Natural Sciences Citations and References

(Author–Year and Numerical Schemes)

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This paper describes package `natbib` version 8.31b from 2010/09/13.

Abstract

The `natbib` package is a reimplementation of the LaTeX `\cite` command, to work with both author–year and numerical citations. It is compatible with the standard bibliographic style files, such as `plain.bst`, as well as with those for `harvard`, `apalike`, `chicago`, `astron`, `authordate`, and of course `natbib`.

In contrast to the packages listed above, the `natbib` package supports not only the various author–year bibliography styles, but also those for standard numerical citations. In fact, it can also produce numerical citations even with an author–year bibliographic style, something that permits easy switching between the two citation modes. To this end, replacements for the standard LaTeX `.bst` files are also provided.

It is possible to define the citation *style* (type of brackets and punctuation between citations) and even to associate it with the name of the bibliographic style so that it is automatically activated. Citation styles can be defined for local `.bst` files by means of a configuration file `natbib.cfg`.

It is compatible with the packages: `babel`, `index`, `citeref`, `showkeys`, `chapterbib`, `hyperref`, `koma` and with the classes `amsbook` and `amsart`. It can also emulate the sorting and compressing functions of the `cite` package as well as the multiple citation (and merging) functions of Thorsten Ohl's `mcite` package. (The `natbib` package, however, is not compatible with either `cite` or `mcite` themselves.)

Note that the `citeref` package (for adding citation page numbers in the bibliography) must be loaded after `natbib`. (The `hyperref` package with the option `pagebackref` also provides this feature, but with hyperlinks.)

*The code for merged numerical bibliography entries, emulating the `mcite` package, has been commissioned by the American Physical Society and provided by Arthur Ogawa

The `natbib` package therefore acts as a single, flexible interface for most of the available bibliographic styles.

Contents

1 Introduction

The `natbib` package is an extension to LaTeX to allow author–year citations along with numerical citations. Standard LaTeX permits only numerical, whereas all extensions for author–year prior to the release of `natbib` in 1993 were limited to just that. Since they normally added new commands (as `natbib` does too), documents written with them could only be used with numerical citations after extensive editing.

The `natbib` package has changed that; switching from author–year to numerical citations is a matter of an option, with no alterations to the source text. It has now become part of the standard LaTeX installations, and is supported (demanded) by many journals. It is the citation package of choice by most of the LaTeX community, mainly because of its flexibility and configurability.

Like all packages, it is loaded in the document preamble, with possible options, with, e.g.

```
\usepackage[sectionbib,square]{natbib}
```

The option `sectionbib` specifies that, when used with the package `chapterbib`, the bibliography will appear as a section at the end of each chapter (Section 2.15). The `square` option says that references are to be enclosed in square bracket rather than round parentheses. See Section 5 for a complete list of options.

The document text itself begins with, e.g.

```
\begin{document}
\bibliographystyle{plainnat}
```

which specifies `plainnat` to be the bibliography style used by the BibTeX program that generates the actual bibliography from a database. The style `plainnat` is the `natbib` version of the standard `plain` (numerical only) style. See Section 2.1 for other styles, or search the installation for `.bst` files.

The `\bibliographystyle` command can be given anywhere in the document, but it makes sense to add it at the start where it can be easily identified (and modified).

To make a citation in the text, use

`\citep{jon90}` for a *parenthetical* citation (Jones et al., 1990),
`\citet{jon90}` for a *textual* one, as Jones et al. (1990).

Both `\citep` and `\citet` are defined by `natbib` and are thus not standard. The standard LaTeX command `\cite` should be avoided, because it behaves like `\citet` for author–year citations, but like `\citep` for numerical ones. There are many other commands for other special effects (Section 2.4).

In the above examples, `jon90` is the identifying key for the reference, as found in the BibTeX database, or in the `thebibliography` environment, Section 2.2:

```
\begin{thebibliography}{1}
  \bibitem[Jones et al.(1990)]{jon90}
  . . . . .
\end{thebibliography}
```

This environment prints the actual bibliography, and the `\bibitem` commands link the entries to the citations via the key, here `jon90`. The key may be perfectly arbitrary as long as it is unique. The text in square brackets contains the pieces of citation information, the authors `Jones et al.` and the year `1990`. Note that these are two pieces of text that may be packaged together in several different ways, depending on the citation command. In fact, if numerical citations are selected, they are (almost) ignored and only the sequence number is used as citation.

The `thebibliography` environment can be made by hand, but it is better and safer to let BibTeX do it. For this, one needs the `\bibliographystyle` command already mentioned, and near the end of the document:

```
\bibliography{mybib}
\end{document}
```

Here `mybib` is the root name of the BibTeX database file (`mybib.bib`) containing the data for the references needed in the document.

The rest of this document presents all the gorey details about everything possible with `natbib`.

2 Using this Package

In this paper, I distinguish between the citation *mode* (author–year or numerical) and citation *style* (the type of punctuation used for citations). The citation style is something that is independent of the bibliography style and is not programmed in the `.bst` files.

2.1 New Bibliography Styles

I provide three new `.bst` files to replace the standard LaTeX numerical ones:

`plainnat.bst` `abbrvnat.bst` `unsrtnat.bst`

These produce reference lists in the same style as the corresponding standard `.bst` file, but work with `natbib`. The advantage is that they can be used in both numerical and author–year mode.

These `.bst` files are not meant to be exhaustive by any means. Other style files conforming to the `natbib` format exist, or may be generated with my `custom-bib` (also known as `makebst`) program.

2.2 The Syntax of the `thebibliography`

The information on the cited author names and year are given as part of the `\bibitem` commands within the `thebibliography` environment. The `natbib` package expects that information to be in a certain format, which is maintained by the above bibliography styles. (It will also be able to interpret formats used by some earlier packages, such as `harvard` and `chicago`.) If one wishes to bypass BibTeX, one must make up the `thebibliography` oneself, such that it conforms to `natbib`.

This syntax looks as follows:

```
\bibitem[Jones et al.(1990)]{jon90}...
```

or alternatively

```
\bibitem[Jones et al.(1990)Jones, Baker,
    and Williams]{jon90}...
```

The text in square brackets contains the pieces of citation texts, the short author list, `Jones et al.`, the year `1990`, and the optional long author list `Jones, Baker and Williams`. If the long list is missing, the short list will be used instead. The parentheses around the year are *not* part of the text, but merely delimit the year from the author lists. Round parentheses must always be used, even if square brackets are wanted for the citations. And there must be no space before or after the year parentheses, else it will become part of the author list.

Note: if any single `\bibitem` entry does not conform to a syntax that `natbib` understands, it switches stubbornly to numerical mode, since it otherwise has no idea what the author and year texts could be.

2.3 Basic Citation Commands

The `natbib` package can be used with bibliography styles that were intended for other, older packages, like `harvard`. However, the commands described in this and the next sections are defined by `natbib` and must be used even with those other bibliography styles.

`\citet` `\citep` The `natbib` package has two basic citation commands, `\citet` and `\citep` for *textual* and *parenthetical* citations, respectively. There also exist the starred versions `\citet*` and `\citep*` that print the full author list, and not just the abbreviated one. All of these may take one or two optional arguments to add some text before and after the citation.

`\citet{jon90}`	⇒	Jones et al. (1990)
`\citet[chap.~2]{jon90}`	⇒	Jones et al. (1990, chap. 2)
`\citep{jon90}`	⇒	(Jones et al., 1990)
`\citep[chap.~2]{jon90}`	⇒	(Jones et al., 1990, chap. 2)
`\citep[see][]{jon90}`	⇒	(see Jones et al., 1990)
`\citep[see][chap.~2]{jon90}`	⇒	(see Jones et al., 1990, chap. 2)
`\citet*{jon90}`	⇒	Jones, Baker, and Williams (1990)
`\citep*{jon90}`	⇒	(Jones, Baker, and Williams, 1990)

The starred versions can only list the full authors if the `.bst` file supports this feature; otherwise, the abbreviated list is printed.

In standard LaTeX, the `\cite` command can only take a single optional text for a note after the citation; here, a single optional text is a post-note, while two are the pre- and post-notes. To have only a pre-note, it is necessary to provide an empty post-note text, as shown above.

More complex mixtures of text and citations can be generated with the all-purpose `\citetext` command in Section 2.4.

Multiple citations may be made by including more than one citation key in the `\cite` command argument. *If adjacent citations have the same author designation but different years, then the author names are not reprinted.*

`\citet{jon90,jam91}`	⇒	Jones et al. (1990); James et al. (1991)
`\citep{jon90,jam91}`	⇒	(Jones et al., 1990; James et al. 1991)
`\citep{jon90,jon91}`	⇒	(Jones et al., 1990, 1991)
`\citep{jon90a,jon90b}`	⇒	(Jones et al., 1990a,b)

These examples are for author–year citation mode. In numerical mode, the results are different.

`\citet{jon90}`	⇒	Jones et al. [21]
`\citet[chap.~2]{jon90}`	⇒	Jones et al. [21, chap. 2]
`\citep{jon90}`	⇒	[21]
`\citep[chap.~2]{jon90}`	⇒	[21, chap. 2]
`\citep[see][]{jon90}`	⇒	[see 21]
`\citep[see][chap.~2]{jon90}`	⇒	[see 21, chap. 2]
`\citep{jon90a,jon90b}`	⇒	[21, 32]

The authors can only be listed if the `.bst` file supports author–year citations. The standard `.bst` files, such as `plain.bst` are numerical only and transfer no author–year information to LaTeX. In this case, `\citet` prints "**(author?)** [21]."

`\cite` In the original versions of `natbib`, the traditional `\cite` command was used for both textual and parenthetical citations. The presence of an empty optional text in square brackets signalled parenthetical. This syntax has been retained for compatibility, but is no longer encouraged.

This means that `\cite` (without notes) is the same as `\citet` in author–year mode, whereas in numerical mode, it is the same as `\citep`. The starred version, as well as the one or two optional notes, may also be used.

It is possible to have multiple citations sorted into the same sequence as they appear in the list of references, regardless of their order as arguments to the `\cite` commands. The option `sort` is required for this feature. See Section 2.16.

Some publishers require that the first citation of any given reference be given with the full author list, but that all subsequent ones with the abbreviated list. Include the option `longnamesfirst` to enable this for `natbib`. See Section 2.18.

2.4 Extended Citation Commands

`\citealt` `\citealp` `\citetext` `\citenum`

As an alternative form of citation, `\citealt` is the same as `\citet` but *without parentheses*. Similarly, `\citealp` is `\citep` without parentheses.

The `\citenum` command prints the citation number, without parentheses, even in author–year mode, and without raising it in superscript mode. This is intended to be able to refer to citation numbers without superscripting them.

Multiple references, notes, and the starred variants also exist for these, except for `\citenum`.

`\citealt{jon90}`	⇒	Jones et al. 1990
`\citealt*{jon90}`	⇒	Jones, Baker, and Williams 1990
`\citealp{jon90}`	⇒	Jones et al., 1990
`\citealp*{jon90}`	⇒	Jones, Baker, and Williams, 1990
`\citealp{jon90,jam91}`	⇒	Jones et al., 1990; James et al., 1991
`\citealp[pg.~32]{jon90}`	⇒	Jones et al., 1990, pg. 32
`\citenum{jon90}`	⇒	11
`\citetext{priv.\ comm.}`	⇒	(priv. comm.)

The `\citetext` command allows arbitrary text to be placed in the current citation parentheses. This may be used in combination with `\citealp`. For example,

```
\citetext{see \citealp{jon90}, or even better \citealp{jam91}}
```

to produce (see Jones et al., 1990, or even better James et al., 1991).

`\citeauthor` `\citeyear` `\citeyearpar` `\citefullauthor`

In author–year schemes, it is sometimes desirable to be able to refer to the authors without the year, or vice versa. This is provided with the extra commands

`\citeauthor{jon90}`	⇒	Jones et al.
`\citeauthor*{jon90}`	⇒	Jones, Baker, and Williams
`\citeyear{jon90}`	⇒	1990
`\citeyearpar{jon90}`	⇒	(1990)

There also exists a command `\citefullauthor` which is equivalent to `\citeauthor*`.

If the full author information is missing, then `\citeauthor*` is the same as `\citeauthor`, printing only the abbreviated list. This also applies to the starred versions of `\citet` and `\citep`.

If the author or year information is missing (as is the case with the standard LaTeX `.bst` files), these commands issue a warning.

Note: these commands may also be used with numerical citations, provided an author–year `.bst` file is being employed.

Note: all `\cite..` commands have the same syntax, allowing multiple citations and up to two notes (there are, however, no starred `\citeyear` or `\citenum` variants). It does not really make much sense to add notes to `\citeyear` and `\citeauthor`, especially with multiple citations; however, this can be done, there will be no error message, but the results are sometimes strange. For example, in numerical mode, the notes are fully ignored, while in author–year mode, only the post-note is accepted. Multiple citations in `\citet` are also not recommended (nor are they in my opinion meaningful), but if they are used with notes, the pre-note will appear before each year, and the post-note only after the last year. These are admittedly bugs, but the effort to remove them is not justified by the questionable usefulness of these features.

In summary, notes are only intended for `\citep` but they may also be used with `\citet` in author–year mode, with single citations. In any other situation, the results are unpredictable.

`\Citet`
`\Citep`
`\Citealt`
`\Citealp`
`\Citeauthor`

2.5 Forcing Upper Cased Name

If the first author's name contains a *von* part, such as "della Robbia", then `\citet{dRob98}` produces "della Robbia (1998)", even at the beginning of a sentence. One can force the first letter to be in upper case with the command `\Citet` instead. Other upper case commands also exist.

when	`\citet{dRob98}`	⇒	della Robbia (1998)
then	`\Citet{dRob98}`	⇒	Della Robbia (1998)
	`\Citep{dRob98}`	⇒	(Della Robbia, 1998)
	`\Citealt{dRob98}`	⇒	Della Robbia 1998
	`\Citealp{dRob98}`	⇒	Della Robbia, 1998
	`\Citeauthor{dRob98}`	⇒	Della Robbia

These commands also exist in starred versions for full author names.

Note: the coding for the upper casing commands is tricky and likely buggy. It operates on the names that are stored in the `\bibitem` entry, and works even if old style font commands are used; however, LaTeX 2_ε commands will cause it to crash. Thus

`\bibitem[{\it della Robbia}(1998)]{dRob98}`	is okay, but
`\bibitem[\textit{della Robbia}(1998)]{dRob98}`	crashes.

2.6 Citation Aliasing

`\defcitealias` `\citetalias` `\citepalias`

Sometimes one wants to refer to a reference with a special designation, rather than by the authors, i.e. as Paper I, Paper II. Such aliases can be defined and used, textual and/or parenthetical with:

`\defcitealias{jon90}{Paper~I}`		
`\citetalias{jon90}`	⇒	Paper I
`\citepalias{jon90}`	⇒	(Paper I)

These citation commands function much like `\citet` and `\citep`: they may take multiple keys in the argument, may contain notes, and are marked as hyperlinks.

A warning is issued if the alias is used before it is defined, or if an alias is redefined for a given citation. No warning is issued if an alias is defined for a citation key that does not exist; the warning comes when it is used!

See Section 2.7 for an alternative means of citing with a code name.

2.7 Authorless and Yearless References

What does one do about references that do not have authors? This has long bothered me but I do have a suggestion. Standard BibTeX styles make use of a `KEY` field in the entries to be used for alphabetizing when the authors or editors are missing. The author–year styles go even further and insert the `KEY` field in place of the authors. One can imagine giving a code designation for the work at this point. For example,

```
@MANUAL{handbk98,
  title = {Assembling Computers},
  year = 1998,
  organization = {MacroHard Inc.},
  key = "MH-MAN"
}
```

With `plain`, the key text `MH-MAN` is used only to order the reference, but with `plainnat` and other author–year styles, it is used in place of the authors. One can then refer to it as `\citeauthor{handbk98}` to get MH-MAN or as `\citetext{\citeauthor{handbk98}}` for (MH-MAN), a parenthetical citation.

This can be greatly simplified if the bibliography style leaves the date blank in the `\bibitem` entry, as

```
\bibitem[MH-MAN()]{handbk98}
```

for then `natbib` suppresses the date, preceding punctuation, and the braces for `\citet`. This means that `\citet` and `\citep` behave automatically like the two examples above. The date still may appear in the text of the reference.

The `natbib` bibliography styles have been modified accordingly to omit the date from the `\bibitem` entry when missing authors and/or editors are replaced by key text.

Similarly, if the year is missing, it will be left blank in the `\bibitem` entry; thus citing such a work will only produce the authors' names.

Note: there are many other possibilities with this feature. One can even produce citations like those of the `alpha` bibliography style, by placing the citation code in place of the authors in the `\bibitem` entry and leaving the year blank. A second code (or maybe even the authors themselves) could be placed where the full author list normally appears, to be printed with the starred version of the `\cite` commands. For example,

```
\bibitem[MH-MAN()MacroHard Inc.]{handbk98}
```

2.8 Extra Features in the `plainnat` Family

The special `.bst` files for `natbib` mentioned in Section 2.1 have a number of extra fields compared to the original files:

`ISBN`	for the ISBN number in books,
`ISSN`	for the ISSN number in periodicals,
`URL`	for the Internet address of online documents,
`DOI`	the *Digital Object Identifier* now being used by many journals as a more robust alternative to URL,
`EID`	*electronic ID*, a substitute for page numbers for online journals that also appear in print; also known as the *sequence number* within the paper volume.

Both the DOI and URL tend to be very long, causing ugly line breaks or sticking out into the margin. This can be avoided by loading the `url` package by Donald Arseneau, which allows text to be broken at punctuation marks without a hyphen. This package is automatically detected by `natbib` and appropriate commands redefined. URLs are printed in typewriter font, DOI in roman. Without the `url` package, these numbers are never broken.

As pointed out in Section 2.7, the `KEY` field is treated differently by `plainnat` than in `plain`. Whereas the latter uses this field only to alphabetize entries without authors, `plainnat` actually inserts it in place of the author, both in the reference text and in the citation label (`\bibitem` entries). Furthermore, the year is left empty in `\bibitem` so that `\citep` prints only the "author" text, which is now the `KEY`. This should be some code designation for the work.

2.9 Selecting Citation Punctuation

`\setcitestyle` The above examples have been printed with the default citation style. It is possible to change this, as well as to select numerical or author–year mode, by means of the `\setcitestyle` command, which takes as argument a comma-separated list of keywords. (This command is new to version 8.)

- Citation mode: `authoryear` or `numbers` or `super` (corresponds to fourth argument of `\bibpunct`).
- Braces: `round` or `square` or `open={`*char*`},close={`*char*`}` (corresponds to first and second arguments of `\bibpunct`).
- Between citations: `semicolon` or `comma` or `citesep={`*char*`}` (corresponds to third argument of `\bibpunct`).
- Between author and year: `aysep={`*char*`}` (corresponds to fifth argument of `\bibpunct`).
- Between years with common author: `yysep={`*char*`}` (corresponds to sixth argument of `\bibpunct`).
- Text before post-note: `notesep={`*text*`}` (corresponds to optional argument of `\bibpunct`).

Defaults are `authoryear`, `round`, `comma`, `aysep={;}`, `yysep={,}`, `notesep={, }`

Example 1, `\setcitestyle{square,aysep={},yysep={;}}` changes the author–year output of

```
\citep{jon90,jon91,jam92}
```

into [Jones et al. 1990; 1991, James et al. 1992].

Example 2, `\setcitestyle{notesep={; },round,aysep={},yysep={;}}` changes the output of

```
\citep[and references therein]{jon90}
```

into (Jones et al. 1990; and references therein).

Note:

- parameters not specified remain unchanged;
- the order of the keywords is unimportant;
- the punctuation between author and year applies only to author–year citations, not numerical;
- the `yysep` punctuation comes between years when multiple citations have the same, non-repeated authors; a space is always inserted as well; if the years too are same, the citation is printed as '2007a,b', without a space; to include a space, add it with `yysep={,~}`;

- for numerical citations with common authors, e.g, `\citet{jon90,jon91}` produces 'Jones et al. [21, 22]' with the punctuation between the numbers; a space is automatically included for numbers, but not for superscripts.
- a single character does not really need to be in `{ }`, other than a comma; `yysep=;` is acceptable;

`\bibpunct` The older command for setting the citation style is `\bibpunct`, which takes one optional and six required arguments:

1. the opening bracket symbol, default = (
2. the closing bracket symbol, default =)
3. the punctuation between multiple citations, default = ;
4. the letter 'n' for numerical style, or 's' for numerical superscript style, any other letter for author–year, default = author–year;
5. the punctuation that comes between the author names and the year
6. the punctuation that comes between years or numbers when common author lists are suppressed (default = ,);

The optional argument is the character preceding a post-note, default is a comma plus space. In redefining this character, one must include a space if one is wanted.

The above `\setcitestyle` examples can be achieved with

`\bibpunct{[}{]}{,}{a}{}{;}` and
`\bibpunct[,~]{(}{)}{,}{a}{}{;}`.

2.10 Predefining a citation style

`\bibstyle@xxx`
`\citestyle` If a particular set of citation punctuations is commonly used, it is possible to store it in the local `natbib.cfg` and to recall it with `\citestyle{`*name*`}`. The definition is done by creating a command `\bibstyle@`*name*, which sets the desired citation style.

For example, the American Geophysical Union (AGU) demands in its publications that citations be made with square brackets and separated by semi-colons. There is an `agu.bst` file to accomplish most of the formatting, but such punctuations are not included in it. Instead, `natbib` has the definition

```
\newcommand{\bibstyle@agu}{\bibpunct{[}{]}{;}{a}{,}{,~}}
```

which allows this set to be selected with the command

```
\citestyle{agu}
```

There is an additional feature to such predefined styles: `natbib` attempts to execute `\citestyle` at the beginning of the document with the name of the bibliography style, as given by the `\bibliographystyle` command (and stored in the `.aux` file). This means that a citation style can be directly associated with a `.bst` file. Such implicit styles are immediately overwritten by any explicit style specifications, such as package options, or by `\setcitestyle`, `\bibpunct`, or `\citestyle` commands.

Predefined citation styles are contained within the `natbib` code for the following bibliography styles:

`plain` etc. (the 4 base styles): square braces, numerical, commas

`plainnat` etc.: square braces, author–year, commas

`agu` (American Geophysical Union): square, author–year, semi-colon

`egu` (European Geosciences Union): round, author–year, semi-colon

`agms, dcu, kluwer` (Harvard set): round, author–year

`cospar` (Committe on Space Research): slashes, numerical, comma

`nature` (Journal *Nature*): superscripts

There are others but they are mainly for my personal convenience. The above represent most of the major variations and can be used as required. The automatic association with other bibliography styles can only be achieved by putting the definitions into the local `natbib.cfg`.

Note that the predefinitions for `plain` and `plainnat` specify square braces, thus changing the normal `natbib` default of round parentheses.

The style defining commands may contain more than just `\bibpunct` or `\setcitestyle`. Some numerical citation scheme require even more changes. For example, *Nature* not only uses superscripted numbers for citations, it also prints the numbers in the list of references without the normal square brackets. To accommodate this, `natbib` contains the style definition

```
\newcommand{\bibstyle@nature}%
    {\bibpunct{}{}{,}{s}{}{\textsuperscript{,}}%
     \renewcommand\bibnumfmt[1]{##1.}}
```

The redefined `\bibnumfmt` command specifies how the reference numbers are to be formatted in the list of references itself.

2.11 Priority of Style Commands

The citation style (punctuation and mode) can be selected by means of the `\setcitestyle`, `\bibpunct`, `\citestyle` commands or via `\bibliographystyle{`*bst*`}` with a predefined `\bibstyle@`*bst*. They can also be selected by package options (Section 5). What happens if there are several conflicting selections?

The lowest priority is assigned to the `\bibliographystyle` command, since this is implicit and not transparent to the user. The package options have the next priority. Finally, any selection by `\setcitestyle`, `\bibpunct` and/or `\citestyle` overrides those of the other methods.

2.12 Other Formatting Options

`\bibsection` The list of references normally appears as a `\section*` or `\chapter*`, depending on the main class. If one wants to redesign one's own heading, say as a numbered section with `\section`, then `\bibsection` may be redefined by the user accordingly.

`\bibpreamble` A preamble appearing after the `\bibsection` heading may be inserted before the actual list of references by redefining `\bibpreamble`. This will appear in the normal text font unless it contains font declarations. The `\bibfont` applies to the list of references, not to this preamble.

`\bibfont` The list of references is normally printed in the same font size and style as the main body. However, it is possible to redefine `\bibfont` to be font commands that are in effect within the `thebibliography` environment after any preamble. For example,

```
\renewcommand{\bibfont}{\small}
```

`\citenumfont` Numerical citations may be printed in a different font. Define `\citenumfont` to be a font declaration like `\itshape` or even a command taking arguments like `\textit`.

```
\renewcommand{\citenumfont}[1]{\textit{#1}}
```

The above is better than `\itshape` since it automatically adds italic correction.

`\bibnumfmt` The format of the numerical listing in the reference list may also be changed from the default [32] by redefining `\bibnumfmt`, for example

```
\renewcommand{\bibnumfmt}[1]{\textbf{#1}:}
```

to achieve **32**: instead.

`\bibhang` The list of references for author–year styles uses a hanging indentation format: the first line of each reference is flush left, the following lines are set with an indentation from the left margin. This indentation is 1 em by default but may be changed by redefining (with `\setlength`) the length parameter `\bibhang`.

\bibsep The vertical spacing between references in the list, whether author–year or numerical, is controlled by the length `\bibsep`. If this is set to 0 pt, there is no extra line spacing between references. The default spacing depends on the font size selected in `\documentclass`, and is almost a full blank line. Change this by redefining `\bibsep` with `\setlength` command.

2.13 Automatic Indexing of Citations

\citeindextrue
\citeindexfalse
If one wishes to have the citations entered in the `.idx` indexing file, it is only necessary to issue `\citeindextrue` at any point in the document. All following `\cite` commands, of all variations, then insert the corresponding entry to that file. With `\citeindexfalse`, these entries will no longer be made.

The `\bibitem` commands in the `thebibliography` environment will also make index entries. If this is not desired, then issue `\citeindexfalse` before `\bibliography` or `\begin{thebibliography}`.

Of course, `\makeindex` must also be issued in the preamble to activate indexing, as usual. Otherwise, no indexing is done at all.

Make sure that the document has been processed at least twice after the last BibTeX run before running the `makeindex` program.

\NAT@idxtxt The form of the index entries is set by the internal `\NAT@idxtxt`, which can be redefined by hackers if wanted (in the `natbib.cfg` file please). By default, it prints the short author list plus date or number in the current parenthesis style and citation mode.

The `natbib` package can also be used with the `index` package of David M. Jones. The order in which the packages are loaded is not important.

\citeindextype In that package, multiple index lists may be made by means of a `\newindex` command. For example, it may be desirable to put all the citation indexing into a separate list. First that list must be initiated with, e.g.,

```
\newindex{cite}{ctx}{cnd}{List of Citations}
```

and then the automatic citation indexing associated with this list with the `natbib` command

```
\renewcommand{\citeindextype}{cite}
```

See the documentation for `index.sty` for details.

2.14 HyperTeX Compatibility

The `natbib` package is compatible with the `hyperref` package of Sebastian Rahtz and Heiko Oberdiek. , for use with LaTeX → HTML conversions, pdfTEX, `pdfmark`. The compatibility is of a mutual nature: both packages contain coding that interact with that of the other.

There is a special option to the `hyperref` package: `breaklinks` which allows the link text to be split over to the next line, avoiding many overfull line messages. By default, the link text is restricted to be on one line. For numerical citations, this may be desirable, but for author–year ones with long link texts, it is not.

2.15 Multiple Bibliographies in One Document

The `natbib` package is compatible with the `chapterbib` package of Donald Arseneau and Niel Kempson, which makes it possible to have several bibliographies in one document. The usual application is to have bibliographies in each chapter of a book, especially if they have been written by different authors.

The `chapterbib` package works in a very natural way for the author; only the editor who puts all the chapters together into one book has to do some extra work.

The package makes use of the `\include` command, and each `\include`d file has its own bibliography. For large books, it makes very good sense to take advantage of this feature in any case.

To review the use of `\include`, recall that the main file

```
\documentclass{...}
\includeonly{ch2}
\begin{document}
  \include{ch1}
  \include{ch2}
  \include{ch3}
\end{document}
```

will process only the file `ch2.tex` as though the files `ch1.tex` and `ch3.tex` were also present. That is, all counters, especially the page and section numbers, as well as cross-referencing definitions, will function as if the whole document were processed. The trick is that each `\include`d file has it own `.aux` file containing these definitions, and they are all read in every time, even if the corresponding `.tex` file is not. The `.aux` files also contain the citation information for BIBTEX, something that the `chapterbib` package exploits.

If `\usepackage{chapterbib}` has been given, the keys in each `\cite` and `\bibitem` command are associated with the current `\include`d file and are distinguished from the identical key in a different file. Each of these files must contain its own `\bibliography` and `\bibliographystyle` commands. One processes BIBTEX on each file separately before processing it under LATEX (at least twice).

2.15.1 Special Considerations for `natbib` and `chapterbib`

The order in which the `chapterbib` and `natbib` packages are loaded is unimportant.

The `chapterbib` package provides an option `sectionbib` that puts the bibliography in a `\section*` instead of `\chapter*`, something that makes sense if there is a bibliography in each chapter. This option will not work when `natbib` is also loaded; instead, add the option to `natbib`. (The `sectionbib` option can always be given, but it only has meaning for the `book` and `report` classes, or for classes derived from them.)

Every `\include`d file must contain its own `\bibliography` command where the bibliography is to appear. The database files listed as arguments to this command can be different in each file, of course. However, what is not so obvious, is that each file must also contain a `\bibliographystyle` command, with possibly differing arguments.

As of version 8.0, the citation style, including mode (author–year or numerical) may also differ between chapters. The `\setcitestyle` command as well as `\bibpunct` and `\citestyle` can be issued at any point in the document, in particular in different chapters. (And this is the only time it would make sense to do so.)

2.16 Sorting and Compressing Numerical Citations

Another package by Donald Arseneau, `cite.sty`, reimplements the entire (numerical) citation system such that one can control the punctuation and citation format, all of which is done by `natbib` as well. However, it also can sort and compress numerical citations, something that is required by some journals.

What this means is that when multiple citations are given with a single `\cite` command, the normal order of the numbers is in the sequence given. This is usually a wild list of numbers, such as [4,2,8,3]. With the `cite` package, this list becomes [2–4,8].

It is impossible to make the `cite` and `natbib` packages compatible, since both reimplement `\cite` from scratch. Instead, I have taken over some of the coding from `cite.sty`, modifying it for `natbib`. This coding is activated by including one of the options `sort` or `sort&compress` in the `\usepackage` command.

For author–year citations, the option `sort` orders the citations in a single `\citep` or `\citet` command into the sequence in which they appear in the list of references. This is normally alphabetical first, year second. This should avoid citations of the type: "James et al. (1994b,a)". For author–year mode, the `sort&compress` option is identical to `sort`.

2.17 Merged Numerical References

> **Note:** the `merge` coding was contributed by Arthur Ogawa for the American Physical Society.

Thorsten Ohl's `mcite` package cannot be used together with `natbib`. Instead, one must invoke the package option `merge` with the `\usepackage` statement.

With this option in effect, citation keys within a multiple `\citep` command may contain a leading * that causes them to be merged in the bibliography together with the previous citation as a single entry with a single reference number. For example, `\citep{feynmann,*salam,*epr}` produces a single number, and all three references are listed in the bibliography under one entry with that number.

Certain restrictions of Thorsten Ohl's `mcite` package are lifted: a * prefix can be used with any citation key, and Ohl's restrictions on syntax do not apply.

An additional feature allows text to be inserted inside the bibliography entry: within the argument of `\citep`, a cite key may be preceded by two optional arguements, e.g., `\citep{[`*pre*`][`*post*`]`*key*`}`, where *pre* represents text to be prepended to the reference (`\bibitem` content), with *post* appended thereto.

Thus it is possible for the user to mark up the document:

```
text \citep{*[{See, e.g., }][ for a simpler explanation]ablebaker}
```

The above example illustrates the use of the star-form and both optional arguments.

Caution: Because the comma (,) character is part of the syntax of `\citep`, and because the bracket delimiters ([]) are mere text characters and not true delimiters (like the braces), you must enclose the optional argument in braces (`{}`) if a comma is present in the argument (that goes for brackets, too, of course).

The `elide` option also activates the merging features, but also sees to it that common parts of the merged references (e.g., authors) are not repeated but are written only once in the single bibliography entry.

The `mcite` option turns off the merging and eliding features, but allows the special syntax (the * and optional inserted texts) to be ignored.

These functions are available only to numerical-mode citations, and only when used parenthetically, similar to the restrictions on `sort` and `compress`.

They also require special `.bst` files, as provided for example by the American Physical Society for their REVTEX class.

2.18 Long Author List on First Citation

A feature that has often been requested by otherwise happy users of `natbib` is one that is found in the `harvard` package as standard: with the first citation of any reference, the full author list is printed, and afterwards only the abbreviated list. One can control this with `\citet*` for the first citation, and `\citet` or `\citep` thereafter. However, the automatic feature is very desired.

This can be activated with the option `longnamesfirst`.

`\shortcites` Some references have so many authors that you want to suppress the automatic long list only for them. In this case, issue

`\shortcites{`⟨*key-list*⟩`}`

before the first citations, and those included in *key-list* will have a short list on their first citation.

Full author lists can still be forced at any time with the starred variants.

3 Numerical Citations with Author–Year Styles

It is possible to produce numerical citations with any author-year `.bst` file, with minimal change to the text. The commands `\citet` and `\citep` will produce sensible results in both modes, without any special editing. Obviously, the opposite is not possible; a `.bst` file intended for numerical citation can never produce author–year citations, simply because the information is not transferred to the auxiliary file.

3.1 Selecting Numerical Mode

By default, `natbib` is in author–year mode. This can be changed by

1. selecting a numerical bibliography style with predefined citation style, defined either in the package or in the local configuration file;
2. giving options `numbers` or `super` to the `\usepackage` command;
3. issuing `\setcitestyle{numbers}`;
4. issuing `\citestyle` with the name of a predefined numerical bibliography style (like `plain` and use it with `plainnat`).

The `natbib` package will automatically switch to numerical mode if any one of the `\bibitem` entries fails to conform to the possible author–year formats. There is no way to override this, since such an entry would cause trouble in the author–year mode.

There are certain special 'numerical' styles, like that of the standard `alpha.bst`, which include a non-numerical label in place of the number, in the form

```
\bibitem[ABC95]{able95}
```

As far as `natbib` is concerned, this label does not conform to the author–year possibilities and is therefore considered to be numerical. The citation mode switches to numerical, and `\cite{able95}` prints [ABC95].

See however, the end of Section 2.7 for another possibility. The above result can be achieved with

```
\bibitem[ABC95()]{able95}
```

4 Local Configuration

It is possible to add a local configuration file `natbib.cfg`, which is read in, if it exists, at the end of the package. It may thus contain coding to supecede that in the package, although its main purpose is to allow the user to add his or her own `\bibstyle@`*bst* definitions to couple citation punctuation with local bibliography styles or for use with `\citestyle`.

5 Package Options

When a package is loaded with `\usepackage`, one can add options to select different features, as

`\usepackage[`*options*`]{natbib}`

The options available provide another means of specifying the punctuation for citations:

`round` (default) for round parentheses;

`square` for square brackets;

`curly` for curly braces;

`angle` for angle brackets;

`semicolon` (default) to separate multiple citations with semi-colons;

`colon` the same as `semicolon`, an earlier mistake in terminology;

`comma` to use commas as separators;

`authoryear` (default) for author–year citations;

`numbers` for numerical citations;

`super` for superscripted numerical citations, as in *Nature*;

`sort` orders multiple citations into the sequence in which they appear in the list of references;

`sort&compress` as `sort` but in addition multiple numerical citations are compressed if possible (as 3–6, 15);

`compress` to compress without sorting, so compression only occurs when the given citations would produce an ascending sequence of numbers;

`longnamesfirst` makes the first citation of any reference the equivalent of the starred variant (full author list) and subsequent citations normal (abbreviated list);

`sectionbib` redefines `\thebibliography` to issue `\section*` instead of `\chapter*`; valid only for classes with a `\chapter` command; to be used with the `chapterbib` package;

`nonamebreak` keeps all the authors' names in a citation on one line; causes overfull hboxes but helps with some `hyperref` problems;

`merge` to allow the * prefix to the citation key, and to merge such a citation's reference with that of the previous citation;

`elide` to elide common elements of merged references, like the authors or year;

`mcite` to recognize (and ignore) the merging syntax.

The options `curly` and `angle` are not really serious; I only added them because that completes the normal list of bracket types. The only other citation possibilities I know have really encountered are solidus, e.g. /21/, or something like (Ref. 21). These must be set with `\setcitestyle{open={/},close={/}}`.

The package options are overwritten by any explicit `\setcitestyle`, `\bibpunct`, or `\citestyle` commands. And both these commands and the package options turn off the automatic setting with `\bibliographystyle`, if effective.

6 Reference Sheet

A summary of the main points on using `natbib` can be obtained by LaTeXing the file `natnotes.tex`, which is extracted from the main source file `natbib.dtx` with the `docstrip` option `notes`. This is intended to act as a handy reference sheet.

This file should be extracted automatically by the supplied installation file, `natbib.ins`.

7 Options with `docstrip`

The source `.dtx` file is meant to be processed with `docstrip`, for which a number of options are available:

`all` includes all of the other interfaces;

`apalike` allows interpretation of minimal `apalike` form of `\bibitem`;

`newapa` allows `\citeauthoryear` to be in the optional argument of `\bibitem` along with the punctuation commands of `newapa.sty`;

`chicago` is the same as `newapa`;

`harvard` includes interpretation of `\harvarditem`;

`astron` allows `\astroncite` to appear in the optional argument of `\bibitem`;

`authordate` adds the syntax of the `\citename` command.

The remaining options are:

`package` to produce a `.sty` package file with most comments removed;

`notes` extracts a summary of usage to be used as a reference sheet; the resulting file is to be LaTeXed;

`driver` to produce a driver `.ltx` file that will print out the documentation when LaTeX'd. This file can be modified to produce various alternatives (page size, fonts, manual only, or with annotated code). The `natbib.dtx` file is itself such a driver but it should never, ever be edited by a user.

The source file `natbib.dtx` is itself a driver file and can be processed directly by LaTeX.

8 Other Author–Year Solutions

This section is of historical interest only.

Before `natbib` was published in 1993, there were several other attempts to provide author–year citations, some of which inspired `natbib`. A few of these are still maintained and used, and for that reason, `natbib` has attempted to include their `\bibitem` syntaxes, to be compatible with those `.bst` files.

Most of these 'packages' are really LaTeX 2.09 style files, so do not have features available with the modern LaTeX 2_ε.

8.1 The `natsci.bst` Style

What gave me my first inspiration was Stephen Gildea's `natsci.bst` for use with his `agujgr.sty` file. This showed me that the problem was solvable. However, Gildea's formats `\bibitem` with just the abbreviated authors and year. Thus only parenthetical citations can be accommodated.

The name `natsci` stands for *natural sciences*, and it was this that led to the name `natbib`. (This is admittedly an ugly name, but it is now established and cannot be changed so easily.)

8.2 The `apalike.bst` Style

Oren Patashnik, the originator of BibTeX and the standard `.bst` files, has also worked on an author–year style, called `apalike.bst` with a corresponding `apalike.sty` to support it. Again, only the parenthetical citation is provided. Its functionality is identical to that of the `natsci` files.

The form of the `thebibliography` entries in this system is

```
\bibitem[Jones et al., 1990]{jon90}...
```

This is the most minimal form that can be given. I name it the `apalike` variant, after Patashnik's `apalike.bst` and `apalike.sty`. However, there could be many independent `.bst` files that follow this line, such as the `natsci` styles.

The bibliography style files belonging to this group include:

`apalike`, `apalike2`, `cea`, `cell`, `jmb`, `phapalik`, `phppcf`, `phrmp`

8.3 The `newapa` Style

A major improvement was achieved with `newapa.bst` and the accompanying `newapa.sty` files by Stephen N. Spencer and Young U. Ryu. Under their system, three separate items of information are included in the `\bibitem` label, to be used as required. These are: the full author list, the abbreviated list, and the year. This is accomplished by means of a `\citeauthoryear` command included in the label, as

```
\bibitem[\protect\citeauthoryear{Jones, Barker,
  and Williams}{Jones et al.}{1990}]{jon90}...
```

Actually, this only illustrates the basic structure of `\citeauthoryear`; the `newapa` files go even further to replace some words and punctuation with commands. For example, the word 'and' above is really `\betweenauthors`, something that must be defined in the `.sty` file. Of course, `\citeauthoryear` is also defined in that file. A number of different `\cite` commands are available to print out the citation with complete author list, with the short list, with or without the date, the textual or parenthetical form.

Thus the `\citeauthoryear` entry in `\bibitem` is very flexible, permitting the style file to generate every citation form that one might want. It is used by a number of other styles, with corresponding `.sty` files. They all appear to have been inspired by `newapa.bst`, although they lack the extra punctuation commands.

Bibliographic style files belonging to the `newapa` group include

`newapa`, `chicago`, `chicagoa`, `jas99`, `named`

Note: the last of these, `named.bst`, uses `\citeauthoryear` in a slightly different manner, with only two arguments: the short list and year.

8.4 The Harvard Family

The same effect is achieved by a different approach in the Harvard family of bibliographic styles. Here a substitute for `\bibitem` is used, as

```
\harvarditem[Jones et al.]{Jones, Baker, and
   Williams}{1990}{jon90}...
```

The accompanying interface package file is called `harvard.sty` and is written by Peter Williams and Thorsten Schnier. It defines `\harvarditem` as well as the citation commands `\cite`, for parenthentical, and `\citeasnoun`, for textual citations. The first citation uses the long author list, following ones the shorter list, if it has been given in the optional argument to `\harvarditem`.

Bibliography styles belonging to the Harvard family are

`agsm`, `dcu`, `kluwer`

This package has been updated for LaTeX 2_ε, with many additions to add flexibility. The result is a powerful interface that should meet most citation needs. (It does not suppress repeated authors, though, as `natbib` does.)

8.5 The Astronomy Style

Apparently realizing the limitations of his `apalike` system, Oren Patashnik went on to develop a 'true' `apa` bibliographic style, making use of the method already employed by an astronomy journal. This is actually very similar to the `newapa` label but with only the short list of authors:

```
\bibitem[\protect\astroncite{Jones et al.}{1990}]{jon90}
   ...
```

It requires the package file `astron.sty` or any other style that defines `\astroncite` appropriately.

Bibliographic styles belonging to the astronomy group are

> `apa`, `astron`, `bbs`, `cbe`, `humanbio`, `humannat`, `jtb`

This is as good as the `\citeauthoryear` command, although not as flexible since the full list of authors is missing.

8.6 The `authordate` Style

Finally, I also found some packages making use of a label command called `\citename` in the form

```
\bibitem[\protect\citename{Jones et al., }1990]{jon90}
    ...
```

This is not a good system since the author list and date are not cleanly separated as individual arguments, and since the punctuation is included in the label text. It is better to keep the punctuation fully removed, as part of the definitions in the `.sty` file, for complete flexibility.

Bibliographic styles belonging to this group are

> `authordate1`, `authordate2`, `authordate3`, `authordate4`, `aaai-named`

with accompanying style file `authordate1-4.sty`.