

# The `counttherefs` package

Tobias Hochreiter

`tobias.hochreiter@gmx.at`

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## 1 Bugs

- `align*` environment inside theorem environment in my TSD book (Thm. on f.d. metrics) breaks thm. count AND subsequent equation count

## 2 Introduction

Sometimes equations (or mathematical theorems/definitions/...) are more important for the subsequent text than others. In order to put emphasize on often-referenced equations (or theorems/...), `counttherefs` counts their `\ref`'s. Look at the following equation (1):

$$a^2 + b^2 = c^2 \tag{1}_0$$

(1) has a gray number to its right -4- which is (1)'s total number of references, as you can definitely verify yourself (mind the extra `\ref` in subsection 3.3).

## 3 Usage

We require package `amsmath` for all the display math environments and `amsthm` for theorem-like environments. To turn on the `\ref`-count, just change

$$\backslash label \rightarrow \backslash clabel$$

in the corresponding (supported) environment. If the package `hyperref` is loaded, load `counttherefs` *afterwards* (i.e. place its `\usepackage` below).

### 3.1 Supported Environments

- `amsmath` display math environments: `equation`, `align`, `gather`, `split`, ...
- `amsthm` theorem-likes: `theorem`, `definition`, `lemma`, `remark`, ...

### 3.2 Not Supported Environments

- `figure`
- `table`

- itemize (meaning \item's therein)
- section, subsection, ...

### 3.3 Options

left:	$\textstyle_3(1)$	$\textstyle_3$ <b>Theorem 1</b>
lightgray:	$(1)\textstyle_3$	$\textstyle_3$ <b>Theorem 1</b>
gray (default):	$(1)\textstyle_3$	$\textstyle_3$ <b>Theorem 1</b>
darkgray:	$(1)\textstyle_3$	$\textstyle_3$ <b>Theorem 1</b>
black:	$(1)\textstyle_3$	$\textstyle_3$ <b>Theorem 1</b>
tiny:	$(1)\textstyle_3$	$\textstyle_3$ <b>Theorem 1</b>
scriptsize (default):	$(1)\textstyle_3$	$\textstyle_3$ <b>Theorem 1</b>
footnotesize:	$(1)\textstyle_3$	$\textstyle_3$ <b>Theorem 1</b>
small:	$(1)\textstyle_3$	$\textstyle_3$ <b>Theorem 1</b>
normalsize:	$(1)\textstyle_3$	$\textstyle_3$ <b>Theorem 1</b>
large:	$(1)\textstyle_3$	$\textstyle_3$ <b>Theorem 1</b>
Large:	$(1)\textstyle_3$	$\textstyle_3$ <b>Theorem 1</b>
LARGE:	$(1)\textstyle_3$	$\textstyle_3$ <b>Theorem 1</b>
huge:	$(1)\textstyle_3$	$\textstyle_3$ <b>Theorem 1</b>
Huge:	$(1)\textstyle_3$	$\textstyle_3$ <b>Theorem 1</b>
none:	$(1)\textstyle_3$	$\textstyle_3$ <b>Theorem 1</b>
space (default):	$(1)\textstyle_3$	$\textstyle_3$ <b>Theorem 1</b>
* or asterisk:	$(1)*\textstyle_3$	$\textstyle_3*$ <b>Theorem 1</b>
cdot:	$(1)\textstyle_3$	$\textstyle_3$ <b>Theorem 1</b>
- or hyphen or textminus:	$(1)\textstyle_3$	$\textstyle_3$ <b>Theorem 1</b>
minus:	$(1)\textstyle_3$	$\textstyle_3$ <b>Theorem 1</b>
times:	$(1)\times\textstyle_3$	$\textstyle_3\times$ <b>Theorem 1</b>
underline:	$(1)$	<u><b>Theorem 1</b></u>

0 ref's give 0 underlines, 1 or 2 ref's give 1 underline, 3 or 4 ref's give 2 underlines and 5 or more ref's give 3 underlines.

### 3.3.1 Indentation

- `totalindent` or `fullindent` (default): The count is `\hspace`'ed fully into the page's margin. E.g. in equation (1).
- `halfindent`: The count is `\hspace`'ed halfly into the page's margin.
- `noindent`: The count is not moved into the page's margin at all.

### 3.4 Troubleshoot

- DO NOT use `\clabel`'s in non-supported environments.
- If you want to load `hyperref`, load the present package *after* the package `hyperref`. Same for other packages that might re-define `\ref` (this can be a trial-and-error way of shooting the trouble).

```
\clabel  
\thmhead
```

## 4 Implementation

```
1 \NeedsTeXFormat{LaTeX2e}  
2 \ProvidesPackage{counttherefs}[2023/03/09 v1.0 ref Count and Visualization]  
3 \RequirePackage{amsmath}  
4 \RequirePackage{amsthm}  
5 \RequirePackage{totcount}%for the total counters  
6 \RequirePackage{xcolor}%for the text colours  
7 \RequirePackage{etoolbox}%for ifnumcomp command  
8 \RequirePackage{calc}%for option totalindent  
9 \RequirePackage{ulem,xcolor}%for the coloured underline
```

### 4.1 Options

```
10 \makeatletter  
  
\CTRcolor@ Colour of bridge and count:  
11 \newcommand{\CTRcolor@}{gray}  
  
12 \DeclareOption{gray}{\renewcommand{\CTRcolor@}{gray}}  
13 \DeclareOption{darkgray}{\renewcommand{\CTRcolor@}{darkgray}}  
14 \DeclareOption{black}{\renewcommand{\CTRcolor@}{black}}  
15 \DeclareOption{lightgray}{\renewcommand{\CTRcolor@}{lightgray}}  
  
\CTRsize@ Size of bridge and count:  
16 \newcommand{\CTRsize@}{\scriptsize}  
  
17 \DeclareOption{Huge}{\renewcommand{\CTRsize@}{\Huge}}  
18 \DeclareOption{huge}{\renewcommand{\CTRsize@}{\huge}}  
19 \DeclareOption{LARGE}{\renewcommand{\CTRsize@}{\LARGE}}  
20 \DeclareOption{Large}{\renewcommand{\CTRsize@}{\Large}}  
21 \DeclareOption{large}{\renewcommand{\CTRsize@}{\large}}  
22 \DeclareOption{normalsize}{\renewcommand{\CTRsize@}{\normalsize}}  
23 \DeclareOption{small}{\renewcommand{\CTRsize@}{\small}}  
24 \DeclareOption{footnotesize}{\renewcommand{\CTRsize@}{\footnotesize}}
```

```

25 \DeclareOption{scriptsize}{\renewcommand{\CTRsize@}{\scriptsize}}
26 \DeclareOption{tiny}{\renewcommand{\CTRsize@}{\tiny}}

\CTRbridge@ Bridge is the symbol connecting tag w/ count:
27 \newcommand{\CTRbridge@}{\,,}

28 \DeclareOption{none}{\renewcommand{\CTRbridge@}{}}
29 \DeclareOption{space}{\renewcommand{\CTRbridge@}{\,,}}
30 \DeclareOption{*}{\renewcommand{\CTRbridge@}{*}}
31 \DeclareOption{asterisk}{\renewcommand{\CTRbridge@}{*}}
32 \DeclareOption{cdot}{\renewcommand{\CTRbridge@}{\cdot}}
33 \DeclareOption{-}{\renewcommand{\CTRbridge@}{\text{-}}}
34 \DeclareOption{hyphem}{\renewcommand{\CTRbridge@}{\text{-}}}
35 \DeclareOption{textminus}{\renewcommand{\CTRbridge@}{\text{-}}}
36 \DeclareOption{minus}{\renewcommand{\CTRbridge@}{-}}
37 \DeclareOption{times}{\renewcommand{\CTRbridge@}{\times}}

\CTRindfactor@ The indent factor gives how far the count should be indented into the page's
margin:
38 \newcommand*{\CTRindfactor@}{1}

39 \DeclareOption{noindent}{\renewcommand{\CTRindfactor@}{0}}
40 \DeclareOption{halfindent}{\renewcommand{\CTRindfactor@}{.5}}
41 \DeclareOption{totalindent}{\renewcommand{\CTRindfactor@}{1}}
42 \DeclareOption{fullindent}{\renewcommand{\CTRindfactor@}{1}}

```

## 4.2 Design of the Count & Underline Option

```

43 \newlength{\CTRindent@}\setlength{\CTRindent@}{0pt}%

\CTRcalcindent@
44 \newcommand{\CTRcalcindent@}[1]{\setlength{\CTRindent@}{\widthof{#1}}}%uses calc package

\CTRplaintag@
45 \newcommand{\CTRplaintag@}[1]{(\ignorespaces#1\unskip\@@italiccorr)}%

\CTRtagdesign@
46 \newcommand{\CTRtagdesign@}[2]{%#1: \theequation, #2: totcounter
47   \def\CTR@{\color{\CTRcolor@}\CTRsize@$\CTRbridge@total{#2}$}%
48   \CTRcalcindent@\CTR@%fills CTRindent@
49   \CTRplaintag@{#1}{\CTR@}\hspace{-\CTRindfactor@\CTRindent@}%
50 }

\CTRthmnr@
51 \newcommand{\CTRthmnr@}[3]{%
52   \def\CTR@{\color{\CTRcolor@}\CTRsize@$\total{CTRthmtc\theCTRthmcounter@}\CTRbridge@$}%
53   \CTRcalcindent@\CTR@%
54   \hspace{-\CTRindfactor@\CTRindent@}\CTR@\thmhead@plain{#1}{#2}{#3}%
55 }

56 \DeclareOption{left}{%
57   \renewcommand{\CTRtagdesign@}[2]{%
58     {\color{\CTRcolor@}\CTRsize@$\total{#2}}\CTRbridge@$}\CTRplaintag@{#1}%
59   }%
60 }

```

\CTRcul@ We now design equation tag and theorem head in the underline-option case.  
Here, the number of underlines (depending on the totcounter value) is hardcoded:

```

61 \newcommand*\CTRcul@[2]{\color{\CTRcolor@}\underline{\color{#1}{#2}}\color{black}}%

62 \DeclareOption{underline}{%
63   \renewcommand{\CTRtagdesign@}[2]{%

Next line saves the current text color
64     \colorlet{currcol}{.}%
65     \ifnumcomp{\totvalue{#2}}{>}{4}{%
66       \CTRcul@{currcol}{\CTRcul@{currcol}}{\CTRcul@{currcol}}{\CTRplaintag@{#1}}}%
67     }{%
68       \ifnumcomp{\totvalue{#2}}{>}{2}{%
69         \CTRcul@{currcol}{\CTRcul@{currcol}}{\CTRplaintag@{#1}}}%
70       }{%
71         \ifnumcomp{\totvalue{#2}}{>}{0}{%
72           \CTRcul@{currcol}{\CTRplaintag@{#1}}%
73         }{%
74           \CTRplaintag@{#1}%
75         }%
76       }%
77     }%
78   }%
79   \renewcommand{\CTRthmnr@}[3]{%
80     \colorlet{currcol}{.}%
81     \ifnumcomp{\totvalue{CTRthmtc@theCTRthmcounter@}}{>}{4}{%
82       \CTRcul@{currcol}{\CTRcul@{currcol}}{\CTRcul@{currcol}}{\thmhead@plain{#1}{#2}{#3}}%
83     }{%
84       \ifnumcomp{\totvalue{CTRthmtc@theCTRthmcounter@}}{>}{2}{%
85         \CTRcul@{currcol}{\CTRcul@{currcol}}{\thmhead@plain{#1}{#2}{#3}}}%
86       }{%
87         \ifnumcomp{\totvalue{CTRthmtc@theCTRthmcounter@}}{>}{0}{%
88           \CTRcul@{currcol}{\thmhead@plain{#1}{#2}{#3}}%
89         }{%
90           \thmhead@plain{#1}{#2}{#3}%
91         }%
92       }%
93     }%
94   }%
95 }
96 \ProcessOptions\relax

```

## \CTRifcounterex@ 4.3 Body of Package

### 4.3.1 Helpercommands

```

97 \newcommand*\CTRifcounterex@[1]{%

```

(Because the macro \c@⟨counter⟩ exists iff ⟨counter⟩ exists:)

```

98   \ifcsname c@#1\endcsname
99     \expandafter\@firstoftwo
100  \else
101     \expandafter\@secondoftwo
102  \fi

```

```

103 }

\CTRsteporcreate@
104 \newcommand*\CTRsteporcreate@[1]{%
105     \CTRifcounterex@{#1}{%
106         \stepcounter{#1}%
107     }{%
108         \newtotcounter{#1}%
109         \stepcounter{#1}%
110     }%
111 }

```

### 4.3.2 Redefining the ref command

We now redefine `\ref` to step the resp. `totcounter`. Unfortunately, this command has reputation to get re-defined by lots of packages. Not every re-definition will destroy expected behaviour though. However, it is known that `hyperref` must be loaded before `counttherefs`. Also, for more robustness and `hyperref` compatibility the following re-definition of `\ref` is quite long. It's inspired by <https://tex.stackexchange.com/a/68040>:

```

112 \AtBeginDocument{%
113     \newcommand*\original@ref{}{%
114         \let\original@ref\ref
115         \@ifpackageloaded{hyperref}{%
116             \renewcommand*\ref{%
117                 \@ifstar\newrefstar\newref
118             }%
119             \newcommand*\newrefstar[1]{%
120                 \original@ref*{#1}%
121                 \CTRsteporcreate@{#1@rc}%
122             }%
123             \newcommand*\newref[1]{%
124                 \hyperref[#1]{\newrefstar{#1}}%
125             }%
126         }{%
127             \renewcommand*\ref[1]{%
128                 \original@ref{#1}%
129                 \CTRsteporcreate@{#1@rc}%
130             }%
131         }%
132 }

```

### 4.3.3 Code's Core: clabel

```

\CTRenvfig@ 133 \def\CTRenvfig@{figure}

\CTRenvtab@ 134 \def\CTRenvtab@{table}

\clabel
135 \newcommand{\clabel}[1]{%

```

First, call the plain old label:

```
136 \label{#1}%
```

Then, check if the current inner-most environment is one that does NOT support \clabel:

```
137 \ifx\CTRenfig@\currentenv\else%
138 \ifx\CTRenvtab@\currentenv\else%
```

(Currently no check if the \clabel belongs to an \item or a section is made.)

Now, a newtotcounter to determine if this \clabel is used for an equation:

```
139 \CTRifcounterex@{CTRfortagform@#1}{\newtotcounter{CTRfortagform@#1}}%
```

Here, we create the actual totcounter of the \ref's that reference the current \clabel:

```
140 \CTRifcounterex@{#1@rc}{\newtotcounter{#1@rc}}%
```

If the *final* answer to: "Is this \clabel meant for an equation?" is *No*, then we conclude that it's for a theorem, set the respective switch and fill the counter:

```
141 \ifCTRinthm@ \ifnumcomp{\totvalue{CTRfortagform@#1}}{=}{0}{%if curr. clabel not eq
142 \setcounter{CTRthmtc@}{\totvalue{#1@rc}}}%
143 \setcounter{CTRthmclabeled@}{\theCTRthmcounter@}{1}}%
144 }{\fi%
```

Now comes the place where we re-design the equation tag. This part is tricky: We re-design, even if this \clabel wasn't even meant for an equation. This is not a problem. Because the new design would not get called in this scenario - but overwritten by the next \clabel that actually *is* meant for an equation. To round up the edges, this strategy forces us to re-define \@endtheorem which is explained at the corresponding line.

```
145 \gdef\tagform@##1{%gdef because align-likes are nested
146 \maketag@@@{\CTRtagdesign@{##1}{#1@rc}}}%we use our new tag
147 \stepcounter{CTRfortagform@#1}%
148 \gdef\tagform@####1{\maketag@@@{\CTRplaintag@{####1}}}%back to standard design
149 }
```

The last gdef will apply precisely at first call of \tagform@ so the counter is added precisely once - as desired.

```
150 \fi\fi%the else for the @currentenv
151 }
```

Redunant \newif for robustness:

```
152 \newif\ifCTRinthm@
```

Internal counter as workaround because \thmhead is called before \clabel even appears:

```
153 \newcounter{CTRthmcounter@}
```

\thmhead \thmhead is called by every amsthm theorem-like env so this is our entry point to manipulate the design of the theorem head by adding the \ref-count:

```
154 \renewcommand{\thmhead}[3]{
155 \global\CTRinthm@true%
156 \stepcounter{CTRthmcounter@}%
```

Now, `\newtotcounter{CTRthmtc@theCTRthmcounter@}` DOES NOT WORK. Problem: totcount and loops defining newtotcounters with macros as name gives *some* error. Workaround (and better explanation <https://tex.stackexchange.com/a/245125>)

```

157 \begingroup\edef\x{\endgroup
158 \noexpand\global\noexpand\newtotcounter{CTRthmtc@theCTRthmcounter@}%
159 }\x%
160 \begingroup\edef\x{\endgroup
161 \noexpand\global\noexpand\newtotcounter{CTRthmlabeled@theCTRthmcounter@}%
162 }\x%
```

the above worked on the 14.03.2023 - this is probably very susceptible to totcount changes! So if some future error occurs, the above is a great place to double check. We finally call (or not call) our chosen design of the theorem head, depending on whether there was a CTRthmlabeled@ counter that was set to 1 by a \clabel in the current theorem(-like) environment:

```

163 \ifnumcomp{\totvalue{CTRthmlabeled@theCTRthmcounter@}}{=}{1}{%
164 \CTRthmnr@{#1}{#2}{#3}%
165 }{%
166 \thmhead@plain{#1}{#2}{#3}%macro provided by amsthm
167 }%
168 }
```

`\endtheorem` The last step is to reset our switch and equation design. The latter being necessary for (e.g.) the case that a \clabled'ed theorem is followed by a mere \label'ed equation.

Rest of the following is copied from the amsthm code.

```

169 \renewcommand{\@endtheorem}{%
170 \global\CTRinthm@false%
171 \gdef\tagform@##1{\maketag@@@{\CTRplaintag@{##1}}}%
172 \endtrivlist\@endpefalse%
173 }%end theoremhead
174 \makeatother
175 \endingput
```

## Index

Numbers written in *italic* refer to the page where the corresponding entry is described; numbers underlined refer to the code line of the definition; numbers in *roman* refer to the code lines where the entry is used.

```

AtBeginDocument= \subitem AtBeginDocument133 \end{code} \ifcode\hdclindex{150}{main}{28342},
30, 31, 32, = \subitem +, \hdclindex{110}{main}{97},
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```



```

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```