The hep-math package∗

Extended math macros

Jan Hajer†

2023/07/01

Abstract

The hep-math package provides some additional features beyond the mathtools and amsmath packages.

To use the package place \usepackage{hep-math} in the preamble.

The mathtools [1] package is loaded, which in turn loads the \texttt{AMS-\LaTeX} amsmath [2] package. Horizontal spacing in inline equations and page breaks in block equations are marginally adjusted.

\left Spacing around \texttt{\left} and \texttt{\right} is fixed with the \texttt{mleftright} package [3].

1 Macros

\mathdef The \texttt{\mathdef{(\text{name})\{(arguments)\}{(code)}}} macro \texttt{(re-)defines macros only within math mode without changing the text mode definition.}
\i The imaginary unit \texttt{\i} and the differential \texttt{\d} are defined using this functionality.
\overline The \texttt{\overline} macro is adjusted to work also outside of math mode using the \texttt{soulutf} package [4].
\oset A better looking over left right arrow is defined i.e. \texttt{\oset{(over)\{(math)}}} functionality.
\overleft A diagonal matrix \texttt{\diag}, signum \texttt{\sgn}, trace \texttt{\Tr}, \texttt{\Tr}, and \texttt{\rank} operators are defined.
\overleftright The real and imaginary projectors are redefined to look like ordinary operators.
\frac The \texttt{\frac{(number)\{(number)}}} macro is accompanied by \texttt{\nicefrac{(number)\{(number)}}}, \texttt{\textfrac{(number)\{(number)}}}, and \texttt{\flatfrac{(number)\{(number)}}} leading to \(\frac{1}{2}\), \(\frac{1}{2}\), \(\frac{1}{2}\), and \(\frac{1}{2}\). The \texttt{\textfrac} macro is mostly intended if a font with oldstyle numerals is used.

Fractions and units

\texttt{\textfrac{(number)\{(number)\}}} The correct spacing for units is provided by the macro \texttt{\unit{(value)\{(unit)}}} from the \texttt{units} package [5] which can also be used in text mode. The macro \texttt{\inv{(power)\{(text)}}} allows to avoid math mode also for inverse units such as \texttt{\inv{\text{fb}^{-1}}} typeset via \texttt{\unit{\inv{\text{fb}}}}.
\tan The \texttt{\tan{(number)\{(number)}}} macro is accompanied by \texttt{\nicefrac{(number)\{(number)}}}, \texttt{\textfrac{(number)\{(number)}}}, and \texttt{\flatfrac{(number)\{(number)}}} leading to \(\frac{1}{2}\), \(\frac{1}{2}\), \(\frac{1}{2}\), and \(\frac{1}{2}\). The \texttt{\textfrac} macro is mostly intended if a font with oldstyle numerals is used.

\*This document corresponds to hep-math v1.2.
†Jan Hajer@tecnico.ulisboa.pt

\texttt{\nicefrac \texttt{\flatfrac \texttt{\textfrac} \texttt{\unit}}
Some macros of the \texttt{physics} package [6] are reimplemented with a more conventional typesetting in mind. Finer details about mathematical typesetting can be found in [7].

### 1.2 Differentials and derivatives

\texttt{\differential{⟨symbol⟩}}, \texttt{\newderivative{⟨name⟩}{⟨symbol⟩}}, and \texttt{\newpartialderivative{⟨name⟩}{⟨symbol⟩}} allow to define a differential with correct spacing, a derivative using this differential, and if necessary a partial derivative that can handle three dimensional derivatives.

These macros are used for the usual differential and derivative, producing \(dx\) via \texttt{\d x} and \(\frac{d}{dx}\) via \texttt{\diff symbol}. Upright differential can be produced via \texttt{\renewcommand{\diffsymbol}{\mathrm d}}. The differential takes care of the correct spacing as long as it is placed at the end of the integral \(\int f(x) dx\). In order to archive correct spacing when it is placed at the beginning of the integral it is advisable to place the whole expression in a \texttt{\mathop{\int\d x} f(x)} such that \(\int dx f(x)\).

\texttt{\pd} Similarly a partial differential and derivative are defined that can be used according to \(\frac{\partial f}{\partial x}\) via \texttt{\pdv f x}, \(\frac{\partial^2 f}{\partial x \partial y}\) via \texttt{\pdv 2 f x y}, \(\frac{\partial^3 f}{\partial x^2 \partial y^2}\) via \texttt{\pdv 3 f x y y}, \(\frac{\partial f}{\partial y}\) via \texttt{\pdv f x y}.

\texttt{\var} Similarly a functional variation and functional derivative are defined.

\texttt{\tdv} The \texttt{\cancel{⟨characters⟩}} macro from the \texttt{cancel} package [8] and the \texttt{\slashed{⟨character⟩}} macro from the \texttt{slashed} package [9] allow to cancel math and use the Dirac slash notation i.e. \(\cancel{\partial}\), respectively.

### 1.3 Paired delimiters

\texttt{\abs} \texttt{\norm} \texttt{\eval} \texttt{\order} \texttt{\newpair{⟨name⟩}{⟨left delim⟩}{⟨right delim⟩}{⟨subscript⟩}{⟨superscript⟩}} macro is defined and used for the definition of (anti-)commutators and Poisson brackets.

\texttt{\comm} \texttt{\acomm}
They can easily be redefined using e.g. \texttt{\newpair\comm\lbrack\rbrack_-}.

\texttt{\bra} Macros for the bra-ket notation are introduced.
\texttt{\ket} \texttt{\braket} \texttt{\ketbra}
\texttt{\bra x \ket x \braket xy \ketbra xy}
\texttt{\bra x \ket x \braket xy \ketbra xy}

\texttt{\mel} \texttt{\ev} \texttt{\vev}
\texttt{\mel xyz \ev x \vev x \ev\Omega x \vev x}
\texttt{\bra x \ket y \braket xy \ketbra xy}
\texttt{\bra x \ket y \braket xy \ketbra xy}

\texttt{\column} \texttt{\row} \texttt{\column{x,y,z} \row{x,y,z}^{\trans}}
\texttt{\column{x,y,z} \row{x,y,z}^{\trans}}
\texttt{\column{x,y,z} \row{x,y,z}^{\trans}}
\texttt{\column{x,y,z} \row{x,y,z}^{\trans}}

2 Environments

eqnarray The eqnarray environment is depreciated, the split, multiline, align, multlined, aligned, alignedat, and cases environments of the amsmath and mathtools packages should be used instead.

equation Use the equation environment for short equations.
\begin{equation}
\left. \begin{array}{c}
\text{left} = \text{right} \\
\end{array} \right) .
\end{equation}
(1)

multline Use the multiline environment for longer equations.
\begin{equation}
\left. \begin{array}{c}
\text{left} = \text{right} 1 \\
+ \text{right} 2
\end{array} \right) .
\end{equation}
(2)

split Use the split sub environment for equations in which multiple equal signs should be aligned.
\begin{equation}
\left. \begin{array}{c}
\text{left} = \text{right} 1 \\
\text{right} 2
\end{array} \right) .
\end{equation}
(3)

align Use the align environment for the vertical alignment and horizontal distribution of multiple equations.
\begin{equation}
\left. \begin{array}{c}
\text{left} = \text{right} 1 \\
\text{right} 2
\end{array} \right) .
\end{equation}
(4a)

\texttt{\begin{align}
\text{left} &= \text{right} 1 \\
\text{right} 2
\end{align}}
(4b)

aligned Use the aligned environment within a equation environment if the aligned equations should be labeled with a single equation number.

multlined Use the multlined environment if either split or align contain very long lines.
\begin{equation}
\begin{split}
\text{left} &= \text{right 1} \quad &\text{right 1} \\
&= \begin{multlined}[t]
\text{right 2} \quad + \text{right 3} \\
\end{multlined}
\end{split}
\end{equation}

alignat
Use the alignat environment together with the \texttt{mathllap} macro for the alignment of multiple
equations with vastly different lengths.
\begin{subequations}
\begin{alignat}{2}
\text{left} &= \text{long right} \quad &\text{long right} \\
\text{le. 2} &= \text{ri. 2} \quad &\text{ri. 2} \\
\text{mathllap{le. 3 = ri. 3}} &\text{ &} \quad \text{le. 3} = \text{ri. 3}
\end{alignat}
\end{subequations}

As a rule of thumb if you have to use \texttt{\notag, \nonumber}, or perform manual spacing via \texttt{\quad}
you are probably using the wrong environment.

References

[2] \texttt{\LaTeX} Team. ‘The \texttt{amsmath} package: AMS mathematical facilities for \texttt{\LaTeX}’ (1994). CTAN: \texttt{amsmath}. URL: \texttt{ams.org/tex/amslatex}.