Concrete Math font, OTF version

Daniel Flipo
daniel.flipo@free.fr

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1 What is concmath-otf?

The concmath-otf package offers an Opentype version of the Concrete Math font created by Ulrik Vieth in MetaFont. concmath-otf.sty is a replacement for the original concmath.sty package.

It requires LuaTeX or XeTeX as engine and the unicode-math package[1].

Please note that the current version (0.21) is *experimental, do expect metrics and glyphs to change* until version 1.0 is reached. Comments, suggestions and bug reports are welcome!

2 Usage

2.1 Calling \setmathfont

A basic call for concmath-otf would be:

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

this loads concmath-otf as math font with the default options, see subsections 3.1 on the following page, 3.2 on page 3 and 3.3 on page 4 for customisation.

Please note that the three sets of text fonts have to be chosen separately, f.i. if you want the Concrete text fonts[2] as Roman font:

```
\setmainfont{cmunorm.otf}
  [BoldFont =       cmunobx.otf ,
   ItalicFont =     cmunoti.otf ,
   BoldItalicFont = cmunobi.otf ]
```

otherwise you would get Latin Modern for text fonts (rm, sf and tt).

[1] Please read the documentation unicode-math.pdf.

[2] They are part of the cm-unicode package.

2.2 Calling `concmat-otf.sty`

A (recommended) alternative is:

`\usepackage[` *options* [3] `]{concmath-otf}`

it loads `unicode-math` with the default options, sets Concrete-Math as Math font and Concrete Text fonts as Roman fonts (families *sf* and *tt* left unchanged) but does a bit more:

1. it checks at `\begin{document}` if packages `amssymb` or `latexsym` are loaded and issues warnings in case they are;
2. it provides aliases for glyphs named differently in Unicode, so that `latexsym` or AMS names are also available;
3. it reduces spacing in math mode: `\thinmuskip`, `\medmuskip` and `\thickmuskip` are reduced as in `fourier.sty`. The option `loose` disables these settings.

Apart from the `loose` option mentionned above, `concmath-otf.sty` provides an option `no-text` to be used for loading the `concmath-otf` font together with roman text fonts other than Concrete.

3 What is provided?

`concmath-otf` provides all glyphs available in the `concmath`, `amssymb` and `latexsym` packages and more. Therefore, these two packages *should not* be loaded as they might override `concmath-otf` glyphs.

Sans-serif, typewriter glyphs are not supplied. A full list of available glyphs is shown in file `unimath-concrete.pdf`.

See in section 3.5 on page 6 how to choose from other Math fonts for these styles.

3.1 Upright or slanted?

Package `unicode-math` follows TEX conventions for Latin and Greek letters: in math mode, the default option (`math-style=TeX`) prints Latin letters $a...z$ $A...Z$ and lowercase greek letters $\alpha...\omega$ slanted (italic) while uppercase greek letters $AB\Gamma...\Omega$ are printed upright. This can be changed by option `math-style` as shown in table 1 on the following page.

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 on the next page.

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

[3] Possible *options* are `loose`, `no-text`, `Scale=` or any of the options described in sections 3.1, 3.2 and 3.3.

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`	$(\mathrm{a}, \mathrm{z}, \mathrm{B}, \mathrm{X})$	$(\alpha, \beta, \Gamma, \Xi)$

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`	$(\mathbf{a}, \mathbf{z}, \mathbf{B}, \mathbf{X})$	$(\boldsymbol{\alpha}, \boldsymbol{\beta}, \boldsymbol{\Gamma}, \boldsymbol{\Xi})$

All these options are offered by the `unicode-math` package but they can be added to the `\setmathfont` call[4], for example:

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

will print for the code

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

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

while the default settings would print

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

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

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

3.2 Character variants

`concmath-otf` provides ten "Character Variants" options, listed on table 3 on the following page, 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{Concrete-Math.otf}[CharacterVariant={3,6}]
```

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

Table 3: Character variants.

	Default	Variant	Name
cv01	$\hbar$	$\hbar$	\hslash
cv02	$\emptyset$	$\emptyset$	\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 $\boldsymbol{\epsilon}$, $\boldsymbol{\phi}$.

Similarly with `math-style=french`, `\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: `unicode-math` defines `\hbar` as `\hslash` (U+210F) while `amsmath` provides two different glyphs (italic h with horizontal or diagonal stroke).
`concmath-otf` 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

`concmath-otf` provides four "Stylistic Sets" options to choose between different glyphs for families of mathematical symbols.

`StylisticSet=4`, alias[5] `Style=leqslant`, converts (large) inequalites into their slanted variants as shown by table 5a on the next page.

`StylisticSet=5`, alias `Style=smaller`, converts some symbols into their smaller variants as shown by table 5b on the following page.

`StylisticSet=6`, alias `Style=subsetneq`, converts some inclusion symbols as shown by table 5 on the next page.

To enable Stylistic Sets 4 and 6 for `concmath-otf`, you should enter

```
\setmathfont{Concrete-Math.otf}[StylisticSet={4,6}]  or
\usepackage[Style={leqslant,subsetneq}]{concmath-otf}
```

then, `\[x\leq y \quad A \subsetneq B\]` will print as
$x \leqslant y \quad A \subsetneq B$ instead of $x \leq y \quad A \subsetneq B$

[5] These `Style` aliases are provided by `concmath-otf.sty`.

Table 4: Stylistic Sets 4 and 5

(a) `Style=leqslant (+ss04)`

Command	Default	Variant
`\leq`	$\leq$	$\leqslant$
`\geq`	$\geq$	$\geqslant$
`\nleq`	$\not\leq$	$\not\leqslant$
`\ngeq`	$\not\geq$	$\not\geqslant$
`\eqless`	$\eqslantless$	$\eqslantless$
`\eqgtr`	$\eqslantgtr$	$\eqslantgtr$
`\lesseqgtr`	$\lesseqgtr$	$\lesseqgtr$
`\gtreqless`	$\gtreqless$	$\gtreqless$
`\lesseqqgtr`	$\lesseqqgtr$	$\lesseqqgtr$
`\gtreqqless`	$\gtreqqless$	$\gtreqqless$

(b) `Style=smaller (+ss05)`

Command	Default	Variant
`\mid`	$\mid$	$\mid$
`\nmid`	$\nmid$	$\nmid$
`\parallel`	$\parallel$	$\parallel$
`\nparallel`	$\nparallel$	$\nparallel$

Table 5: Stylistic Sets 6

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

3.4 Standard LaTeX math commands

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

Various wide acccents are also supported:

- `\widehat` and `\widetilde`

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

- `\overline` and `\underline`

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

- `\wideoverbar`: $\overline{x}\quad \overline{xy}\quad \overline{xyz}$

- `\overparen` and `\underparen`

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

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

- `\overbrace` and `\underbrace`

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

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

- `\overrightarrow` and `\overleftarrow`

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

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

- Finally `\widearc` and `\overrightarc` (loading `concmath-otf.sty` is required)

$$\widearc{AMB} \quad \overrightarc{AMB}$$

3.5 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:
  $\mathcal{ABCDEFGHIJKLMNOPQRSTUVWXYZ}$
- Blackboard-bold alphabet (`\symbb` or `\mathbb` command), uppercase only except lowercase `\Bbbk` (AMS)
  $\mathbb{ABCDEFGHIJKLMNOPQRSTUVWXYZ} \quad \Bbbk$
- Fraktur alphabet, borrowed from Latin Modern
  $\mathfrak{ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz}$
  but this can overwritten, i.e.

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

  $\mathfrak{ABCDEFGHIJKL...XYZ\ abcdefghijkl...xyz}$
- Sans serif and Typewriter alphabets have to be imported, i.e.

```
\setmathfont{STIXTwoMath-Regular.otf}[range={sfup,sfit},
                              Scale=MatchUppercase]
$\symsfup{ABCD...klm}\quad\symsfit{NOPQ...xyz}$
```

ABCDEFGHIJKLMabcdefghijklm *NOPQRSTUVWXYZnopqrstuvwxyz*

```
\setmathfont{STIXTwoMath-Regular.otf}[range=tt,Scale=MatchUppercase]
$\symtt{ABCDE...XYZ abcde...xyz}$
```

ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz

3.6 Missing symbols

concmath-otf does not aim at being as complete as STIXTwoMath-Regular or Cambria, the current glyph coverage compares with TeXGyre Math fonts. In case some symbols do not show up in the output file, you will see warnings in the .log file, for instance:

Missing character: There is no ⇒ (U+2964) in font ErewhonMath

Borrowing them from a more complete font, say Asana-Math, is a possible workaround:
`\setmathfont{Asana-Math.otf}[range={"2964},Scale=1.02]`
scaling is possible, multiple character ranges are separated with commas:
`\setmathfont{Asana-Math.otf}[range={"294A-"2951,"2964,"2ABB-"2ABE}]`

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+2964", see the manpage or albatross-manual.pdf.

4 Acknowledgements

The original Metafont glyphs have been converted first to Type 1 (pfa) using mftrace and fontforge. The cm-unicode package has also helped a lot while cleaning the glyphs.

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