

# The `counttherefs` package

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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):

$$a^2 + b^2 = c^2 \tag{1}_4$$

(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

<code>left:</code>	$\textstyle\frac{3}{1}$	$\textstyle\frac{3}{3}$ <b>Theorem 1</b>
<code>lightgray:</code>	$\textstyle\frac{1}{3}$	$\textstyle\frac{3}{3}$ <b>Theorem 1</b>
<code>gray (default):</code>	$\textstyle\frac{1}{3}$	$\textstyle\frac{3}{3}$ <b>Theorem 1</b>
<code>darkgray:</code>	$\textstyle\frac{1}{3}$	$\textstyle\frac{3}{3}$ <b>Theorem 1</b>
<code>black:</code>	$\textstyle\frac{1}{3}$	$\textstyle\frac{3}{3}$ <b>Theorem 1</b>
<code>tiny:</code>	$\textstyle\frac{1}{3}$	$\textstyle\frac{3}{3}$ <b>Theorem 1</b>
<code>scriptsize (default):</code>	$\textstyle\frac{1}{3}$	$\textstyle\frac{3}{3}$ <b>Theorem 1</b>
<code>footnotesize:</code>	$\textstyle\frac{1}{3}$	$\textstyle\frac{3}{3}$ <b>Theorem 1</b>
<code>small:</code>	$\textstyle\frac{1}{3}$	$\textstyle\frac{3}{3}$ <b>Theorem 1</b>
<code>normalsize:</code>	$\textstyle\frac{1}{3}$	$\textstyle\frac{3}{3}$ <b>Theorem 1</b>
<code>large:</code>	$\textstyle\frac{1}{3}$	$\textstyle\frac{3}{3}$ <b>Theorem 1</b>
<code>Large:</code>	$\textstyle\frac{1}{3}$	$\textstyle\frac{3}{3}$ <b>Theorem 1</b>
<code>LARGE:</code>	$\textstyle\frac{1}{3}$	$\textstyle\frac{3}{3}$ <b>Theorem 1</b>
<code>huge:</code>	$\textstyle\frac{1}{3}$	$\textstyle\frac{3}{3}$ <b>Theorem 1</b>
<code>Huge:</code>	$\textstyle\frac{1}{3}$	$\textstyle\frac{3}{3}$ <b>Theorem 1</b>
<code>none:</code>	$\textstyle\frac{1}{3}$	$\textstyle\frac{3}{3}$ <b>Theorem 1</b>
<code>space (default):</code>	$\textstyle\frac{1}{3}$	$\textstyle\frac{3}{3}$ <b>Theorem 1</b>
<code>* or asterisk:</code>	$\textstyle\frac{1}{*3}$	$\textstyle\frac{3}{*3}$ <b>Theorem 1</b>
<code>cdot:</code>	$\textstyle\frac{1}{3}$	$\textstyle\frac{3}{3}$ <b>Theorem 1</b>
<code>- or hyphen or textminus:</code>	$\textstyle\frac{1}{-3}$	$\textstyle\frac{3}{-3}$ <b>Theorem 1</b>

minus:	$(1)_{-3}$	$3-$ <b>Theorem 1</b>
times:	$(1)_{\times 3}$	$3\times$ <b>Theorem 1</b>
underline:	<u><math>(1)</math></u>	<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 }

```

#### \CTRenvfig@ 4.3.3 Code's Core: clabel

```

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\CTRenvfig@\@currenvir\else%

```

```

138   \ifx\CTRenvtab@\@currenvir\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@theCTRthmcounter@}{\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 @currenvir
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{CTRthmclabeled@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 `CTRthmclabeled@` counter that was set to 1 by a `\clabel` in the current theorem(-like) environment:

```

163 \ifnumcomp{\totvalue{CTRthmclabeled@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\@endpfalse%
173 }%end theoremhead
174 \makeatother
175 \endinput
```

## 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.

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