

The letterswitharrows package

Max Teegen
tex@jnteegen.eu

Released 2020-02-04

This package provides math-mode commands for setting left and right arrows over mathematical symbols, so that the arrows dynamically scale with the symbols. Here is a sample:

$$\vec{s} \leq \vec{t} \in \vec{U_r} \quad |\overrightarrow{AB}| = |\overleftarrow{AB}| \quad A \overleftrightarrow{\text{X}} B$$

While it is possible to set arrows over longer strings of symbols, the focus lies on single characters.

Only PDF output is supported. Output to PS is implemented, but rarely tested. For a wider range of formats there is pgf-based output.

1 Usage

The package provides the general-purpose `\arrowoverset` command, as well as some sets of predefined shorthand commands.

1.1 Presets

The presets are selected by passing them as options to the `presets` package option. For instance, to define the `abc` and the `vec-cev` sets of commands you would load the package like so:

```
\usepackage[presets={abc,vec-cev}]{letterswitharrows}
```

By default, the `abc`, `ABC` and `cAcBcC` presets are loaded.

`abc` Passing `abc` to the `presets` option allows you to use the `\v<char>` and `\<char>v` commands for all the lower-case letters `a` through `z` except for `v`.

`\v<char>`
`\<char>v`
`\vleft`
`\vright`

For the letter `v` the commands `\vleft` and `\vright` are provided.

$$\vec{a}, \vec{b}, \vec{c}, \vec{d}, \vec{m}, F_{\vec{t}}$$

```
\[ \va, \vb, \vc, \dv, \mv, F_{\tv} \]
```

`ABC` Passing `ABC` to the `presets` option allows you to use the `\v<CHAR>` and `\<CHAR>v` commands for all the upper-case letters `A` through `Z`.

`\v<CHAR>`
`\<CHAR>v`

$\vec{A}, \vec{B}, \vec{C}, \vec{D}, \vec{E}, F_{\vec{G}}$

`\[\vA, \vB, \vC, \vD, \vE, F_\vG \]`

`cAcBcC` Passing `cAcBcC` to the `presets` option allows you to use the `\vc<CHAR>` and `\c<CHAR>v` commands for all the upper-case letters A through Z to set arrows over `\mathcal`-letters.

`\vc<CHAR>`
`\c<CHAR>v`

$\vec{A}, \vec{B}, \vec{C}, \vec{D}, \vec{E}, F_{\vec{G}}$

`\[\vcA, \vcB, \vcC, \cDv, \cEv, F_\cGv \]`

`vec-cev` Passing `vec-cev` to the `presets` option (re)defines the `\vec` and `\cev` commands.

`\vec`
`\cev`

Unlike the other commands these do not automatically consume subsequent subscripts or ' tokens.

$\vec{x} := \overrightarrow{AB} \quad \langle \vec{w}, \vec{v} \rangle = 42$

`\[\vec{\mathbf{x}} := \cev{AB} \quad \langle \vw, \vright \rangle = 42 \]`

1.2 The `\arrowoverset` command

`\arrowoverset`
`\arrowoverset*`

`\arrowoverset` [*xoffset*] [*xscale*] [*yoffset*] {*math*}
`\arrowoverset*` [*xoffset*] [*xscale*] [*yoffset*] {*math*}

This command sets a right (or left if `\arrowoverset*` is used) arrow over *math*. The base length of the arrow is the width of the *math* multiplied by *xscale*, which must be specified as a fraction *num*/*denom*. The arrow is offset by *xoffset* to the right, which must be a math skip expression, and by *yoffset* to the top, which must be a skip expression.

This command consumes subsequent subscripts or up to two primes '. The former does not affect the length of the arrow.

1.3 Other package options

`pgf` If you specify the `pgf` option, every arrow is drawn as a `pgfpicture`. This requires the `pgf` package.

T_EXhackers note: You can set up custom arrow drawing code by redefining `_jmt_lwa_arrow_draw:nnn`. The command is expected to draw an arrow with its head at the current position. Its length should be #1 and it should be drawn at a font size of #2pt. If #3 is - if the arrow should point rightwards and empty otherwise.

`tweaks` Specifying the `tweaks` option applies per-letter scaling adjustments to some of the single-letter shorthands. This is enabled by default. These are specific to Latin Modern Math and subject to be changed on a whim. If you wish a more stable behaviour specify `tweaks=false`. This documentation uses `tweaks=false`.

2 Implementation

```

1 \NeedsTeXFormat{LaTeX2e}
2 \RequirePackage{expl3}
3 \ProvidesExplPackage {letterswitharrows} {2020-02-04} {} {Draw arrows over math letters.}
4 \RequirePackage{xparse,l3keys2e,mathtools}
5 % TODO: I just use mathtools for mathrlap; replace.
6
7 <@@=jmt_lwa>
8 \msg_new:nnn {letterswitharrows} {pdf-only} {Only-pdf-output-is-supported.}
9 \AtBeginDocument{
10   \sys_if_output_pdf:F {
11     \msg_warning:nn {letterswitharrows} {pdf-only}
12   }
13 }

```

The drawing code.

```

\__jmt_lwa_arrow_draw_special:nnm
\__jmt_lwa_arrow_draw_pgf:nnm
\__jmt_lwa_arrow_left:nn
\__jmt_lwa_arrow_right:nn
14 \cs_new:Nn \__jmt_lwa_arrow_draw_special:nnm % length, font size, sign
15 {
16   \sys_if_output_pdf:TF {
17     \tex_special:D {pdf::~
18       q~
19       1~J~1~j~
20       1~0~0~\dim_to_decimal:n{#3#2pt/10}~0~0~cm~
21       .3~w~
22       q~
23       \dim_to_decimal:n{#3#2pt/10}~0~0~1~0~0~cm~
24       1~0~0~1~-1~0~cm~
25       0~1~m~
26       .25~0~1~0~1~0~c~
27       1~0~.25~0~0~-1~c~
28       S~
29       Q~
30       0~0~m~
31       -1~0~0~1~0~0~cm~
32       \dim_to_decimal:n{#3#1}~0~1~S~
33       Q
34     }
35   } {
36     \tex_special:D {"~
37       1~setlinecap~1~setlinejoin~
38       1~0~0~\dim_to_decimal:n{#3#2pt/10}~0~0~6~array~astore~concat~
39       .3~setlinewidth~
40       gsave~
41       \dim_to_decimal:n{#3#2pt/10}~0~0~1~0~0~6~array~astore~concat~
42       1~0~0~1~-1~0~6~array~astore~concat~
43       0~1~moveto~
44       .25~0~1~0~1~0~curveto~
45       1~0~.25~0~0~-1~curveto~
46       stroke~
47       grestore~
48       0~0~moveto~
49       -1~0~0~1~0~0~6~array~astore~concat~

```

```

50     \dim_to_decimal:n{#3#1}-0~lineto~stroke
51   }
52 }
53 }
54
55 % TODO
56 % \tl_new:N \g__jmt_lwa_pgf_arrow_style_tl
57 % \tl_set:Nn \g__jmt_lwa_pgf_arrow_style_tl
58 % {Computer~Modern~Rightarrow[width=#2pt*2/10,length=#2pt/10,sharp]}
59
60 \cs_new:Nn \__jmt_lwa_arrow_draw_pgf:nnn {
61   \begin{pgfpicture}
62     \pgfsetlinewidth{#2pt/30}
63     \pgfsetarrowsstart
64       {Computer~Modern~Rightarrow[width=#2pt*2/10,length=#2pt/10,sharp]}
65     % \pgfsetarrowsstart{\tl_use:N \g__jmt_lwa_pgf_arrow_style_tl}
66     \pgfpathmoveto{\pgfpointorigin}
67     \pgfpathlineto{\pgfpoint{-#3#1}{0cm}}
68     \pgfusepath{stroke}
69     \pgfresetboundingbox
70   \end{pgfpicture}
71 }
72
73 \cs_new_eq:NN \__jmt_lwa_arrow_draw:nnn \use_none:nnn
74
75 \cs_new:Nn \__jmt_lwa_arrow_right:nn {
76   \skip_horizontal:n {#1}
77   % \rule[\dimexpr -#2pt/6\relax]{#1}{\dimexpr #2pt/3\relax}
78   \__jmt_lwa_arrow_draw:nnn {#1} {#2} {}
79 }
80
81 \cs_new:Nn \__jmt_lwa_arrow_left:nn {
82   \__jmt_lwa_arrow_draw:nnn {#1} {#2} {-}
83   \skip_horizontal:n {#1}
84   % \rule[\dimexpr -#2pt/6\relax]{#1}{\dimexpr #2pt/3\relax}
85 }

```

(End definition for __jmt_lwa_arrow_draw_special:nnn and others.)

The core functions.

__jmt_lwa_arrow_overset_style:Nnncnnn

__jmt_lwa_arrow_overset:mnnnn

```

86 \cs_new:Npn \__jmt_lwa_arrow_overset_style:Nnncnnn #1#2#3#4#5#6#7 {
87   \hbox_set:Nn \l_tmpa_box {$\m@th#1#3$}
88   \dim_set:Nn \l_tmpa_dim {#2 pt/10}
89   \vbox:n {
90     \tex_lineskiplimit:D = \maxdimen
91     \tex_baselineskip:D = 0pt
92     \tex_lineskip:D = \dim_eval:n {\l_tmpa_dim * 3/2 + #7}
93     \tex_halign:D { ## \tex_cr:D
94       \skip_horizontal:n {\l_tmpa_dim / 2}
95     $
96     \m@th
97     #1
98     \tex_mskip:D \muskip_eval:n {#5}
99     \use:c {#4} {\dim_eval:n{\box_wd:N \l_tmpa_box * #6}} {#2}

```

```

100     $
101     \tex_cr:D
102     \box_use_drop:N \l_tmpa_box
103     \tex_cr:D
104   }
105 }
106 }
107
108 \cs_new:Nn \__jmt_lwa_arrow_overset:nnnnn { % content, direction, xoffset, scale, yoffset
109   \mathchoice {
110     \__jmt_lwa_arrow_overset_style:Nnncnnn
111     \displaystyle {\tf@size} {#1} {\__jmt_lwa_arrow_#2:nn} {#3} {#4} {#5}
112   } {
113     \__jmt_lwa_arrow_overset_style:Nnncnnn
114     \textstyle {\tf@size} {#1} {\__jmt_lwa_arrow_#2:nn} {#3} {#4} {#5}
115   } {
116     \__jmt_lwa_arrow_overset_style:Nnncnnn
117     \scriptstyle {\sf@size} {#1} {\__jmt_lwa_arrow_#2:nn} {#3} {#4} {#5}
118   } {
119     \__jmt_lwa_arrow_overset_style:Nnncnnn
120     \scriptscriptstyle {\ssf@size} {#1} {\__jmt_lwa_arrow_#2:nn} {#3} {#4} {#5}
121   }
122 }

```

(End definition for __jmt_lwa_arrow_overset_style:Nnncnnn and __jmt_lwa_arrow_overset:nnnnn.)

__jmt_lwa_arrow_overset:w

\arrowoverset

```

123 \cs_new_protected:Npn \__jmt_lwa_arrow_overset:w {
124   \c_group_begin_token
125   \__jmt_lwa_arrow_overset_aux:w
126 }
127
128 \cs_new:Nn \__jmt_lwa_bool_convert:n {
129   \IfBooleanTF {#1} {\c_true_bool} {\c_false_bool}
130 }
131
132 % This exp_args is necessary because _ generates the wrong token in expl3 syntax
133 \exp_args:NNx \NewDocumentCommand \__jmt_lwa_arrow_overset_aux:w
134 {s O{0mu} O{1} O{0ex} m t' e{\char_generate:nn {95}{8}} t'} {
135   \__jmt_lwa_arrow_overset:nnnnn
136   {
137     #5
138     \exp_args:Nf\bool_if:nT{\__jmt_lwa_bool_convert:n{#6} || \__jmt_lwa_bool_convert:n{#8}}
139     \c_math_superscript_token {
140       \scriptscriptstyle\IfBooleanT{#6}{\prime}\IfBooleanT{#8}{\prime}
141     }
142     } % TODO: Better positioning etc?
143   \exp_args:Nf\IfValueT{\use:n#7} {
144     \c_math_subscript_token {
145       \mathrlap{#7}
146     }
147   }
148 }
149 {\IfBooleanTF{#1}{left}{right}}
150 {#2} {#3} {#4}

```

```

151
152 \exp_args:Nf\IfValueTF{\use:n#7}{
153   % TODO: Better way to do this? This is all kinds of wrong.
154   \hphantom{\c_math_subscript_token{#7}}
155 } {}
156 \c_group_end_token
157 }
158 \cs_set_eq:NN \arrowoverset \__jmt_lwa_arrow_overset:w

```

Replacements for hyperref bookmarks.

```

159 \AtBeginDocument{
160   \@ifpackageloaded{hyperref}{
161     \pdfstringdefDisableCommands{
162       % Why does this only work with Expandable?
163       \DeclareExpandableDocumentCommand \__jmt_lwa_arrow_overset:w {s o o o m} {
164         \ifpdfstringunicode
165           {#5 \IfBooleanTF{#1}{\unichar{"20D6}}{\unichar{"20D7}}}
166         {#5}
167       }
168     }
169   }{}
170 }

```

(End definition for `__jmt_lwa_arrow_overset:w` and `\arrowoverset`. This function is documented on page 2.)

Package option handling.

```

\g__jmt_lwa_tweak_shortcuts_bool
\g__jmt_lwa_selected_presets_prop
\__jmt_lwa_arrow_draw:nnn
171 \bool_new:N \g__jmt_lwa_tweak_shortcuts_bool
172 \prop_new:N \g__jmt_lwa_selected_presets_prop
173 \keys_define:nn {letterswitharrows} {
174   mode .choice:,
175   mode / special .code:n = {
176     \cs_set_eq:NN \__jmt_lwa_arrow_draw:nnn \__jmt_lwa_arrow_draw_special:nnn
177   },
178   mode / pgf .code:n = {
179     \RequirePackage{pgf}
180     \ExplSyntaxOff\usepgflibrary{arrows.meta}\ExplSyntaxOn
181     \cs_set_eq:NN \__jmt_lwa_arrow_draw:nnn \__jmt_lwa_arrow_draw_pgf:nnn
182   },
183   mode .initial:n = {special},
184   pgf .meta:n = {mode = pgf},
185   presets .multichoices:nn = {abc, ABC, cAcBcC, vec-cev} {
186     \int_compare:nNnTF \l_keys_choice_int = 1 {
187       \prop_gclear:N \g__jmt_lwa_selected_presets_prop
188     } {}
189     \prop_gput:NVn \g__jmt_lwa_selected_presets_prop \l_keys_choice_tl {}
190   },
191   presets .initial:n = {abc, ABC, cAcBcC},
192   tweaks .bool_set:N = \g__jmt_lwa_tweak_shortcuts_bool,
193   tweaks .initial:n = {true},
194 }
195 \ProcessKeysPackageOptions{letterswitharrows}

```

(End definition for `\g__jmt_lwa_tweak_shortcuts_bool`, `\g__jmt_lwa_selected_presets_prop`, and `__jmt_lwa_arrow_draw:nnn`.)

```

\<char>
\<char>v 196 \prop_if_in:NnTF \g__jmt_lwa_selected_presets_prop {abc} {
\left 197 \int_step_inline:nnn {1} {26} {
\right 198 \int_compare:nNnTF {#1} = {22} {
199 \cs_new:cpx {vright} {
200 \exp_not:N\__jmt_lwa_arrow_overset:w{v}
201 }
202 \cs_new:cpx {vleft} {
203 \exp_not:N\__jmt_lwa_arrow_overset:w*{v}
204 }
205 } {
206 \cs_new:cpx {v\int_to_alph:n{#1}} {
207 \exp_not:N\__jmt_lwa_arrow_overset:w{\int_to_alph:n{#1}}
208 }
209 \cs_new:cpx {\int_to_alph:n{#1}v} {
210 \exp_not:N\__jmt_lwa_arrow_overset:w*{\int_to_alph:n{#1}}
211 }
212 }
213 }
214 } {}

```

(End definition for \<char> and others. These functions are documented on page 1.)

```

\<CHAR>
\<CHAR>v 215 \prop_if_in:NnTF \g__jmt_lwa_selected_presets_prop {ABC} {
216 \int_step_inline:nnn {1} {26} {
217 \cs_new:cpx {v\int_to_Alph:n{#1}} {
218 \exp_not:N\__jmt_lwa_arrow_overset:w{\int_to_Alph:n{#1}}
219 }
220 \cs_new:cpx {\int_to_Alph:n{#1}v} {
221 \exp_not:N\__jmt_lwa_arrow_overset:w*{\int_to_Alph:n{#1}}
222 }
223 }
224 } {}

```

(End definition for \<CHAR> and \<CHAR>v. These functions are documented on page 2.)

```

\vc<CHAR>
\c<CHAR>v 225 \prop_if_in:NnTF \g__jmt_lwa_selected_presets_prop {cAcBcC} {
226 \int_step_inline:nnn {1} {26} {
227 \cs_new:cpx {vc\int_to_Alph:n{#1}} {
228 \exp_not:N\__jmt_lwa_arrow_overset:w{\exp_not:N\mathcal{\int_to_Alph:n{#1}}}
229 }
230 \cs_new:cpx {c\int_to_Alph:n{#1}v} {
231 \exp_not:N\__jmt_lwa_arrow_overset:w*{\exp_not:N\mathcal{\int_to_Alph:n{#1}}}
232 }
233 }
234 } {}

```

(End definition for \vc<CHAR> and \c<CHAR>v. These functions are documented on page 2.)

```

\vec
\cev 235 \prop_if_in:NnTF \g__jmt_lwa_selected_presets_prop {vec-cev} {
236 \RenewDocumentCommand \vec {m} {

```

```

237   \__jmt_lwa_arrow_overset:w {#1} \scan_stop:
238   }
239   \DeclareDocumentCommand \cev {m} {
240     \__jmt_lwa_arrow_overset:w* {#1} \scan_stop:
241   }
242 } {}

```

(End definition for `\vec` and `\cev`. These functions are documented on page 2.)

Some personal-preference tweaks.

```

243 \bool_if:NnTF \g__jmt_lwa_tweak_shortcuts_bool {
244   \prop_if_in:NnTF \g__jmt_lwa_selected_presets_prop {ABC} {
245     \int_step_inline:nnn {1} {26} {
246       \cs_set:cpx {v\int_to_Alph:n{#1}} {
247         \exp_not:N\__jmt_lwa_arrow_overset:w[2.5mu][8/10]{\int_to_Alph:n{#1}}
248       }
249       \cs_set:cpx {\int_to_Alph:n{#1}v} {
250         \exp_not:N\__jmt_lwa_arrow_overset:w*[2.5mu][7/10]{\int_to_Alph:n{#1}}
251       }
252     }
253     \cs_set:cpn {vS} {
254       \__jmt_lwa_arrow_overset:w[3mu][7/10]{S}
255     }
256     \cs_set:cpn {vT} {
257       \__jmt_lwa_arrow_overset:w[2mu][8/10]{T}
258     }
259     \cs_set:cpn {Tv} {
260       \__jmt_lwa_arrow_overset:w*[1mu][8/10]{T}
261     }
262     \cs_set:cpn {vU} {
263       \__jmt_lwa_arrow_overset:w[2mu][7/10]{U}
264     }
265     \cs_set:cpn {Uv} {
266       \__jmt_lwa_arrow_overset:w*[2mu][7/10]{U}
267     }
268     \cs_set:cpn {vV} {
269       \__jmt_lwa_arrow_overset:w[2.5mu][7/10]{V}
270     }
271     \cs_set:cpn {Vv} {
272       \__jmt_lwa_arrow_overset:w*[2mu][7/10]{V}
273     }
274     \cs_set:cpn {vX} {
275       \__jmt_lwa_arrow_overset:w[3mu][7/10]{X}
276     }
277     \cs_set:cpn {vY} {
278       \__jmt_lwa_arrow_overset:w[2mu][8/10]{Y}
279     }
280     \cs_set:cpn {Yv} {
281       \__jmt_lwa_arrow_overset:w*[2mu][7/10]{Y}
282     }
283   } {}
284   \prop_if_in:NnTF \g__jmt_lwa_selected_presets_prop {cAcBcC} {
285     \int_step_inline:nnn {1} {26} {
286       \cs_set:cpx {vc\int_to_Alph:n{#1}} {
287         \exp_not:N\__jmt_lwa_arrow_overset:w[1mu][9/10]{\exp_not:N\mathcal{\int_to_Alph:n{#1}}}

```



```

288     }
289     \cs_set:cpx {c\int_to_Alph:n{#1}v} {
290         \exp_not:N\__jmt_lwa_arrow_overset:w*[1.5mu][8/10]{\exp_not:N\mathcal{\int_to_
291     }
292 }
293 } {}
294 \prop_if_in:NnTF \g__jmt_lwa_selected_presets_prop {abc} {
295     \cs_new:cpn {vell} {
296         \__jmt_lwa_arrow_overset:w{\ell}
297     }
298     \cs_new:cpn {ellv} {
299         \__jmt_lwa_arrow_overset:w{\ell}
300     }
301 } {}
302 } {}

```

Change History

2019/02/04	2019/11/21
General: Tweaks for capital letters. . . . 8	General: Require expl3 before
\arrowoverset: Subscript spacing	\ProvidesExplPackage. 3
adjustments 5	