mismath
Miscellaneous mathematical macros*

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Contents

1 Introduction

According to the International Standards ISO 31-0:1992 to ISO 31-13:1992, superseded by ISO 80000-2:2009, mathematical constants e, i, π should be typeset in roman (upright shape) and not in italic (sloping shape) like variables (see [1] [2] [3] [4]). This package provides some tools to achieve this automatically.

Even though it is recommended to typeset vectors names in bold italic style [2] [4], they are often represented with arrows (especially in school documents or in physics). To draw visually appealing arrows above vectors, we use the esvect package by Eddie Saudrais [5]. Additionally we provide a few more macros related to vectors with

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arrows, particularly to enhance the typesetting of the norm: $\left\|\overrightarrow{AB}\right\|$ instead of LaTeX version $\|\overrightarrow{AB}\|$ which is not vertically adjusted, or worse $\left\|\overrightarrow{AB}\right\|$.

The package also offers other macros for:

- tensors,
- some common operator names,
- a few useful aliases,
- enhancing spacing in mathematical formulas,
- systems of equations and small matrices,
- displaymath in double columns for lengthy calculations.

To avoid compatibility issues, most of our macros will only be defined if there isn't already a command with the same name in the packages loaded before mismath. If a macro is already defined, a warning message will be displayed and the mismath definition will be ignored. If you wish to keep the mismath or the existing command, you can use `\let\⟨command⟩\relax`, before loading mismath, or after.

`[⟨options⟩]` The mismath package loads the amsmath package [6] without any options. If you want to use amsmath with specific options (refer to its documentation), you can include these options when calling mismath, or you can load amsmath with the desired options before loading mismath. *When using the package unicode-math [7], mismath must be loaded before unicode-math,* just like amsmath.

In addition mismath loads the mathtools package by Morten Høgholm and Lars Madsen [8]. This package offers numerous helpful macros and improvements of the amsmath package.

A recommendation, although rarely followed, is to typeset uppercase Greek letters in italic shape, similar to other variables [4]. This can be automatically achieved, for some particular fonts, with packages such as fixmath by Walter Schmidt [9], isomath by Günter Milde [10] or pm-isomath by Claudio Beccari [11] and optionally with many others (such as mathpazo or mathptmx with the option `slantedGreek`). However this feature is not implemented here due to a conflicting rule in France, where all capital letters in mathematics are required to be typeset in upright shape[1].

2 Usage

2.1 Mathematical constants

`\mathup` As for classic functions identifiers, *predefined* mathematical constants should be typeset in upright shape (typically in roman family), even though this practice is not very common and can be tedious to adhere to. A first solution is to use the `\mathup`

[1] The frenchmath package [25] ensures to follow the recommended French rules.

macro, which is superior to \mathrm[2], for setting any math text in upright shape. For example you can use \mathup{e} to get the Euler's number.

\e
\i
\j

To avoid cluttering a document that contains many occurrences of Euler's number (e) or imaginary numbers (i) with \mathup{e} or \mathup{i}, the package provides the \e command for Euler's number and \i or \j for imaginary numbers. Let us notice that \i and \j already exist in LaTeX. In LR (left-to-right) mode, they produce 'ı, ȷ' without the dot, allowing you to place accents on them. However, in mathematical mode, they produce the warning "LaTeX Warning: Command \i invalid in math mode on input line ⟨*line*⟩". With the new definition provided by the package, \i and \j will be redefined specifically for mathematical mode.

\MathUp

Indeed, typing a lot of backslashes for constants like e, i, or j in a document with numerous formulas can become tiresome. To alleviate this, the package proposes a powerful solution with the macro \MathUp{⟨*char*⟩}. For example, when \MathUp{e} is called, any subsequent occurrence of e will automatically be set in roman (upright shape), without the need to type \e explicitly. The effect of this macro can be either global or local, depending on whether it is used outside or inside an environment or braces. Furthermore, you can call this macro in the preamble to apply the change from the beginning of the document. This powerful feature allows you to bring a document up to the standards effortlessly. In fact, \MathUp can be applied to any valid single character, offering flexibility for various use cases (another use of it with probability will be presented in section 2.3).

\MathIt

When there are other occurrences of *e*, *i* or *j* as variables, you can still obtain italicized *e*, *i* or *j* using LaTeX commands \mathit or \mathnormal, which are useful for a single use. However, you also have the option to use the inverse switch \MathIt{⟨*char*⟩}, which has a global effect when used outside environments or braces, or a local effect when used inside them. Similar to \MathUp, \MathIt can be applied to any single character.

\MathNumbers
\MathNormal

These macros enable you to set upright or normal (italic) typesetting for multiple letters in a single command. For instance, \MathNumbers{e,i} is equivalent to \MathUp{e}\MathUp{i}. In \MathNumbers, the comma separator between letters can be modified or removed as needed. In fact, this macro only affects the letters e, i, or j; it has no effect on other characters. On the other hand, \MathNormal can be utilized for probability as well (refer to section 2.3), and it accepts any comma-separated list of arguments. This means you can apply the normal italic math mode typesetting to various letters at once using \MathNormal.

\pinumber[⟨command⟩]

The mathematical constant π should also be typeset in upright shape (see [1], [2], [4]), which is different from italicized *π*. However, this recommendation is even less commonly followed compared to the one concerning e and i [1]. Several

[2]The \mathup macro is based on \operatorfont, which comes from the amsopn package, automatically loaded by amsmath. In beamer, the default math font is sans serif, but \mathrm produces a font with serifs, which might not match the overall style of the presentation. Hence, using \mathup is indeed a better choice in beamer presentations to ensure that mathematical constants are typeset in upright shape and consistent with the default sans serif math font.

packages enable the typesetting of mathematical Greek letters in upright shape. Notably, let us mention upgreek [12], mathdesign [13] (used in the present document), kpfonts [15], fourier [16], libertinust1math, pxgreeks, txgreeks[3], libgreek, etc. A special mention goes to lgrmath of Jean-François Burnol [17] which allows the use of any Greek LGR-encoded font in math mode. These packages provide commands like `\uppi` (upgreek), `\piup` (mathdesign, kpfonts, lgrmath), `\otherpi` (fourier), etc.[4] To preserve default italic style for lowercase Greek letters, with the exception of pi, and to avoid the need to type a lot of `\uppi` or `\piup`, we offer the macro `\pinumber[`⟨*command*⟩`]`. This macro redefines `\pi` to match the optional command name provided (without a backslash), such as `piup`, assuming that the appropriate package has been loaded beforehand[5].

By using the preliminary code `\MathNumbers{ei}\pinumber[piup]` (assuming the mathdesign package is loaded) you can achieve the following result:

`$e^{i\pi} = -1$` which yields $e^{i\pi} = -1$.

When you call `\pinumber` without any argument, it defines `\pi` using the default LGR font encoding for Greek letters, resulting in the character π. In this case the appropriate option `LGR` for the fontenc package will be automatically loaded if the `\pinumber` command is called in the preamble (at least the first time it is used). The pi character obtained with this setting will look the same as the one provided by Günter Milde's textalpha package [14]. This π character is particularly well-suited for use with the default Computer Modern or Latin Modern font family[6].

`\itpi` When you activate `\pinumber`, the original italic π is still accessible using `\itpi`.

`\pinormal` In fact `\pinumber` acts as a switch, enabling the upright π. Additionally, there is an inverse switch, `\pinormal`, which you can call anywhere to revert to the original behavior of the `\pi` command (italic π).

2.2 Vectors (and tensors)

`\vect` By default, the `\vect` command[7], produces vectors with arrows (thanks to the esvect package by Eddie Saudrais[8]) which are more elegant than those produced by LaTeX's `\overrightarrow` command. The esvect package has an optional argument (a single letter between `a` and `h`) to define the desired type of arrow (see [5]). In mismath,

[3] When using pxgreeks or txgreeks, they should be loaded *after* mismath to avoid an error due to conflict with the existing macros `\iint`, `\iiint`, `\iiiint`, `\idotsint` in amsmath.

[4] They also have options to typeset all the Greek lowercase letters in upright shape by default, but this in not our goal here.

[5] The macro `\pinumber` doesn't work with unicode-math, but, with this package, you can use `\uppi` instead (or set all greek lowercase letters in upright shape with the option `math-style=french`).

[6] This default π character may not always fit well with various text fonts, especially those that are bolder or different from the default Computer Modern font. The upgreek package [12] provides a better π character with the Symbol option, utilizing the Adobe Symbol font. This π character matches well with several text fonts, such as Times.

[7] The definition of most macros in this package, will only take effect if the macro has not been previously defined by another package. This ensures compatibility and avoids conflicts when using the mismath package with other LaTeX packages.

[8] esvect provides the `\vv` macro used by `\vect`.

esvect is loaded with the option b: `\vect{AB}` gives $\overrightarrow{AB}$. If you wish to use a different type of arrow, you must call esvect with the appropriate option *before* loading mismath. For example, using `\usepackage[d]{esvect}` will provide the arrows produced by default in [5].

`\boldvect` The `\vect` macro allows vector names to be typeset using bold italic font, as recommended by ISO [2] [3], instead of using arrows. By using the `\boldvect` command, you can modify the behavior of `\vect` locally or globally, depending on its placement in the document (inside or outside a group or an environment):

```
\[ \boldvect \vect{v}
   =\lambda\vect{e}_x+\mu\vect{e}_y. \]
```

$$\boldsymbol{v} = \lambda \boldsymbol{e}_x + \mu \boldsymbol{e}_y.$$

`\boldvectcommand` By default `\boldvect` uses the `\boldsymbol` command[9] from the amsbsy package, which is automatically loaded by amsmath. However, you may prefer other packages that produce bold italic fonts, such as fixmath with the `\mathbold` command, isomath with `\mathbfit` or bm with the `\bm` command; unicode-math provides the `\symbfit` command. To use an alternative command instead of `\boldsymbol` in mismath, redefine `\boldvectcommand`, for instance after loading fixmath:

```
\renewcommand\boldvectcommand{\mathbold}.
```

According to ISO rules, symbols for matrices are also in bold italic. Therefore you can use the same `\boldvect` command or create another alias.

`\arrowvect` At any moment, you can revert to the default behavior using the inverse switch `\arrowvect`. These switches can be placed anywhere, whether inside mathematical mode or within an environment (with a local effect) or outside (with a global effect).

`\hvect` When vectors with arrows are typeset side by side, the arrows can be set up slightly higher using `\hvect` (which places a vertical phantom box containing "t") to avoid inelegant effects. For example, writing

- $\overrightarrow{AB} = \vec{u} + \overrightarrow{AC}$, obtained with `\hvect{u}`, is better than $\overrightarrow{AB} = \vec{u} + \overrightarrow{AC}$;
- $\vec{a} \cdot \vec{b} = 0$, obtained with `\hvect{a}`, is better thant $\vec{a} \cdot \vec{b} = 0$.

This adjustment ensures a more visually pleasing appearance when vectors with arrows are combined in an equation. The `\boldvect` and `\arrowvect` switches have the same effect on `\hvect` as they do on `\vect`.

`\hvec` In a similar way, `\hvec` raises the little arrow produced by the LaTeX command `\vec`, to the height of the letter "t" (but `\boldvect` have no effect here):

- $\mathscr{P} = \vec{f} \cdot \vec{v}$, obtained with `\hvec{v}`, is better than $\mathscr{P} = \vec{f} \cdot \vec{v}$.
- $\vec{f} = m\vec{a}$, obtained with `\hvec{a}`, is better than $\vec{f} = m\vec{a}$.

`\norm` The norm of a vector is conventionally represented using the delimiters `\lVert` and `\rVert` (or `\|` unless a plus (+) or minus (-) sign follows the opening delimiter) or

[9] `\mathbf` produces upright bold font, even when used in combination with `\mathit`.

`\left\Vert` and `\right\Vert` for adaptive delimiters. Unfortunately, these delimiters are always vertically centered, relatively to the middle of the base line, whereas vectors with arrows are asymmetric objects. The code `$\norm{\vec{h}}$` raises a smaller double bar to produce $\|\vec{h}\|$ instead of $\left\|\vec{h}\right\|$. Let's notice that the height of the bars don't adjust to content, but however to context: main text, subscripts or exponents, e.g. $e^{\|\vec{h}\|}$. This macro is useful only for arguments of special height, such as $\vec{h}$ or $\overrightarrow{AB}$ and may give bad results in other situations.

`\mathbfsfit` `\tensor`

For tensors symbols, ISO rules recommend using sans serif bold italic, but there is no such math alphabet in the default TEX mathematical style. However, the mismath package defines this alphabet (assuming the font encoding and package you use permits it) and provides the macro `\mathbfsfit` or its alias `\tensor`. By using `\tensor{T}` you can produce $\boldsymbol{\mathsf{T}}$.

2.3 Standard operator names

`\di`

The *differential* operator should be typeset in upright shape, not in italics, to distinguish it from variables (as mentioned in [1] [2] [4] [27]). To achieve this, we provide the `\di` command. Take a look at the following examples (notice the thin spaces before the d, just like with classic function's names):

```
\[ \iint xy\di x\di y \]
```

$$\iint xy \,\mathrm{d}x \,\mathrm{d}y$$

```
\[ m\frac{\di^2x}{\di t^2}
   + h\frac{\di x}{\di t} + kx = 0 \]
```

$$m\frac{\mathrm{d}^2x}{\mathrm{d}t^2} + h\frac{\mathrm{d}x}{\mathrm{d}t} + kx = 0$$

This command can also represent *distance* (hence its name):

$$\lambda\, \mathrm{d}(A, \mathscr{F}) + \mu\, \mathrm{d}(B, \mathscr{H}).$$

`\P` `\E`

To refer to probability[10] and expectation the proper use is to typeset the capital letters P, E in roman just like any standard function identifier. This can be achieved with `\P` and `\E` commands.

`\Par`

The `\P` command already existed to refer to the end of paragraph symbol ¶ and has been redefined, but this symbol can still be obtained with `\Par`.

`\V`

Variance is generally denoted by var or Var (see table below), but some authors prefer to use V, which can be produced using `\V`.

`\MathProba` `\MathNormal`

In the same way as for e, i or j, you can use `\MathUp{P}`, `\MathUp{E}` or `\MathUp{V}` to avoid typing many `\P`, `\E` or `\V`. However you can also achieve this in a single command with `\MathProba`, for example `\MathProba{P,E}`. We get the inverse switch with `\MathIt` for any individual letter or `\MathNormal` for a list.

`\probastyle`

Some authors use "blackboard bold" font to represent probability, expectation and variance: $\mathbb{P}, \mathbb{E}, \mathbb{V}$. The `\probastyle` macro sets the appearance of `\P`, `\E` and `\V`.

[10] LaTeX provides also `Pr` which gives Pr.

For instance `\renewcommand\probastyle{\mathbb}`[11] brings the previous "open-work" letters. The `\mathbb` command comes from amsfonts package (loaded by amssymb but also available standalone) which needs to be called in the preamble.

The following standard operator names are defined in mismath:

`\adj`	adj	`\erf`	erf	`\Re`	Re
`\Aut`	Aut	`\grad`	$\overrightarrow{\text{grad}}$	`\rot`	$\overrightarrow{\text{rot}}$
`\codim`	codim	`\id`	id	`\sgn`	sgn
`\Conv`	Conv	`\Id`	Id	`\sinc`	sinc
`\cov`	cov	`\im`	im	`\spa`	span
`\Cov`	Cov	`\Im`	Im	`\tr`	tr
`\curl`	$\overrightarrow{\text{curl}}$	`\lb`	lb	`\var`	var
`\divg`	div	`\lcm`	lcm	`\Var`	Var
`\End`	End	`\rank`	rank	`\Zu`	Z

By default, operators returning vectors, `\grad` and `\curl` (or its synonym `\rot` rather used in Europe), are written with an arrow on the top. When `\boldvect` is activated, they are typeset in bold style: **grad**, **curl**, **rot**. For the variance, the covariance and the identity function, two notations are proposed, with or without a first capital letter, because both are very common. On the other hand, 'im' stands for the image of a linear transformation (like 'ker' for the kernel) whereas 'Im' is the imaginary part of a complex number. Please note that `\div` already exists (÷) and `\span` is a TEX primitive; they haven't been redefined. Therefore the provided macros are called `\divg` (divergence) and `\spa` (span of a set of vectors). Furthermore `\Z` is used to denote the set of integers (see 2.4), which is why we used `\Zu`, to designate the center of a group: Z(*G*) (from German Zentrum).

`\oldRe` `\oldIm`

The `\Re` and `\Im` macros already existed to refer to real and imaginary part of a complex number, producing outdated symbols $\Re$ and $\Im$. However, they have been redefined according to current usage, as mentioned in the above table. Nevertheless, it is still possible to obtain the old symbols with `\oldRe` and `\oldIm`.

The package mismath also provides some (inverse) circular or hyperbolic functions, that are missing in LATEX:

`\arccot`	arccot	`\arsinh`	arsinh	`\arcoth`	arcoth
`\sech`	sech	`\arcosh`	arcosh	`\arsech`	arsech
`\csch`	csch	`\artanh`	artanh	`\arcsch`	arcsch

`\bigO` `\bigo` `\lito`

Asymptotic comparison operators (in Landau notation) are obtained with `\bigO` or `\bigo` and `\lito` commands:

$$n^2 + \mathcal{O}(n \log n) \quad \text{or} \quad n^2 + \mathrm{O}(n \log n) \quad \text{and} \quad \mathrm{e}^x = 1 + x + \mathrm{o}(x^2).$$

[11] The effect of this redefinition is global or local to the container environment in which it is used.

2.4 A few useful aliases

In the tradition of Bourbaki and D. Knuth, proper use requires that classic sets of numbers are typeset in bold roman: **R**, **C**, **Z**, **N**, **Q**, whereas "openwork" letters ($\mathbb{R}, \mathbb{Z}, \ldots$) are reserved for writing at the blackboard [27]. Similarly, to designate a field we use **F** or **K** (Körper in German). We get obtain these symbols with the following macros:

`\R, \C, \Z, \N, \Q, \F, \K.`

`\mathset` The `\mathset` command enables you to change the behavior of all these macros in a global way. By default, `\mathset` is an alias for `\mathbf`, but if you prefer openwork letters, you can simply place `\renewcommand\mathset{\mathbb}` where you want, for instance in the preamble after loading the amsfonts package (which provides the "blackboard bold" typeface, also loaded by amssymb).

`\onlymathC` The macro `\onlymathC` is designed for cases when `\C` is already defined, but only in text mode (usually when loading the Russian language with babel or polyglossia). The macro preserves the original definition for text mode and allows you to use `\C` for the complex number set in math mode. For this purpose, simply call `\onlymathC` once in the preamble or anywhere in the document.

`\ds` The `\displaystyle` command is very common, so the `\ds` alias is provided. Not only it eases typing but also it makes source code more readable.

Symbols with limits behave differently for in-line formulas or for displayed equations. In the latter case, "limits" are placed under or above the symbol whereas for in-line math mode, they are placed on the right, as a subscript or exponent. Compare: $\zeta(s) = \sum_{n=1}^{\infty} \frac{1}{n^s}$ with

$$\zeta(s) = \sum_{n=1}^{\infty} \frac{1}{n^s}.$$

`\dlim` `\dsum` `\dprod` `\dcup` `\dcap` With in-line math mode, displaymath can be forced with `\displaystyle` or its alias `\ds`. However, when using these commands, all the rest of the current mathematical environment will be set in displaymath mode (as shown in the previous example, where the fraction will be expanded). To limit the display style effect to the affected symbol only, similar the the amsmath command `\dfrac`, we can use the following macros: `\dlim`, `\dsum`, `\dprod`, `\dcup`, `\dcap`. So

`$\dlim_{x\to +\infty}\frac{1}{x}$` yields $\dlim_{x\to +\infty} \frac{1}{x}$.

`\lbar` `\hlbar` Large bars over expressions are obtained with `\overline` or its alias `\lbar`, to get for instance $\overline{z_1 z_2}$. Similar to vectors, you can raise the bar (from the height of "h") with the `\hlbar` command, to correct uneven bars heights.

$\overline{z+z'} = \overline{z} + \overline{z'}$, obtained with `\hlbar{z}`, is better than $\overline{z+z'} = \overline{z} + \overline{z'}$.

`\eqdef` `\eqdef*` The `\eqdef` macro writes the equality symbol topped with 'def', or with '$\triangle$' for `\eqdef*` (thanks to the LaTeX command `\stackrel`):

```
\[ \e^{\i\theta} \eqdef
   \cos\theta + \i\sin\theta \]
```

$$e^{i\theta} \stackrel{\text{def}}{=} \cos\theta + i\sin\theta$$

```
\[ \e^{\i\theta} \eqdef*
   \cos\theta + \i\sin\theta \]
```
$$e^{i\theta} \triangleq \cos\theta + i\sin\theta$$

\unbr `\unbr` is an alias for `\underbrace`[12], making source code more compact.

```
\[ (QAP)^n = \unbr{QAP\mul QAP\mul
   \cdots\mul QAP}_{n\text{ times}} \]
```
$$(QAP)^n = \underbrace{QAP\times QAP\times\cdots\times QAP}_{n\text{ times}}$$

\iif `\iif` is an alias for "if and only if", to be used in text mode.

2.5 Improved spacing in mathematical formulas

\then \txt The `\then` macro produces the symbol $\Longrightarrow$ surrounded by large spaces just like the standard macro `\iff` does it with $\Longleftrightarrow$. Similarly, the `\txt`, based on the `\text` macro from the amstext package (loaded by amsmath), leaves em quad spaces (`\quad`) around the text. See the following example:

```
\[ \ln x=a \then x=\e^a, \txt{rather than}
     \ln x=a \Longrightarrow x=\e^a \]
```
$$\ln x = a \Longrightarrow x = e^a, \quad \text{rather than} \quad \ln x = a \Longrightarrow x = e^a$$

\mul The multiplication symbol obtained with `\times` produces the same spacing as addition or subtraction operators, whereas division obtained with / is closer to its operands. This actually hides the priority of multiplication over + and −. That's why we provide the `\mul` macro, behaving like / (ordinary symbol) and leaving less space around than `\times`:

$\lambda+\alpha\times b-\beta\times c$, obtained with `\mul`, is better than $\lambda+\alpha\times b-\beta\times c$.

When using `\mul` before a function name or around a `\left...\right` structure, the space may be too large on one side of `\mul`. To ensure the same amount of space on both sides of `\mul`, you can use thin negative spaces `\!` or enclose the function or structure with braces:

$x\times\sin x$, obtained with `x\mul{\sin x}`, is slightly better than $x\times\sin x$.

`$\sin\!{\left( \frac{\pi}{3} \right)} \mul 2$`
gives $\sin\left(\frac{\pi}{3}\right)\times 2$, which is better than $\sin\left(\frac{\pi}{3}\right)\times 2$.

The thin negative space after the function name is not relative to `\mul`, but is due to the fact that spaces around a `\left...\right` structure are bigger than those produced by single parenthesis `(...)`.

\pow In the same way, when typesetting an exponent after a closing *big* parenthesis produced by `\right)`, the exponent appears to be a little to far from the parenthesis. To address this issue, the `\pow{⟨expr⟩}{⟨pow⟩}` command is provided, which sets

[12] The mathtools package by Morten Høgholm and Lars Madsen [8] provides a new and improved version of the `\underbrace` command, along with many other useful macros. It is loaded by mismath.

⟨*expr*⟩ between parentheses and adjusts the positioning of the exponent ⟨*pow*⟩ slightly closer to the right parenthesis[13]. Compare:

$$e^a \sim \left(1+\frac{a}{n}\right)^n \quad \text{which may be better than} \quad e^a \sim \left(1+\frac{a}{n}\right)^n.$$

`\abs` The correct typesetting of absolute value (or modular for a complex number) is achieved using `\lvert ... \rvert`, rather than |, as the latter doesn't maintain proper spacing in some situations (when a sign follows the open delimiter). For bars whose height has to adapt to the content, we can use `\left\vert ... \right\vert` or, more simply, the `\abs{...}` command, which is equivalent[14].

`\lfrac` The `\lfrac` macro behaves like `\frac` but with thicker spaces around the arguments, making the corresponding fraction bar slightly longer:

```
\[ \lbar{Z} =
   \lfrac{\lbar{z_1-z_2}}{\lbar{z_1+z_2}} \]
```

$$\overline{Z} = \frac{\overline{z_1 - z_2}}{\overline{z_1 + z_2}}$$

`[ibrackets]` Open intervals are commonly represented with parenthesis, e.g. $(0,+\infty)$, but sometimes square brackets are used, especially in French mathematics: $]0,+\infty[$. In that specific case, the space around the square brackets is often inappropriate, as in the expression $x \in]0,+\infty[$. To address this issue, we have redefined the brackets in the ibrackets package [26] which can be optionally[15] loaded by mismath using the `ibrackets` package option. Thus `$x\in ]-\pi,0[ \cup ]2\pi,3\pi[$`

yields $x \in]-\pi,0[\cup]2\pi,3\pi[$ with ibrackets,
instead of $x \in]-\pi,0[\cup]2\pi,3\pi[$ without ibrackets.

In our code, the symbols [and] are set as 'active' characters, behaving like ordinary characters and not as delimiters in most cases. Therefore, a line break could occur between the two brackets, but it is always possible to transform them into delimiters using `\left` and `\right`.

However, when a bracket is *immediately* followed by a + or - character, it becomes an open delimiter. Therefore, when the left bound contains an operator sign, *you don't have to leave a space between the first bracket and the sign*, otherwise, the spaces surrounding the operator will be too large. For example if you write `$x \in ] -\infty, 0]$`, it yields $x \in]-\infty,0]$ instead of $x \in]-\infty,0]$. Conversely, when dealing with algebraic expressions involving intervals, *you must leave a blank space between the second bracket and the +/- operation*. For instance `$[a,b] + [c,d]$` yields $[a,b]+[c,d]$ but `$[a,b]+ [c,d]$` yields $[a,b]+[c,d]$.

Besides, there are other approaches, for example the `\interval` macro from the interval package [18], or `\DeclarePairedDelimiters` from the mathtools package [8] (but the latter is incompatible with ibrackets for managing brackets).

`[decimalcomma]` In many countries, except notably in English-speaking countries, the comma is

[13] This macro gives bad results with normal-sized parenthesis.

[14] Another solution is to define `\abs` using the `\DeclarePairedDelimiter` command from the mathtools package [8].

[15] This functionality is optional because there is a conflict when using another command for open intervals with square brackets defined by `\DeclarePairedDelimiter` from mathtools [8].

used as a decimal separator for numbers. However, in the math mode of LaTeX, the comma is always, by default, treated as a punctuation symbol and therefore is followed by a space. This is appropriate in intervals: `$[a,b]$` results in $[a, b]$, but is not appropriate for numbers where the comma represents the decimal separator. For example, `$12,5$` is displayed as $12, 5$ instead of 12,5.

Two very convenient packages allow handling the decimal comma in math mode: icomma by Walter Schmidt [19] and ncccomma by Alexander I. Rozhenko [20]. The second package takes a more generic approach, however it poses several compatibility issues, in particular when compiling with LuaLaTeX, using unicode-math and calling `\setmathfont`. Therefore we propose the decimalcomma package [21], functionally identical to that of ncccomma but with lighter code and without the aforementioned incompatibility. It can be loaded by mismath using the `decimalcomma` package option[16].

2.6 Environments for systems of equations and small matrices

`system` The `system` environment, defined in the mismath package, is used to represent a system of equations:

```
\[ \begin{system}
       x=1+2t \\ y=2-t \\ z=-3-t
   \end{system} \]
```

$$\begin{cases} x = 1+2t \\ y = 2-t \\ z = -3-t \end{cases}$$

`\systemsep` This first example could also have been achieved using the `cases` environment from the amsmath package, although `cases` places mathematical expressions closer to the bracket. The `\systemsep` command allows you to adjust the gap between the bracket and the expressions. By default, the gap is set to `\medspace`. You can reduce the gap by redefining the command, for instance: `\renewcommand{\systemsep}{\thinspace}`. Alternatively you can increase the gap using `\thickspace` (and with `\renewcommand\systemsep}{}` you can achieve the same spacing as the `cases` environment). The `\systemsep` command allows for greater flexibility in adjusting the spacing within the `system` environment.

`system[⟨coldef⟩]` By default, a system is written like an `array` environment with only one column, left aligned. However the `system` environment has an optional argument that allows to create systems with multiple columns, specifying their alignment using the same syntax as the `array` environment in LaTeX. For instance, using `\begin{system}[cl]` will produce a two-column system, with the first column centered and the second column left-aligned, as shown in the following example:

```
\[ \begin{system}[cl]
       y & =\dfrac{1}{2}x-2 \\[1ex]
       (x,y) & \neq (0,-2)
   \end{system} \]
```

$$\begin{cases} y & = \dfrac{1}{2}x-2 \\ (x,y) & \neq (0,-2) \end{cases}$$

`\systemstretch` The default spacing between the lines of a `system` environment has been slightly

[16] `ibrackets` and `decimalcomma` are the only options specific to the mismath package.

enlarged compared to the one used in `array` environments (using a factor of 1.2). This can be adjusted by using `\renewcommand{\systemstretch}{`⟨*stretch*⟩`}`, where ⟨*stretch*⟩ is the desired value for the spacing. You can place this command inside the current mathematical environment for a local change, or outside for a global change. The default value for is 1.2. Furthermore you can also use the end of the line with a spacing option, as demonstrated above with `\\[1ex]`, to control the spacing between specific lines in the system.

Another example with `\begin{system}[rl@{\quad}l]`[17]:

$$\begin{cases} x+3y+5z=0 & R_1 \\ 2x+2y-z=3 & R_2 \\ 3x-y+z=2 & R_3 \end{cases} \Longleftrightarrow \begin{cases} x+3y+5z=0 & R_1 \\ 4y+11z=3 & R_2 \leftarrow 2R_1-R_2 \\ 5y+7z=-1 & R_3 \leftarrow \frac{1}{2}(3R_1-R_3) \end{cases}$$

Let's also mention the systeme package [22] which provides a lighter syntax and automatic alignments for linear systems. Additionally, there is the spalign package [23], which offers a convenient and easy syntax for systems and matrices with visually appealing alignments.

`spmatrix` The amsmath package offers several environments to typeset matrices : For example, the `pmatrix` environment surrounds the matrix with parenthesis, and the `smallmatrix` environment creates a smaller matrix suitable for insertion within a text line. We provide a combination of the these both functionalities with the `spmatrix` environment: `$\vec{u}\begin{spmatrix}-1\\2\end{spmatrix}$` yielding $\vec{u}\left(\begin{smallmatrix}-1\\2\end{smallmatrix}\right)$.

The mathtools package enhances the amsmath matrix environments and also provides a small matrix environment with parenthesis: `psmallmatrix`. Moreover, with the starred version `\begin{psmallmatrix*}[`⟨*col*⟩`]`, you can choose the alignment inside the columns (`c`, `l` or `r`). However, the space before the left parenthesis is unfortunately too narrow compared to the space inside the parenthesis. To illustrate this, consider the following comparison: $\vec{u}\left(\begin{smallmatrix}-1\\2\end{smallmatrix}\right)$ (using mismath's `spmatrix`) vs. $\vec{u}\left(\begin{smallmatrix}-1\\2\end{smallmatrix}\right)$ (using mathtools `psmallmatrix`).

For typesetting various kinds of matrices, let's mention the excellent nicematrix package by François Pantigny [24].

2.7 Displaymath in double columns

`mathcols` The `mathcols` environment allows you to arrange "long" calculations in double columns, separated with a central rule, as shown in the following example. However, to use this feature, the multicol package must be loaded in the preamble. The `mathcols` environment activates mathematical mode in display style and uses an `aligned` environment.

[17] `@{...}` sets inter-column space.

$$\begin{aligned} & \frac{1}{2\times\left(\frac{1}{4}\right)^n+1} \geq 0.999 \\ \iff & 1 \geq 1.998\left(\frac{1}{4}\right)^n + 0.999 \\ \iff & 0.001 \geq \frac{1.998}{4^n} \end{aligned} \quad \left| \quad \begin{aligned} \iff & 4^n \geq 1998 \\ \iff & n\ln 4 \geq \ln(1998) \\ \iff & n \geq \frac{\ln(1998)}{\ln 4} \approx 5.4 \\ \iff & n \geq 6 \end{aligned} \right.$$

`\changecol` The `\changecol` macro is used to switch to the next column, and alignments within the columns is done using the classic delimiters `&`, to separate entries, and `\\`, to start a new row.

```
\begin{mathcols}
          & \frac{1}{2 \mul {\pow{\frac{1}{4}}{n}} + 1} \geq 0.999 \\
    \iff\ & 1 \geq 1.998  \pow{\frac{1}{4}}{n} + 0.999 \\
    \iff\ & 0.001 \geq \frac{1.998}{4^n} \\
\changecol
    & \iff 4^n \geq 1998 \\
    & \iff n \ln 4 \geq \ln(1998) \\
    & \iff n \geq \frac{\ln(1998)}{\ln 4} \approx 5.4 \\
    & \iff n \geq 6
\end{mathcols}
```

2.8 Old commands

Here is a summary table of old commands that were used until version 2.2. These commands are still functional and will be maintained for the time being, but a warning message indicates the new alternative. They used to work only in the preamble, affecting the entire document globally, and lacked an inverse switch. These old commands can now be replaced by the more versatile and powerful `\MathUp` macro, which can be used anywhere in the document or preamble and has an inverse switch `\MathIt`.

Old command	New alternative
`\enumber`	`\MathUp{e}`
`\inumber`	`\MathUp{i}`
`\jnumber`	`\MathUp{j}`
`\PEupright`	`\MathUp{P}\MathUp{E}`

You can also utilize `\MathNumbers` instead of `\MathUp` with an argument containing all the constants you want to be typeset in roman (among 'e, i, j'). Additionally `\MathProba{P,E}` can be used instead of `\MathUp{P}\MathUp{E}`, and you can include V in its argument to refer to variance.

In version 2.3 we attempted to replace these old commands with package options based on keyval. However, we found that this method was less efficient and have decided to abandon it. As a result, the command `\mismathset` is now obsolete. Additionally, the command, `\paren`, which was used before version 2.0, is no longer supported.

3 Implementation

We load certain packages conditionally to avoid 'option clash' errors in cases where these packages have been previously loaded with other options.

```
\newif\ifmm@ibrackets % initialized to false
\newif\ifmm@decimalcomma
\DeclareOption{ibrackets}{\mm@ibracketstrue}
\DeclareOption{decimalcomma}{\mm@decimalcommatrue}
\DeclareOption*{\PassOptionsToPackage{\CurrentOption}{amsmath}}
\ProcessOptions \relax
\@ifpackageloaded{amsmath}{}{\RequirePackage{amsmath}}
\@ifpackageloaded{mathtools}{}{\RequirePackage{mathtools}}
\@ifpackageloaded{esvect}{}{\RequirePackage[b]{esvect}}
\RequirePackage{ifthen}
\RequirePackage{xparse} % provides \NewDocumentCommand
\RequirePackage{xspace}
\RequirePackage{iftex}
\RequirePackage{etoolbox} % provides \AtEndPreamble

```

The package unicode-math causes some compatibility issues with the options ibrackets or decimalcomma: the respective packages must be loaded *after* unicode-math, but mismath (like amsmath) must be loaded *before* unicode-math. And to complicate matters, unicode-math defines (or redefines) all its commands by `\AtBeginDocument`. Therefore we used the command `\AtBeginDocument` within `\AtEndPreamble` (from the etoolbox package).

Moreover the command `\mathbfsfit` (used for tensors) is already defined in unicode-math and will not be redefined if unicode-math is loaded.

```
\newif\ifmm@unicodemath
\newif\ifmm@multicol
\AtEndPreamble{% necessary to work with unicode-math
    \@ifpackageloaded{multicol}{\mm@multicoltrue}{\mm@multicolfalse}
    \@ifpackageloaded{unicode-math}{\mm@unicodemathtrue}{
        \mm@unicodemathfalse
        \DeclareMathAlphabet{\mathbfsfit}{\encodingdefault}%
            {\sfdefault}{bx}{it}}
    \AtBeginDocument{% necessary to work with unicode-math
        \ifmm@ibrackets\RequirePackage{ibrackets}\fi
        \ifmm@decimalcomma\RequirePackage{decimalcomma}\fi
    }
}

```

`\bslash` The `\bslash` macro originates from Frank Mittelbach's doc.sty package. It can be employed in other documents as an alternative to `\textbackslash`, especially in situations where `\textbackslash` does not work correctly, such as inside warning messages.

```
{\catcode`\|=\z@ \catcode`\\=12 |gdef|bslash{\}} % \bslash command

```

\mm@warning
\mm@macro
\mm@operator

The next three internal macros serve as meta commands for conditionally defining macros while providing a warning message if the macro already exists. These macros can be useful in other packages as well.

```
\newcommand\mm@warning[1]{
    \PackageWarningNoLine{mismath}{
        Command \bslash #1 already exist and will not be redefined}
}
\newcommand\mm@macro[2]{
    \@ifundefined{#1}{
        \expandafter\def\csname #1\endcsname{#2}
    }{\mm@warning{#1}}
}
\NewDocumentCommand\mm@operator{O{#3}mm}{%
    \@ifundefined{#1}{
        \DeclareMathOperator{#2}{#3}
    }{\mm@warning{#1}}
}

```

To produce the correct upright shape font when working with the beamer package, you don't have to use \mathrm but rather \mathup (based on \operatorfont from the amsopn package). This command also works fine with other sans serif fonts like cmbright.

Moreover for beamer, which changes the default font family (to sans serif), \e, \i, \j have no effect without \AtBeginDocument. \AtBeginDocument is also necessary to redefine \i when calling the hyperref package which overwrites the \i definition.

```
\@ifundefined{mathup}{
    \providecommand*{\mathup}[1]{{\operatorfont #1}}
    }{\mm@warning{mathup} } % also in kpfonts (and unicode-math)
\mm@macro{e}{\mathup{e}}
\AtBeginDocument{\let\oldi\i \let\oldj\j
    \renewcommand{\i}{\TextOrMath{\oldi}{\mathup{i}}}
    \renewcommand{\j}{\TextOrMath{\oldj}{\mathup{j}}} }

```

\MathFamily

The following macros \MathUp and \MathIt are switches that transform any chosen letter in math mode to roman or italic style. These switches can be used anywhere in the document or preamble. They are based on the generic macro \MathFamily. To obtain a letter in roman style instead of italic, we need to change the mathcode digit that represents the font family: 1 to 0.

For example, except for LuaLaTeX, mathcode of the 'e' letter is: 'e="7165 (decimal 29029), with the second digit '1' indicating "italic" style. To get a roman 'e', we need to change its mathcode to "7065.

When used in the preamble, we call \MathFamily by \AtBeginDocument for working with the beamer package. Let's notice that \MathFamily has an erratic behavior when unicode-math is loaded, but fortunately, in that case, the \DeclareMathSymbol can be used instead, even outside the preamble.

```
\newcount\mm@charcode
\newcount\mm@charclass
\newcount\mm@charfam
\newcount\mm@charslot

\newcommand*\MathFamily[2]{%
    \mm@charfam=#2
    \ifluatex
        \mm@charclass=\Umathcharclass`#1
        %\mm@charfam=\Umathcharfam`#1
        \mm@charslot=\Umathcharslot`#1
        \Umathcode`#1= \mm@charclass \mm@charfam \mm@charslot
    \else
        \mm@charcode=\mathcode`#1
        % extract charclass
        \@tempcnta=\mm@charcode
        \divide\@tempcnta by "1000
        \multiply\@tempcnta by "1000 % charclass
        \mm@charclass=\@tempcnta
        % extract charslot
        \@tempcnta=\mm@charcode
        \@tempcntb=\mm@charcode
        \divide\@tempcnta by "100
        \multiply\@tempcnta by "100 % charclass + charfam
        \advance\@tempcntb by -\@tempcnta % charslot
        \mm@charslot=\@tempcntb
        % construct charcode
        \mm@charcode=\mm@charclass
        \multiply\mm@charfam by "100
        \advance\mm@charcode by \mm@charfam
        \advance\mm@charcode by \mm@charslot
        \mathcode`#1=\mm@charcode
    \fi
}

\newcommand*\MathUp[1]{%
    \ifx\@onlypreamble\@notprerr % not in preamble
        \ifmm@unicodemath
            \DeclareMathSymbol{#1}{\mathalpha}{operators}{`#1}
        \else
            \MathFamily{#1}{0}
        \fi
    \else % in preamble
      \AtBeginDocument{
        \ifmm@unicodemath
            \DeclareMathSymbol{#1}{\mathalpha}{operators}{`#1}
        \else
            \MathFamily{#1}{0}
        \fi
      }
```

```
    \fi
}

\newcommand*\MathIt[1]{%
    \ifx\@onlypreamble\@notprerr % not in preamble
        \ifmm@unicodemath
            \DeclareMathSymbol{#1}{\mathalpha}{letters}{`#1}
        \else
            \MathFamily{#1}{1}
        \fi
    \else % in preamble
      \AtBeginDocument{
        \ifmm@unicodemath
            \DeclareMathSymbol{#1}{\mathalpha}{letters}{`#1}
        \else
            \MathFamily{#1}{1}
        \fi
      }
    \fi
}

```

With a similar approach we could also create additional macros to set any letter in bold or sans serif. However, there is no default family number associated with these typefaces. The family number depends on the font package being loaded and may vary depending on specific `\DeclareSymbolFont` used. Therefore, setting letters in bold or sans serif requires additional consideration and may not have a straightforward solution.

In addition to `\MathUp` and `\MathIt`, we also offer the following two commands to set a group of letters in roman typeface: one for for mathematical constants, among 'e, i, j', and the other for probability operators, among or 'P, E, V'.

```
\newcommand*\MathNumbers[1]{%
    \in@{e}{#1} \ifin@ \MathUp{e} \fi
    \in@{i}{#1} \ifin@ \MathUp{i} \fi
    \in@{j}{#1} \ifin@ \MathUp{j} \fi
}

\newcommand*\MathProba[1]{%
    \in@{P}{#1} \ifin@ \MathUp{P} \fi
    \in@{E}{#1} \ifin@ \MathUp{E} \fi
    \in@{V}{#1} \ifin@ \MathUp{V} \fi
}

```

`\apply` With the inverse switch `\MathNormal`, you can apply the normal (italic) style on any comma-separated list of characters. This is achieved using the `\apply` macro, e.g. `\apply\macro{arg1,arg2}` expands to `\macro{arg1}\macro{arg2}`. Thus `\apply\MathUp{e,i,j}` is equivalent to `\MathUp{e}\MathUp{i}\MathUp{j}`.

I discovered this powerfull macro on `iterate190.rssing.com` by searching for "TeX How to iterate over a comma separated list". The answer was posted under the pseudonym 'wipet' on 2021/02/26. Let its author, Petr Olšák, be thanked. This macro allows to accomplish tasks that usual loop instructions like `\@for` or `\foreach` cannot achieve due to errors like "! Improper alphabetic constant". For instance, if you try `\def\letter{A} \MathUp{\letter}` it will fail because the control sequence `\letter` is not strictly equivalent here to the single character 'A'.

```
\def\apply#1#2{\apply@#1#2,\apply@,}
\def\apply@#1#2,{\ifx\apply@#2\empty
    \else #1{#2}\afterfi@{\apply@#1}\fi}
\def\afterfi@#1#2\fi{\fi#1}

\newcommand*\MathNormal[1]{% list argument
    \apply\MathIt{#1}
}

```

The following commands were used until version 2.2 but still work. They were intended to set some letters in upright shape in math mode, but only worked in the preamble. This is now managed by the more powerful `\MathUp` command, and the old commands are maintained for compatibility reasons.

```
\newcommand{\enumber}{%
    \PackageWarning{mismath}{Old command \string\enumber\space
        is used. \MessageBreak
        It can be replaced by \string\MathUp{e}}
    \MathUp{e}
}
\newcommand{\inumber}{%
    \PackageWarning{mismath}{Old command \string\inumber\space
        is used. \MessageBreak
        It can be replaced by \string\MathUp{i}}
    \MathUp{i}
}
\newcommand{\jnumber}{
    \PackageWarning{mismath}{Old command \string\jnumber\space
        is used. \MessageBreak
        It can be replaced by \string\MathUp{j}}
    \MathUp{j}
}
\newcommand{\PEupright}{
    \PackageWarning{mismath}{Old command \string\PEupright\space
        is used. \MessageBreak
        It can be replaced by \string\MathUp{P}\space
        and \string\MathUp{E}}
    \MathUp{P}\MathUp{E}
}

```

Obtaining an upright Greek letter π must be handled differently. The switches are called `\pinumber` and `\pinormal`. When given without an argument, `\pinumber` uses the LGR font encoding. A particularity of the fontenc package is that it can be loaded several times with different options without triggering an "option clash" error. This macro doesn't work with unicode-math, which provides the `\uppi` command but it cannot be redefined in `\pi`.

```
\newcommand*\pinumber[1][]{
    \ifmm@unicodemath
        \PackageError{mismath}{Command \string\pinumber\space
            is incompatible with unicode-math. \MessageBreak
            Use \string\uppi\space to get the upright pi}{}
    \fi
    \@ifundefined{itpi}{\let\itpi\pi}{}
    \ifthenelse{\equal{#1}{}}{
      \ifx\@onlypreamble\@notprerr % not in preamble
        \@ifundefined{savedpi}{
            \PackageWarning{mismath}{%
                \string\pinumber\space without argument\MessageBreak
                must be used in the preamble first\MessageBreak
                to load LGR fontenc for upright pi}
        }{\let\pi\savedpi}
      \else % in the preamble
        \RequirePackage[LGR,T1]{fontenc}
        \DeclareSymbolFont{UpGr}{LGR}{lmr}{m}{n}
        \let\pi\relax
        \DeclareMathSymbol{\pi}\mathalpha{UpGr}{"70}
        \let\savedpi\pi
      \fi
    }{
      \@ifundefined{#1}{
          \PackageWarning{mismath}{%
              #1 must be a valid command name\MessageBreak
              for pinumber, but command \bslash #1
              is undefined.\MessageBreak
              Perhaps a missing package}
      }{\renewcommand{\pi}{%
          \csname #1\endcsname}
      }
    }
}

\newcommand{\pinormal}{\@ifundefined{itpi}{}{\let\pi\itpi}}

```

And now the commands for vectors (and tensors).

```
\newboolean{arrowvect}
\setboolean{arrowvect}{true}
\newcommand{\arrowvect}{\setboolean{arrowvect}{true}}
\newcommand{\boldvect}{\setboolean{arrowvect}{false}}
```

```
\newcommand{\boldvectcommand}{\boldsymbol} % from amsbsy package
\mm@macro{vect}{\ifthenelse{\boolean{arrowvect}}{
        \vv}{\boldvectcommand}} % doesn't work well with \if... \fi
\newcommand*{\hvect}[1]{\vect{\vphantom{t}#1}}
\newcommand*{\hvec}[1]{\vec{\vphantom{t}#1}}

\newcommand*{\@norm}[1]{
    \mbox{\raisebox{1.75pt}{\small$\bigl\Vert$}} #1
    \mbox{\raisebox{1.75pt}{\small$\bigr\Vert$}} }
% works better than with relative length
\newcommand*{\@@norm}[1]{
    \mbox{\footnotesize\raisebox{1pt}{$\Vert$}} #1
    \mbox{\footnotesize\raisebox{1pt}{$\Vert$}} }
\newcommand*{\@@@norm}[1]{
    \mbox{\tiny\raisebox{1pt}{$\Vert$}} #1
    \mbox{\tiny\raisebox{1pt}{$\Vert$}} }
\@ifundefined{norm}{\providecommand*{\norm}[1]{
    \mathchoice{\@norm{#1}}{\@norm{#1}}{\@@norm{#1}}{\@@@norm{#1}}
    }
}{\mm@warning{norm}} % bad result with libertinust1math

\newcommand{\tensor}{\mathbfsfit} % isomath uses \mathsfbfit

```

Classic identifiers are presented below.

```
\mm@macro{di}{\mathop{}\!\mathup{d}}
\newcommand\probastyle{}
\let\Par\P % end of paragraph symbol
\renewcommand{\P}{\operatorname{\probastyle{P}}}
\mm@macro{E}{\operatorname{\probastyle{E}}}
\mm@macro{V}{\operatorname{\probastyle{V}}}

\mm@operator{\adj}{adj}
\mm@operator{\Aut}{Aut}
\mm@operator{\codim}{codim}
\mm@operator{\Conv}{Conv}
\mm@operator{\cov}{cov}
\mm@operator{\Cov}{Cov}
\mm@macro{curl}{\operatorname{\vect{\mathup{curl}}}}
\mm@operator[divg]{\divg}{div}
\mm@operator{\End}{End}

\mm@operator{\erf}{erf}
\mm@macro{grad}{\operatorname{\vect{\mathup{grad}}}}
\mm@operator{\id}{id} % mathop or mathord?
\mm@operator{\Id}{Id}
\mm@operator{\im}{im}
\let\oldIm\Im \renewcommand{\Im}{\operatorname{Im}}
\mm@operator{\lb}{lb}
\mm@operator{\lcm}{lcm}
```

```
\mm@operator{\rank}{rank}
\let\oldRe\Re \renewcommand{\Re}{\operatorname{Re}}
\mm@macro{rot}{\operatorname{\vect{\mathup{rot}}}}
\mm@operator{\sgn}{sgn}
\mm@operator{\sinc}{sinc}
\mm@operator[spa]{\spa}{span}
\mm@operator{\tr}{tr}
\mm@operator{\var}{var}
\mm@operator{\Var}{Var}
\mm@operator[Zu]{\Zu}{Z}

\mm@operator{\arccot}{arccot}
\mm@operator{\sech}{sech}
\mm@operator{\csch}{csch}
\mm@operator{\arsinh}{arsinh}
\mm@operator{\arcosh}{arcosh}
\mm@operator{\artanh}{artanh}
\mm@operator{\arcoth}{arcoth}
\mm@operator{\arsech}{arsech}
\mm@operator{\arcsch}{arcsch}

\mm@operator[bigO]{\bigO}{\mathcal{O}}
\mm@operator[bigo]{\bigo}{O}
\mm@operator[lito]{\lito}{o}

```

And finally we present the remaining macros.

With Cyrillic languages, the command `\C` may already be defined (only for text mode). Thus, it will not be redefined by `mismath`. However, one may still want to use our `\C` macro only for math mode without interfering the definition of the text `\C`, therefore the `\onlymathC` macro.

```
\mm@macro{mathset}{\mathbf}
\mm@macro{R}{\mathset{R}}
\mm@macro{C}{\mathset{C}}
\providecommand\onlymathC{\let\oldC\C
    \renewcommand{\C}{\TextOrMath{\oldC}{\mathset{C}}} }
\mm@macro{N}{\mathset{N}}
\mm@macro{Z}{\mathset{Z}}
\mm@macro{Q}{\mathset{Q}}
\mm@macro{F}{\mathset{F}}
\mm@macro{K}{\mathset{K}}

\mm@macro{ds}{\displaystyle}
\mm@macro{dlim}{\lim\limits}
\mm@macro{dsum}{\sum\limits}
\mm@macro{dprod}{\prod\limits}
\mm@macro{dcup}{\bigcup\limits}
\mm@macro{dcap}{\bigcap\limits}
```

```
\mm@macro{lbar}{\overline}
\@ifundefined{hlbar}{
    \providecommand*{\hlbar}[1]{\overline{\vphantom{t}#1}}}{
    \mm@warning{hlbar} }
\newcommand\@eqdef{\stackrel{\mathup{def}}{=}}
\newcommand\@@eqdef{\stackrel{\mathrm{\Delta}}{=}}
\mm@macro{eqdef}{\@ifstar{\@@eqdef}{\@eqdef}}
\mm@macro{unbr}{\underbrace}
\mm@macro{iif}{if and only if\xspace}

```

Above, we have used `\mathrm` before `\Delta` in case of defining capital Greek letters in italics (for example with the fixmath package).

The use of `\mbox{}` ensures that the space produced by `\` in the `\then` macro is not suppressed in tables.

```
\mm@macro{then}{\ \Longrightarrow \ \mbox{} }
\@ifundefined{txt}{
    \providecommand*{\txt}[1]{\quad\text{#1}\quad} }{
    \mm@warning{txt} }
\mm@macro{mul}{\mathord{\times}}
\@ifundefined{pow}{
    \providecommand*{\pow}[2]{\left( #1 \right)^{\!#2}} }{
    \mm@warning{pow} }
\@ifundefined{abs}{
    \providecommand*{\abs}[1]{\left\vert#1\right\vert} }{
    \mm@warning{abs} }
\@ifundefined{lfrac}{
    \providecommand*{\lfrac}[2]{\frac{\;#1\;}{\;#2\;}} }{
    \mm@warning{lfrac} }

\newcommand{\systemstretch}{1.2}
\newcommand{\systemsep}{\medspace}
\newenvironment{system}[1][1]{
    \renewcommand{\arraystretch}{\systemstretch}
    \setlength{\arraycolsep}{0.15em}
    \left\{\begin{array}{@{\systemsep}#1@{}} %
}{\end{array}\right.}

\newenvironment{spmatrix}{
    \left(\begin{smallmatrix}
}{\end{smallmatrix}\right)}

\newenvironment{mathcols}{% needs multicol package
  \ifmm@multicol
    \renewcommand{\columnseprule}{0.1pt}
    \begin{multicols}{2}
        \par\noindent\hfill
        \begin{math}\begin{aligned}\displaystyle
```

```
  \else
    \PackageError{mismath}{The mathcols environment
        needs the multicol package}{Add the package multicol
        to your preamble.}
  \fi
}{%
        \end{aligned}\end{math} \hfill\mbox{}
    \end{multicols}
}
\newcommand{\changecol}{%
    \end{aligned}\end{math} \hfill\mbox{}
    \par\noindent\hfill
    \begin{math}\begin{aligned}\displaystyle
}
```

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