMixin method	, ,
module, 25			Single	FileBuilder	*	in
sage_docbuild.ext.sage_au	todoc			sage_docbuild.b		
module, 14					odule sage_docbuil	
sage_docbuild.sphinxbuild			SlotsM		sage_docbuild.ext.s	age_autodoc),
module, 8			<i>c</i> .	23		C 1 · 1
sage_docbuild.utils			softsp	_	puild.sphinxbuild.Sc	igeSphinxLog-
module, 10				ger attribute), 8		
SagecodeTransform ( <i>class in sag</i>		<sup>c</sup> ), 9	sort_m	_	e_docbuild.ext.sage	?_autoaoc.Doc-
3 2	(class	in		umenter method		a sutadaa Mad
sage_docbuild.sphinxbuild),			sort_m		e_docbuild.ext.sage	:_autoaoc.moa-
save_cache() (sage_docbuild.bu	iilders.Reference	Sub-		uleDocumenter i	neinoa), 22	
Builder method), 6			Т			
set_intersphinx_mappings(	) (in mo	odule	-			
sage_docbuild.conf), 10				ass in sage_docb	* '	
setup() (in module sage_docbuild.c			_		emoteException attr	
setup() (in module sage tory_builder), 13	e_docbuild.ext.ir	ıven-	tb (sa	ige_docbuild.utils tribute), 10	s.RemoteException V	Vrapper at-
setup() (in module sage_docbuild.e	xt.multidocs), 26	5	term_w	idth_line()	(in	module
setup() (in module sage docbuild.e.			_	sage_docbuild.s	phinxbuild), 9	

```
titles_allowed(sage_docbuild.ext.sage_autodoc.Doc-
         umenter attribute), 19
U
UninitializedGlobalVariableMixin (class in
         sage_docbuild.ext.sage_autodoc), 24
UninitializedInstanceAttributeMixin
         (class in sage_docbuild.ext.sage_autodoc), 24
update_annotations()
         (sage_docbuild.ext.sage_autodoc.Attribute-
         Documenter method), 15
update_annotations()
         (sage_docbuild.ext.sage_autodoc.DataDocu-
        menter method), 16
update_content() (sage_docbuild.ext.sage_autodoc.Data-
         DocumenterMixinBase method), 17
update_content() (sage_docbuild.ext.sage_autodoc.Gener-
         icAliasMixin method), 20
\verb"update_mtimes"() \textit{ (sage\_docbuild.builders.Reference-}
        SubBuilder method), 6
W
web () (sage_docbuild.builders.DocBuilder method), 5
WebsiteBuilder (class in sage_docbuild.builders), 7
WorkerDiedException, 10
\verb|write()| (sage\_docbuild.sphinxbuild.SageSphinxLogger|
         method), 8
write_auto_rest_file()
         (sage\_docbuild.builders.Reference SubBuilder
        method), 6
write_citations()
                                 (in
                                             module
        sage docbuild.ext.multidocs), 26
                      (sage_docbuild.sphinxbuild.Sage-
writelines()
        SphinxLogger method), 9
```