

# The `apxproof` package

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## Abstract

This package makes it easier to write articles where proofs and other material are deferred to the appendix. The appendix material is written in the  $\text{\LaTeX}$  code along with the main text which it naturally complements, and it is automatically deferred. The package can automatically send proofs to the appendix, can repeat in the appendix the theorem environments stated in the main text, can section the appendix automatically based on the sectioning of the main text, and supports a separate bibliography for the appendix material.

## 1 Usage

The `apxproof` package is intended to simplify the writing of articles where some of the content needs to be deferred to an appendix. This is in particular useful for the submission of scientific articles to conferences or journals that limit the number of pages in the main text but allow an extra appendix, where proofs of theorems and other material can be added.

### 1.1 Basics

To use `apxproof`, first load it in the header of your document:

```
\usepackage{apxproof}
```

On its own, this does not do anything and should not change the appearance of your document. To add an appendix with some material from your document, use the `toappendix` environment:

```
toappendix (env.) \begin{toappendix}
                  ...
                  \end{toappendix}
```

The content will appear at the end of your document, in an automatically generated section that refers to the current section in the main text.

**Example 1.** *Throughout this documentation, all examples produce content deferred to the appendix, at the very end of this document.*

```
\begin{toappendix}
```

```
This content is in the appendix.
\end{toappendix}
```

When the content to put in appendix is an entire section, make sure that `\section` is the very first command that appears within the `toappendix` environment. It will disable the automatic production of a section heading.

## 1.2 Repeated Theorems and Proofs

In some scientific papers that include proofs, it is common to defer proofs to the appendix. This can easily be achieved using the `appendixproof` environment:

```
appendixproof (env.)    \begin{appendixproof}
                        ...
                        \end{appendixproof}
```

This behaves like the `toappendix` environment, except that a proof environment is generated.

**Example 2.** *We now send a proof to the appendix:*

```
\begin{appendixproof}
This proof is in the appendix.
\end{appendixproof}
```

When deferring proofs to the appendix, an annoying problem is that the statement of the theorem remains in the main text; it is hard to read a proof that is far away from the statement it proves. `apxproof` solves this issue by allowing statements of theorems to be *repeated*: once in the main text, and once in the appendix before the proof of the statement. To use this feature, you can define a new *repeated theorem* environment using the `\newtheoremrep` command:

```
\newtheoremrep    \newtheoremrep{<name>}[<counter>]{<title>}[<countersec>]
```

Usage is exactly the same as that of AMS L<sup>A</sup>T<sub>E</sub>X's `\newtheorem` macro:

- `<name>` (e.g., `theorem`) is the name of an environment that is created for this kind of theorem;
- `<counter>` (e.g., `definition`) is an optional counter describing from which kind of environment the numbering of these environments should be inherited;
- `<title>` (e.g., `Theorem`) is the title that will be used to display this theorem environment;
- `<countersec>` (e.g., `section`) is an optional counter of a sectioning command indicating that counters for this theorem should be prefixed by this counter (and reset at each occurrence of the sectioning command).

`<counter>` and `<countersec>` should not be used together. What differs from `\newtheorem` is that, when the following is written:

```
\newtheoremrep{foobar}{Foobar}
```

then *two* environments are defined: the `foobar` environment, which behaves as if `\newtheorem` had been used, and the `foobarrep` environment, which results in the statement of this environment being repeated in the appendix.

One interesting feature of `apxproof` is that in most situations, there is no need to `proof (env.)` use the `appendixproof` environment. Indeed, the `proof` environment is redefined by `apxproof` to automatically put the proof either in the main text (if it follows a regular theorem) or in the appendix (if it follows a repeated theorem).

**Example 3.** Assume we have first defined a repeated theorem environment `foobar` as above. We can now use this theorem environment, first for a regular theorem in the main text, then for a theorem repeated in the main text and in the appendix:

```
\begin{foobar}
This foobar is a regular one, in the main text.
\end{foobar}
\begin{proof}
This is the proof of the regular foobar.
\end{proof}
```

We obtain:

**Foobar 1.** *This foobar is a regular one, in the main text.*

*Proof.* This is the proof of the regular foobar. □

Now, if we use a repeated theorem:

```
\begin{foobarrep}
This foobar is repeated in the appendix.
\end{foobarrep}
\begin{proof}
This is the proof of the repeated foobar.
\end{proof}
```

We now obtain:

**Foobar 2.** *This foobar is repeated in the appendix.*

Note that, since `hyperref` is loaded, there are hyperlinks created between the statements of the theorems in the main text and in the appendix.

When the proof is deferred to the appendix, it is common practice to add a proof sketch in the main text. `apxproof` defines a simple `proofsketch` environment for this purpose:

```
proofsketch (env.) \begin{proofsketch}
...
\end{proofsketch}
```

The proof sketch is typeset similarly to a proof, but is always in the main text. Similarly, an `inlineproof` environment is provided so as to be able to have both a proof in the appendix (using the regular `proof` environment, or alternatively the `appendixproof` environment) and a different proof in the main text (using the `inlineproof` environment).

**Example 4.** *Here are simple examples of proof sketches and inline proofs:*

```
\begin{proofsketch}
This is a proof sketch.
\end{proofsketch}
```

*Proof sketch.* This is a proof sketch. □

```
\begin{inlineproof}
This is an inline proof.
\end{inlineproof}
```

*Proof.* This is an inline proof. □

### 1.3 Bibliography

By default, `apxproof` automatically adds a bibliography in the appendix with only the references cited in the appendix material. This allows for a clean separation of references used solely in the main text, and those used in the appendix.

**Example 5.** *Assume we have citations both in the main text and in the appendix.*

```
This is a citation in the main text~\cite{lamport86}.
\begin{toappendix}
This is a citation in the appendix~\cite{proofsAreHard}.
\end{toappendix}
```

*This is a citation in the main text [1].*

The bibliography in the appendix can use a different style and heading than the bibliography in the main text (and, by default, it does). See Section 1.5 for how to configure the appearance of that bibliography.

*option* `bibliography` In order to use a single appendix for the main text and the bibliography, one can specify the value `common` to the `bibliography` option when loading the package. (By default this option is set to `separate`.)

### 1.4 Mode

*option* `appendix` An optional `<mode>` can be specified when loading the package:

```
\usepackage[appendix=<mode>]{apxproof}
```

`<mode>` can take one of the following four values:

**append** This is the default. Appendix material gathered by `apxproof` is appended to the main text.

**inline** In this mode, `apxproof` simply inlines the content along with the main text.

**strip** This mode functions similarly to **append** except that the appendix is not appended at the end of the document. All appendix material is therefore removed.

**chapterend** In this mode, appendix material for each chapter is gathered separately and emitted at the end of that chapter (i.e., just before the next **\chapter** command, or at the end of the document), using the **subappendices** environment from the **appendix** package. Only **bibliography=common** is supported in this mode. See Section 1.5 for the **\chapterappendixprelim** customization macro.

## 1.5 Customization

**apxproof** provides a few macros that can be redefined (using **\renewcommand**) to customize the appearance of the appendix:

**\mainbodyrepeatedtheorem** **\mainbodyrepeatedtheorem** is a macro that is executed at the beginning of the body of every repeated theorem. This can be used to notify the reader that the theorem is repeated in appendix in some way, e.g., with a margin note.

**\appendixsectionformat** **\appendixsectionformat{<number>}{<title>}** is a macro that indicates how to format the section titles in the Appendix, given the number and title of the section in the main text. By default, they appear as “Proofs for Section <number> (<title>)”.

**\appendixrefname** **\appendixrefname** contains the heading that is displayed before the bibliography. By default, this is “References for the Appendix”. (Note that this command is also defined and used by the **memoir** document class.)

**\appendixbibliographystyle** **\appendixbibliographystyle** contains the **.bst** bibliography style that is used in the bibliography in appendix. By default, this is **alpha**.

**\appendixbibliographyprelim** **\appendixbibliographyprelim** contains arbitrary code that is executed just before the production of the bibliography in appendix, which can be used to configure the way it is displayed.

**\appendixprelim** **\appendixprelim** contains arbitrary code that is executed just before the production of the appendix, which can be used to configure the way it is displayed. By default, this command contains **\clearpage\onecolumn** (the appendix is typeset on a new page in single-column mode) but redefining this option allows changing this behavior. This macro has no effect in **chapterend** mode; use **\chapterappendixprelim** instead.

**\chapterappendixprelim** **\chapterappendixprelim** (**chapterend** mode only) contains arbitrary code that is executed just before each chapter’s appendix block. By default, this command contains **\clearpage** (each chapter appendix starts on a new page). This macro has no effect in **append** or **strip** mode; use **\appendixprelim** instead.

*option* Another customization capability concerns *numbered equations* that are present within repeated theorems. An optional **repeqn** option can be specified when loading the package, which controls whether equation numbers should be as in the main text (by setting this option to **same**, the default) or independently numbered (by setting this option to **independent**). In the latter case, whenever a referenceable counter is set with **\label{<counter>}**, **\ref{<counter>}** references the counter in the main text, while **\ref{<counter>-apx}** references the counter in the appendix (except in **inline** mode, where both have the same effect).

*option* Another customization option concerns hyperlinking. Usually, when `hyperref` `forwardlinking` is loaded, `foobarrep` environments in the main text have their number link to their repetition in the appendix. To suppress this behavior and have `foobarrep` environments treated as if `hyperref` were not loaded, one can specify the value `no` to the `forwardlinking` option when loading the package. (By default this option is set to `yes`.)

## 1.6 Advanced Features

We now describe a few advanced macros and environments, the usage of which is limited to special cases:

`nestedproof (env.)` `nestedproof` is an environment that can be used within a `proof` environment deferred in the appendix; this is required because, for technical reasons, no `proof` environment can be nested within a deferred `proof` environment.

`\noproofinappendix` `\noproofinappendix` can be used inside repeated theorems that are not followed by a `proof` or `appendixproof` environment; the point is to ensure that a further `proof` environment cannot be mistakenly understood as a proof of the repeated theorem. It should not be needed in most situations as `apxproof` tries figuring out when a proof follows a repeated theorem automatically, but may occasionally be needed in complex scenarios.

`\nosectionappendix` `\nosectionappendix` is to be used inside a section that *does* contain appendix material, but for which a section in the appendix should not be created. This should be rarely needed. When this command is present, appendix material is appended to the end of the previously created section.

## 2 Supported Document Classes

Because `apxproof` modifies sectioning commands, bibliographies, and proofs, it may not work straight away with arbitrary document classes. It has currently been tested with and is supported for the following document classes:

- L<sup>A</sup>T<sub>E</sub>X standard document classes (e.g., `article.cls`)
- KOMA-Script (e.g., `scrartcl.cls`, `scrbook.cls`)
- `memoir.cls`
- ACM SIG Proceedings (e.g., `sig-alternate.cls`, `acmart.cls`)
- Springer's Lecture Notes in Computer Science (e.g., `llncs.cls`)
- Schloß Dagstuhl's Leibniz International Proceedings in Informatics (e.g., `lipics.cls`, `lipcs-v2016.cls`)

Other classes may work out of the box. Adding support for specific classes is possible and can be requested from the author of this package.

### 3 Known Issues and Limitations

We report here some issues we are currently aware of:

- When using `hyperref`, the appendix in the bibliography is not hyperlinked. This is to avoid possible issues with multiply defined bibliography entries.
- `appendixproof`, `proof`, `toappendix` environments cannot be nested. This is a limitation of the `fancyvrb` package that `apxproof` relies on. Note the existence of the `nestedproof` environment for nested proofs.
- `apxproof` poorly interacts with SyncTeX: identifying which source line has produced which box does not work for appendix content managed by `apxproof` or repeated theorems. No obvious fix is known, though this issue will be investigated in the long term.
- Unless the `bibliography` option is set to `common`, the `bibunits` package is used to generate a second bibliography. This means any package, such as `biblatex`, that is incompatible with `bibunits` will not be compatible with `apxproof` unless `bibliography` is set to `common`.

Issues not listed here should be reported to the author.

### 4 License

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### 5 Contact

- <https://github.com/PierreSenellart/apxproof>
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Bug reports and feature requests should preferably be submitted through the *Issues* feature of GitHub.

### 6 Acknowledgments

Thanks to Antoine Amarilli for feedback and proofreading. Thanks to K. D. Bauer for the implementation of the forward-linking mechanism, and for various bugfixes. Thanks to Leonid Kostrykin for an initial implementation of the `forwardlinking` option.

## 7 Implementation

We now describe the entire code of the package, in a literate programming fashion. Throughout the package, we use the `axp@` prefix to identify local macros and environment names, which are not meant to be used by the final user.

### 7.1 Dependencies

We first load a few package dependencies:

- `environ` to easily define the repeated theorem environments.

```
1 \RequirePackage{environ}
```

- `etoolbox` to define simple toggles.

```
2 \RequirePackage{etoolbox}
```

- `fancyvrb` for the bulk of the work of exporting appendix material in an auxiliary file.

```
3 \RequirePackage{fancyvrb}
```

- `ifthen` for easier comparison of character strings.

```
4 \RequirePackage{ifthen}
```

- `kvoptions` to manage options passed to the package.

```
5 \RequirePackage{kvoptions}
```

- `catchfile` to be able to check the content of files `\input` within appendix content.

```
6 \RequirePackage{catchfile}
```

- `amsthm` for its `\newtheorem` macro. Some document classes (e.g., `lipics`) preload `amsthm`: this is fine, `\RequirePackage{amsthm}` will simply have no effect. On the other hand, some other document classes (e.g., `llncs` or `sig-alternate`) define a `proof` environment that conflicts with `amsthm`, so we have to undefine this environment before loading `amsthm`. In that case, we reestablish the existing proof environments, in case they had been customized (e.g., `sig-alternate`)

```
7 \@ifpackageloaded{amsthm}{  
8   }{  
9     \let\apx@oldamsthmproof\proof  
10    \let\apx@oldamsthmendproof\endproof  
11    \let\proof\undefined  
12    \let\endproof\undefined  
13  }  
14  \RequirePackage{amsthm}  
15  \ifdefined\apx@oldamsthmproof  
16    \let\proof\apx@oldamsthmproof  
17    \let\endproof\apx@oldamsthmendproof  
18  \fi
```



## 7.2 Option Processing

Many names throughout the package use an arobase (@) to avoid name conflict with user-defined names. To simplify the compilation of the documentation, we simply make it a regular character in all the rest.

```
19 \makeatletter
```

We setup the processing of options using keyval facilities.

```
20 \SetupKeyvalOptions{
21   family=axp,
22   prefix=axp@
23 }
```

We declare the following options:

- `append`, with a default value of `append` (other possible values: `strip`, `inline`);
- `bibliography`, with a default value of `separate` (other possible value: `common`);
- `repeqn`, with a default value of `same` (other possible value: `independent`).

```
\axp@appendix
```

```
24 \DeclareStringOption[append]{appendix}
```

```
\axp@bibliography
```

```
25 \DeclareStringOption[separate]{bibliography}
```

```
\axp@repeqn
```

```
26 \DeclareStringOption[same]{repeqn}
```

```
\axp@forwardlinking
```

```
27 \DeclareStringOption[yes]{forwardlinking}
```

```
28 \ProcessLocalKeyvalOptions*
```

We check that the value of the options are valid, and add a message to the compilation log.

```
29 \ifthenelse{\equal{\axp@appendix}{append}}{
30   \message{apxproof: Appendix material appended to the document}
31 }{\ifthenelse{\equal{\axp@appendix}{strip}}{
32   \message{apxproof: Appendix material stripped}
33 }{\ifthenelse{\equal{\axp@appendix}{inline}}{
34   \message{apxproof: Appendix material inlined within the document}
35 }{\ifthenelse{\equal{\axp@appendix}{chapterend}}{
36   \message{apxproof: Appendix material appended at the end of each chapter}
37 }{
38   \errmessage{Error: unsupported option appendix=\axp@appendix\ for
39   package apxproof}
40 }}}}
41 \ifthenelse{\equal{\axp@bibliography}{separate}}{
```

The external bibunits package is used to add a second bibliography for the appendix material.

```

42 \RequirePackage{bibunits}
43 \message{apxproof: Separate bibliography for appendix material}
44 }\ifthenelse{\equal{\axp@bibliography}{common}}{
45 \message{apxproof: Common bibliography for appendix and main text}
46 }{
47 \errmessage{Error: unsupported option bibliography=\axp@bibliography\ for
48 package apxproof}
49 }}
50 \ifthenelse{\equal{\axp@appendix}{chapterend}
51 \AND\equal{\axp@bibliography}{separate}}{
52 \PackageError{apxproof}{%
53 bibliography=separate is not supported with appendix=chapterend}{%
54 Use bibliography=common instead.}
55 }{
56 \ifthenelse{\equal{\axp@repeqn}{same}}{
57 \message{apxproof: Repeated equations keep the same numbering}
58 }\ifthenelse{\equal{\axp@repeqn}{independent}}{
59 \message{apxproof: Repeated equations are independently numbered}
60 }{
61 \errmessage{Error: unsupported option repeqn=\axp@repeqn\ for
62 package apxproof}
63 }}

```

\axp@forward@suppress

```

64 \newbool{axp@forward@suppress}
65 \ifthenelse{\equal{\axp@forwardlinking}{yes}}{
66 }\ifthenelse{\equal{\axp@forwardlinking}{no}}{
67 \message{apxproof: Disable forward linking}
68 \global\booltrue{axp@forward@suppress}%
69 }{
70 \errmessage{Error: unsupported option forwardlinking=\axp@repeqn\ for
71 package apxproof}
72 }}

```

### 7.3 Macros Common to All Compilation Modes

`\axp@newtheoremrep@definetheorem` Common to all compilation modes, we define `\axp@newtheoremrep@definetheorem`. When called with first argument `foobar`, we first undefine the existing `foobar` environment (and its counter) if it has already been defined (e.g., by the document class), then invoke `\axp@newtheorem` for the regular version of the theorem `foobar`, saving and restoring any existing theorem counter unless the `\newtheoremdep` redefines the base counter.

```

73 \def\axp@newtheoremrep@definetheorem#1#2#3#4{%
74 \expandafter\let\csname #1\endcsname\undefined
75 \expandafter\let\csname the#1\endcsname\undefined
76 \ifcsname c@#1\endcsname
77 \expandafter\expandafter\expandafter\let\expandafter\expandafter
78 \csname c@axp@#1\endcsname\csname c@#1\endcsname
79 \expandafter\let\csname c@#1\endcsname\undefined
80 \fi
81 \axp@newtheorem{#1}{#2}{#3}{#4}%

```

```

82 \ifcsname c@axp@#1\endcsname
83 \ifx\relax#2\relax
84 \expandafter\expandafter\expandafter\let\expandafter\expandafter
85 \csname c@#1\endcsname\csname c@axp@#1\endcsname
86 \else
87 \fi
88 \fi
89 }

```

`\axp@newtheorem` We introduce an intermediate `\axp@newtheorem` command to define a new theorem, differently depending on whether there is a section counter or not. This will be useful, in particular to allow changing this definition depending on the document class. This command uses two intermediary commands, `\@axp@newtheorem` and `\@@axp@newtheorem`, for the non-starred and starred versions.

```

90 \def\axp@newtheorem{\@ifstar\@axp@newtheorem\@axp@newtheorem}
91 \def\@axp@newtheorem#1#2#3#4{%
92 \ifx\relax#4\relax
93 \newtheorem{#1}[#2]{#3}%
94 \else
95 \newtheorem{#1}{#3}[#4]%
96 \fi
97 }
98 \def\@@axp@newtheorem#1#2{%
99 \newtheorem*{#1}{#2}%
100 }

```

`\newtheoremrep` We define the high-level `\newtheoremrep` to have the same syntax as `amsthm`'s `\axp@newtheoremreptmp` `\newtheorem`. For this purpose, we need a little trick to deal with the second and fourth optional arguments, which is what `\@oparg` and `\axp@newtheoremreptmp` are used for. `\axp@newtheoremrep` is defined differently depending on the compilation mode.

```

101 \newcommand\newtheoremrep[1]{%
102 \@oparg{\axp@newtheoremreptmp{#1}}[]%
103 }
104 \def\axp@newtheoremreptmp#1[#2]#3{%
105 \@oparg{\axp@newtheoremrep{#1}[#2]{#3}}[]%
106 }

```

`proofsketch` (*env.*) Simple `proofsketch` environment.

```

107 \newenvironment{proofsketch}{\begin{axp@oldproof}[Proof sketch]}\end{axp@oldproof}}

```

`\mainbodyrepeatedtheorem` We provide sensible defaults for these user-customizable macros. Even though they are not all useful in all modes, we define them for all modes so that a `\appendixbibliographystyle` `\renewcommand` works in all cases.

```

\appendixbibliographystyle \renewcommand works in all cases.
\appendixbibliographyprelim 108 \newcommand{\mainbodyrepeatedtheorem}{}
\appendixprelim 109 \providecommand{\appendixrefname}{References for the Appendix}
\appendixsectionformat 110 \newcommand{\appendixbibliographystyle}{alpha}
111 \newcommand{\appendixbibliographyprelim}{}
112 \newcommand{\appendixprelim}{\clearpage\onecolumn}
113 \newcommand{\appendixsectionformat}[2]{Proofs for Section~#1\ (#2)}

```

`axp@oldproof` (*env.*) We save the definition of the existing proof environment.

```

114 \let\axp@oldproof\proof
115 \let\endaxp@oldproof\endproof

```

We define a utility macro that will be used to properly set the `\label` command (and its `amsmath` counterpart, `\label@in@display`) for equations within repeated theorems, depending on the compilation mode.

```
\axp@redefinelabels
116 \newcommand{\axp@redefinelabels}{%
117   \providecommand\label@in@display{}%
118   \ifthenelse{\equal{\axp@appendix}{inline}}{%
119     \let\axp@oldlabel\label
120     \let\axp@oldlabel@in@display\label@in@display
121     \renewcommand\label[1]{%
122       \axp@oldlabel{##1}%
123       \axp@oldlabel{##1-axp}%
124     }%
125     \renewcommand\label@in@display[1]{%
126       \axp@oldlabel@in@display{##1}%
127       \axp@oldlabel{##1-axp}%
128     }%
129   }{%
130     \let\axp@oldlabel\label
131     \let\axp@oldlabel@in@display\label@in@display
132     \renewcommand\label[1]{\axp@oldlabel{##1-axp}}%
133     \renewcommand\label@in@display[1]{\axp@oldlabel@in@display{##1-axp}}%
134   }%
135 }
```

### 7.3.1 Class-Specific Behavior

Finally, some class-specific behavior common to all compilation modes.

#### llncs and other Springer document classes

```
136 \ifdefined\spnewtheorem

\@axp@newtheorem It is necessary to use \spnewtheorem instead of \newtheorem in Springer document
\@axp@newtheorem classes to obtain standard formatting.

137 \def\@axp@newtheorem#1#2#3#4{%
138   \ifx\relax#4\relax
139     \ifx\relax#2\relax
140       \spnewtheorem{#1}{#3}{\bfseries}{\itshape}%
141     \else
142       \spnewtheorem{#1}[#2]{#3}{\bfseries}{\itshape}%
143     \fi
144   \else
145     \spnewtheorem{#1}{#3}[#4]{\bfseries}{\itshape}%
146   \fi
147 }
148 \def\@axp@newtheorem#1#2{%
149   \spnewtheorem*{#1}{#2}{\upshape\bfseries}{\itshape}%
150 }
```

`proofsketch` We redefine the `proofsketch` environment, which is used differently in the base class.

```
151 \renewenvironment{proofsketch}{\begin{axp@oldproof}[sketch]}\end{axp@oldproof}}
```

We have to redefine the macro `\@thmcountersep` for proper sectioned counters.

```
152 \def\@thmcountersep{.}
153 \fi
```

**acmart** Some versions of `acmart` define a `\ACM@origsection` macro and verify that `\section` has the same content. We need to update `\ACM@origsection` accordingly.

```
154 \ifdefined\ACM@origsection
155 \AtBeginDocument{\let\ACM@origsection\section}
156 \fi
```

## 7.4 Inline Compilation Mode

```
157 \ifthenelse{\equal{\axp@appendix}{inline}}{
```

`\axp@newtheoremrep` In inline mode, `\axp@newtheoremrep` uses `\axp@newtheoremrep@definetheorem` to define the regular theorem environment and creates a repeated theorem environment that behaves exactly as the regular theorem environment, while calling `\axp@redefinelabels` to make sure that `-axp` variants of equation counters are defined.

```
158 \def\axp@newtheoremrep#1[#2]#3[#4]{%
159 \axp@newtheoremrep@definetheorem{#1}{#2}{#3}{#4}%
160 \NewEnviron{#1rep}[1][]{%
161 \ifx\relax##1\relax
162 \begin{#1}\axp@redefinelabels\BODY\end{#1}%
163 \else
164 \begin{#1}[##1]\axp@redefinelabels\BODY\end{#1}%
165 \fi
166 }
167 }
```

`inlineproof (env.)` In inline mode, these environments behave like the regular `proof` environment.

```
168 \let\inlineproof\proof
169 \let\endinlineproof\endproof
170 \let\nestedproof\proof
171 \let\endnestedproof\endproof
172 \let\appendixproof\proof
173 \let\endappendixproof\endproof
```

`toappendix (env.)` In inline mode, this environment and these macros are no-ops.

```
174 \newenvironment{toappendix}{}{}
175 \let\noproofinappendix\relax
176 \let\nosectionappendix\relax
177 }
```

## 7.5 Append, Strip, or Chapter End Compilation Modes

```
178 {
```

We now deal with the case where `apxproof` really does something useful: either append the appendix material to the document, or strip it entirely.

### 7.5.1 Auxiliary File for the Appendix

`\axp@proofsfile` We open a new auxiliary file, with extension `.axp`, where the appendix material will be dumped.

```

179 \AtBeginDocument{
180   \newwrite\axp@proofsfile
181   \ifthenelse{\equal{\axp@appendix}{chapterend}}{%
182     \axp@openchapterfile
183   }{%
184     \immediate\openout\axp@proofsfile=\jobname.axp
185   }%
186 }
```

`proof (env.)` At the beginning of this file, we make `@` a regular character (since it will be used in several places for internal names) and reestablish the original definition of the `proof` environment and the `\section` macro.

```

187 \newcommand{\axp@writeproofsfilepreamble}{%
188   \immediate\write\axp@proofsfile{%
189     \noexpand\makeatletter
190     \noexpand\let\noexpand\proof\noexpand\axp@oldproof
191     \noexpand\let\noexpand\endproof\noexpand\endaxp@oldproof
192     \noexpand\let\noexpand\claimproof\noexpand\axp@oldclaimproof
193     \noexpand\let\noexpand\endclaimproof\noexpand\endaxp@oldclaimproof
194     \noexpand\let\noexpand\section\noexpand\axp@oldsection
195   }%
196 }
197 \AtBeginDocument{
198   \ifthenelse{\equal{\axp@appendix}{chapterend}}{%
199     \axp@writeproofsfilepreamble
200   }%
201 }
```

`\axp@unactivateeightbit` We need an auxiliary macro to disable active characters that have the high bit set when writing to the `.axp` file. See <https://tex.stackexchange.com/a/145361/166858>

```

202 \def\axp@unactivateeightbit{%
203   \count@=128%
204   \loop
205     \catcode\count@=12%
206     \ifnum\count@<255%
207       \advance\count@\@ne
208     \repeat}
```

`axp@VerbatimOut (env.)` Using the functionalities of the `fancyvrb` package, we define a custom verbatim environment `axp@VerbatimOut` that writes every line to the `\axp@proofsfile`.

`\FVB@axp@VerbatimOut` We also use the previous macro to disable active characters with the eighth bit set, and we make sure the catcode of `@` is reset for every verbatim environment, in case it is used by the user (e.g., as in the `xypic` package). Finally, as an additional precaution, we reset `\FV@CatCodesHook` that is for example set by the `commandchars` or `commentchar` option of `\fvset`.

```

209 \DefineVerbatimEnvironment{axp@VerbatimOut}{axp@VerbatimOut}{}
210 \def\FVB@axp@VerbatimOut{%
211   \@bsphack
```

```

212 \begingroup
213 \axp@unactivateeightbit
214 \FV@DefineWhiteSpace
215 \def\FV@Space{\space}%
216 \FV@DefineTabOut
217 \def\FV@ProcessLine{\immediate\write\axp@proofsfile}%
218 \let\FV@FontScanPrep\relax
219 \let\@noligs\relax
220 \def\FV@CatCodesHook{}%
221 \FV@Scan}
222 \def\FVE@axp@VerbatimOut{%
223 \immediate\write\axp@proofsfile{\noexpand\makeatletter}%
224 \endgroup\@esphack}

```

`\axp@markchapterhasappendix` No-op by default; overridden in `chapterend` mode to set a flag indicating that the current chapter has appendix content.

```
225 \newcommand{\axp@markchapterhasappendix}{}

```

`toappendix` (*env.*) The entire content of this environment is put in appendix, starting a new appendix section beforehand if needed.

```

226 \newenvironment{toappendix}
227 {\axp@markchapterhasappendix\axp@writesection\axp@VerbatimOut}
228 {\endaxp@VerbatimOut}

```

### 7.5.2 Definition of New Theorems

`axp@seenrepththeorem` Used to indicate whether a repeated theorem was just typeset, without its proof.

```
229 \newtoggle{axp@seenrepththeorem}

```

`axp@rpcounter` Sequentially incremented for every repeated theorem, used to create labels.

```
230 \newcounter{axp@rpcounter}

```

`axp@equation` Used to save the value of the `equation` counter, when `repeqn` is set to `same`.

```

axp@equationx 231 \newcounter{axp@equation}
232 \newcounter{axp@equationx}

```

`axp@newtheoremrep` With first argument `foobar`, we use `\axp@newtheoremrep@definetheorem` to define the regular version of the theorem `foobar`. We then patch `\begin{foobar}` so as not to expect a proof in the appendix and define an internal theorem `axp@foobarrp` that will be used in the appendix to restate the existing theorem.

```

233 \def\axp@newtheoremrep#1[#2]#3[#4]{%
234 \axp@newtheoremrep@definetheorem{#1}{#2}{#3}{#4}%
235 \expandafter\pretocmd\csname #1\endcsname{\noproofinappendix}{-}{-}%
236 \axp@newtheorem*{axp@#1rp}{#3}%
237 \axp@forward@setup{#1}{#2}{#3}{#4}%

```

We then define a `foobarrp` environment that increments the `axp@rpcounter` and typeset the regular `foobar` theorem with a label derived from the counter, along with a possible custom command to identify repeated theorems. We distinguish the case when the theorem argument has a note and when it does not. We save the equation counter before typesetting the theorem environment, to reset it to the same value in the repeated environment when `repeqn` is set to `same`.

```
238 \NewEnviron{#1rep}[1][{}]{%

```

```

239 \ifthenelse{\equal{\axp@repeqn}{same}}{%
240 \setcounter{axp@equation}{\value{equation}}}%
241 }{}%
242 \addtocounter{axp@rcounter}{1}%
243 \ifx\relax##1\relax
244 \axp@with@forward{#1}{\begin{#1}}\label{axp@r\roman{axp@rcounter}}}%
245 \else
246 \axp@with@forward{#1}{\begin{#1}[\##1]}\label{axp@r\roman{axp@rcounter}}}%
247 \fi
248 \mainbodyrepeatedtheorem
249 \BODY\end{#1}%

```

We set the `axp@seenrepththeorem` toggle to indicate that we are looking for the proof of the theorem, then store in a macro the content of the theorem's body.

```

250 \global\toggletrue{axp@seenrepththeorem}%
251 \global\expandafter\let\csname rplet\roman{axp@rcounter}%
252 \endcsname
253 \BODY

```

Possibly after starting a new appendix section if needed, we typeset a repeated version of the theorem using the `axp@foobarrp` environment and a reference to the previously defined label. We use `\axp@redefinlabels` in this environment to avoid multiply defined labels. We have to deal in a careful way with theorem notes: we want to use a theorem note to display the number of the repeated theorem, but theorem notes are usually typeset in a much different way (different font, parentheses) than theorem headings. In the case of the Springer document classes, we use the `\theopargself` macro to disable parentheses. For other document classes, we need to manually patch the `\thmhead` command at the right time. We also specially cover the case of the ACM document class where `\acmplainnotefont` is used instead of `\thm@notefont`.

```

254 \axp@markchapterhasappendix
255 \axp@writesection%
256 \immediate\write\axp@proofsfile{\noexpand\makeatletter}%
257 \ifthenelse{\equal{\axp@repeqn}{same}}{%
258 \immediate\write\axp@proofsfile{%
259 \noexpand\setcounter{axp@equationx}{\value{equation}}}%
260 \noexpand\setcounter{equation}{\theaxp@equation}%
261 }%
262 }{}%
263 \ifbool{axp@forward@suppress}{%
264 \global\def\axp@refstar{\ref*}%
265 }{%
266 \global\def\axp@refstar{\ref}%
267 }
268 \immediate\write\axp@proofsfile{%
269 \ifdefined\theopargself
270 \noexpand\theopargself
271 \else
272 \noexpand\pretocmd{\noexpand\@begintheorem}{%
273 \noexpand\patchcmd{\noexpand\thmhead}{\noexpand\acmplainnotefont}{-}{-}{-}%
274 \noexpand\patchcmd{\noexpand\thmhead}{\noexpand\the\noexpand\thm@notefont}{-}{-}{-}%
275 \noexpand\patchcmd{\noexpand\thmhead}{({}{-})}{-}{-}{-}%
276 \noexpand\patchcmd{\noexpand\thmhead}{-}{-}{-}{-}%
277 }{}{}

```



```

278     \fi
279     \noexpand\begin{axp@#1rp}
280     [%
281     \noexpand\axp@refstar{axp@r\roman{axp@rpcounter}}}%
282     \@ifnotempty{##1}{%
283     \ifdefined\theopargself
284     \else
285     \ifdefined\@acmplainnotefont
286     \noexpand\@acmplainnotefont
287     \else
288     \noexpand\ifdefined\noexpand\thm@notefont
289     \noexpand\the\noexpand\thm@notefont
290     \noexpand\fi
291     \fi
292     \fi
293     } (\unexpanded{##1})}%
294     }%
295     ]%
296     \noexpand\axp@forward@target{axp@fw@r\roman{axp@rpcounter}}}%
297     \noexpand\axp@redefinelabels
298     \expandafter\noexpand\csname rplet\roman{axp@rpcounter}}%
299     \endcsname
300     \noexpand\end{axp@#1rp}
301     }%
302     \ifthenelse{\equal{\axp@repeqn}{same}}{%
303     \immediate\write\axp@proofsfile{%
304     \noexpand\setcounter{equation}{\value{axp@equationx}}}%
305     }%
306     }{}%
307     }%
308     }

```

### 7.5.3 Forward-Linking Mechanism

When hyperref is loaded, foobarrep environments in the main text have their number link to their repetition in the appendix.

`\axp@with@forward` In order to make the number of the foobarrep theorem a link to its repeated version, we temporarily redefine the `\thefoobar` command, or, if we inherited the counter from a bazbar environment, the `\thebazbar` command. This seems to be the only robust way to make the number a `\hyperlink`, without adding extensive dependence on internals of amsthm, the builtin `\newtheorem` and possibly document-class specific definitions.

In order to allow users to redefine `\thefoobar` without breaking this feature, we redefine `\thefoobar` only for the duration of the `\begin{foobar}` form, resetting it to the old value as soon as possible.

Redefining `\thefoobar` has the side effect of changing `\newlabel` entries in the .aux file, so we need to be able to disable addition of the hyperlink, which is why we use an intermediate `\axp@forward@link{<target>}{<text>}` macro. We also redefine `\theHfoobar` which is used by hyperref but not defined if hyperref was loaded after `\newtheoremrep` was used and `\protect` it to output it verbatim into the .aux file.

These hyperlinks are of course disabled in the `strip` compilation mode.

```

309 \newcommand{\axp@with@forward}[2]{%
310 \ifthenelse{\equal{\axp@appendix}{strip}}{#2}{
311 \global\booltrue{axp@forward}%
312 \ifcsundef{axp@old@the\csname axp@cn@#1\endcsname}{%
313 \csletcs{axp@old@the\csname axp@cn@#1\endcsname}{the\csname axp@cn@#1\endcsname}%
314 \csletcs{theH\csname axp@cn@#1\endcsname}{the\csname axp@cn@#1\endcsname}%
315 \csdef{the\csname axp@cn@#1\endcsname}{%
316 \protect\axp@forward@link{axp@fw@r\roman{axp@rpcounter}}}%
317 {\csname axp@old@the\csname axp@cn@#1\endcsname\endcsname}%
318 }%
319 }{}%
320 #2%
321 \ifcsdef{axp@old@the\csname axp@cn@#1\endcsname}{%
322 \csletcs{the\csname axp@cn@#1\endcsname}{axp@old@the\csname axp@cn@#1\endcsname}%
323 }{}%
324 \global\boolfalse{axp@forward}
325 }%

```

`\axp@forward@link` Dummy macro, for handling the unwanted change of the `\newlabel` entry in `axp@forward` the `.aux` file caused by changing the definition of `\thefoobar`. We also use `\texorpdfstring` to detect whether the reference appears within a PDF bookmark, in which case we skip the test altogether.

```

326 \newbool{axp@forward}
327 \newcommand{\axp@forward@link}[2]{%
328 \ifdefined\texorpdfstring\else\newcommand\texorpdfstring[2]{#2}\fi
329 \texorpdfstring{%
330 \ifboolexpr{ bool {axp@forward} and not bool {axp@forward@suppress} }{%
331 \ifcsdef{hyperlink}{%
332 \hyperlink{#1}{#2}%
333 }{%
334 #2%
335 }%
336 }{%
337 #2%
338 }%
339 }{%
340 #2%
341 }%
342 }%

```

`\axp@forward@target` Provides the needed `\hypertarget`. Intended to be written to the `.axp` file.

```

343 \newcommand{\axp@forward@target}[2]{%
344 \ifcsname hypertarget\endcsname
345 \hypertarget{#1}{#2}%
346 \else
347 #2%
348 \fi
349 }

```

`\axp@forward@setup` In order to support counter inheritance with the first optional argument of `\newtheoremrep`, we need access to the name of the counter. For compliance with the behavior of `\@axp@newtheorem`, the first optional argument (`#2`) is ignored if the second optional argument (`#4`) is given. We also check whether

`aliascnt` was used to define this counter; if so, we use the original name as the counter name to handle the way such aliases work.

```

350 \newcommand{\axp@forward@setup}[4]{%
351   \csedef{axp@cn@#1}{\ifblank{#4}{\ifblank{#2}{#1}{\ifcsdef{AC@cnt@#1}{#1}{#2}}}{#1}}%
352 }
```

#### 7.5.4 Proof Environments

`\noproofinappendix` Utility macro that toggles `axp@seenreptheorem` to false.

```

353 \newcommand\noproofinappendix{%
354   \global\togglefalse{axp@seenreptheorem}%
355 }
```

`appendixproof` (*env.*) We dump the content of this in appendix, within an original `proof` environment, possibly after creating a new appendix section. We support optional arguments in proofs, but we need to be careful not to gobble any newline character, that would make it impossible to process the first line with `fancyvrb`.

```

356 \def\appendixproof{\catcode'\^M=\active\ifnextchar[{\catcode'\^M=5\@appendixproof[axp@
357 \def\@appendixproof[#1]%
358   {%
359     \axp@markchapterhasappendix
360     \axp@writesection
361     \immediate\write\axp@proofsfile{%
362       \noexpand\makeatletter\noexpand\begin{#1}\noexpand\makeatother%
363     }%
364     \axp@VerbatimOut
365   }
366 \def\@appendixproof[#1][#2]%
367   {%
368     \axp@markchapterhasappendix
369     \axp@writesection
370     \immediate\write\axp@proofsfile{%
371       \noexpand\makeatletter\noexpand\begin{#1}[\unexpanded{#2}]\noexpand\makeatother%
372     }%
373     \axp@VerbatimOut
374   }
375 \def\endappendixproof
376   {%
377     \endaxp@VerbatimOut
378     \immediate\write\axp@proofsfile{%
379       \noexpand\end{axp@oldproof}%
380     }%
381     \noproofinappendix
382   }
```

`proof` (*env.*) This environment either puts the proof in appendix, if we are after a repeated theorem without its proof, or inlines it otherwise. We support optional arguments in proofs, but we need to be careful not to gobble any newline character, that would make it impossible to process the first line with `fancyvrb`.

```

383 \def\proof{\catcode'\^M=\active\ltx@ifnextchar@nospace[{\catcode'\^M=5\axp@proof}{\catco
384 \def\axp@proof
385   {%
386     \iftoggle{axp@seenreptheorem}{%
```

```

387     \appendixproof
388   }{%
389     \axp@oldproof
390   }%
391 }
392 \def\axp@@proof[#1]%
393 {%
394   \iftoggle{axp@seenreptheorem}{%
395     \appendixproof[#1]
396   }{%
397     \axp@oldproof[#1]
398   }%
399 }
400 \def\endproof
401 {%
402   \iftoggle{axp@seenreptheorem}{%
403     \endappendixproof
404   }{%
405     \endaxp@oldproof
406   }%
407 }

```

`claimproof` (*env.*) If the `claimproof` environment exists (lipics document class or user-defined), we also redefine it, in the same way.

```

408 \AtBeginDocument{
409   \ifdefined\claimproof
410     \let\axp@oldclaimproof\claimproof
411     \let\endaxp@oldclaimproof\endclaimproof
412     \def\claimproof{\catcode'\^^M=\active\ltx@ifnextchar@nospace[{\catcode'\^^M=5\axp@@claimproof}]
413     \def\appendixclaimproof{\catcode'\^^M=\active\ltx@ifnextchar[{\catcode'\^^M=5\@appendixproof}]
414     \def\axp@claimproof
415     {%
416       \iftoggle{axp@seenreptheorem}{%
417         \appendixclaimproof
418       }{%
419         \axp@oldclaimproof
420       }%
421     }
422     \def\axp@@claimproof[#1]%
423     {%
424       \iftoggle{axp@seenreptheorem}{%
425         \appendixclaimproof[#1]%
426       }{%
427         \axp@oldclaimproof[#1]%
428       }%
429     }
430     \def\endclaimproof
431     {%
432       \iftoggle{axp@seenreptheorem}{%
433         \endappendixclaimproof
434       }{%
435         \endaxp@oldclaimproof
436       }%
437     }

```

```

438 \def\endappendixclaimproof
439 {%
440 \endaxp@VerbatimOut
441 \immediate\write\axp@proofsfile{%
442 \noexpand\end{axp@oldclaimproof}}%
443 }%
444 \noproofinappendix
445 }
446 \fi
447 }

```

`inlineproof` (*env.*) These two environments are synonyms for the original `proof` environment.

```

nestedproof (env.) 448 \let\inlineproof\axp@oldproof
449 \let\endinlineproof\endaxp@oldproof
450 \let\nestedproof\axp@oldproof
451 \let\endnestedproof\endaxp@oldproof

```

### 7.5.5 Section Management

`axp@seccounter` Sequentially incremented for every section, used to create labels.

```

452 \newcounter{axp@seccounter}

```

`\axp@sectitle` Saves the title of the last encountered section.

```

453 \def\axp@sectitle{}

```

`\axp@section` This command `\axp@section` behaves similarly to `\axp@oldsection`, except that `\axp@@sectionskippar` it first tests whether a `\section` follows, and if so, does not produce anything. This `\axp@@sectiontestinput` is useful to avoid producing empty sections in the appendix. Using the `catchfile` `\axp@@sectiontestinclude` package, we also check whether a `\section` is within an `\input` or `\include` that `\axp@@sectionfinishinclude` immediately follows. We also skip any `\par` tokens (produced by blank lines) `\axp@@sectiontestsection` before performing the check.

```

454 \def\axp@section#1{%
455 \ifnextchar\par
456 {\axp@@sectionskippar{#1}}%
457 {\ifnextchar\input
458 {\axp@@sectiontestinput{#1}}%
459 {\ifnextchar\include
460 {\axp@@sectiontestinclude{#1}}%
461 {\axp@@sectiontestsection{#1}}}%
462 }
463 \def\axp@@sectionskippar#1\par{\axp@section{#1}}
464 \def\axp@@sectiontestinput#1\input#2{%
465 \CatchFileDef{\axp@tmp}{#2}{}%
466 \def\axp@tmptmp{\axp@@sectiontestsection{#1}}%
467 \expandafter\axp@tmptmp\axp@tmp%
468 }
469 \def\axp@@sectiontestinclude#1\include#2{%
470 \set@curr@file{#2}%
471 \edef\axp@tmp{\@strip@tex@ext\@curr@file.tex}%
472 \expandafter\CatchFileDef\expandafter\axp@tmp\expandafter{\axp@tmp}{}%
473 \def\axp@tmptmp{\axp@@sectionfinishinclude{#1}{#2}}%
474 \expandafter\axp@tmptmp\axp@tmp\@nil
475 }

```

```

476 \long\def\axp@@sectionfinishinclude#1#2#3#4\@nil{%
477   \ifx#3\section
478     \makeatother
479   \else
480     \axp@oldsection{#1}\makeatother
481   \fi
482   \include{#2}%
483 }
484 \def\axp@@sectiontestsection#1{\@ifnextchar\section{\makeatother}{\axp@oldsection{#1}\make

```

**\axp@oldsection** We redefine the `\section` command to create a label based on `axp@seccounter` and to store its title in `\axp@sectitle`. In order to support starred and unstarred `\@section` versions, as well as the optional short-title argument, the intermediate macros `\@@section` `\@section` and `\@@@section` are needed.

```

485 \let\axp@oldsection\section
486 \def\section{\@ifstar\@section\@@section}
487 \newcommand{\@section}[2][\relax]{\axp@@section*{#1}{#2}}%
488 \newcommand{\@@section}[2][\relax]{\axp@@@section{#1}{#2}}%
489 \newcommand{\axp@@@section}[3]{%
490   \global\def\axp@sectitle{#3}%
491   \ifx\relax#2\relax
492     \axp@oldsection#1{#3}%
493   \else
494     \axp@oldsection#1[{#2}]{#3}%
495   \fi
496   \addtocounter{axp@seccounter}{1}%
497   \label{axp@s\roman{axp@seccounter}}}%
498 }

```

**\nosectionappendix** We remove the current section title, to indicate no section should be created in the appendix.

```

499 \newcommand{\nosectionappendix}{
500   \global\def\axp@sectitle{}%
501 }

```

**\axp@writesection** If `\axp@sectitle` is not empty, we create a new section in the appendix, referring to the main text section.

Here, we wrap `\ref{axp@si}` into `\axp@protectref@i`, in order to protect the label name from wrongly being converted to uppercase, e.g., in `fancyhdr` with `\pagestyle{fancy}`.

This macro is defined both in the `.aux` file (in order to ensure availability when typesetting the `\tableofcontents`), and immediately before typesetting the appendix section (to ensure availability in the `\section` command).

```

502 \newcommand\axp@writesection{%
503   \ifx\axp@sectitle\@empty
504   \else
505     \edef\axp@tmp{%
506       \noexpand\global\noexpand\def
507       \expandonce{\csname axp@protectref@\roman{axp@seccounter}\endcsname}{%
508         \noexpand\ref{axp@s\roman{axp@seccounter}}}%
509     }%
510   }%
511   \immediate\write\@auxout{\expandonce\axp@tmp}

```

```

512     \immediate\write\axp@proofsfile{%
513     \expandonce\axp@tmp^^J%
514     \noexpand\axp@section{%
515         \noexpand\appendixsectionformat{%
516             \protect
517             \expandonce{\csname axp@protectref@\roman{axp@seccounter}\endcsname}%
518             }{\expandonce\axp@sectitle}%
519     }%
520 }%
521 \nosectionappendix
522 \fi
523 }

```

Finally, in a somewhat ad hoc manner, we disable the whole section management for `\tableofcontents`, which may be typeset using a section heading, but for which automatic section management does not make sense.

```

\axp@oldtableofcontents
\tableofcontents 524 \let\axp@oldtableofcontents\tableofcontents
525 \def\tableofcontents{\let\section\axp@oldsection\axp@oldtableofcontents}}

```

### 7.5.6 Append Compilation Mode

```

526 \ifthenelse{\equal{\axp@appendix}{append}}{
\axp@oldbibliography Unless the bibliography option is set to common, we need to set the appendix
\ Bibliography bibliography source to be the same as that of the main text, thanks to bibunits's
\defaultbibliography macro.
527 \ifthenelse{\equal{\axp@bibliography}{separate}}{
528 \let\axp@oldbibliography\Bibliography
529 \renewcommand\Bibliography[1]{%
530 \defaultbibliography{#1}%
531 \axp@oldbibliography{#1}%
532 }
533 }{

```

After the end of the main text, we add the appendix (after the command `\appendixprelim` is issued) within a `bibunit` environment so as to typeset a separate bibliography for the appendix (unless the `bibliography` option is set to `common`). This is done using `\pretocmd` on `\@enddocumenthook` instead of `\AtEndDocument` because we want the code to be run before any code in the `\@enddocumenthook` that has been set in the document class, as in the `amsart` document class. There is an extra test to ensure an empty bibliography environment is not produced. The name of the bibliography is changed to `\appendixrefname`; in most document classes, it is called `\refname` but it is occasionally (`scrartcl`, `scrreprt`) called `\bibname`. An ad-hoc test is added to fix a conflict with the `natbib` package which redefines `bibcite` at the end of the document.

```

534 \pretocmd{\@enddocumenthook}{%
535 \ifdefined\NAT@testdef
536 \renewcommand\bibcite[2]{%
537 \global\@namedef{b@#1\@extra@binfo}{#2}%
538 }
539 \fi

```

```

540 \appendixprelim
541 \appendix
542 \ifthenelse{\equal{\axp@bibliography}{separate}}{
543 \begin{bibunit}[\appendixbibliographystyle]
544 }{
545 \immediate\closeout\axp@proofsfile
546 \input{\jobname.axp}
547 \ifthenelse{\equal{\axp@bibliography}{separate}}{
548 \ifdefined\refname
549 \renewcommand{\refname}{\appendixrefname}
550 \else\ifdefined\bibname
551 \renewcommand{\bibname}{\appendixrefname}
552 \fi\fi
553 \let\axp@oldthebibliography\thebibliography
554 \let\endaxp@oldthebibliography\endthebibliography
555 \renewenvironment{thebibliography}[1]{%
556 \def\axp@tmp{#1}%
557 \ifx\axp@tmp\empty
558 \gdef\axp@noappendixbibliography1\relax
559 \else
560 \begin{axp@oldthebibliography}{#1}%
561 \fi
562 }{
563 \ifdefined\axp@noappendixbibliography\relax\else\end{axp@oldthebibliography}%
564 \fi}
565 \appendixbibliographyprelim
566 \putbib
567 \end{bibunit}
568 \ifdefined\NAT@testdef
569 \let\bibcite\NAT@testdef
570 \fi
571 }{}
572 }{}{}
573 }{}

```

### 7.5.7 Chapter End Compilation Mode

In `chapterend` mode, appendix material for each chapter is gathered in a per-chapter auxiliary file and emitted immediately after that chapter's content (and bibliography). This requires the `appendix` package for its `subappendices` environment.

```

574 \ifthenelse{\equal{\axp@appendix}{chapterend}}{
575 \RequirePackage{appendix}

```

`\chapterappendixprelim` User-customizable hooks surrounding each chapter's appendix block. By default they open and close a `subappendices` environment.

```

\axp@beginchapterappendix
\axp@endchapterappendix
576 \newcommand{\chapterappendixprelim}{\clearpage}
577 \newcommand{\axp@beginchapterappendix}{%
578 \chapterappendixprelim
579 \begin{subappendices}%
580 }
581 \newcommand{\axp@endchapterappendix}{%

```



```

582     \end{subappendices}%
583 }

axp@chaptercounter Counter for unique per-chapter file names, a boolean tracking whether the current
axp@chapterhasappendix chapter has any appendix content, and the current file name.
\axp@currenttaxpfile 584     \newcounter{axp@chaptercounter}
585     \newbool{axp@chapterhasappendix}
586     \def\axp@currenttaxpfile{}

\axp@markchapterhasappendix Override the no-op to set the boolean when content is written.
587     \renewcommand{\axp@markchapterhasappendix}{%
588         \global\booltrue{axp@chapterhasappendix}%
589     }

\axp@openchapterfile Open a fresh auxiliary file for the current chapter. We write \begingroup
first so that all the preamble \let assignments (and any catcode changes from
\makeatletter) are scoped to this chapter's appendix and do not leak into the
rest of the document when the file is \input'd. We also reset the section-title
tracker and the repeated-theorem toggle so that state from the previous chapter
cannot bleed into the new file.
590     \newcommand{\axp@openchapterfile}{%
591         \edef\axp@currenttaxpfile{\jobname-\arabic{axp@chaptercounter}.axp}%
592         \immediate\openout\axp@proofsfile=\axp@currenttaxpfile
593         \immediate\write\axp@proofsfile{\noexpand\begingroup}%
594         \axp@writeproofsfilepreamble
595         \global\boolfalse{axp@chapterhasappendix}%
596         \global\def\axp@sectitle{}%
597         \global\togglefalse{axp@seenreptheorem}%
598     }

\axp@flushchapterappendix Close the current chapter's auxiliary file (appending \endgroup to close the group
opened in \axp@openchapterfile) and, if it contains any content, emit it inside
a subappendices block.
599     \newcommand{\axp@flushchapterappendix}{%
600         \immediate\write\axp@proofsfile{\noexpand\endgroup}%
601         \immediate\closeout\axp@proofsfile
602         \ifbool{axp@chapterhasappendix}{%
603             \axp@beginchapterappendix
604             \input{\axp@currenttaxpfile}%
605             \axp@endchapterappendix
606         }{}%
607     }

At the start of each \chapter, flush the previous chapter's auxiliary file, increment
the counter, and open the next one. At \end{document}, flush the last chapter's
file.
608     \AtBeginDocument{%
609         \ifdef{\chapter}{%
610             \pretocmd{\chapter}{%
611                 \axp@flushchapterappendix
612                 \stepcounter{axp@chaptercounter}%
613                 \axp@openchapterfile
614             }{\PackageWarning{apxproof}{%

```

```

615         Could not hook into \string\chapter;^^J%
616         chapter appendices may not be emitted correctly}}%
617     }{%
618         \PackageWarning{apxproof}{%
619             appendix=chapterend used but \string\chapter\space
620             is not defined}%
621     }%
622 }
623 \pretocmd{\@enddocumenthook}{%
624     \axp@flushchapterappendix
625 }{}{}
626 }{}

```

### 7.5.8 Class-Specific Behavior

We conclude with some class-specific behavior.

#### ACM Document Classes (old versions, till 2017)

```

627 \ifdefined\@acmttitlebox

```

We first redefine the `proofsketch` environment, which is used differently in the base class.

```

628 \renewenvironment{proofsketch}{\begin{axp@oldproof}[sketch]}\end{axp@oldproof}}

```

We adjust the styling of theorems for the needs of `apxproof`.

```

629 \newtheoremstyle{mystyle}
630 {6pt}
631 {6pt}
632 {\itshape}
633 {10pt}
634 {\scshape}
635 {.}
636 {.5em}
637 {}
638 \theoremstyle{mystyle}

```

`\thebibliography` The section title of the bibliography is in uppercase in these document classes. In addition, the `\thebibliography` macro hard-codes twice the section title, so we un-hardcode it so that it can be modified in the appendix.

```

639 \patchcmd{\thebibliography}{References}{\protect\refname}{}{}
640 \patchcmd{\thebibliography}{References}{\protect\refname}{}{}
641 \newcommand{\refname}{REFERENCES}
642 \renewcommand{\appendixrefname}{REFERENCES FOR THE APPENDIX}
643 \fi

```

#### lipcs

```

644 \ifdefined\lipics@opterrshort

```

`\appendixbibliographyprelim` The default bibliography in the `lipics` document class formatting is not compatible with the `alpha` bibliography style. We fix this here.

```

645 \renewcommand{\appendixbibliographyprelim}{%

```

```

646     \global\let\@oldbiblabel\@biblabel
647     \def\@biblabel{\hspace*{-2em}\small\@oldbiblabel}%
648   }

649 \fi
650 }

```

## Change History

|  |  |       |
|--|--|-------|
| v1.0.0   | Deal with document classes where the bibliography is called  |       |
| General: Initial released version . . .  | <code>\bibname</code> . . . . .  | 1 23  |
| v1.0.1   | Support of new ACM document class ( <code>acmart.cls</code> ) . . . . .  | 26    |
| General: Prevent empty bibliography environment; fix typos . . . . .                     | <code>\axp@newtheorem</code> : Introduce intermediary command for theorem macro . . . . .  | 1 11  |
| v1.0.2   | <code>\axp@newtheoremrep</code> : Fix display of repeated theorem counter in some document classes . . . . .   | 16    |
| Fix missing space between repeated theorem counter and theorem note . . . . .            | <code>\axp@writesection</code> : Fix extraneous space after section number in appendix titles . . . . .  | 16 22 |
| v1.0.3   | General: Note on entire sections in appendix . . . . .   | 2     |
| <code>\appendixbibliographyprelim</code> : Support for lipics-v2016 . . . . .            | <code>axp@newtheoremrep</code> : Better handling of note-free theorems in document classes that treat theorems differently when they have an empty note . . . . .                                | 26 15 |
| <code>proofsketch</code> : Ignore spaces after beginning of Proof sketch . . . . .       | Fix incorrect use of <code>\noexpand</code> in optional argument of macro environment . . . . .  | 11 16 |
| v1.0.4   | v1.1.0   |       |
| General: More faithful theorem style for ACM templates . . . . .                         | General: Added forward-link mechanism (K. D. Bauer) . . . . .  | 26 17 |
| More robust coherent styling of proof sketches . . . . .                                 | <code>\appendixsectionformat</code> : Fix missing space in default <code>\appendixsectionformat</code> . . . . .   | 26 11 |
| Re-establish custom proof environments . . . . .   | <code>\axp@proofsfile</code> : Initialization deferred to <code>\AtBeginDocument</code> for compatibility with <code>\dumped</code> precompiled preambles (K. D. Bauer) . . . . .                | 8 14  |
| Show options commented on in margin and index . . . . .                                  | <code>\axp@redefinelabels</code> : Fix <code>\label</code> not being disabled in <code>amsmath</code> environments, where <code>\label@in@display</code> is used instead (K. D. Bauer) . . . . . | 1 12  |
| <code>\appendixprelim</code> : Configurable appendix style . . . . .                     | <code>\axp@repeqn</code> : <code>repeqn</code> option . . . . .  | 11 9  |
| <code>\axp@bibliography</code> : <code>bibliography</code> option . . . . .              | <code>\axp@unactivateeightbit</code> : Fix compilation of non-ASCII characters with <code>\usepackage[utf8]{inputenc}</code> . . . . .   | 9 14  |
| v1.0.5   | <code>\axp@writesection</code> : Make <code>\axp@tmp</code> wrapper more robust.   |       |
| General: Ability to specify a sectioning counter in <code>newtheoremrep</code> . . . . . |  | 2     |
| Fix compilation of <code>proofsketch</code> environment in inline mode . . . . .         |  | 3     |
| v1.0.6   |  |       |
| General: Better support of Springer document classes . . . . .                           |  | 12    |

|   |    |        |  |    |
|---|----|--------|--|----|
| Resolves issues from use of section title in <code>fancyhdr</code> , and in <code>\tableofcontents</code> (K. D. Bauer). . . . .  | 22 | v1.2.2 | Fix compatibility with other uses of <code>fancyvrb</code> that set <code>\FV@CatCodesHook</code> . . . . .                          | 14 |
| <code>\FVE@axp@VerbatimOut</code> : Make <code>apxproof</code> compatible with independent use of <code>fancyvrb</code> . .       | 14 |        | General: Compatibility with AMS document classes: do not use <code>\AtEndDocument</code> . . . . .                                   | 23 |
| <code>\section</code> : Fix handling of fragile macros within section headings. See #22. . . . .                                  | 22 |        | <code>\axp@section</code> : Detect a section within an included file to avoid produced useless sections . . . .                      | 21 |
| Rewrote definition of <code>\section</code> to enable optional argument. See #23. (K. D. Bauer) . . . .                           | 22 |        | <code>axp@newtheoremrep</code> : Fix handling of optional arguments of repeated theorems containing optional arguments . . . . .     | 15 |
| <code>\tableofcontents</code> : Disable section management for table of contents . . . . .  | 23 | v1.2.3 | General: More robust redefinition of <code>thebibliography</code> environment, for compatibility with <code>tocbibind</code> . . . . | 23 |
| v1.2.0  |    |        | <code>\axp@forwardlinking</code> : <code>forwardlinking</code> option . . . . .  | 9  |
| General: Do not load <code>bibunits</code> if <code>bibliography</code> is set to <code>common</code> . . . . .                   | 10 |        | v1.2.4   |    |
| <code>\axp@newtheoremrep</code> : Fix formatting of theorems without notes in some document classes in inline mode . . . . .      | 13 |        | <code>appendixproof</code> : Support optional arguments in proofs . . . . .  | 19 |
| <code>\axp@newtheoremrep@definetheorem</code> : Restore predefined theorem counters . . . . .                                     | 10 |        | <code>claimproof</code> : Support for <code>claimproof</code> environment from <code>lipics</code> . . . . .                         | 20 |
| <code>\axp@redefinelabels</code> : Fix extra spacing erroneously introduced within the <code>\axp@redefinelabels</code> macro . . | 12 | v1.2.5 | <code>claimproof</code> : Support for locally defined <code>claimproof</code> environment . . . . .                                  | 20 |
| <code>\mainbodyrepeatedtheorem</code> : Configurable repeated theorem command . . . . .   | 11 |        | <code>axp@forward</code> : Remove forward linking command from PDF bookmarks . . . . .   | 18 |
| <code>proofsketch</code> : Fix proof sketches in inline compilation mode for Springer document classes . . .                      | 12 | v1.2.6 | General: Fix compilation issues in recent versions of <code>acmart</code> . . . .  | 13 |
| <code>axp@newtheoremrep</code> : Fix display of theorem notes . . . . .   | 16 |        | <code>\axp@forward@setup</code> : Support for <code>aliascnt</code> counters . . . . .   | 18 |
| v1.2.1  |    |        | <code>\axp@newtheoremrep@definetheorem</code> : Undefine counter printing command to avoid warning . . .                             | 10 |
| General: Ad hoc fix for <code>natbib</code> package conflict . . . . .  | 23 | v1.3.0 | General: Added <code>chapterend</code> appendix mode . . . . .   | 24 |
| <code>\appendixrefname</code> : Fix compatibility with <code>memoir</code> document class . . . . .                               | 11 |        | <code>\axp@section</code> : Detect a section within an <code>\include</code> 'd file . . . .   | 21 |
| <code>\FVE@axp@VerbatimOut</code> : Fix compatibility with <code>xypic</code> package . . . . .                                   | 14 |        | Skip blank lines before detecting a section command . . . . .  | 21 |

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## A Proofs for Section 1 (Usage)

*Proof.*

□

**Foobar 2.** *This foobar is repeated in the appendix.*

*Proof.*

□