Lato Math

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https://github.com/abccsss/LatoMath

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1 What is Lato Math?

Lato Math is an OpenType maths font meant to be used with the Lato font, or other sans-serif text fonts. It requires LuaTeX or XeTeX as engine and the `unicode-math` package[1].

Please note that the current version (0.37) is *experimental, do expect metrics and glyphs to change* until version 1.0 is reached. Comments, suggestions and bug reports are welcome!

Some examples[2]:

$$\int_0^1 \frac{1}{x^x}\,\mathrm{d}x = \sum_{n=1}^{\infty} \frac{1}{n^n}$$

$$\iiiint_{\mathbf{Q}} f(w,x,y,z)\,\mathrm{d}w\,\mathrm{d}x\,\mathrm{d}y\,\mathrm{d}z \leq \oint_{\partial\mathbf{Q}} f'\left(\max\left\{\frac{\|w\|}{|w^2+x^2|};\frac{\|z\|}{|y^2+z^2|};\frac{\|w\oplus z\|}{|x\oplus y|}\right\}\right)$$
$$\approx \biguplus_{\mathbb{Q}\in\bar{\mathbf{Q}}} \left[f^*\left(\frac{\int \mathbb{Q}(t)\rfloor}{\sqrt{1-t^2}}\right)\right]_{t=\alpha}^{t=\vartheta} - (\Delta+\nu-v)^3$$

[1] Please read the documentation `unicode-math.pdf`.
[2] The second one is borrowed from the LaTeX Companion, 3rd edition.

2 Usage

2.1 Calling `\setmathfont`

A basic call for Lato Math would be:

```
\usepackage{unicode-math}
\setmathfont{LatoMath.otf}  % Call by file name or
\setmathfont{Lato Math}     % Call by font name
```

this loads Lato Math as maths font[3] with the default options, see subsections 3.1 on page 4, 3.2 on page 5 and 3.3 on page 6 for customisation.

Please note that the text fonts have to be chosen separately, f.i.:

```
\setsansfont{Lato}[Extension = .ttf,
    UprightFont =     *-Regular,
    BoldFont =        *-Bold,
    ItalicFont =      *-Italic,
    BoldItalicFont =  *-BoldItalic]
```

otherwise you would get Latin Modern for text fonts.

2.2 Calling `lato-math.sty` (recommended)

As an alternative to load Lato Math you can type:

`\usepackage[` *options*[4] `]{lato-math}`

it loads `unicode-math` with the default options, sets Lato Math as maths font and does a bit more:

1. it checks at `\begin{document}` if packages `amssymb` or `latexsym` are loaded and issues warnings in case they are;

[3] Both calls work equally well with LuaTeX; with XeTeX a call by font name will fail unless the font is declared as a *system font*.

[4] Possible *options* are `tight`, `Scale=` or any of the options described in sections 3.1, 3.2 and 3.3.

2. it provides aliases for glyphs named differently in Unicode, so that all `latexsym` or AMS commands are also available;

3. it defines specific maths characters like `\BbbDelta` (𝛥), `\parallelslant` (⫽), `\shortparallelslant` (⫻), etc.;

4. it provides an option `tight` which reduces spacing (`\thinmuskip`, `\medmuskip` and `\thickmuskip`) in maths mode.

Please note that the `lato-math` package does not load any text fonts. The Lato text fonts can be loaded directly (see section 2.1), or via the `lato` package[5] —see this package's documentation, file `lato.pdf`, for all the available options:
`\usepackage[default]{lato}`
will load the Lato text fonts as main (roman) font while
`\usepackage[defaultsans]{lato}`
will load the Lato text fonts as sans font (use both options if necessary). Consider loading `realscripts.sty` which redefines `\textsuperscript` to output the *real* superscripts available with the Lato fonts: M^{r}, M^{lle}, N^{2} instead of *faked* ones, M^{r}, M^{lle}, N^{2}.

The `lato-math` also provides a `Scale=`<*decimal*> option meant to be used to load the Lato Math font together with text fonts other than Lato, while keeping the advantages 1. to 4. pointed in the preceding list, f.i.

```
\usepackage[Scale=0.98]{lato-math}
```

3 What is provided?

Lato Math provides all common `unicode-math` glyphs plus all glyphs available in the `amssymb` and `latexsym` packages. Therefore, the latter two packages *should not* be loaded as they might override Lato Math glyphs.

A full list of available glyphs is shown in file `unimath-lato.pdf` which also shows the coverage of other sans-serif maths fonts compared to the serif maths fonts NewComputerModern and Cambria.

[5] The `lato` package loads all available weights, `Hairline` to `Black`, hence loading takes significantly longer…

3.1 Upright or slanted?

Package `unicode-math` follows TEX conventions for Latin and Greek letters: in maths mode, the default option (`math-style=TeX`) prints Latin letters *a*…*z* *A*…*Z* and lowercase Greek letters *α*…*ω* slanted (italic) while uppercase Greek letters ΑΒΓ…Ω are printed upright. This can be changed by option `math-style` as shown in table 1.

Table 1: Effects of the `math-style` package option.

Package option	Latin	Greek
`math-style=ISO`	(a, z, B, X)	$(\alpha, \beta, \Gamma, \Xi)$
`math-style=TeX`	(a, z, B, X)	$(\alpha, \beta, \Gamma, \Xi)$
`math-style=french`	$(a, z, \mathrm{B}, \mathrm{X})$	$(\alpha, \beta, \Gamma, \Xi)$
`math-style=upright`	$(\mathrm{a}, \mathrm{z}, \mathrm{B}, \mathrm{X})$	$(\alpha, \beta, \Gamma, \Xi)$

Bold letters are printed upright except lowercase Greek letters which are slanted (the default option is `bold-style=TeX`). This can be changed by option `bold-style` as shown in table 2.

Table 2: Effects of the `bold-style` package option.

Package option	Latin	Greek
`bold-style=ISO`	$(\boldsymbol{a}, \boldsymbol{z}, \boldsymbol{B}, \boldsymbol{X})$	$(\boldsymbol{\alpha}, \boldsymbol{\beta}, \boldsymbol{\Gamma}, \boldsymbol{\Xi})$
`bold-style=TeX`	$(\mathbf{a}, \mathbf{z}, \mathbf{B}, \mathbf{X})$	$(\boldsymbol{\alpha}, \boldsymbol{\beta}, \boldsymbol{\Gamma}, \boldsymbol{\Xi})$
`bold-style=upright`	$(\mathbf{a}, \mathbf{z}, \mathbf{B}, \mathbf{X})$	$(\boldsymbol{\alpha}, \boldsymbol{\beta}, \boldsymbol{\Gamma}, \boldsymbol{\Xi})$

Other possible customisation: ∇ is printed upright and *∂* is printed slanted by default, but `nabla=italic` and `partial=upright` can change this.

All these options are offered by the `unicode-math` package, they can be added to the `\setmathfont` call as well[6], for example:

```
\setmathfont{LatoMath.otf}[math-style=french,partial=upright]
```

will print for the code

```
\[ \frac{\partial f}{\partial x} = \alpha \symbf{V} + a\nabla\Gamma
                                 + \symbf{\beta}\symbf{M} \]
```

$$\frac{\partial f}{\partial x} = \alpha\mathbf{V} + a\nabla\Gamma + \boldsymbol{\beta}\mathbf{M}$$

[6] IMHO it is easier to add *all options* to the `\setmathfont` command.

while the default settings would print

$$\frac{\partial f}{\partial x} = \alpha\mathbf{V} + a\nabla\Gamma + \boldsymbol{\beta}\mathbf{M}$$

Both shapes remain available anytime: `$\uppi , \itpi$` prints π, π.

If your text editor is able to handle Greek letters or maths symbols, they can be entered in the code instead control sequences (i.e. α, β, Γ,... for `\alpha`, `\beta`, `\Gamma`,...).

3.2 Character variants

Lato Math provides nine "Character Variants" options, listed on table 3, to choose between different glyphs for Greek characters and some others.

For instance, to get `\epsilon` and `\phi` typeset as ε and φ instead of ϵ and ϕ, you can add option `CharacterVariant={3,6}` to the `\setmathfont` call:

```
\setmathfont{LatoMath.otf}[CharacterVariant={3,6}]
```

Table 3: Character variants.

	Default	Variant	Name
cv01	$\hbar$	$\hslash$	`\hslash`
cv02	$\varnothing$	$\emptyset$	`\emptyset`
cv03	ϵ	ε	`\epsilon`
cv04	κ	$\varkappa$	`\kappa`
cv05	π	ϖ	`\pi`
cv06	ϕ	φ	`\phi`
cv07	ρ	ϱ	`\rho`
cv08	σ	ς	`\sigma`
cv09	θ	ϑ	`\theta`
cv10	Θ	$\varTheta$	`\Theta`

This works for all shapes and weights of these characters: f.i. `$\symbf{\epsilon}$`, `$\symbf{\phi}$` are output as $\boldsymbol{\varepsilon}$, $\boldsymbol{\varphi}$ instead of $\boldsymbol{\epsilon}$, $\boldsymbol{\phi}$. If `math-style=french` has been chosen, `\epsilon` and `\phi` are output as ε and φ (upright).

Please note that curly braces are mandatory whenever more than one "Character Variant" is selected.

Note about \hbar: amsmath provides two different glyphs (italic *h* with horizontal or diagonal stroke) while unicode-math defines \hbar as \hslash (U+210F). lato-math follows unicode-math; the italic *h* with horizontal stroke can be printed using \hslash or \hbar together with character variant cv01 or with \mithbar (replacement for AMS' command \hbar).

3.3 Stylistic sets

Lato Math provides five "Stylistic Sets" options to choose between different glyphs for families of maths symbols.

StylisticSet=4, alias[7] Style=leqslant, converts inequalities into their slanted variants, see table 5a.

StylisticSet=5, alias Style=smaller, converts some symbols into their smaller variants, see table 5b.

Table 4: Stylistic Sets 4 and 5

(a) Style=leqslant (+ss04)

Command	Default	Variant
\leq	≤	⩽
\geq	≥	⩾
\nleq	≰	⩽̸
\ngeq	≱	⩾̸
\leqq	≦	⪇
\geqq	≧	⪈
\nleqq	≦̸	⪇̸
\ngeqq	≧̸	⪈̸
\eqless	⋜	⪕
\eqgtr	⋝	⪖
\lesseqgtr	⋚	⪋
\gtreqless	⋛	⪌
\lesseqqgtr	⪋	⋚
\gtreqqless	⪌	⋛

(b) Style=smaller (+ss05)

Command	Default	Variant
\in	∈	∊
\ni	∋	∍
\mid	∣	∣
\nmid	∤	∤
\parallel	∥	∥
\nparallel	∦	∦
\parallelslant	⫽	⫽
\nparallelslant	⫽̸	⫽̸

StylisticSet=6, alias Style=subsetneq, converts some inclusion symbols, as shown in table 6a on the following page.

[7] These Style aliases are provided by lato-math.sty.

StylisticSet=7, alias Style=parallelslant, converts “parallel” symbols into their slanted variants, see table 6b.

Table 5: Stylistic Sets 6 and 7

(a) Style=subsetneq (+ss06)

Command	Default	Variant
\subsetneq	$\subsetneq$	$\subsetneq$
\supsetneq	$\supsetneq$	$\supsetneq$
\subsetneqq	$\subsetneqq$	$\subsetneqq$
\supsetneqq	$\supsetneqq$	$\supsetneqq$

(b) Style=parallelslant (+ss07)

Command	Default	Variant
\parallel	$\parallel$	$\parallel$
\nparallel	$\nparallel$	$\nparallel$
\shortparallel	$\shortparallel$	$\shortparallel$
\nshortparallel	$\nshortparallel$	$\nshortparallel$

To enable Stylistic Sets 4 and 8 for Lato Math, you should enter

```
\setmathfont{LatoMath.otf}[StylisticSet={4,8}]  or
\usepackage[Style={leqslant,upint}]{lato-math}
```

then, `\[x\leq y \quad \int_{a}^{b} f(x) \;\symup{d}x\]` will print as

$$x \leqslant y \quad \int_a^b f(x)\,\mathrm{d}x$$

instead of

$$x \leq y \quad \int_a^b f(x)\,\mathrm{d}x$$

StylisticSet=8, alias[8] Style=upint, converts integrals signs into their upright variants, see table 6 on the following page.

3.4 Other font features

To get oldstyle numbers in maths, the feature +onum is available:

```
\setmathfont{LatoMath.otf}[Numbers=OldStyle]  or
\usepackage[Style=fulloldstyle]{lato-math}
```

0123456789, $\mathbf{0123456789}$

[8] These Style aliases are provided by lato-math.sty.

Table 6: Style=upint (+ss08)

Command	\int	\iint	\iiint	\iiiint	\oint	\oiint	\oiiint
Default	$\int$	$\iint$	$\iiint$	$\iiiint$	$\oint$	$\oiint$	$\oiiint$
Upright	$\int$	$\iint$	$\iiint$	$\iiiint$	$\oint$	$\oiint$	$\oiiint$

Command	\intclockwise	\awint	\varointclockwise	\ointctrclockwise
Default	$\intclockwise$	$\awint$	$\varointclockwise$	$\ointctrclockwise$
Upright	$\intclockwise$	$\awint$	$\varointclockwise$	$\ointctrclockwise$

3.5 Standard LaTeX maths commands

All standard LaTeX maths commands, all `amssymb` commands and all `latexsym` commands are supported by Lato Math, for some of them loading `lato-math.sty` is required.

Various wide accents and extensible arrows are also supported:

☞ `\wideoverbar` and `\mathunderbar`[9]

$$\overline{x} \quad \overline{xy} \quad \overline{xyz} \quad \overline{A \cup B} \quad \overline{A \cup (B \cap C) \cup D} \quad \underline{m+n+p}$$

☞ `\widehat` and `\widetilde`

$$\hat{x}\ \widehat{xx}\ \widehat{xxx}\ \widehat{xxxx}\ \widehat{xxxxx}\ \widehat{xxxxxx}\ \widetilde{x}\ \widetilde{xx}\ \widetilde{xxx}\ \widetilde{xxxx}\ \widetilde{xxxxx}\ \widetilde{xxxxxx}$$

☞ `\widecheck` and `\widebreve`

$$\check{x} \quad \widecheck{xxxx} \quad \widecheck{xxxxxx} \quad \breve{x} \quad \widebreve{xxxx} \quad \widebreve{xxxxxx}$$

☞ `\overparen` and `\underparen`

$$\overparen{x} \quad \overparen{xy} \quad \overparen{xyz} \quad \overparen{\mathring{A \cup B}} \quad \overparen{\mathring{A \cup (B \cap C) \cup D}} \quad \overparen{x+y}^{2} \quad \overparen{a+b+\ldots+z}^{26}$$

[9] `\overline` and `\underline` are not font related, they are based on `\rule`.

$$\underbrace{x} \quad \underbrace{xz} \quad \underbrace{xyz} \quad \underbrace{x+z}_{2} \quad \underbrace{a+b+\ldots+z}_{26}$$

☞ \overbrace and \underbrace

$$\overbrace{a} \quad \overbrace{ab} \quad \overbrace{abc} \quad \overbrace{abcd} \quad \overbrace{abcde} \quad \overbrace{a+b+c}^{3} \quad \overbrace{a+b+\ldots+z}^{26}$$

$$\underbrace{a} \quad \underbrace{ab} \quad \underbrace{abc} \quad \underbrace{abcd} \quad \underbrace{abcde} \quad \underbrace{a+b+c}_{3} \quad \underbrace{a+b+\ldots+z}_{26}$$

☞ \overbracket and \underbracket

$$\overbracket{a} \quad \overbracket{ab} \quad \overbracket{abc} \quad \overbracket{abcd} \quad \overbracket{abcde} \quad \overbracket{a+b+c}^{3} \quad \overbracket{a+b+\ldots+z}^{26}$$

$$\underbracket{a} \quad \underbracket{ab} \quad \underbracket{abc} \quad \underbracket{abcd} \quad \underbracket{abcde} \quad \underbracket{a+b+c}_{3} \quad \underbrace{a+b+\ldots+z}_{26}$$

☞ \overrightarrow and \overleftarrow

$$\vec{v} \quad \overrightarrow{M} \quad \overrightarrow{vv} \quad \overrightarrow{AB} \quad \overrightarrow{ABC} \quad \overrightarrow{ABCD} \quad \overrightarrow{ABCDEFGH}.$$

$$\overleftarrow{v} \quad \overleftarrow{M} \quad \overleftarrow{vv} \quad \overleftarrow{AB} \quad \overleftarrow{ABC} \quad \overleftarrow{ABCD} \quad \overleftarrow{ABCDEFGH}$$

☞ \overrightharpoon and \overleftharpoon

$$\vec{v} \quad \overrightarrow{M} \quad \overrightarrow{vv} \quad \overrightarrow{AB} \quad \overrightarrow{ABC} \quad \overrightarrow{ABCD} \quad \overrightarrow{ABCDEFGH}.$$

$$\overleftarrow{v} \quad \overleftarrow{M} \quad \overleftarrow{vv} \quad \overleftarrow{AB} \quad \overleftarrow{ABC} \quad \overleftarrow{ABCD} \quad \overleftarrow{ABCDEFGH}$$

☞ \underrightarrow and \underleftarrow

$$\underrightarrow{v} \quad \underrightarrow{M} \quad \underrightarrow{vv} \quad \underrightarrow{AB} \quad \underrightarrow{ABC} \quad \underrightarrow{ABCD} \quad \underrightarrow{ABCDEFGH}.$$

$$\underleftarrow{v} \quad \underleftarrow{M} \quad \underleftarrow{vv} \quad \underleftarrow{AB} \quad \underleftarrow{ABC} \quad \underleftarrow{ABCD} \quad \underleftarrow{ABCDEFGH}$$

☞ \underrightharpoon and \underleftharpoondown

$$\underrightarrow{v} \quad \underrightarrow{M} \quad \underrightarrow{vv} \quad \underrightarrow{AB} \quad \underrightarrow{ABC} \quad \underrightarrow{ABCD} \quad \underrightarrow{ABCDEFGH}.$$

$$\underleftarrow{v} \quad \underleftarrow{M} \quad \underleftarrow{vv} \quad \underleftarrow{AB} \quad \underleftarrow{ABC} \quad \underleftarrow{ABCD} \quad \underleftarrow{ABCDEFGH}.$$

All the extensible arrows provided by the `mathtools` package are available in the Lato Math font (loading `lato-math.sty` is required), f.i.:

$$X \xLeftrightarrow{\text{above}} Y \underset{\text{under}}{\longhookrightarrow} Z \xmapsto{\text{above}} W$$

A wide range of extensible vertical delimiters is provided:

$$\left/ \begin{pmatrix} a_1 \\ a_2 \\ a_3 \end{pmatrix} \begin{bmatrix} a_1 \\ a_2 \\ a_3 \end{bmatrix} \begin{Bmatrix} a_1 \\ a_2 \\ a_3 \end{Bmatrix} \begin{vmatrix} a_1 \\ a_2 \\ a_3 \end{vmatrix} \begin{Vmatrix} a_1 \\ a_2 \\ a_3 \end{Vmatrix} \begin{Vmatrix} a_1 \\ a_2 \\ a_3 \end{Vmatrix} \left\lceil \begin{matrix} a_1 \\ a_2 \\ a_3 \end{matrix} \right\rceil \left\lfloor \begin{matrix} a_1 \\ a_2 \\ a_3 \end{matrix} \right\rfloor \left[\!\left[\begin{matrix} a_1 \\ a_2 \\ a_3 \end{matrix} \right]\!\right] \left\langle \begin{matrix} a_1 \\ a_2 \\ a_3 \end{matrix} \right\rangle \left\langle\!\left\langle \begin{matrix} a_1 \\ a_2 \\ a_3 \end{matrix} \right\rangle\!\right\rangle \right\backslash$$

3.6 Mathematical alphabets

- ☞ All Latin and Greek characters are available in italic, upright, bold and bold italic via the `\symit{}`, `\symup{}`, `\symbf{}` and `\symbfit{}` commands.
- ☞ Calligraphic alphabet (`\symscr` or `\symcal` or `\mathcal` command), uppercase:

  $\mathcal{ABCDEFGHIJKLMNOPQRSTUVWXYZ}$

  also in boldface (`\symbfscr`,`\symbfcal` or `\mathbfcal` command):

  $\boldsymbol{\mathcal{ABCDEFGHIJKLMNOPQRSTUVWXYZ}}$
- ☞ Blackboard-bold alphabet (`\symbb` or `\mathbb` command):

  $\mathbb{ABCDEFGHIJKLMNOPQRSTUVWXYZ}$
  $\mathbb{abcdefghijklmnopqrstuvwxyz}\quad\mathbb{0123456789}$
- ☞ Fraktur alphabet is borrowed from Latin Modern, medium and bold (`\symfrak`, or `\symbffrak` commands):

  $\mathfrak{ABCDEFGHIJKLMNOPQRSTUVWXYZ}\ \mathfrak{abcdefghijklmnopqrstuvwxyz}$
  $\boldsymbol{\mathfrak{ABCDEFGHIJKLMNOPQRSTUVWXYZ}}$
  $\boldsymbol{\mathfrak{abcdefghijklmnopqrstuvwxyz}}$

  but this can overwritten, i.e.

  ```
  \setmathfont{Asana-Math.otf}[range=frak,Scale=MatchUppercase]
  $\symfrak{ABCDEFGHIJKL...XYZ abcdefghijkl...xyz}$
  ```

☞ Typewriter alphabet is sans-serif: 0123456789

ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz

but it can be borrowed from another maths font.

Like Latin Modern, lato-math provides only four lowercase Latin letters in script (or calligraphic) shape: e, g, ℓ, o (\mscre, \mscrg, \ell, \mscro).

All others (range "1D4B6 to "1D4CF) have to be borrowed from another maths font if needed, i.e.

```
\setmathfont{LibertinusMath-Regular.otf}%
            [range="1D4B6-"1D4CF, Scale=MatchLowercase]
```

3.7 Bold variant

In case short maths formulas have to be printed in section titles, a *limited* bold variant is provided. Example of usage: **Einstein's equation $E = mc^2$**

```
\setmathfont{LatoMath-Bold.otf}[version=bold, options]
\section{\mathversion{bold} Einstein's equation $E=mc^2$}
```

It is also possible to use the \boldmath command[10]:

```
\setmathfont{LatoMath-Regular.otf}[BoldFont=LatoMath-Bold.otf]
\section{\boldmath Einstein's equation $E=mc^2$}
```

3.8 Missing symbols

Lato Math is fairly complete (see file unimath-lato.pdf), if you happen to need some of the few missing glyphs you can borrow them from a more complete font, say New Computer Modern. For instance if you need Italic Blackboard Bold (U+2145 to U+2149) you could try:

```
\setmathfont{NewCMMath-Book.otf}[range={"2145-"2149},Scale=1.05]
```

Let's mention albatross, a useful tool to find out the list of fonts providing a given glyph: f.i. type in a terminal "albatross U+2145", see the manpage or albatross-manual.pdf.

[10] The \boldmath command works out of the box when lato-math.sty is loaded.

4 Acknowledgements

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