1 Introduction

1.1 Background

A browse through journals and handbooks, in particular those concerned with
dynamics, reveals an amazing array of private notations for vectors and tensors.
Every author has his or her own notation, making it very difficult to comprehend
what is going on in complex multi reference axes environments.

The mattens package contains the definitions to typeset vectors and tensors
such as $\vec{e}_i$, $\vec{x}'$, $E''$, etc., for the representation of common vectors and tensors
such as forces, velocities, moments of inertia, etc. It is based on the well defined
notation of Hassenpflug[1, 2]. It was developed and over many years of teaching
engineering:

“It is designed particulary to distinguish between vectors and tensors
and their representation as vectors and matrices in different coordinate
systems. The main purpose of this notation is that it can be used in the
teaching situation, therefore, it conveys all the information explicitly
in the symbols, and it can be used in handwriting.”

Hassenpflug[1] identifies the following list of requirements for a good notation for
tensor quantities and operations, to which his notation conforms. A notation
must:

- Be easily written by hand;
- Distinguish between vector and scalar quantities;
- Distinguish between (second order) tensors and vectors;
- Distinguish between physical vectors and their representation by vector ar-
  rays, and between physical (second order) tensors and their representation
  by matrices;
- Distinguish between row and column vectors;
- Use the same symbol as name for the same vector or tensor in either its
  physical sense or its representation by a vector array or matrix in different
  coordinate axes;
- Distinguish between matrix/vector representation of the same vector/tensor
  in different coordinate axes;

*This file has version number v1.3b, last revised 2022/03/01.
• Be equally valid in orthonormal and skew coordinate axes;
• Indicate all intended operations uniquely;
• Be equally valid in all dimensions;
• Be equally valid for algebraic vector/matrix algebra which has no connection to any metric space;
• Be applicable to differentials;
• Allow for defaults to avoid repetitive elaborate symbols, i.e., not all the symbols need to be written down explicitly if it is clear from the context.
• It must be well documented (own addition).

The **mattens** package was developed to typeset the Hassenpflug matrix tensor symbols in a consistent manner.

### 1.2 Why the **mattens** package?

The Hassenpflug notation contains symbols such as, $\overrightarrow{e_i}$, $\overrightarrow{g_i}$, $\overrightarrow{E_a}$, etc. These symbols are quite common and variants thereof are found on many blackboards of engineering schools. Based on the reputation of \TeX{} it would seem trivial to typeset them, but to the contrary ...

\[
\begin{align*}
\dot{\overline{f}}^a_b & \quad \text{(correct typesetting)} \\
\dot{\overline{f}}_{a\ b} & \\
\dot{\overline{f}}{}^a_b & \\
\dot{\overline{f}^a_b} &
\end{align*}
\]

### 2 Usage of **mattens** package

The **mattens** package is loaded in the document preamble with:

\begin{verbatim}
\usepackage[⟨options⟩]{mattens}
\end{verbatim}

When **mattens** is loaded, the **amsmath** package is loaded automatically, because it is needed for the redefined \overrightarrow and \underrightarrow commands, as well as the \boldsymbol command. It must be loaded before any font packages that redefine some of the **amsmath** symbols or commands.

\textit{AMS} recommends the **bm** package instead of the \boldsymbol command for bold italic math symbols\footnote{The \boldsymbol puts its contents in a box, \mbox{\boldmath$⟨contents⟩$}, while \bm is a font changing command that uses the appropriate bold math font.}. The **bm** package reroutes the \boldsymbol command to point to \bm. If \boldsymbol is called after the \bm package is loaded, it is equivalent to \bm. If the \bm package is not loaded, **mattens** defaults to the \boldsymbol command.

The **mattens** package by default sets bold italics symbols. This choice stems from the ISO standards for typesetting of vectors and tensors. The formatting of symbols then indicates the fact that it is a vector/tensor and the lines, arrows and sub- and superscripts indicate the specific type and reference axes.
The following options are recognized by **mattens**:

**noformat**: No symbol formatting is performed, otherwise symbols are set by default in bold italics with the `\boldsymbol` command. It is important to note that the Hassenpflug requirement of easily written by hand is not fulfilled if the symbols are formatted by anything else than normal math fonts.

**mathstrut**: A mathstrut is inserted with the symbol to force all the lines and arrows to the same height and depth. The default is no mathstrut.

## 3 List of mattens commands

### Table 1: List of Matrix Tensor typing commands

<table>
<thead>
<tr>
<th>Type</th>
<th>Command</th>
<th>Description</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical column vector</td>
<td>\aS{\langle\text{Symbol}\rangle}</td>
<td>arrow–Symbol</td>
<td>\vec{\alpha}</td>
</tr>
<tr>
<td>Physical row vector</td>
<td>\Sa{\langle\text{Symbol}\rangle}</td>
<td>Symbol–arrow</td>
<td>\vec{\alpha}</td>
</tr>
<tr>
<td>Column vector</td>
<td>\bS{\langle\text{Symbol}\rangle}</td>
<td>bar–Symbol</td>
<td>\vec{\beta}</td>
</tr>
<tr>
<td>Row vector</td>
<td>\Sb{\langle\text{Symbol}\rangle}</td>
<td>Symbol–bar</td>
<td>\vec{\beta}</td>
</tr>
<tr>
<td>Physical tensor</td>
<td>\aSa{\langle\text{Symbol}\rangle}</td>
<td>arrow–Symbol–arrow</td>
<td>\vec{\epsilon}</td>
</tr>
<tr>
<td>Tensor (mixed base)</td>
<td>\aSb{\langle\text{Symbol}\rangle}</td>
<td>arrow–Symbol–bar</td>
<td>\vec{\epsilon}</td>
</tr>
<tr>
<td>Tensor (mixed base)</td>
<td>\bSa{\langle\text{Symbol}\rangle}</td>
<td>bar–Symbol–arrow</td>
<td>\vec{\epsilon}</td>
</tr>
<tr>
<td>Tensor</td>
<td>\bSb{\langle\text{Symbol}\rangle}</td>
<td>bar–Symbol–bar</td>
<td>\vec{\epsilon}</td>
</tr>
<tr>
<td>Cross-product tensor†</td>
<td>\aCSa{\langle\text{Symbol}\rangle}</td>
<td>arrow–CSymbol–arrow</td>
<td>\vec{\epsilon}</td>
</tr>
<tr>
<td>Cross-product tensor†</td>
<td>\bCSb{\langle\text{Symbol}\rangle}</td>
<td>bar–CSymbol–bar</td>
<td>\vec{\epsilon}</td>
</tr>
</tbody>
</table>

† It is defined as the tensor \( \vec{\alpha} \) associated with the vector \( \vec{\alpha} \), where \( \vec{\alpha} \times \vec{\epsilon} = \vec{\alpha} \cdot \vec{\epsilon} \)

### 3.1 General syntax

The general syntax of the **mattens** commands is

\[
\begin{array}{ll}
\alpha S \{\langle\text{Symbol}\rangle\} & \alpha S* \{\langle\text{Symbol}\rangle\} \\
\beta S \{\langle\text{Symbol}\rangle\} & \beta S* \{\langle\text{Symbol}\rangle\} \\
\beta S\{\langle\text{Symbol}\rangle\} & \beta S* \{\langle\text{Symbol}\rangle\} \\
\beta CS\{\langle\text{Symbol}\rangle\} & \beta CS* \{\langle\text{Symbol}\rangle\} \\
\end{array}
\]

The “starred” form is used to set the symbol in normal math. This can be used for compound tensors or for pre-declared symbols (see **bm** documentation). An example of the usage is

\[
\begin{array}{ll}
\alpha S\{e\} & \alpha S*\{e\} \\
\beta S\{x\} & \beta S*\{x\} \\
\beta CS\{z\} & \beta CS*\{z\} \\
\end{array}
\]

\[\vec{\epsilon} \quad \vec{\epsilon} \quad \vec{\epsilon} \quad \vec{\epsilon} \]

3
The optional argument \textit{(accent)} is intended for \LaTeX accent commands such as \texttt{\textbackslash dot}, \texttt{\textbackslash ddot}, etc., or their \texttt{\textbackslash AMS} equivalents, \texttt{\textbackslash Dot}, \texttt{\textbackslash Ddot}.

\texttt{\textbackslash bS[\textbackslash Ddot](x)} \quad \vec{\mathbf{r}}

The \texttt{mattens} commands look ahead for sub- and superscripts (including primes) in order to place them at the correct horizontal and vertical positions.

\texttt{\textbackslash bS[\textbackslash Dot]{x}^s_i} \quad \dot{x}_i^s

\texttt{\textbackslash bS[\textbackslash Ddot]{x}^s_i} \quad \ddot{x}_i^s

\texttt{\textbackslash bS[a(E)]^k} \quad \vec{E}_k

\texttt{\textbackslash aSb[\textbackslash Dot]{E}_s} \quad \dot{E}_s

\texttt{\textbackslash bS{x}''^s_i} \quad x_i''^s

The commands are also robust and can be used in moving commands such as footnotes\footnote{A vector $\vec{e}_i$ in a footnote}, headers, etc.

\texttt{\footnote{A vector $\vec{e}_i$ in a footnote}}

The symbols scale to the appropriate sizes if used in sub- and superscripts. For example, for an integration path parameterized by the vector $\vec{r}^s(\xi)$, the equation for a line integral

\begin{equation*}
\oint_{\vec{r}^s(\xi)} \ldots 
\end{equation*}

gives

\[ \int \ldots \, \vec{r}^s(\xi) \]

4 Symbol formatting commands

4.1 Bold italic symbols

The symbol format can be set with the package options

\texttt{\usepackage{mattens}} \quad \% Uses \texttt{\textbackslash boldsymbol} as default

or

\texttt{\usepackage[noformat]{mattens}} \quad \% No symbol formatting

or anywhere in the document with the command

\texttt{\textbackslash SetSymbFont{\langle font-command\rangle}}

\footnote{A vector $\vec{e}_i$ in a footnote}
In general a typical setup to include unicode math

\usepackage{ifxetex}
\ifxetex
  ... Unicode-math and font selection ...
  \SetSymbFont{symbfit}
\else
  ... Font selection ...
  \usepackage{bm}
  \SetSymbFont{bm}
\fi

If the symbols are interpreted as tensors, then according to the ISO, it can be
typeset in a slanted sans serif font (if you are fond of fonts). For the Computer
Modern fonts with an OT1 encoding, you can put in the preamble

\DeclareMathAlphabet{\mathsfsl}{OT1}{cmss}{m}{sl}

Examples of formats are

\SetSymbFont{bm} \rightarrow \vec{E} ,
\SetSymbFont{relax} \vec{E} ,
\SetSymbFont{mathsfsl} \vec{E} .

Only the first symbol (or group) in multi-symbol constructions is formatted.
This can be used to obtain

\bS{\{xy\}} \bS*{xy} \xy \xy
\bS{xy} \xy
\bS{\{xy\}} \xy

or

\bCSb*{\bS{x}+\bS{y}} \xy \xy
\bS{\E_{313}}^s_r \E_{313}^s .

When a font does not have bold italic symbols and is properly configured,
the \bm command constructs the symbols with the “poor man’s bold” method.
This results in the loss of the subscript kerning. This is the case for the mathptm
package for Times fonts. If bold italic symbols are needed for Times fonts, it is
advisable to use the txfonts package or one of the commercial fonts.

4.2 Struts

A strut can be inserted inside the tensor construction to force all the lines to the
same height. This can be given in the package options

\usepackage{mattens} % No strut as default

or

\usepackage[mathstrut]{mattens} % Uses \mathstrut

or anywhere in the document with the command

\SetSymbStrut{(strut)}
For example
\SetSymbStrut{relax}
\bSb{E}, \bS{x}, \bS{y} \quad E, x, y

\SetSymbStrut{mathstrut}
\bSb{E}, \bS{x}, \bS{y} \quad \bar{E}, \bar{x}, \bar{y}

\SetSymbStrut{\phantom{E}}
\bSb{E}, \bS{x}, \bS{y} \quad E, x, y

4.3 Additional sub- and superscript spaces

The placing of the sub- and superscripts was fine-tuned for Computer Modern fonts. Other fonts may require the sub- and superscript to shift closer or further away from the lines and the symbols. Additional spaces can be inserted before the sub- and superscripts with the following commands:

\SetArrowSkip{⟨muskip length⟩}
\SetBarSkip{⟨muskip length⟩}
\SetSymSubSkip{⟨muskip length⟩}
\SetSymSupSkip{⟨muskip length⟩}

The length units must be in math units (μ), where 18 μ = 1 em (a little less than the width of the letter “M”).

5 Other packages and classes

bm: The bm package is preferred for bold/heavy symbols in math mode. It can also be used to predeclare bold symbols for use with the starred form of the tensor commands, for example:
\bmdefine{\bO}{\mathit{\Omega}}
\bSb*{\bO_i} \quad \Omega_i

hyperref: When tensor symbols are set in chapter and section headers, hyperref crashes if the \textorpdfstring command is not used.
\section{A header with \textorpdfstring{$\bS{x}^i_j$}{xij} in it}

color: To change the colour of a symbol the \color command must be grouped two levels deep to survive all the expansions if the bm package is loaded.
\color{red} \aSb{{\color{red}E}}_i \quad \vec{E}

accents: For the creation of alternative accents the mattens package is fully compatible with the accents package. As an example of its usage, the equation in Hassenpflug[1], §10.1, p.82

6
\text{apparent velocity} = \frac{\partial_r}{\mathrm{d}t} \aS{r} = \aSb{E}_s \cdot \bS{\dot{r}}^s \equiv \aS{v}_{\text{app}} = \aS{v}_{\text{rel}}

which gives

\text{apparent velocity} = \frac{\partial_r}{\mathrm{d}t} \vec{r} = \vec{\dot{r}} = \vec{E}_s \cdot \vec{r}^s \equiv \vec{v}_{\text{app}} = \vec{v}_{\text{rel}}

6 To do’s

- The vertical spacing between the symbols and the lines and arrows differs, $\vec{E}, \vec{F}$. This problem cannot be fixed easily and would need some additional struts or even a rewriting of the arrows and lines commands.
- For the purists: The ends of the $\overrightarrow{\text{overrightarrow}}$ are rounded (ligature of symbols), while the ends of the $\overline{\text{oline}}$ are squared (TeX line drawing).
- The shape of the arrow tip of the $\overrightarrow{\text{overrightarrow}}$ command was probably not designed for this type of application and is much too broad in the final CM font version. This broad arrow shape is incidentally one of last changes by Prof. Knuth to the CM font symbols. The PostScript version of the CM fonts typesets the arrow much better, but it is highly likely that it is still the old outdated version of the symbol. The \texttt{esvect} provides alternative vector symbols that can be used in $\overrightarrow{\text{overrightarrow}}$.

References


7 The Code: mattens.sty

7.1 Identification

\NeedsTeXFormat{LaTeX2e}
\ProvidesPackage{mattens}[2022/03/01 v1.3b Matrix/Tensors (DNJ Els)]

7.2 Options

\MT@SymbStrt \SetSymbStrut
Struts to set all the lines and arrows at predetermined heights and depths.
\newcommand*{\MT@SymbStrt}{}  
\newcommand*{\SetSymbStrut}[1]{{\renewcommand*{\MT@SymbStrt}{#1}}}  
\SetSymbStrut{\relax}  
\DeclareOption{mathstrut}{{\SetSymbStrut{\mathstrut}}}  

\MT@SymbFnt \SetSymbFont
Initialize the symbol font formatting commands.
\newcommand*{\MT@SymbFnt}{}  
\newcommand*{\SetSymbFont}[1]{{\renewcommand*{\MT@SymbFnt}{#1}}}  
\SetSymbFont{\boldsymbol}  
\DeclareOption{noformat}{{\SetSymbFont{\relax}}}  

Process the options
\DeclareOption*{  
  \PackageWarning{mattens}{Unknown option: \CurrentOption}}  
\ProcessOptions\relax

7.3 Packages

The amsmath package is loaded to provide the scalable \overrightarrow and \underrightarrow commands, as well as the \boldsymbol command for setting bold math symbols.
\RequirePackage{amsmath}

7.4 Workaround commands

\MT@Overarrow \MT@Underarrow
We define over- and under-arrows that bypass the \mathpalette part of the amsmath macros \overrightarrow and \underrightarrow. It uses the amsmath internal macros \overarrow@, \underarrow@ and \rightarrowfill@. The first parameter #1 consists of math styles \displaystyle, \textstyle, etc. The second parameter #2 is the symbol or character.
\newcommand*{\MT@Overarrow}[2]{{\overarrow@{\rightarrowfill@}{#1}{#2}}}  
\newcommand*{\MT@Underarrow}[2]{{\underarrow@{\rightarrowfill@}{#1}{#2}}}  

\MT@Overline \MT@Underline
Make over- and underlines with the same calling syntax as the arrows.
\newcommand*{\MT@Overline}[2]{{#1\overline{#2}}}  
\newcommand*{\MT@Underline}[2]{{#1\underline{#2}}}
The `\usebox` command does not function properly when the `pdftex.def` driver is loaded, because `pdftex` does not implement a colour stack such as in the `dvips` driver, but simulate it at TeX macro level. The `\usebox` is a workaround where the `\usebox` command is grouped.\footnote{Thanks to Heiko Oberdiek for this workaround} A `\mathord` is added around the box to regain its height in the `pdftex` case.

```
\AtBeginDocument{%
  \if@ifl@aded{def}{pdftex}%
    \newcommand*{\xusebox}{\mathord{\usebox{#1}}}%
    \let\xusebox\usebox%
  %}
```

### 7.5 Initialize

Define skip lengths for insertion in front of sub- and superscripts.

```
\newmuskip{\MT@Askip}
\newmuskip{\MT@Bskip}
\newmuskip{\MT@SPskip}
\newmuskip{\MT@SBskip}
```

```
\SetArrowSkip{0mu}
\SetBarSkip{1mu}
\SetSymSubSkip{0mu}
\SetSymSupSkip{0mu}
```

### 7.6 Main `mattens` commands

Setup command templates and lengths to function as global variables and pointers.

```
\MT@accent The `\MT@accent` command points to the math accent that are inserted as the optional argument inside the main `mattens` commands.
```

```
\newcommand*{\MT@accent}{}
```

```
\MT@cmd The commands `\MT@cmd` and `\MT@cmd` do the actual typesetting of the symbols.
```

```
\newcommand*{\MT@cmd}{}
\newcommand*{\MT@cmd}{}
```
They can be seen as function pointers that are set with \let commands inside the main \texttt{mattens} commands to point to specific commands.

<table>
<thead>
<tr>
<th>Cmd</th>
<th>Primary command</th>
<th>Secondary command</th>
</tr>
</thead>
<tbody>
<tr>
<td>\aS</td>
<td>\MT@cmd \rightarrow \MT@OverAandB, \MT@cmd \rightarrow \MT@Overarrow</td>
<td>\MT@cmd \rightarrow \MT@OverAandB, \MT@cmd \rightarrow \MT@Overline</td>
</tr>
<tr>
<td>\bS</td>
<td>\MT@cmd \rightarrow \MT@OverAandB, \MT@cmd \rightarrow \MT@Underarrow</td>
<td>\MT@cmd \rightarrow \MT@OverAandB, \MT@cmd \rightarrow \MT@Underline</td>
</tr>
<tr>
<td>\Sa</td>
<td>\MT@cmd \rightarrow \MT@UnderAandB, \MT@cmd \rightarrow \MT@Underarrow</td>
<td>\MT@cmd \rightarrow \MT@UnderAandB, \MT@cmd \rightarrow \MT@Underline</td>
</tr>
<tr>
<td>\SB</td>
<td>\MT@cmd \rightarrow \MT@DoubleAandB, \MT@cmd \rightarrow \MT@BoldSB</td>
<td>\MT@cmd \rightarrow \MT@DoubleAandB, \MT@cmd \rightarrow \MT@BoldSa</td>
</tr>
<tr>
<td>\Sa</td>
<td>\MT@cmd \rightarrow \MT@DoubleAandB, \MT@cmd \rightarrow \MT@BoldSa</td>
<td>\MT@cmd \rightarrow \MT@DoubleAandB, \MT@cmd \rightarrow \MT@BoldCSa</td>
</tr>
<tr>
<td>\SB</td>
<td>\MT@cmd \rightarrow \MT@DoubleAandB, \MT@cmd \rightarrow \MT@BoldCSa</td>
<td>\MT@cmd \rightarrow \MT@DoubleAandB, \MT@cmd \rightarrow \MT@BoldSa</td>
</tr>
</tbody>
</table>

\MT@bold The \MT@bold command is used internally and set by the “starred” command option.

44 \newcommand*{\MT@bold}{}

\aS Type the tensor: \boldsymbol{x}

45 \DeclareRobustCommand*{\aS}{
46 \let\MT@cmd=\MT@OverAandB
47 \let\MT@cmd=\MT@Overarrow
48 \MT@SupSkip=\MT@Askip
49 \MT@SubSkip=\MT@SBskip
50 \MT@Tensor}

\bS Type the tensor: \boldsymbol{\pi}

51 \DeclareRobustCommand*{\bS}{
52 \let\MT@cmd=\MT@OverAandB
53 \let\MT@cmd=\MT@Overline
54 \MT@SupSkip=\MT@Bskip
55 \MT@SubSkip=\MT@SBskip
56 \MT@Tensor}

\Sa Type the tensor: \boldsymbol{\xi}

57 \DeclareRobustCommand*{\Sa}{
58 \let\MT@cmd=\MT@UnderAandB
59 \let\MT@cmd=\MT@Underarrow
60 \MT@SupSkip=\MT@SPskip
61 \MT@SubSkip=\MT@Askip
62 \MT@Tensor}

\SB Type the tensor: \boldsymbol{\epsilon}

63 \DeclareRobustCommand*{\SB}{
64 \let\MT@cmd=\MT@UnderAandB
65 \let\MT@cmd=\MT@Underline
66 \MT@SupSkip=\MT@SPskip
67 \MT@SubSkip=\MT@Bskip
68 \MT@Tensor}
\bSb Type the tensor: $E$
\aSb Type the tensor: $\overrightarrow{E}$
\bSa Type the tensor: $E$
\aSa Type the tensor: $\overrightarrow{E}$
\bCSb Type the tensor: $\omega$
\aCSa Type the tensor: $\overrightarrow{\omega}$

General tensor commands to look for starred form and initiate script extraction.
\newcommand*{\MT@Tensor}{\let\MT@bold=\@firstofone\MT@Tensor}
\let\MT@SymbFnt=\MT@Tensor
\let\MT@bold=\MT@SymbFnt
\let\MT@accent=#1\relax
\MT@GetScripts{#2}

7.7 Sub- and superscripts

\MT@GetScripts This part of the code looks ahead for sub- and superscripts.
\newcommand*{\MT@GetScripts}[1]{\@ifnextchar'\MT@GetPrimes{#1}{\prime}\MT@UnprimedScripts{#1}}
\MT@GetPrimes Extract primes and look ahead for superscripts \(^\). Note that the sequence of operators for a primed symbol is: \(\langle\text{symb}\rangle^{\prime}\langle\text{sup}\rangle_{\langle\text{sub}\rangle}
\newcommand*{\MT@GetPrimes}[3]{\@ifnextchar'\MT@GetPrimes{#1}{#2\prime}\@ifnextchar^\MT@GetPrimedSuper{#1}{#2}\@ifnextchar_\MT@GetPrimedSub{#1}{#2}\MT@SetScripts{#1}{#2}{\@empty}}
\def\MT@GetPrimedSuper#1#2^#3{\@ifnextchar_{\MT@GetPrimedSub{#1}{#2#3}}\MT@SetScripts{#1}{#2#3}{\@empty}}
\def\MT@GetPrimedSub#1#2_#3{\MT@SetScripts{#1}{#2}{#3}}
\MT@UnprimedScripts The first extraction command for symbols without primes. It looks ahead for \(^\) or \(_\), if not present, then pass \@empty flags forward, otherwise it passes the tokens on to the next extraction commands.
\newcommand*{\MT@UnprimedScripts}[1]{\@ifnextchar^\MT@GetSuper{#1}\@ifnextchar_\MT@GetSub{#1}\MT@SetScripts{#1}{\@empty}{\@empty}}
\def\MT@GetSuper#1^#2{\MT@SetScripts{#1}{\@empty}{#2}}
\def\MT@GetSub#1_#2{\MT@SetScripts{#1}{#2}{\@empty}}
\MT@GetSuper Extract scripts of the form \(\langle\text{Sym}\rangle^{\prime}\langle\text{sup}\rangle\) if there are no further \(_\) tokens available, otherwise pass the tokens on to the next extraction command.
\newcommand*{\MT@GetSuper}[1]{\@ifnextchar'\MT@GetSuper{#1}{\prime}\@ifnextchar^\MT@GetSuper{#1}{\prime}}
\def\MT@GetSuper#1^#2{\ifnextchar_{\MT@GetSuperSub{#1}{#2}}{\MT@SetScripts{#1}{#2}{\@empty}}}\\
\def\MT@GetSub#1_#2{\ifnextchar^\MT@GetSubSuper{#1}{#2}{\MT@SetScripts{#1}{\@empty}{#2}}}\\
\def\MT@GetSuperSub#1#2_#3{\MT@SetScripts{#1}{#2}{#3}}\\
\def\MT@GetSubSuper#1#2^#3{\MT@SetScripts{#1}{#3}{#2}}\\
\MT@SetSup\MT@SetSub\MT@SetSubS\\
\newcommand*{\MT@SetScripts}[3]{\let\MT@SetSup\relax\let\MT@SetSub\relax\let\MT@SetSubS\relax\ifx\@empty#2\@empty\else\def\MT@SetSup{^\mskip\MT@SupSkip\relax#2}\fi\ifx\@empty#3\@empty\else\def\MT@SetSub{_{\mskip\MT@SubSkip\relax#3}}\def\MT@SetSubS{^{}_{\mskip\MT@SubSkip\relax#3}}\fi\MT@cmd{#1}}\\
\MT@Symb\MT@SymbC\\
\newcommand*{\MT@Symb}{\MT@SymbStrt\MT@bold#1}\\
\newcommand*{\MT@SymbC}{\MT@SymbStrt\widetilde{\MT@bold#1}}\\
\newcommand*{\MT@SetSup}{\let\MT@SetSup\relax\let\MT@SetSub\relax\let\MT@SetSubS\relax}\newcommand*{\MT@SetSub}{\let\MT@SetSup\relax\let\MT@SetSub\relax\let\MT@SetSubS\relax}\newcommand*{\MT@SetSubS}{^{}_{\let\MT@SetSup\relax\let\MT@SetSub\relax\let\MT@SetSubS\relax}}\if\@empty#2\@empty\else\def\MT@SetSup{^\mskip\MT@SupSkip\relax#2}\fi\if\@empty#3\@empty\else\def\MT@SetSub{_{\mskip\MT@SubSkip\relax#3}}\def\MT@SetSubS{^{}_{\mskip\MT@SubSkip\relax#3}}\fi\MT@cmd{#1}}\\

7.8 Symbol formatting\\
\MT@Symb\MT@SymbC\\
\newcommand*{\MT@Symb}{\MT@SymbStrt\MT@bold#1}\\
\newcommand*{\MT@SymbC}{\MT@SymbStrt\widetilde{\MT@bold#1}}
7.9 Main typesetting commands

The commands in this section are the ones pointed to by the \MT@cmd and \MT@@cmd commands to perform the typesetting of the full tensor symbol.

Declare some save boxes

\newsavebox{\MT@Abox} % for overline/arrow
\newsavebox{\MT@Sbox} % for symbol
\newsavebox{\MT@Tbox} % for temporaries
\newsavebox{\MT@APbox} % for overline/arrow phantom
\newsavebox{\MT@SPbox} % for symbol phantom

and some lengths.

\newlength{\MT@SPwdth} % symbol width
\newlength{\MT@BPwdth} % Bar width
\newlength{\MT@Wwdth} % leading whitespace width

\MT@OverAandB This command generates the tensor symbols $\overrightarrow{e}$ and $e$. It utilizes the \mathpalette macro for the sizing of the final tensor. LATEX commands \smash and \phantom with embedded \mathpalette calls are avoided to prevent nested \mathchoice calls.

\newcommand*{\MT@OverAandB}{% 
\mathpalette\MT@@OverAandB}

\MT@@OverAandB For this command the first parameter \texttt{#1} is supplied by \mathpalette and consists of math styles \texttt{\displaystyle}, \texttt{\textstyle}, etc. The second parameter \texttt{#2} is the original \texttt{⟨symbol⟩} from the call \MT@cmd{⟨symbol⟩}.

\newcommand*{\MT@@OverAandB}[2]{% 
\settowidth{\MT@SPbox}\null
\setlength{\MT@Wwdth}{\the\wd\MT@APbox}
\addtolength{\MT@Wwdth}{-\the\wd\MT@SPbox}
\setbox\MT@Sbox\box\MT@Tbox
\addtolength{\ht\MT@Sbox}{\the\ht\MT@Tbox}
\addtolength{\dp\MT@Sbox}{\the\dp\MT@Tbox}
\settowidth{\MT@Sbox}\null
\addtolength{\ht\MT@Sbox}{\the\ht\MT@Tbox}
\addtolength{\dp\MT@Sbox}{\the\dp\MT@Tbox}
\addtolength{\wd\MT@Sbox}{\the\wd\MT@Tbox}
\setlength{\wd\MT@APbox}{\the\wd\MT@APbox}
\addtolength{\wd\MT@APbox}{\the\wd\MT@APbox}
\ADDTOCONTENT{\MT@SetSubS}{\hskip \MT@Wwdth}
\setbox\MT@Sbox\ht\MT@Tbox
\addtolength{\ht\MT@Sbox}{\the\ht\MT@Tbox}
\addtolength{\dp\MT@Sbox}{\the\dp\MT@Tbox}
\addtolength{\wd\MT@Sbox}{\the\wd\MT@Sbox}
\addtolength{\wd\MT@Sbox}{0.5\MT@Wwdth}
\addtolength{\wd\MT@Sbox}{\relax\MT@Sbox[2]\MT@SetSubS}}

Set the symbol inside a box for measurement purposes.

\setbox\MT@Tbox{$\math@th{\MT@Symb{#2}}$}%
\setbox\MT@SPbox\null
\ht\MT@SPbox\ht\MT@Tbox
\dp\MT@SPbox\dp\MT@Tbox
\wd\MT@SPbox\wd\MT@Tbox
\setlength{\wd\MT@APbox}{\the\wd\MT@APbox}%
\addtolength{\wd\MT@APbox}{\the\wd\MT@APbox}%
\setbox\MT@SPbox\ht\MT@Tbox
\addtolength{\ht\MT@SPbox}{\the\ht\MT@Tbox}
\addtolength{\dp\MT@SPbox}{\the\dp\MT@Tbox}
\addtolength{\wd\MT@SPbox}{\the\wd\MT@SPbox}
\addtolength{\wd\MT@SPbox}{0.5\MT@Wwdth}
\addtolength{\wd\MT@SPbox}{\relax\MT@Symb{#2}\MT@SetSubS}}%
Final overline/overarrow box including accent and superscript at end.

Overtype the symbol and the overline/overarrow boxes. The wider box of the two is typed last to ensure that the spacing after the full tensor symbol is correct.

This command generates the tensor symbols $e_\rightarrow$ and $e_\leftarrow$. It is identical to the previous command except the sub- and superscripts are swapped and the phantom box is set to the width of the accent.

These commands are pointed to by \MT@cmd and called from within \MT@DoubleAandB. It has the same calling syntax as the \MT@Overarrow and \MT@Underarrow commands.
This command is used for the remaining tensor symbols and is not so complex compared to the previous commands.

\begin{verbatim}
\newcommand*{\MT@DoubleAandB}{% 
\mathpalette\MT@@DoubleAandB}
\newcommand*{\MT@@DoubleAandB}[2]{% 
\sbox{\MT@Abox}{$\m@th#1\MT@@cmd{#1}{#2}$}% 
\sbox{\MT@Tbox}{$\m@th#1\MT@accent{\xusebox{\MT@Abox}}$}% 
\ht\MT@Tbox\ht\MT@Abox% 
\dp\MT@Tbox\dp\MT@Abox% 
\xusebox{\MT@Tbox}\MT@SetSup\MT@SetSub}
\end{verbatim}
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