The bracealign package*

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https://github.com/julienlabbe/latex-packages

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Abstract

A LaTeX package to align braces under and over math expressions. A new environment called `bracealign` (→ P. 3) is provided, inside which braces and brackets drawn with the commands `\underbrace`, `\overbrace`, `\underbracket`, `\overbracket`, `\underparen` or `\overparen` are vertically aligned. The package also allows adding support for new commands.

Example:

```
\[
  \rho c \frac{\partial T}{\partial t} =
  \begin{bracealign}
    \underbrace{
      \begin{bracealign}
        \underbrace{
          - \lambda \frac{\partial^2 T}{\partial x^2}
        }_{\text{diffusion}}
        - \underbrace{
          \mu (T^4 - {T_0}^4)
        }_{\substack{\text{radiative loss}}}
      \end{bracealign}
    }_{\text{heat transferts}}
    + \underbrace{
      \sum_{i=1}^{n} \dot{q}_i
    }_{\substack{\text{heat}\\\text{sources}}}
  \end{bracealign}
\]
```

$$\rho c \frac{\partial T}{\partial t} = \underbrace{\underbrace{-\lambda \frac{\partial^2 T}{\partial x^2}}_{\text{diffusion}} \underbrace{-\mu(T^4 - {T_0}^4)}_{\text{radiative loss}}}_{\text{heat transferts}} + \underbrace{\sum_{i=1}^{n} \dot{q}_i}_{\substack{\text{heat}\\\text{sources}}}$$

*This document corresponds to bracealign v1.0, dated 2025/04/17.

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1 Introduction

The bracealign package provides the environment `bracealign` inside which brace-like commands are vertically aligned. Supported brace-like commands are:

`\underbrace`	`\underbracket`	`\underparen`
`\overbrace`	`\overbracket`	`\overparen`

`\underbrace` and `\overbrace` are standard LaTeX commands. The commands `\underbracket` and `\overbracket` are defined, for example, by the packages: unicode-math, mathtools, stix2 or libertinus; the commands `\underparen` and `\overparen` by: unicode-math, stix2 or libertinus. The support for new commands can be added by the user.

Inside the `bracealign` environment, the content of brace-like commands is grabbed and appended inside all same braces with a `\vphantom` macro to generate the braces alignment. Note that this prohibits the use of optional arguments for the commands (see *Known issue*, section 3.1, page 7).

This package originates in an answer on the TeX – LaTeX Stack Exchange network[1].

2 User interface

The examples given in this section use the following commands:

```
\newcommand{\smallcontent}{\textcolor{cyan}{\rule[-3pt]{1cm}{6pt}}}
\newcommand{\medcontent}  {\textcolor{cyan}{\rule[-6pt]{1.2cm}{12pt}}}
\newcommand{\bigcontent}  {\textcolor{cyan}{\rule[-12pt]{2cm}{24pt}}}
\newcommand{\hugecontent} {\textcolor{cyan}{\rule[-18pt]{2.5cm}{36pt}}}
```

The xcolor package is also required (for the command `\textcolor`), as loading the amsmath package (for the command `\text`) and a package that defines `\underbracket` (such as mathtools).

2.1 Environment

`\begin{bracealign}`[⟨*options list*⟩]
  ⟨*environment content*⟩
`\end{bracealign}`

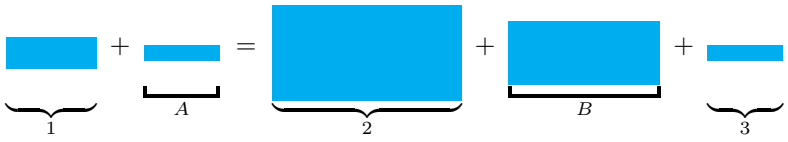
Vertically aligns the brace-like commands in ⟨*environment content*⟩. Each command is aligned separately (note that commands that uses internally a brace-like command are also aligned). `bracealign` environments can be nested.

The keys described in section 2.3, can be used in ⟨*options list*⟩ to activate, or deactivate, the alignment of each braces.

[1] `https://tex.stackexchange.com/a/740290`.

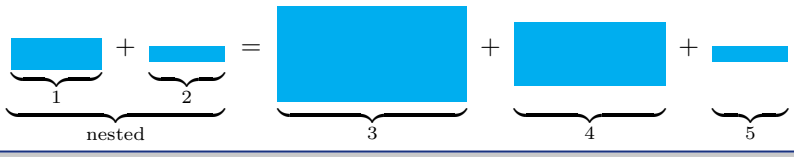
Separate alignment of brace-like commands

```
\[
  \begin{bracealign}
    \underbrace{\medcontent}_{1}
    ~+~ \underbracket{\smallcontent}_{A}
    ~=~ \underbrace{\hugecontent}_{2}
    ~+~ \underbracket{\bigcontent}_{B}
    ~+~ \underbrace{\smallcontent}_{3}
  \end{bracealign}
\]
```



Nested `bracealign` environments

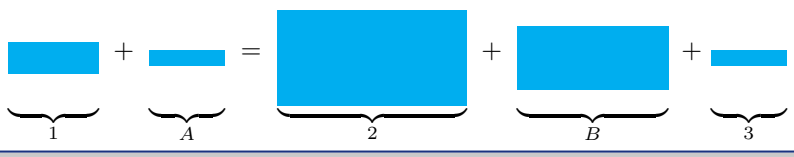
```
\[
  \begin{bracealign}
    \underbrace{
      \begin{bracealign}
        \underbrace{\medcontent}_{1}
        ~+~ \underbrace{\smallcontent}_{2}
      \end{bracealign}
    }_{\text{nested}}
    ~=~ \underbrace{\hugecontent}_{3}
    ~+~ \underbrace{\bigcontent}_{4}
    ~+~ \underbrace{\smallcontent}_{5}
  \end{bracealign}
\]
```



Using internally a brace-like command

Note: the `\ubrace` *command has been suggested by Enrico Gregorio to fix the syntax and spacing issues of* `\underbrace` *(see* `https://tex.stackexchange.com/a/728627/`*).*

```
\newcommand{\ubrace}[2]{{\underbrace{#1}_{#2}}}
\[
  \begin{bracealign}
    \ubrace{\medcontent}{1}
    ~+~ \underbrace{\smallcontent}_{A}
    ~=~ \ubrace{\hugecontent}{2}
    ~+~ \underbrace{\bigcontent}_{B}
    ~+~ \ubrace{\smallcontent}{3}
  \end{bracealign}
\]
```



2.2 Command

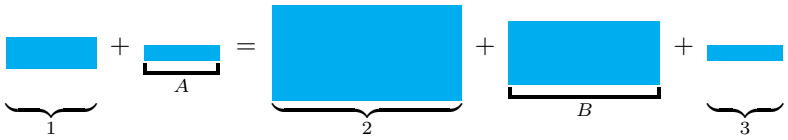
`\bracealignsetup{`⟨*options list*⟩`}`

Sets options for every `bracealign`→P. 3 environments. All keys described in the section 2.3 can be used in ⟨*options list*⟩.

This is equivalent to `\SetKeys [bracealign] {`⟨*options list*⟩`}`.

```
\bracealignsetup{underbracket=false}

\[
  \begin{bracealign}
    \underbrace{\medcontent}_{1}
    ~+~ \underbracket{\smallcontent}_{A}
    ~=~ \underbrace{\hugecontent}_{2}
    ~+~ \underbracket{\bigcontent}_{B}
    ~+~ \underbrace{\smallcontent}_{3}
  \end{bracealign}
\]
```



2.3 Keys

`/bracealign/overbrace=true|false` (default `true`, initially `true`)
`/bracealign/nooverbrace=true|false` (default `true`, inverse of `overbrace`)

`/bracealign/underbrace=true|false` (default `true`, initially `true`)
`/bracealign/nounderbrace=true|false` (default `true`, inverse of `underbrace`)

`/bracealign/overbracket=true|false` (default `true`, initially `true`)
`/bracealign/nooverbracket=true|false` (default `true`, inverse of `overbracket`)

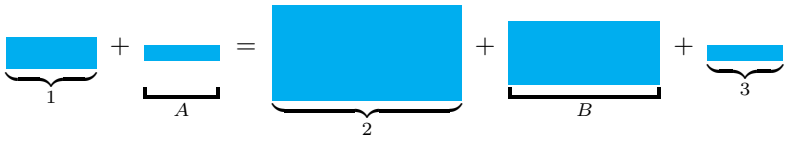
`/bracealign/underbracket=true|false` (default `true`, initially `true`)
`/bracealign/nounderbracket=true|false` (default `true`, inverse of `underbracket`)

`/bracealign/overparen=true|false` (default `true`, initially `true`)
`/bracealign/nooverparen=true|false` (default `true`, inverse of `overparen`)

`/bracealign/underparen=true|false` (default `true`, initially `true`)
`/bracealign/nounderparen=true|false` (default `true`, inverse of `underparen`)

Activates, or deactivates, the alignment of the corresponding brace-like command. These boolean keys are defined when the package bracealign is loaded, whether the commands are defined or not (as they can be defined later).

```
\[
  \begin{bracealign}[underbrace=false]
    \underbrace{\medcontent}_{1}
    ~+~ \underbracket{\smallcontent}_{A}
    ~=~ \underbrace{\hugecontent}_{2}
    ~+~ \underbracket{\bigcontent}_{B}
    ~+~ \underbrace{\smallcontent}_{3}
  \end{bracealign}
\]
```



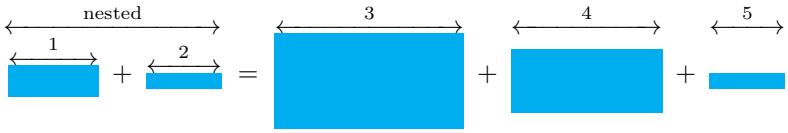
`/bracealign/add-brace=`\⟨*command*⟩
`/bracealign/add-braces={`⟨*commands list*⟩`}`

`/bracealign/add-brace` adds the support for the new brace-like command \⟨*command*⟩. This also defines the keys ⟨*command*⟩ and `no`⟨*command*⟩ to activate or deactivate the alignment of \⟨*command*⟩ braces.

`/bracealign/add-braces` adds the support for multiple brace-like commands, given as a comma separated list of commands.

```
\newcommand*{\mybrace}[1]{\mathop{\overleftrightarrow{#1}}\limits}
\bracealignsetup{add-brace=\mybrace}

\[
  \begin{bracealign}
    \mybrace{
      \begin{bracealign}[mybrace=false]
        \mybrace{\medcontent}^{1}
        ~+~ \mybrace{\smallcontent}^{2}
      \end{bracealign}
    }^{\text{nested}}
    ~=~ \mybrace{\hugecontent}^{3}
    ~+~ \mybrace{\bigcontent}^{4}
    ~+~ \mybrace{\smallcontent}^{5}
  \end{bracealign}
\]
```



`/bracealign/default-braces={`⟨*commands list*⟩`}`
(no default, initially {\underbrace, \overbrace, \underbracket, \overbracket, \underparen, \overparen})

Sets the list of brace-like commands that must be supported by `bracealign` → P. 3. At the beginning of the document (through the `begindocument` hook) the existence of each command is tested and, if the test sucesses, the command is passed to `/bracealign/add-brace`.

3 Complements

3.1 Known issue: Commands with optional arguments

The brace-like commands are expected to have only one mandatory argument (this argument is grabbed and used to align the braces). In particular, if a command handles optional arguments (such as the commands `\underbracket` and `\overbracket` as defined by the mathtools package), these optional arguments can't be used inside the `bracealign` → P. 3 environment.

3.2 Changelog

v1.0 Initial version.

4 Implementation

4.1 Adding brace command

The sequence that store the brace-like commands.

```
\seq_new:N \l_bracealign_brace_seq
```

\bracealign_add_brace:n
\bracealign_add_brace:e
\bracealign_add_brace:N

Add the brace command `#1`.

```
\msg_new:nnn { bracealign } { already-added-brace }
  { Brace~command~\token_to_str:c #1~has~already~been~added.~Skipped. }
\cs_new:Nn \bracealign_add_brace:n
  {
    \seq_if_in:NnTF \l_bracealign_brace_seq { #1 }
      {
        \msg_warning:nnn { bracealign } { already-added-brace } { #1 }
      }
      {
        \seq_put_right:Nn \l_bracealign_brace_seq { #1 }
```

Backup the standard command.

```
        \cs_set_eq:cc { @@_#1_std_cmd:n } { #1 }
```

Define switches, if needed (for commands initially in `\l@@_default_brace_clist`, the switches are defined when the package is loaded, but the commands are added through the hook `begindocument`).

```
        \bool_if_exist:cF { l@@_#1_bool }
          { \@@_define_switches:e { #1 } }
```

These token lists store the content of braces.

```
        \tl_new:c { g@@_#1_strutcontent_tl }
        \tl_new:c { l@@_#1_strutcontent_tl }
        \tl_new:c { l@@_#1_strutcontent_surround_tl }
```

Command wrapper to collect the braces content.

```
        \cs_new:cn { @@_#1_collect_strutcontent:n }
          {
            \tl_gput_right:cn { g@@_#1_strutcontent_tl } { ##1 }
            \use:c { @@_#1_std_cmd:n } { }
          }
```

Command wrapper to use the braces content in `\vphantom`.

```
        \cs_new:cn { @@_#1_use_strutcontent:n }
          {
            \use:c {  @@_#1_std_cmd:n }
              {
                \vphantom
                  {
                    \tl_use:c { l@@_#1_strutcontent_tl }
                  }
                  ##1
              }
          }
      }
  }
\cs_generate_variant:Nn \bracealign_add_brace:n { e }
\cs_new:Nn \bracealign_add_brace:N
  {
    \bracealign_add_brace:e { \cs_to_str:N #1 }
  }
```

Keys `/bracealign/add-brace` → P. 6 and `/bracealign/add-braces` → P. 6 (wrapper to `\bracealign_add_brace:N`).

```
\keys_define:nn { bracealign }
  {
    add-brace   .code:n = { \bracealign_add_brace:N  #1 },
    add-braces  .code:n =
      {
        \clist_map_function:nN { #1 } \bracealign_add_brace:N
      },
  }
```

`\@@_define_switches:n`
`\@@_define_switches:e`
`\@@_define_switches:N`

Define the switches for the brace command `#1`.

```
\cs_new:Nn \@@_define_switches:n
  {
    \bool_new:c { l@@_#1_bool }
    \bool_set_true:c { l@@_#1_bool }
    \keys_define:nn { bracealign }
      {
        #1   .bool_set:c          = { l@@_#1_bool },
        no#1 .bool_set_inverse:c  = { l@@_#1_bool },
      }
  }
\cs_generate_variant:Nn \@@_define_switches:n { e }
\cs_new:Nn \@@_define_switches:N
  {
    \@@_define_switches:e { \cs_to_str:N #1 }
  }
```

4.2 Alteration of brace command

`\@@_initialize:n`

These three commands are used for each brace. `#1` is the brace name.

Sets the brace command to collect its content in `\g@@_#1_strutcontent_tl`.

```
\cs_new:Nn \@@_initialize:n
  {
    \tl_set_eq:cc
      { l@@_#1_strutcontent_surround_tl }
      { g@@_#1_strutcontent_tl }
    \tl_clear:c { g@@_#1_strutcontent_tl }
    \cs_set_eq:cc
      { #1 }
```

```
      { @@_#1_collect_strutcontent:n }
  }
```

`\@@_use_strutcontent:n`

Set the brace command to use the all braces contents as strut (using `\vphantom`).

```
\cs_new:Nn \@@_use_strutcontent:n
  {
    \tl_set_eq:cc
      { l@@_#1_strutcontent_tl }
      { g@@_#1_strutcontent_tl }
    \cs_set_eq:cc
      { #1 }
      { @@_#1_use_strutcontent:n }
  }
```

`\@@_finalize:n`

Restore `\g@@_#1_strutcontent_tl` for the surrounding group.

```
\cs_new:Nn \@@_finalize:n
  {
    \tl_set_eq:cc
      { g@@_#1_strutcontent_tl }
      { l@@_#1_strutcontent_surround_tl }
  }
```

4.3 Main command

Sequence of active braces.

```
\seq_new:N \l@@_active_brace_seq
```

`\@@_update_active_braces:`

Update the sequence of active brace commands.

```
\cs_new:Nn \@@_update_active_braces:
  {
```

Restore standard brace commands (in the case the command is set is the surrounding group, and unset in the current one).

```
    \seq_map_inline:Nn \l@@_active_brace_seq
      {
        \cs_set_eq:cc { ##1 } { @@_##1_std_cmd:n }
      }
```

Set `\l@@_active_brace_seq`.

```
    \seq_clear:N \l@@_active_brace_seq
    \seq_map_inline:Nn \l_bracealign_brace_seq
      {
        \bool_if:cT { l@@_##1_bool }
          { \seq_put_right:Nn \l@@_active_brace_seq { ##1 } }
      }
  }
```

`\bracealign_bracealign:n`

Align braces in `#1`.

```
\cs_new:Nn \bracealign_bracealign:n
  {
```

List active brace commands.

```
    \@@_update_active_braces:
```

Set the braces to collect their contents.

```
    \seq_map_inline:Nn \l@@_active_brace_seq
      { \@@_initialize:n { ##1 } }
```

Expand `#1` in an unused box.

```
    \hbox_set:Nn \l_tmpa_box { $ #1 $ }
```

Set the braces to automatically use a strut, and align.

```
    \seq_map_inline:Nn \l@@_active_brace_seq
      { \@@_use_strutcontent:n { ##1 } }
```

Typeset `#1`.

```
    #1
```

Finalize.

```
    \seq_map_inline:Nn \l@@_active_brace_seq
      { \@@_finalize:n { ##1 } }
  }
```

4.4 User interface

`\bracealignsetup`

Set bracealign keys.

```
\NewDocumentCommand { \bracealignsetup } { m }
  {
    \keys_set:nn { bracealign } { #1 }
  }
```

`bracealign` (*env.*) Main environment.

```
\NewDocumentEnvironment { bracealign } { O{} b }
  {
    \bracealignsetup{ #1 }
    \bracealign_bracealign:n { #2 }
  }
  {
  }
```

4.5 Default braces

The `clist` that stores the default brace commands.

```
\clist_new:N \l@@_default_brace_clist
\keys_define:nn { bracealign }
  {
    default-braces  .clist_set:N = \l@@_default_brace_clist,
    default-braces  .initial:n =
      {
        \underbrace,    \overbrace,
        \underbracket,  \overbracket,
        \underparen,    \overparen
      },
  }
```

Define the switches for the commands initially in `\l@@_default_brace_clist` to make them available in the preamble (these commands are added through the hook `begindocument`).

```
\clist_map_inline:Nn \l@@_default_brace_clist
  {
   \@@_define_switches:N #1
  }
```

4.6 Hook: `begindocument`

All these packages define brace commands. Wait for their commands definition.

```
\clist_map_inline:nn
  {
    mathtools,
    unicode-math-luatex, unicode-math-xetex,
    libertinus, libertinust1math,
    stix2-type1, stix2
  }
  { \hook_gset_rule:nnnn { begindocument } { . } { after } { #1 } }
```

Add braces in `\l@@_default_brace_clist`.

```
\hook_gput_code:nnn { begindocument } { . }
  {
    \clist_map_inline:Nn \l@@_default_brace_clist
      {
        \cs_if_exist:NT #1 { \bracealign_add_brace:N #1 }
      }
  }
```

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Change History

v1.0

General: Initial version. 1