keytheorems package

version 0.1.0

Matthew Bertucci

September 9, 2024

Abstract

An expl3-implementation of a key-value interface to amsthm, implementing most of the functionality provided by thmtools. Several issues encountered with thmtools are avoided (see the README for a list) and a few new features are added.

Contents

1 Dependencies

Without using the `tcolorbox`$^{\rightarrow P.\,6}$ or `tcolorbox-no-titlebar`$^{\rightarrow P.\,7}$ options, the package loads the aliascnt, amsthm, refcount, and translations packages. A LaTeX kernel no older than 2023-06-01 is required; if older than 2024-06-01, nameref is required.

2 Global Options

\keytheoremset{⟨*options*⟩}

Every key in this section can be given as a package option with \usepackage[⟨*options*⟩]{keytheorems} or in \keytheoremset{⟨*options*⟩}, with the exception that `continues-code`$^{\rightarrow P.\,2}$ can only be used in the latter.

overload (initially unset)

Redefines `\newtheorem` to internally use the keytheorems machinery. The syntax remains the same. This is automatically set by `thmtools-compat`.

thmtools-compat (initially unset)

For compatibility with thmtools syntax. Currently defines the commands in the left column below. The right column lists the corresponding keytheorems replacement that should be used in new documents.

thmtools command	keytheorems replacement
`\declaretheorem`	`\newkeytheorem`
`\declaretheoremstyle`	`\newkeytheoremstyle`$^{\rightarrow P.7}$
`\listoftheorems`	`\listofkeytheorems`$^{\rightarrow P.9}$
`\addtotheorempreheadhook`	
`\addtotheorempostheadhook`	`\addtotheoremhook`$^{\rightarrow P.11}$
`\addtotheoremprefoothook`	
`\addtotheorempostfoothook`	
`restatable` environment	`store`$^{\rightarrow P.3}$ key

Also defined are the **shaded** and **thmbox** keys, implemented internally with tcolorbox rather than the shadethm and thmbox packages, respectively.

store-all (initially unset)

Tells keytheorems to grab the body of each theorem so it can later be printed with the `print-body`$^{\rightarrow P.10}$ option of `\listofkeytheorems`$^{\rightarrow P.9}$. Note that this means a theorem body *cannot* contain verbatim material.

restate-counters={⟨*comma-list of counters*⟩} (initially {equation})

Additional counters whose values are preserved when a theorem is restated. This key does not reset the list, so you don't need to include `equation` in ⟨*comma-list*⟩.

continues-code=⟨*code with* #1⟩ (initially `\GetTranslation{keythms_continues}\pageref{#1}`)

The code used to typeset the note produced by the `continues`$^{\rightarrow P.3}$ key. If English or an unknown language is used, defaults to `continuing from p.\,\pageref{#1}`. Currently (likely inaccurate!) translations exist for French, German, and Spanish.

qed-symbol=⟨*symbol*⟩ (initially `\openbox`)

Redefines `\qedsymbol` to be ⟨*symbol*⟩.

auto-translate=true|false (default `true`, initially `true`)

If `false`, keytheorems does not automatically translate the title text for `\listofkeytheorems`$^{\rightarrow P.9}$ and the note produced by the `continues`$^{\rightarrow P.3}$ key. These texts can be manually customized with the `title`$^{\rightarrow P.10}$ and `continues-code` keys, respectively.

3 Defining Theorems

`\newkeytheorem`{⟨*env name*⟩}[⟨*options*⟩]

Defines a theorem environment ⟨*env name*⟩ which itself takes a few options (see subsection 3.1). You can also declare multiple theorems at once by replacing ⟨*env name*⟩ with a comma-list of names, e.g. `\newkeytheorem{theorem,lemma,proposition}[⟨options⟩]`.

By default, the theorem's printed name is a title-cased ⟨*env name*⟩. This can be changed with the `name`$^{\rightarrow P.4}$ key. All ⟨*options*⟩ are described in subsections 3.2 and 3.3.

```
% preamble
\newkeytheorem{theorem}

% document
\begin{theorem}
Some text
\end{theorem}
```

Theorem 1. *Some text*

3.1 Keys available to theorem environments

As in amsthm, theorems can take an optional argument that contains a note or heading.

```
\begin{theorem}[some heading]
Some text
\end{theorem}
```
Theorem 2 (some heading)**.** *Some text*

Alternatively, the optional argument may contain any of the following keys.

note=⟨*text*⟩ (initially unset)

Alias **name**. This is the key-value equivalent of the optional argument described above. This syntax, however, allows the argument to contain other keys.

```
\begin{theorem}[some heading]
Some text
\end{theorem}
\begin{theorem}[note=another heading]
Some more text
\end{theorem}
```
Theorem 3 (some heading)**.** *Some text*

Theorem 4 (another heading)**.** *Some more text*

short-note=⟨*text*⟩ (initially unset)

Alias **short-name**. This replaces the value of **note** when displayed in **\listofkeytheorems**[→ P. 9].

label=⟨*label name*⟩ (initially unset)

This is the key-value equivalent of \begin{theorem} \label{⟨*label name*⟩}.

```
\begin{theorem}[label=foo]
Some text
\end{theorem}
\ref{foo}
```
Theorem 5. *Some text*

5

continues∗=⟨*label name*⟩ (initially unset)

Pick up a theorem where you left off. The theorem number remains the same. The printed text can be customized with the **continues-code**[→ P. 2] option. The starred version also copies the theorem note, if it exists.

```
\begin{theorem}[continues=foo]
\dots and some more text.
\end{theorem}
```
Theorem 5 (continuing from p. 3)**.** *. . . and some more text.*

store=⟨*tag*⟩ (initially unset)

Alias **restate**. Stores the the theorem to be restated at any point in the document with \getkeytheorem[→ P. 8].

```
\begin{theorem}[store=blub]
A theorem worth restating.
\end{theorem}
More brilliant mathematics.
\getkeytheorem{blub}
```
Theorem 6. *A theorem worth restating.*

More brilliant mathematics.

Theorem 6. *A theorem worth restating.*

A theorem given this key *cannot* contain verbatim material or other unexpected catcodes, such as a tikz-cd diagram. The latter issue can be averted with the ampersand-replacement key.

```
% preamble
\usepackage{tikz}
\usetikzlibrary{cd}

% document
\begin{lemma}[store=diagram]
Some commutative diagram:
\[\begin{tikzcd}[ampersand
↪  replacement=\&]
X\times_S Y \ar[r] \ar[d] \& X \ar[d]
↪  \\
Y \ar[r] \& S
\end{tikzcd}\]
\end{lemma}
\dots
\getkeytheorem{diagram}
```

Lemma 7. *Some commutative diagram:*

$$X \times_S Y \longrightarrow X$$
$$\downarrow \qquad\qquad \downarrow$$
$$Y \longrightarrow S$$

. . .

Lemma 7. *Some commutative diagram:*

$$X \times_S Y \longrightarrow X$$
$$\downarrow \qquad\qquad \downarrow$$
$$Y \longrightarrow S$$

listhack=**true**|**false**   (initially `false`)

Meant only to be used with the break^{→ P. 8} style key for a theorem starting with a list. Compare:

```
% preamble
\newkeytheoremstyle{breaksty}{break}
\newkeytheorem{observation}[style=breaksty]

% document
\begin{observation}
\begin{enumerate}
\item First item
\end{enumerate}
\end{observation}

\begin{observation}[listhack=true]
\begin{enumerate}
\item First item
\end{enumerate}
\end{observation}
```

Observation 1.   *1. First item*

Observation 2.

  1. First item

Note that the value `true` must be explicitly set so that `listhack` is not interpreted as the note text.

seq=⟨*name*⟩   (initially unset)

Adds the theorem to a custom sequence ⟨*name*⟩ that can then be listed with `\listofkeytheorems[seq=⟨name⟩]`. See seq^{→ P. 10} for more details.

3.2   Keys inherited from **thmtools**

These are the [⟨*options*⟩] available to `\newkeytheorem`. Except for name and style^{→ P. 5}, each key below can also be used in `\newkeytheoremstyle`^{→ P. 7}. For more description, see the thmtools package.

name=⟨*display name*⟩   (initially title-cased ⟨*env name*⟩)

Aliases `title` and `heading`.

```
% preamble
\newkeytheorem{mythm}[name=Some Name]

% document
\begin{mythm}
Some text
\end{mythm}
```

Some Name 1. *Some text*

4

numbered=**true**|**false**|**unless-unique**   (default `true`, initially `true`)

For compatibility with thmtools, also accepts the values **yes**, **no**, and **unless unique**.

```
% preamble
\newkeytheorem{theorem*}[
  name=Theorem, numbered=false
  ]

% document
\begin{theorem*}
An unnumbered theorem.
\end{theorem*}
```
Theorem. *An unnumbered theorem.*

parent=⟨*counter*⟩   (initially unset)

Aliases **numberwithin** and **within**.

```
% preamble
\newkeytheorem{conjecture}[parent=section]

% document
\begin{conjecture}
The first number is the section.
\end{conjecture}
```
Conjecture 3.1. *The first number is the section.*

sibling=⟨*counter*⟩   (initially unset)

Aliases **numberlike** and **sharenumber**.

```
% preamble
\newkeytheorem{lemma}[sibling=theorem]

% document
\begin{lemma}
This shares its counter with
\texttt{theorem}.
\end{lemma}
```
Lemma 8. *This shares its counter with* `theorem`.

style=⟨*style name*⟩   (initially unset)

Accepts any ⟨*style name*⟩ defined by **\newkeytheoremstyle**^{→P.7}, as well as any of the predefined amsthm styles: **plain**, **definition**, and **remark**.

```
% preamble
\newkeytheorem{remark}[style=remark]

% document
\begin{remark}
Some text
\end{remark}
```
Remark 1. Some text

preheadhook=⟨*code*⟩   (initially unset)
postheadhook=⟨*code*⟩   (initially unset)
prefoothook=⟨*code*⟩   (initially unset)
postfoothook=⟨*code*⟩   (initially unset)

Details in section 7.

```
% preamble
\newkeytheorem{test}[
  preheadhook=PREHEAD,
  postheadhook=POSTHEAD,
  prefoothook=PREFOOT,
  postfoothook=POSTFOOT
]

% document
\begin{test}
Some text
\end{test}
```

PREHEAD

Test 1. *POSTHEADSome text PREFOOT*

POSTFOOT

refname=⟨*ref name*⟩ or {⟨*singular name*⟩,⟨*plural name*⟩}   (initially ⟨*display name*⟩)

If a single string, then the name used by hyperref's \autoref and cleveref's \cref. If two strings separated by a comma, then the second string is the plural form used by \cref.

Refname=⟨*ref name*⟩ or {⟨*singular name*⟩,⟨*plural name*⟩}   (initially ⟨*display name*⟩)

Same as **refname** but for **\Autoref** and \Cref. Note that **\Autoref** is defined by keytheorems, but requires hyperref to work.

```
% preamble
\newkeytheorem{prop}[
  name=Proposition,
  refname={proposition,propositions},
  Refname={Proposition,Propositions}
  ]

% document
\begin{prop}[label=abc]
Some text
\end{prop}
\begin{prop}[label=def]
Some more text
\end{prop}
\begin{theorem}
Consider \cref{abc,def}.
\Autoref{abc} \dots
\end{theorem}
```

Proposition 1. *Some text*

Proposition 2. *Some more text*

Theorem 9. *Consider propositions 1 and 2. Proposition 1 . . .*

qed=⟨*symbol*⟩   (default \openbox, initially unset)

Adds ⟨*symbol*⟩ to the end of the theorem body. If no value is given, the symbol □ is used.

```
% preamble
\newkeytheorem{example}[qed]
\newkeytheorem{solution}[qed=$\clubsuit$]

% document
\begin{example}
Some text
\end{example}
\begin{solution}
Some more text
\end{solution}
```

Example 1. *Some text*   □

Solution 1. *Some more text*   ♣

3.3 Keys added by **keytheorems**

tcolorbox={⟨*tcolorbox options*⟩}   (initially unset)

This key specifies that the theorem be placed inside a tcolorbox environment with ⟨*options*⟩. The theorem head is typeset as a tcolorbox title; to avoid this see **tcolorbox-no-titlebar**→P. 7.

```
% preamble
\tcbset{
  defstyle/.style={
    arc=0mm,
    colback=blue!5!white,
    colframe=blue!75!black
    },
  }
\newkeytheorem{corollary}[tcolorbox]
\newkeytheorem{definition}[
  style=definition,
  tcolorbox={defstyle}
  ]

% document
\begin{corollary}
Some text
\end{corollary}
\begin{definition}
Some more text
\end{definition}
```

Corollary 1.

Some text

Definition 1.

Some more text

tcolorbox-no-titlebar={⟨*tcolorbox options*⟩}   (initially unset)

Same usage as `tcolorbox`^(→ P. 6) but the theorem head is typeset as usual, not as a tcolorbox title.

```
% preamble
\newkeytheorem{boxcor}[
  tcolorbox-no-titlebar={
    colback=red!10
    },
  name=Corollary,sibling=corollary
  ]

% document
\begin{boxcor}
Some text
\end{boxcor}
```

Corollary 2. *Some text*

4 Theorem Styles

\newkeytheoremstyle{⟨*name*⟩}{⟨*options*⟩}

This is keytheorems' version of thmtools' \declaretheoremstyle[⟨*options*⟩]{⟨*name*⟩}. Since it makes little sense to define a style with no keys, we've made the ⟨*options*⟩ argument mandatory. Note that unlike amsthm's \newtheoremstyle, this command will error if a style has already been defined. To overwrite an existing style, there is the analogous **\renewkeytheoremstyle**. For completeness, there is also **\declarekeytheoremstyle** and **\providekeytheoremstyle**.

! For the AMS classes amsart, amsbook, and amsproc, as well as the amsart-based acmart, the initial key values are slightly different than what's below in order to match those class's defaults.

4.1 Keys inherited from **thmtools**

The following keys have the same meaning and syntax as the corresponding thmtools keys. In addition to the list below, most of the keys available to \newkeytheorem^(→ P. 2) can be used in \newkeytheoremstyle.

spaceabove=⟨*length*⟩   (initially \topsep)

spacebelow=⟨*length*⟩   (initially \topsep)

bodyfont=⟨*font declarations*⟩ (initially `\itshape`)

headindent=⟨*length*⟩ (initially `0pt`)

headfont=⟨*font declarations*⟩ (initially `\bfseries`)

headpunct=⟨*code*⟩ (initially `{.}`)

postheadspace=⟨*length*⟩ (initially `5pt plus 1pt minus 1pt`)

Do not use this with the **break** key.

break (initially unset)

Do not use this with the **postheadspace** key.

notefont=⟨*font declarations*⟩ (initially `\fontseries\mddefault\upshape`)

notebraces={⟨*left brace*⟩}{⟨*right brace*⟩} (initially `{(}{)}`)

headstyle=**margin**|**swapnumber**|⟨*code using \NAME, \NUMBER, and \NOTE*⟩

Alias **headstyle**. Within ⟨*code*⟩, the commands **\NAME**, **\NUMBER**, and **\NOTE** correspond to the formatted parts of the theorem head.

4.2 Keys added by **keytheorems**

inherit-style=⟨*style name*⟩ (initially unset)

Inherit the keys of any style declared with **\newkeytheoremstyle**[→ P. 7]. Additionally, the three styles predefined by amsthm are possible values: **plain**, **definition**, and **remark**.

5 Restating Theorems

When a theorem is given the **store**[→ P. 3] key, the contents of the theorem are saved and written to a `.thlist` file. At the start of the next run, this file is input at the beginning of the document and allows you to retrieve the stored theorems at any point, before or after the original theorem.

\getkeytheorem[⟨*property*⟩]{⟨*tag*⟩}

Retrieves the theorem given the key **store**=⟨*tag*⟩. An optional ⟨*property*⟩ can be given to retrieve only the corresponding part of the theorem. Currently only the property `body` is implemented, which retrieves the (unformatted) body of the theorem.

```
\getkeytheorem{mytag}

\begin{example}[store=mytag]
Fascinating example.
\end{example}

\getkeytheorem[body]{mytag}
```

Example 2. *Fascinating example.* □

Example 2. *Fascinating example.* □

Fascinating example.

\IfRestatingTF{⟨*true code*⟩}{⟨*false code*⟩}

Executes ⟨*true code*⟩ if being retrieved with **\getkeytheorem** and ⟨*false code*⟩ if in the original theorem.

```
\begin{example}[store=hmm]
I am the
\IfRestatingTF{restated}{original}
example!
\end{example}

\getkeytheorem{hmm}
```

Example 3. *I am the original example!* □

Example 3. *I am the restated example!* □

6 Listing Theorems

\listofkeytheorems[⟨*options*⟩]

\keytheoremlistset{⟨*options*⟩}

<table>
<tr><td>\listofkeytheorems</td><td>

List of Theorems

</td></tr>
</table>

6.1 Keys inherited from **thmtools**

numwidth=⟨*length*⟩   (initially `2.3em`)

ignore={⟨*comma-list of env names*⟩}   (initially unset)

show={⟨*comma-list of env names*⟩}   (initially all theorems)

onlynamed={⟨*comma-list of env names*⟩}   (initially unset)

ignoreall   (initially unset)

```
\listofkeytheorems[ignoreall,show=theorem]
\listofkeytheorems[
  ignoreall, show=conjecture,
  title=List of Conjectures
  ]
```

showall (initially set)

title=⟨*text*⟩ (initially \GetTranslation{keythms_listof_title})

Defaults to "List of Theorems" if English or an unknown language is used. Currently French, German, and Spanish have (likely inaccurate!) translations. A translation can be added with a GitHub pull request or manually with \DeclareTranslation{⟨*lang*⟩}{keythms_listof_title}{⟨*text*⟩}.

swapnumber=true|false (initially **false**)

6.2 Keys added by **keytheorems**

onlynumbered={⟨*comma-list of env names*⟩} (initially unset)

Similar to onlynamed[→ P. 9], but lists only those theorems which are numbered. This is useful if you'd like to exclude things like unnumbered definitions and remarks from the list of theorems.

seq=⟨*name*⟩ (initially unset)

Used to list only the theorems added to the custom sequence ⟨*name*⟩ with the seq[→ P. 4] theorem key. This is the only way to fully customize which theorems appear in the list of theorems. Unlike with show[→ P. 9], you do not need to use ignoreall[→ P. 9] to prevent theorems not in ⟨*name*⟩ from being printed.

title-code=⟨*code with* #1⟩ (initially \section*{#1})

If \chapter is defined, then initially this is instead \chapter*{#1}.

no-title (initially unset)

Suppresses the title of the list of theorems. Useful for custom ordering of the list.

```
\keytheoremlistset{ignoreall}
\listofkeytheorems[show=example]
\listofkeytheorems[show=solution,no-title]
```

note-code=⟨*code with* #1⟩ (initially { (#1)})

Formats the optional note in the list of theorems.

print-body (initially unset)

Instead of listing the theorem headings, the theorems are restated with their body text. Not very useful without the store-all[→ P. 2] load-time option.

no-continues=true|false   (initially `false`)

Suppresses the printing of theorems given the `continues` key in the list of theorems.

no-chapter-skip=true|false   (initially `false`)

By default a small vertical space is inserted between each chapter's chunk of theorems. Setting this key to `true` removes this space.

chapter-skip-length=⟨*dimension*⟩   (initially `10pt`)

Controls the amount of space inserted between chunks.

6.3   Adding code to list of theorems

There are analogous commands to `\addcontentsline` and `\addtocontents` for adding entries or arbitrary code to the list of theorems.

> **!** You *must* use these commands rather than the aforementioned because the `.thlist` file is also used to define restated theorems and cannot contain unexpected code.

`\addtheoremcontentsline`{⟨*level*⟩}{⟨*text*⟩}

`\addtotheoremcontents`{⟨*code*⟩}

7   Theorem Hooks

`\addtotheoremhook`[⟨*env name*⟩]{⟨*hook name*⟩}{⟨*code*⟩}

⟨*hook name*⟩ can be `prehead`, `posthead`, `prefoot`, `postfoot`, or `restated`. If no ⟨*env name*⟩ is given, the ⟨*code*⟩ is added to the "generic" hook, i.e. applied to all theorems. As in thmtools, the order of hooks is as follows:

$$
\boxed{\begin{matrix}⟨\textit{env name}⟩\\ \texttt{prehead}\end{matrix}} \rightarrow \boxed{\begin{matrix}\text{generic}\\ \texttt{prehead}\end{matrix}} \rightarrow \boxed{\texttt{\textbackslash begin\{}⟨\textit{env name}⟩\texttt{\}}} \rightarrow \boxed{\begin{matrix}⟨\textit{env name}⟩\\ \texttt{posthead}\end{matrix}} \rightarrow \boxed{\begin{matrix}\text{generic}\\ \texttt{posthead}\end{matrix}}
$$

$$
\rightarrow \boxed{⟨\textit{theorem body}⟩} \rightarrow
$$

$$
\boxed{\begin{matrix}\text{generic}\\ \texttt{prefoot}\end{matrix}} \rightarrow \boxed{\begin{matrix}⟨\textit{env name}⟩\\ \texttt{prefoot}\end{matrix}} \rightarrow \boxed{\texttt{\textbackslash end\{}⟨\textit{env name}⟩\texttt{\}}} \rightarrow \boxed{\begin{matrix}\text{generic}\\ \texttt{postfoot}\end{matrix}} \rightarrow \boxed{\begin{matrix}⟨\textit{env name}⟩\\ \texttt{postfoot}\end{matrix}}
$$
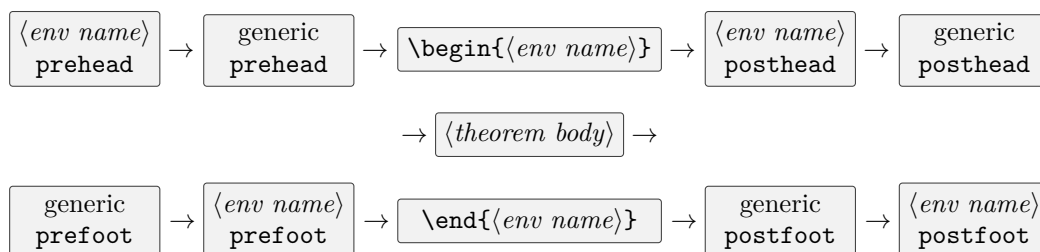
The `restated` hook is applied at the start of theorems retrieved with `\getkeytheorem`, before the `prehead` hook. This can be useful for disabling commands such as `\footnote` in the restated theorems, e.g.

```
\addtotheoremhook{restated}{%
  \renewcommand\footnote[2][]{}%
  }
```

By default, keytheorems disables the `\label` and `\RecordProperties` commands in restated theorems.

In thmtools, the `prefoot` and `postfoot` hooks always prepend code, i.e. the code

```
\addtotheorempostfoothook{A}
\addtotheorempostfoothook{B}
```

results in `BA` after the theorem. With keytheorems, code is added in the order declared, meaning

```
\addtotheoremhook{postfoot}{A}
\addtotheoremhook{postfoot}{B}
```

results in `AB` after the theorem. This is the behavior of the LaTeX kernel hooks that keytheorems uses under the hood.

Right now, code added using the hook keys `preheadhook`[→ P. 5], etc. is outermost, meaning executed first in `prehead` and `posthead` and last in `prefoot` and `postfoot`. This may change if I think of good reasons to do so. . .

Index