Using the *MathTimeProfessional II* fonts with LaTeX*

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Abstract

This document describes the macro package mtpro2, which serves for using the *MathTimeProfessional II* fonts with LaTeX. The package code was partially adopted from the mathtime package written by Frank Mittelbach and David Carlisle.

Contents

*This document refers to version v2.1a of the mtpro2 package, to be used with version 2 of the *MathTimeProfessional II* fonts.

1 The *MathTimeProfessional* fonts

MathTimeProfessional II is a set of math fonts particularly designed for use with TEX or LATEX.

Separate fonts for text size, superscripts, and second order superscripts are provided, allowing quality mathematical typesetting that has hitherto been available only with metal type or with the Computer Modern and the Euler fonts. Furthermore, *MathTimeProfessional* includes, for instance,

- ▷ individually designed delimiters and radical signs for sizes up to 4 inches tall and extra-wide mathematical accents,
- ▷ complete Greek alphabets, both slanted and upright,
- ▷ matching script, fraktur and BlackBoard Bold fonts,
- ▷ AMS symbols, and more.

In addition to the 'Complete' set of the *MathTimeProfessional II* fonts, there is a 'Lite' version, which includes only a basic set, essentially replacing the standard Computer Modern math fonts that are required for plain TEX.

2 The mtpro2 package

Basically, loading the macro package mtpro2

```
\usepackage[⟨options⟩]{mtpro2}
```

makes LATEX use *MathTimeProfessional* in place of the default Computer Modern math fonts. The following sections describe the particular features of the package and the additional options that control its behavior.

The package mtpro2 constitutes a successor to the previously separate packages mtpro, mtpams and mtpb and integrates all of their capabilities.

2.1 *Lite* vs. *Complete* font set

If you are using the 'lite' font set, you should disable all those features that would require the complete collection. To do so, load the package with the option lite:

```
\usepackage[lite,...]{mtpro2}
```

In particular, the following features are available only with the complete font set:

- ▷ Bold math fonts, except for the bold upright math alphabets `\mathbf` and `\mbf`, and for the bold versions of the CM Calligraphic and the Euler fonts;
- ▷ Times-compatible script, curly, fraktur and 'blackboard bold' fonts;
- ▷ AMS symbols.

When mtpro2 is loaded with the option lite, they are disabled so that you cannot use any missing fonts inadvertently. Features requiring the complete font set are ☞ marked appropriately in the remainder of the present document.

2.2 Text fonts

Loading the mtpro2 package does not change LaTeX's default text font families (Computer Modern). However, the *MathTimeProfessional* fonts were designed to blend best with Times. The Monotype Times New Roman fonts are an ideal match, but mtpro2 can equally well be used with Adobe Times, Times Ten and similar typefaces, such as Baskerville or Concorde.

The roman, sans-serif and typewriter font families and the encoding of the text fonts are to be selected *before* loading of mtpro2 (unless you stay with LaTeX's defaults), so that the package 'knows' the fonts and the encoding to be used for operator names such as 'sin' and for the math alphabets `\mathrm`, `\mathsf` and `\mathtt`. For instance,

```
\usepackage[T1]{fontenc}
\usepackage{textcomp}
\renewcommand{\rmdefault}{ptm}
\usepackage[scaled=0.92]{helvet}
\usepackage{mtpro2}
```

selects T1 encoding with additional text companion symbols and loads *MathTimeProfessional* in conjunction with Adobe Times (`ptm`) and Helvetica, while the default typewriter font family (CM Typewriter) is unchanged. This is how the present document has been typeset.

2.3 Greek letters

With TeX or LaTeX, uppercase Greek letters in math mode are usually typeset as upright, even though they are usually meant to designate variables. Since this violates the International Standards ISO31-0:1992 to ISO31-13:1992, the mtpro2 package provides an option slantedGreek, which causes uppercase Greek (`\Gamma`, `\Delta` etc.), to be typeset as slanted.

Upright lowercase and uppercase Greek letters are available with command names such as `\upalpha`, `\upbeta`, `\upGamma`, `\upDelta`, etc. They are always upright, regardless of the slantedGreek option.

The response of the Greek letters to math alphabet commands differs from that of standard LaTeX when mtpro2 is used: Lowercase Greek letters will respond to math alphabet commands; otherwise, `\mathbold` and `\mathbb` would not work as described below.

This behavior, may, however, cause problems with legacy documents, because applying a different math alphabet than `\mathbold` or one of the italic doublestroke alphabets on lowercase Greek letters will result in garbage output (or no output at all). To avoid this, specify the package option compatiblegreek, which causes the lowercase Greek letters to be declared as 'ordinary' symbols—however, with the drawback that they will no longer honor `\mathbold` or `\mathbb`.

2.4 Numbers and punctuation in math mode

LaTeX's default behavior is to typeset numbers and punctuation in math mode using the `\mathrm` alphabet, which normally equals the default text font.

With the mtpro2 package, in contrast, numerals and punctuation characters are—in math mode—taken from the *MathTimeProfessional* fonts. Thus, entering `$1.23$` will yield a different result than `1.23`, and you will have to decide in each case whether an input fragment is a math or a non-math entity.

2.5 Bold math fonts

☞ Bold and 'heavy' math fonts are available only with the complete font set, except for the alphabets `\mathbf` and `\mbf`, and for the bold versions of the CM Calligraphic and Euler fonts.

2.5.1 Emboldening complete formulas

The declaration `\boldmath` will embolden all formulas within its scope, just as with the standard CM math fonts. Use it, for instance, to emphasize complete formulas or to make sure that mathematical expressions within bold section titles also appear in bold type. Bold formulas should, however, not contain the extra-large parentheses, roots and operators described in section 2.12 below. The `\wide...` accents (2.13) cannot be emboldened, either.

2.5.2 Bold letters and symbols

The declaration `\boldmath` cannot be issued when you are already in math mode. Thus it is not a suitable means to embolden single letters, e.g., if you want to designate vectors with bold type. This use of bold letters in formulas is supported through a number of bold *math alphabets*:

- ▷ `\mathbf` prints its argument using the **bold upright** text font.
- ▷ `\mbf` is similar, but uses a specially modified version of the bold upright Times font, with the spacing and the letter shapes adapted to math typesetting. Thus `\mbf` is appropriate to typeset single variables, while `\mathbf` can be used, e.g., to emphasize an operator name.
- ▷ An additional ***bold italic*** math alphabet named `\mathbold` is provided—something that isn't easily available with standard LaTeX. In contrast to `\mathbf` and `\mbf`, this alphabet also includes Greek letters.[1]
- ▷ Beside the usual `\mathcal`, there is also a bold variant `\mathbcal`; see, however, section 2.6 for a possible exception.
- ▷ When a `\mathscr` alphabet is set up (see below), a corresponding bold `\mathbscr` is defined, too.

An *alternative* to the use of several different bold math alphabets is available through the macro package bm. It defines the command `\bm`, which can embolden not only letters but also symbols or arbitrary expressions—provided that the required fonts exist. The command `\bm` should, however, not be used on constructs like `\PARENS` or `\SQRT` or the `\wide...` accents. The package bm belongs to the tools collection, which is part of every LaTeX system. *It is highly recommended to read the documentation of the package before using it!* To recognize the existence of the bold math fonts, the package bm is to be loaded *after* mtpro2.

2.5.3 'Heavy' symbols

Most—but not all—of the mathematical symbols of the *MathTimeProfessional* fonts exist also in a 'heavy' (i.e., extra-bold) variant, which can be used through the command `\hm` of the above-mentioned package bm. (Use of the corresponding `\heavymath` declaration is, however, pointless, because the heavy math fonts are incomplete.)

[1] The shape of the uppercase Greek letters follows the slantedGreek option.

The ‘heavy’ symbols are darker and more prominent than the ‘bold’ ones, so they are suitable, for instance, if you need an extra-bold plus sign with a different mathematical meaning than the regular $+$. Applying `\hm` to characters that are not available as ‘heavy’ yields either normal type or a ‘slug’ (a black box), depending on the math alphabet. In particular, this restriction affects Latin and Greek letters, as well as the ‘extra-large’ delimiters, root, operators and accents described below.

2.6 Calligraphic math alphabet

`\mathcal` defaults to the calligraphic font of the Computer Modern family. Other script fonts can be used through the following package options:

eucal assigns the Euler Calligraphic font to the math alphabet `\mathcal`,

mtpcal assigns the Times-compatible Math Script font to `\mathcal`,

mtpccal assigns the Times-compatible upright ‘Curly’ font to `\mathcal`,

mtpscr assigns Math Script to a new math alphabet `\mathscr`.

While the calligraphic CM and Euler fonts are standard components of any LaTeX system, the Math Script and Curly fonts are available only with the complete version of the *MathTimeProfessional* font set:

$$\mathcal{ABC}[\mathcal{C}]\mathcal{DEFG}[\mathcal{G}]\mathcal{HI}[\mathcal{I}]\mathcal{JKL}[\mathcal{L}]\mathcal{MNOPQ}[\mathcal{Q}]\mathcal{RS}[\mathcal{S}]\mathcal{TUVWXY}[\mathcal{Y}]\mathcal{Z}[\mathcal{Z}]$$
$$abcdefghiıjȷklmnopqr[r]stuvwxyz[z]$$
$$\mathfrak{ABCDEFG}[\mathfrak{G}]\mathfrak{HI}[\mathfrak{I}]\mathfrak{JKL}\mathfrak{M}[\mathfrak{M}]\mathfrak{N}[\mathfrak{N}]\mathfrak{OPQ}[\mathfrak{Q}]\mathfrak{RST}\mathfrak{UVWXY}[\mathfrak{Y}]\mathfrak{Z}$$
$$\mathfrak{abcdefghiıjȷklmnopqrstuvwxyz}$$

There is no bold variant of the Curly font, so `\mathbcal` is *not* defined when `\mathcal` is assigned to this font.

Section 4 lists further options to set up `\mathcal` or an additional math alphabet `\mathscr`. They are somewhat confusing and are provided only for the sake of compatibility with the old mathtime package.

Do not try to use the declaration `\cal` in place of the text-generating command `\mathcal`. This syntax is obsolete and may not work with the package mtpro2.

2.7 Fraktur math alphabet

A Fraktur alphabet `\mathfrak` can be be made available through a package option:

eufrak assigns the Euler Fraktur font to `\mathfrak`;

mtpfrak assigns the Times-compatible Math Fraktur font to `\mathfrak`.

☞ While the Euler fraktur font is a standard component of any LaTeX system, the Math Fraktur font is available only with the complete version of the *MathTimeProfessional* font set:

$$\mathfrak{ABCDEFGHIJKLMNOPQRSTUVWXY[Y]Z}$$
$$\mathfrak{abcdefghijjklmnopqrstuvwx[x]y[y]z}$$

The symbols `\Re` and `\Im` from the basic *MathTimeProfessional* fonts are not exactly the same as the corresponding letters from these `\mathfrak` alphabets. If you would prefer to have `\Re` and `\Im` use the `\mathfrak` alphabet, just redefine these macros appropriately:

```
\renewcommand{\Re}{\mathfrak{R}}
\renewcommand{\Im}{\mathfrak{I}}
```

2.8 Variant letters in the Fraktur and Script alphabets

☞ This section is relevant with the complete font set only!

Several letters on the Times-compatible Math Script, Curly and Fraktur fonts are available with alternative shapes:

Script:				Curly:				Fraktur:			
C	$\mathscr{C}$	`\altC`	$\mathscr{C}$	G	$\mathcal{G}$	`\altG`	$\mathcal{G}$	Y	$\mathfrak{Y}$	`\altY`	$\mathfrak{Y}$
G	$\mathscr{G}$	`\altG`	$\mathscr{G}$	M	$\mathcal{M}$	`\altM`	$\mathcal{M}$	x	$\mathfrak{x}$	`\altx`	$\mathfrak{x}$
I	$\mathscr{I}$	`\altI`	$\mathscr{I}$	N	$\mathcal{N}$	`\altN`	$\mathcal{N}$	y	$\mathfrak{y}$	`\alty`	$\mathfrak{y}$
L	$\mathscr{L}$	`\altL`	$\mathscr{L}$	Q	$\mathcal{Q}$	`\altQ`	$\mathcal{Q}$				
Q	$\mathscr{Q}$	`\altQ`	$\mathscr{Q}$	Y	$\mathcal{Y}$	`\altY`	$\mathcal{Y}$				
S	$\mathscr{S}$	`\altS`	$\mathscr{S}$								
Y	$\mathscr{Y}$	`\altY`	$\mathscr{Y}$								
Z	$\mathscr{Z}$	`\altZ`	$\mathscr{Z}$								
r	$\mathscr{r}$	`\altr`	$\mathscr{r}$								
z	$\mathscr{z}$	`\altz`	$\mathscr{z}$								

The `\alt...` commands work only in conjunction with the *MathTimeProfessional* Script, Curly and Fraktur fonts, i.e., within the argument of a related math alphabet command. For instance, `\mathfrak{\altx}` yields $\mathfrak{x}$, provided that Math Fraktur is in fact assigned to `\mathfrak`. When the commands are used with other fonts, the corresponding 'normal' letter is printed.

2.9 'Blackboard Bold' math alphabet

A 'blackboard bold' font can be made available as math alphabet `\mathbb`. Various fonts can be selected using the following package options:

amsbb AMS 'B'

mtphrb Times-compatible Holey Roman Bold

mtpbb Times-compatible Blackboard Bold

mtphbi Times-compatible Holey Roman Bold Italic

mtpbbi Times-compatible Blackboard Bold Italic

mtphrd Times-compatible Holey Roman Dark

mtpbbd Times-compatible Blackboard Bold Dark

☞ While the AMS 'B' font is a standard component of any LaTeX system, the Times-compatible fonts are available only with the complete version of the *MathTimeProfessional* font set:

The first version, **h**oley **r**oman **b**old, is a 'bold open' font, formed by hollowing out bold letters:

$$\mathbb{ABCDEFGHIJKLMNOPQRSTUVWXYZ}$$
$$\mathbb{abcdefghijklmnopqrstuvwxyz0123456789}$$

By contrast, the **b**lackboard **b**old font is the sort of alphabet that one might actually write on a blackboard:

$$\mathbb{ABCDEFGHIJKLMNOPQRSTUVWXYZ}$$
$$\mathbb{abcdefghijklmnopqrstuvwxyz0123456789}$$

Beside these, corresponding italic fonts are available, too. They comprise also Greek letters, which are accessible through the usual commands `\alpha`...`\Omega`.

$$\mathbb{\mathit{ABCDEFGHIJKLMNOPQRSTUVWXYZ}}$$
$$\mathbb{\mathit{abcdefghijklmnopqrstuvwxyz0123456789}}$$
$$\mathbb{\alpha\ldots\omega\ldots\Gamma\ldots\Omega}$$

and

$$\mathbb{\mathit{ABCDEFGHIJKLMNOPQRSTUVWXYZ}}$$
$$\mathbb{\mathit{abcdefghijklmnopqrstuvwxyz0123456789}}$$
$$\mathbb{\alpha\ldots\omega\ldots\Gamma\ldots\Omega}$$

Or you might prefer one of the dark versions, **h**oley **r**oman **d**ark:

$$\mathfrak{ABCDEFGHIJKLMNOPQRSTUVWXYZ}$$
$$\mathfrak{abcdefghijklmnopqrstuvwxyz0123456789}$$

or **b**lackboard **b**old **d**ark:

$$\mathbb{ABCDEFGHIJKLMNOPQRSTUVWXYZ}$$
$$\mathbb{abcdefghijklmnopqrstuvwxyz0123456789}$$

`\boldmath` and `\bm` also act on the Times Blackboard Bold and Holey Roman Bold fonts and yield the related 'dark' font. However, if you have already chosen one of the 'dark' fonts for the `\mathbb` alphabet (option mtpbbd or mtphrd), it will not be emboldened further, and the italic doublestroke fonts also have no bold counterparts.

2.10 Positioning of subscripts

The appearance of subscripts can be improved by loading the package with the option subscriptcorrection. When certain letters, like f or j, occur as a subscript, the positioning will be automatically adjusted. In the following example, the left sum was typeset with subscript correction, the right one without:

$$C_f + C_j + X_A \qquad C_f + C_j + X_A$$

The `\enablesubscriptcorrection` and `\disablesubscriptcorrection` commands can also be used to turn subscript correction on and off within the document.

No guarantee is made as to the proper functioning of the automatic subscript correction in conjunction with any additional macro package, because the underscore character _ is made active.

2.11 Styles of operator symbols

The operators $\sum$, $\prod$ and $\coprod$ have slanted versions, too: $\sum$, $\prod$ and $\coprod$. These are selected as the default ones by specifying the package option sloperators. Whichever convention you use, you can always use `\slsum` etc. to get the slanted versions and `\upsum` etc. to get the upright versions.

2.12 The big differences

2.12.1 Extra-large delimiters and roots

The *MathTimeProfessional* font set includes individually designed parentheses and other delimiters, all of which go up to to 4 inches high.

The large parentheses are produced by the command `\PARENS{...}`; just compare the left matrix with the output obtained from the ordinary `\left(` and `\right(` macros:

$$\left(\begin{array}{ccc} x_{11} & x_{12} & \dots \\ x_{21} & x_{22} & \dots \\ x_{31} & x_{32} & \dots \\ \vdots & \vdots & \ddots \end{array}\right) \qquad \left(\begin{array}{ccc} x_{11} & x_{12} & \dots \\ x_{21} & x_{22} & \dots \\ x_{31} & x_{32} & \dots \\ \vdots & \vdots & \ddots \end{array}\right)$$

Basically, `\PARENS{...}` is just an abbreviation for `\LEFTRIGHT(){...}`. In general, you can use `\LEFTRIGHT` directly with any two delimiters, including the period for an empty delimiter. In addition to parentheses, you can get `/`, `\backslash`, `<` (or `\langle`), and `>` (or `\rangle`), all up to 4 inches high. As to curly braces, see the next section.

A combination like `\LEFTRIGHT[]{`⟨*formula*⟩`}` is also possible; the] just gets extended in the usual way. At large sizes, however, the (might end up slightly larger than the], since the] grows at the same (6 pt) rate, no matter how large the argument, while the parentheses grow faster for larger formulas. So in such cases you may need to replace `{`⟨*formula*⟩`}` with

`\vcorrection{`⟨*dimen*⟩`}{`⟨*formula*⟩`}`

to artificially increase its vertical size to ⟨*dimen*⟩, thereby forcing the square bracket to be larger.

In addition to the `\sqrt` command, which uses an 'extensible' symbol, mtpro2 provides `\SQRT`, with the same syntax. It produces individually designed root signs up to 4 inches high: In the example below, the left root was typeset using `\SQRT`, the right one results from the ordinary `\sqrt` command.

$$\sqrt[3]{\sum_{i=1}^{n}(y^i - x^i)^3} \qquad \sqrt[3]{\sum_{i=1}^{n}(y^i - x^i)^3}$$

The positioning of the root index can be adjusted through the commands `\LEFTROOT` and `\UPROOT`. They are to be issued in math mode, they are valid inside the current formula only, and they act only on roots produced from `\SQRT`.

Positive arguments to these commands will move the root index to the left and up respectively, while a negative argument will move it to the right and down. The units of increment are quite small, which is useful for such adjustments. In the example below, the index β of the left root is moved 2 units to the right and 6 units up by saying `\LEFTROOT{-2} \UPROOT{6} \SQRT...`; the right root shows the default appearance:

$$\sqrt[\beta]{k} \qquad \sqrt[\beta]{k}$$

Notice that the syntax of the `\LEFTROOT` and `\UPROOT` commands differs both from the amsmath package and from `mtp.tex`!

You can nest `\PARENS` (or `\LEFTRIGHT`), though of course that shouldn't be needed very often. Doing so slows TEX down exponentially and may also exhaust its capacity. It should also be mentioned that `\PARENS` ends up typesetting its argument more than once, in order to find out the right size of the delimiters, so you need to be careful when using boxes: For example, if you have stored a formula in `\box\eqnbox`, then you should be sure to type `\PARENS{\copy\eqnbox}`, rather than `\PARENS{\box\eqnbox}`. The same precaution applies to `\SQRT` and to the new `\wide...` accents explained in section 2.13.

2.12.2 Curly braces

The commands `\{` and `\}` (or `\lbrace` and `\rbrace`) can also be used after `\LEFTRIGHT`, in order to obtain curly braces up to 4 inches high.[2] Again, compare the output obtained by `\LEFTRIGHT\{\}{...}` with the result of the usual `\left\{...\right\}`:

$$\left\{\begin{array}{ccc} x_{11} & x_{12} & \dots \\ x_{21} & x_{22} & \dots \\ x_{31} & x_{32} & \dots \\ \vdots & \vdots & \ddots \end{array}\right\} \qquad \left\{\begin{array}{ccc} x_{11} & x_{12} & \dots \\ x_{21} & x_{22} & \dots \\ x_{31} & x_{32} & \dots \\ \vdots & \vdots & \ddots \end{array}\right\}$$

To go along with this, a `\ccases` construction is provided, which yields a decorated array with two columns, both left aligned:

$$S(x) := \begin{cases} -1 & x < 0 \\ 0 & x = 0 \\ 1 & x > 0 \end{cases}$$

[2] `\lcbrace` and `\rcbrace` can be used, too, with respect to previous package versions.

The syntax is similar to the `\cases` macro[3], but the lines are separated in a LaTeX-like manner by `\\`:

```
S(x) \coloneq \ccases{
 -1 & x < 0 \\
  0 & x = 0 \\
  1 & x > 0}
```

The mtpro2 package provides two further alternatives, as far as the shape of braces is concerned: If you prefer straight braces at all sizes, load the package with the option straightbraces, and use the normal `\left\{...\right\}` construct for large, extensible braces. Or, if you want small braces to be 'curly', while the larger ones become more and more straight, load the package with the option morphedbraces, also on conjunction with `\left\{...\right\}`. Compare the default behavior

$$\left\{\begin{array}{l} x_1 \\ x_2 \\ x_3 \end{array}\right\}$$

with the results obtained using straightbraces

$$\left\{\begin{array}{l} x_1 \\ x_2 \\ x_3 \end{array}\right\}$$

and morphedbraces:

$$\left\{\begin{array}{l} x_1 \\ x_2 \\ x_3 \end{array}\right\}$$

2.12.3 Extra-large under- and overbraces

Individually designed curly underbraces and overbraces up to 4 inches wide are available by using the macros `\undercbrace` or `\overcbrace` instead of the usual `\underbrace` and `\overbrace`. Compare these (left) with standard LaTeX (right);

$$\underbrace{A_1 + \cdots + A_i + \cdots + A_n} \qquad \underbrace{A_1 + \cdots + A_i + \cdots + A_n}$$

[3]There is, however, no beautified counterpart to the `cases` environment of the amsmath package!

2.12.4 Extra-large operator symbols

In a displayed formula like

$$\sum_{i\notin I} \frac{\int_{-\infty}^{+\infty} f(\alpha_i x)\,dx + 1}{\oint_C f(\beta_i z)\,dz - 1}$$

you might feel the need for a larger sum sign. Normally printers don't provide one, but with the *MathTimeProfessional* fonts you can get an extra-large `\sum` with the `\xl` command. For instance, `\xl\sum_{i \notin I}...` yields:

$$\sum_{i\notin I} \frac{\int_{-\infty}^{+\infty} f(\alpha_i x)\,dx + 1}{\oint_C f(\beta_i z)\,dz - 1}$$

`\xl` can be applied to all 'large' operators, including those in section 2.14.1. In most cases `\xl` produces a symbol about 18 pt tall. There are also `\XL and \XXL` versions that are 36 pt and 72 pt (a full inch) high! And, heaven forbid, you can even get `\XXXL` versions that are two inches high, thereby assuring yourself (as well as the designer of the MathTime fonts) the lasting enmity of journal editors everywhere.

As usual, you can also add `\nolimits` after the `\sum` if you want the subscript and superscript to be placed to the side. And, in combinations like `\xl\int` where they are normally placed to the side, you can add `\limits` if you do want them to be set above and below the integral sign.

When the package amsmath is used, its options nosumlimits and inlimits are, however, not honored, i.e., the *default* placement of subscripts and superscripts on extra-large operators will always follow the normal LaTeX convention.

2.13 Accents in math

In addition to `\widehat` and `\widetilde`, there is now `\widecheck`. The `\widehat`, `\widecheck`, and `\widetilde` accents are extended in a similar fashion as the large delimiters and roots (see above); in each case you can get accents up to 4 inches wide:

$$\widehat{a+b} + \widehat{a+b+c} + \widehat{a+b+c+d} + \widehat{a+b+c+d+e}$$

If, for some reason, you need double `\wide...` accents, you may be disappointed to find that `\widehat{\widehat...` gives

$$\overline{\overline{A+B+C+D+E+F+G}}$$

with the top accent seemingly too high (its base is at the level of the top of the lower `\widehat`). So there is also `\widehatdown{`⟨*dimen*⟩`}{...}` to move a `\widehat` down (and similarly for the `\widetilde` and the `\widecheck` accents). For example,

```
\widehatdown{2pt}{\widehat{A+B+C+D+E+F+G }}
```

produces

$$\overline{\overline{A+B+C+D+E+F+G}}\,.$$

In a combination like $\hat{A}$, the `\hat` accent might look a little small, while `\widehat` produces an accent $\widehat{A}$ that looks too large (and also isn't positioned well, because `\widehat` is meant for entire formulas, and doesn't properly position the accent for single letters). So there is `\what` to produce a slightly wider hat accent, $\what{A}$. Similarly, there are `\wtilde`, `\wcheck`, and `\wbar`.

In addition, there are slightly larger `\wwhat`, `\wwcheck`, `\wwtilde`, and `\wwbar`. The `\wwhat`, `\wwcheck`, and `\wwtilde` accents are identical to the smallest versions of the accents produced by `\widehat` etc., but in some cases it might be preferable to force this smallest size instead of relying on the `\wide...` accents themselves. For example, `\widehat M` yields $\widehat{M}$, because the M (counting the white space on its sides) happens to be just a bit too wide for the smallest `\widehat` accent, whereas `\wwhat M` will result in $\what{M}$.

The `\wwbar` accent is what used to be called `\widebar` in the *MathTime* fonts, but that really wasn't a very good name, since `\overline` is what actually corresponds to the `\wide...` accents.

The standard commands `\dot` and `\ddot` are complemented with ready-made triple and quadruple dot accents `\dddot` and `\ddddot`; they work with or without the amsmath package.

In situations like $\dot{\Gamma}$, the dot accents might look better if they were moved up a bit. So there are `\dotup`, `\ddotup`, `\dddotup` and `\ddddotup`, to produce $\dotup{\Gamma}$, $\ddotup{\Gamma}$, etc.

2.14 Additional symbols not available with standard LaTeX

2.14.1 Integrals

The *MathTimeProfessional* fonts include multiple, surface and line integrals. They are available in text size (as shown in the below table) as well as display size:

$\iint$	\iint	$\iiint$	\iiint	$\oiint$	\oiint	$\oiiint$	\oiiint
$\cwoint$	\cwoint	$\awoint$	\awoint	$\cwint$	\cwint		
$\barint$	\barint	$\slashint$	\slashint				

The macros are compatible with the amsmath package, which may be loaded additionally.

2.14.2 Negated relation symbols

MathTimeProfessional includes a number of ready-made negated relation symbols, see table 1, which are normally built from pieces. For instance, with *MathTimeProfessional* you should write `\notleq` instead of `\not\leq`. Almost all of of these symbols are accessible also through an alternative name, which follows the naming scheme of the amssymb package.

$\notless$	\notless, \nless	$\notsupset$	\notsupset, \nsupset
$\notleq$	\notleq, \nleq	$\notsupseteq$	\notsupseteq, \nsupseteq
$\notprec$	\notprec, \nprec	$\notsqsupseteq$	\notsqsupseteq, \nsqsupseteq
$\notpreceq$	\notpreceq, \npreceq	$\neq$	\neq
$\notsubset$	\notsubset, \nsubset	$\notequiv$	\notequiv, \nequiv
$\notsubseteq$	\notsubseteq, \nsubseteq	$\notsim$	\notsim
$\notsqsubseteq$	\notsqsubseteq, \nsqsubseteq	$\notsimeq$	\notsimeq, \nsimeq
$\notgr$	\notgr, \ngtr	$\notapprox$	\notapprox, \napprox
$\notgeq$	\notgeq, \ngeq	$\notcong$	\notcong, \ncong
$\notsucc$	\notsucc, \nsucc	$\notasymp$	\notasymp, \nasymp
$\notsucceq$	\notsucceq, \nsucceq		

Table 1: Non-standard negated relation symbols.

2.14.3 Miscellaneous symbols

The *MathTimeProfessional* fonts provide various symbols and letters that are not defined with standard LaTeX, see table 2

Relations:

$\nrightarrow$	`\simarrow`	$\widehat{=}$	`\hateq`
$:=$	`\coloneq`	$=:$	`\eqcolon`
$\circ\!\!-\!\!\bullet$	`\circdashbullet`	$\bullet\!\!-\!\!\circ$	`\bulletdashcirc`

Binary operators:

$\barwedge$	`\capprod`	$\barvee$	`\cupprod`
$\circ$	`\comp`	$\smallsetminus$	`\setdif`
$\lrcorner$	`\contraction`	&	`\varland`

Large operators:

$\bigbarwedge$	`\bigcapprod`	$\bigbarvee$	`\bigcupprod`
$\ast$	`\bigast`	&	`\bigvarland`

Letters:

$\varbeta$	`\varbeta`	$\upvarbeta$	`\upvarbeta`
∂	`\vardelta`	$\upvardelta$	`\upvardelta`
$\varkappa$	`\varkappa`	$\upvarkappa$	`\upvarkappa`
$\hbar$	`\hslash`	F	`\digamma`
$đ$	`\dbar`	đ	`\updbar`

Alternative card suit symbols:

♤	`\openspadesuit`	♠	`\shadedspadesuit`
♧	`\openclubsuit`	♣	`\shadedclubsuit`

Table 2: Miscellaneous non-standard symbols

Table 2 shows `\bigcapprod`, `\bigcupprod`, `\bigast` and `\bigvarland` as they would appear within inline formulas. Being 'large operators', they are enlarged when used within displayed formulas, for instance:

$$\bigbarwedge_{i=1}^{n} \alpha_i \qquad \bigbarvee_{i=1}^{n} \alpha_i \qquad \bigast_{i=1}^{n} \alpha_i \qquad \bigvarland_{i=1}^{n} \alpha_i$$

`\varbeta` and `\vardelta` are old forms of β and δ that you might find useful if you are trying to imitate certain old books. Notice that `\vardelta` is hardly distinguishable from the `\partial` symbol (the circular portion of `\vardelta` is taller, to match the height of letters like x and o in math formulas). The only reason for providing `\vardelta` is that all the various Greek alphabets specified for mathematics in the Unicode standard include this variant (perversely called 'partial').

The bold or heavy versions of ♠ and ♣ are somewhat grotesque. If you need to have different varieties of these, you might like to use the `\open...` or `\shaded..` macros. Notice, however, that these variants themselves have no bold or heavy counterparts!

2.14.4 Alternative shapes of z in math mode

Some people like to have an italic z with a 'swash' tail: z. Loading the package with the option zswash cause z to yield z instead of z in your equations.

2.15 AMS symbols

The 'lite' *MathTimeProfessional* font set already provides several symbols that are normally available only with the package amssymb—see the sections 2.14.2 and 2.14.3 above.

☞ With the complete font set, in contrast, *all* of the so-called 'AMS symbols' are available in a Times-compatible style. You need *not* load the packages amsfonts or amssymb additionally; in fact, you *must not* do so, because the packages are not compatible with mtpro2.

The definitions of the AMS symbols consume a huge amount of TEX resources, so you can disable them through the package option noamssymbols. This does, however, not affect any of the symbols shown in the tables 1 and 2; they always remain accessible.

2.15.1 Ordinary symbols

Most of the AMS symbols are binary operators or relations, but first we have a group of various ordinary symbols, shown in table 3. `\yen`, `\maltese`, `\circledR` and `\checkmark` are sort of special, since they can be used both in text mode and in math mode. ◇ (`\Diamond`) was adopted from the so-called LATEX symbols, and you may prefer its shape over ♢.

The AMS symbols F (`\digamma`), and $\hbar$ (`\hslash`), have been placed on the *MathTimeProfessional* 'lite' fonts, along with the $\hbar$ (`\bar`).

2.15.2 Delimiters

Table 4 shows four special delimiters (which occur in only one size).

‵	\backprime	∅	\varnothing
△	\vartriangle	▲	\blacktriangle
▽	\triangledown	▼	\blacktriangledown
□	\square	■	\blacksquare
◊	\lozenge	⧫	\blacklozenge
◇	\Diamond	★	\bigstar
∡	\measuredangle	∢	\sphericalangle
∄	\nexists	∁	\complement
℧	\mho	ð	\eth
ⅎ	\Finv	⅁	\Game
⁄	\diagup	╲	\diagdown
ב	\beth	ג	\gimel
ד	\daleth	¥	\yen
✠	\maltese	®	\circledR
✓	\checkmark	Ⓢ	\circledS

Table 3: AMS symbols of type ‘ordinary’

⌜	\ulcorner	⌝	\urcorner
⌞	\llcorner	⌟	\lrcorner

Table 4: AMS symbols: Delimiters

2.15.3 Binary operators

Table 5 shows the additional binary operator symbols in the complete font set. The macro `\smallsetminus` is actually just a synonym for `\setdif` on the *MathTimeProfessional* basic fonts.

2.15.4 Binary relations

In table 6, note that ⊏ (`\sqsubset`) and ⊐ (`\sqsupset`) are ‘AMS’ symbols, while the more complicated ⊑ (`\sqsubseteq`) and ⊒ (`\sqsupseteq`) already exist in the basic fonts!

Note also that ⌣ (`\smallsmile`) and ⌢ (`\smallfrown`) are different from the symbols ∪ (`\cupprod`) and ∩ (`\capprod`), and that the old ⊨ (`\models`) is different from ⊨ (`\vDash`).

$\dot{+}$	\dotplus	$\smallsetminus$	\smallsetminus
$\ltimes$	\ltimes	$\rtimes$	\rtimes
$\Cap$	\Cap ,\doublecap	$\Cup$	\Cup,\doublecup
$\leftthreetimes$	\leftthreetimes	$\rightthreetimes$	\rightthreetimes
$\barwedge$	\barwedge	$\veebar$	\veebar
$\doublebarwedge$	\doublebarwedge		
$\curlywedge$	\curlywedge	$\curlyvee$	\curlyvee
$\boxplus$	\boxplus	$\boxminus$	\boxminus
$\boxtimes$	\boxtimes	$\boxdot$	\boxdot
$\circleddash$	\circleddash	$\circledast$	\circledast
$\circledcirc$	\circledcirc	$\divideontimes$	\divideontimes
$\centerdot$	\centerdot	$\intercal$	\intercal

Table 5: AMS symbols: Binary operators

2.15.5 Negated relations

Negated relation symbols are summarized in table 7. They are partly available already with the 'lite' font set; see table 1.

Note that $\nsim$ (\nsim) from the AMS symbols is definitely different from $\not\sim$ (\notsim) from the basic fonts.

2.15.6 Arrows

The arrows from table 8 are of type \mathrel. It should be noted that $\rightleftharpoons$ (\rightleftharpoons) is already provided with the 'lite' font set. The arrow $\leadsto$ (\leadsto) appears in the 'LaTeX symbols', and its shape is more common than $\rightsquigarrow$ from the AMS fonts. A number of arrows are also provided in negated form, see table 9.

\rarrowhead, \larrowhead, and \midshaft (which are not given names in the AMS fonts) can be used to construct longer dashed arrows. For example

```
\mathrel{\midshaft\midshaft\midshaft\rarrowhead}
```

can be used to produce the arrow in the formula

$$A \dashrightarrow B.$$

2.15.7 Alternative symbol names

Several symbols are made available both under the names introduced by the AMS and under the names known from LaTeX 2.09 or from the latexsym package—see

$\leqq$	\leqq	$\geqq$	\geqq
$\leqslant$	\leqslant	$\geqslant$	\geqslant
$\eqslantless$	\eqslantless	$\eqslantgtr$	\eqslantgtr
$\lesssim$	\lesssim	$\gtrsim$	\gtrsim
$\lessapprox$	\lessapprox	$\gtrapprox$	\gtrapprox
$\approxeq$	\approxeq		
$\lessdot$	\lessdot	$\gtrdot$	\gtrdot
$\lll$	\lll, \llless	$\ggg$	\ggg, \gggtr
$\lessgtr$	\lessgtr	$\gtrless$	\gtrless
$\lesseqgtr$	\lesseqgtr	$\gtreqless$	\gtreqless
$\lesseqqgtr$	\lesseqqgtr	$\gtreqqless$	\gtreqqless
$\doteqdot$	\doteqdot, \Doteq	$\eqcirc$	\eqcirc
$\fallingdotseq$	\fallingdotseq	$\risingdotseq$	\risingdotseq
$\circeq$	\circeq	$\triangleq$	\triangleq
$\backsim$	\backsim	$\thicksim$	\thicksim
$\backsimeq$	\backsimeq	$\thickapprox$	\thickapprox
$\subseteqq$	\subseteqq	$\supseteqq$	\supseteqq
$\Subset$	\Subset	$\Supset$	\Supset
$\sqsubset$	\sqsubset	$\sqsupset$	\sqsupset
$\preccurlyeq$	\preccurlyeq	$\succcurlyeq$	\succcurlyeq
$\curlyeqprec$	\curlyeqprec	$\curlyeqsucc$	\curlyeqsucc
$\precsim$	\precsim	$\succsim$	\succsim
$\precapprox$	\precapprox	$\succapprox$	\succapprox
$\vartriangleleft$	\vartriangleleft	$\vartriangleright$	\vartriangleright
$\trianglelefteq$	\trianglelefteq	$\trianglerighteq$	\trianglerighteq
$\blacktriangleleft$	\blacktriangleleft	$\blacktriangleright$	\blacktriangleright
$\vDash$	\vDash	$\Vdash$	\Vdash
$\Vvdash$	\Vvdash		
$\smallsmile$	\smallsmile	$\smallfrown$	\smallfrown
$\shortmid$	\shortmid	$\shortparallel$	\shortparallel
$\bumpeq$	\bumpeq	$\Bumpeq$	\Bumpeq
$\therefore$	\therefore	$\because$	\because
$\between$	\between	$\pitchfork$	\pitchfork
$\varpropto$	\varpropto	$\backepsilon$	\backepsilon

Table 6: AMS symbols: Binary relations

$\not<$	\nless	$\not>$	\ngtr
$\not\leq$	\nleq	$\not\geq$	\ngeq
$\not\leqslant$	\nleqslant	$\not\geqslant$	\ngeqslant
$\not\leqq$	\nleqq	$\not\geqq$	\ngeqq
$\lneq$	\lneq	$\gneq$	\gneq
$\lneqq$	\lneqq	$\gneqq$	\gneqq
$\lvertneqq$	\lvertneqq	$\gvertneqq$	\gvertneqq
$\lnsim$	\lnsim	$\gnsim$	\gnsim
$\lnapprox$	\lnapprox	$\gnapprox$	\gnapprox
$\not\prec$	\nprec	$\not\succ$	\nsucc
$\not\preceq$	\npreceq	$\not\succeq$	\nsucceq
$\precneqq$	\precneqq	$\succneqq$	\succneqq
$\precnsim$	\precnsim	$\succnsim$	\succnsim
$\precnapprox$	\precnapprox	$\succnapprox$	\succnapprox
$\not\sim$	\nsim	$\not\cong$	\ncong
$\nshortmid$	\nshortmid	$\nshortparallel$	\nshortparallel
$\nmid$	\nmid	$\nparallel$	\nparallel
$\nvdash$	\nvdash	$\nvDash$	\nvDash
$\nVdash$	\nVdash	$\nVDash$	\nVDash
$\not\triangleleft$	\ntriangleleft	$\not\triangleright$	\ntriangleright
$\not\subseteq$	\nsubseteq	$\not\supseteq$	\nsupseteq
$\not\subseteqq$	\nsubseteqq	$\not\supseteqq$	\nsupseteqq
$\subsetneq$	\subsetneq	$\supsetneq$	\supsetneq
$\varsubsetneq$	\varsubsetneq	$\varsupsetneq$	\varsupsetneq
$\subsetneqq$	\subsetneqq	$\supsetneqq$	\supsetneqq
$\varsubsetneqq$	\varsubsetneqq	$\varsupsetneqq$	\varsupsetneqq
* $\not\sqsubset$	\nsqsubset	* $\not\sqsupset$	\nsqsupset

Table 7: AMS symbols: Negated relations. Symbols marked by an asterisk do not exist on the Computer Modern AMS fonts.

$\dashrightarrow$	\dashrightarrow, \dasharrow	$\dashleftarrow$	\dashleftarrow
* $\leftarrowtail$	\larrowhead	* $\rightarrowtail$	\rarrowhead
* $\shortmid$	\midshaft		
$\leftleftarrows$	\leftleftarrows	$\rightrightarrows$	\rightrightarrows
$\leftrightarrows$	\leftrightarrows	$\rightleftarrows$	\rightleftarrows
$\Lleftarrow$	\Lleftarrow	$\Rrightarrow$	\Rrightarrow
$\twoheadleftarrow$	\twoheadleftarrow	$\twoheadrightarrow$	\twoheadrightarrow
$\leftarrowtail$	\leftarrowtail	$\rightarrowtail$	\rightarrowtail
$\looparrowleft$	\looparrowleft	$\looparrowright$	\looparrowright
$\leftrightharpoons$	\leftrightharpoons	$\rightleftharpoons$	\rightleftharpoons
$\curvearrowleft$	\curvearrowleft	$\curvearrowright$	\curvearrowright
* $\circlearrowleft$	\undercurvearrowleft	* $\circlearrowright$	\undercurvearrowright
$\circlearrowleft$	\circlearrowleft	$\circlearrowright$	\circlearrowright
$\Lsh$	\Lsh	$\Rsh$	\Rsh
$\upuparrows$	\upuparrows	$\downdownarrows$	\downdownarrows
$\upharpoonright$	\upharpoonright, \restriction	$\upharpoonleft$	\upharpoonleft
$\downharpoonright$	\downharpoonright	$\downharpoonleft$	\downharpoonleft
$\updownarrows$	\updownarrows	$\downuparrows$	\downuparrows
$\updownharpoons$	\updownharpoons	$\downupharpoons$	\downupharpoons
$\upupharpoons$	\upupharpoons	$\downdownharpoons$	\downdownharpoons
$\rightsquigarrow$	\rightsquigarrow	$\leadsto$	\leadsto
$\leftrightsquigarrow$	\leftrightsquigarrow	$\multimap$	\multimap

Table 8: AMS arrows. Symbols marked by an asterisk do not exist on the Computer Modern AMS fonts or are not given names of their own with the AMS macros.

$\nleftarrow$	\nleftarrow	$\nrightarrow$	\nrightarrow
$\nLeftarrow$	\nLeftarrow	$\nRightarrow$	\nRightarrow
$\nleftrightarrow$	\nleftrightarrow	$\nLeftrightarrow$	\nLeftrightarrow

Table 9: AMS arrows (negated)

table 10.

$\square$	\square	\Box
$\lhd$	\vartriangleleft	\lhd
$\trianglelefteq$	\trianglelefteq	\unlhd
$\rhd$	\vartriangleright	\rhd
$\trianglerighteq$	\trianglerighteq	\unrhd
$\bowtie$	\bowtie	\Join

Table 10: Alternative symbol names

2.16 Change history

Version 2.0 as of 2006-07-31:

- ▷ `\LEFTRIGHT` works with `\lbrace`, `\rbrace`, `\{` and `\}`.
- ▷ Various shapes of curly braces are provided.
- ▷ Improved code to select the size of `\big` delimiters; note that this may cause formulas to require a different amount of space, as compared with the previous package version.

3 Transition from mtpro to mtpro2

As explained above, mtpro2 constitutes the successor to the three packages mtpro, mtpams and mtpb. Transition from the predecessor packages should be easy:

1. Load mtpro2 in place of mtpro; adopt its options (with the exception of boldalphabet, see below).
2. If you were using the package mtpams, pass its options (if any) to mtpro2 now.
3. If you were using the package mtpb, pass its options to mtpro2 now.

Only few incompatibilities are to be mentioned:

- ▷ The syntax of `\xl` & friends has changed: The limits can be specified ‘as usual’ now.
- ▷ The option boldalphabet does not exist any more, and all Greek letters are of type ‘mathalpha’ by default.

▷ No blackboard bold math alphabet `\mathbb` is set up by default. To declare a blackboard bold alphabet, one of the options explained in section 2.9 needs to be used.

4 Option summary

This section lists all options of the mtpro2 package. Options that correspond to the default behavior of the package are marked by an asterisk and need normally not to be specified.

complete* Uses all of the *MathTimeProfessional* fonts.

lite Uses the fonts of the 'lite' release only.

uprightGreek* Makes the uppercase Greek letters upright.

slantedGreek Makes the uppercase Greek letters slanted.

compatiblegreek Declares the lowercase Greek letters as 'ordinary' symbols, which are not affected by math alphabet commands.

uprightoperators* Makes `\sum`, `\prod` and `\coprod` upright.

slantedoperators Makes `\sum`, `\prod` and `\coprod` slanted.

cmcal* Assigns the Computer Modern calligraphic fonts to the math alphabets `\mathcal` and `\mathbcal`.

eucal Assigns Euler Script to `\mathcal` and `\mathbcal`.

mtpluscal Assigns the MTMS and MTMSB script fonts, which were part of Y&Y's *MathTime* Plus collection, to `\mathcal` and `\matbcal`.

lucidacal Assigns Lucida Script to `\mathcal` and `\mathbcal`.

lucidascr Like lucidacal, but assigns the fonts to `\mathscr` and `\mathbscr`.

mtplusscr Like mtpluscal, but assigns the fonts to `\mathscr` and `\mathbscr`.

eufrak Declares a new math alphabet `\mathfrak` and assigns the Euler Calligraphic fonts to it.

amsbb Declares a math alphabet `\mathbb` and assigns the AMS 'B' font.

subscriptcorrection Redefines the underscore character so that it automatically corrects the spacing of subscripts.

nosubscriptcorrection* Disables the subscript correction.

curlybraces* Uses curly braces (for fixed sizes).

straightbraces Uses straight braces.

morphedbraces Uses braces that morph from curly to straight.

zswash Makes `$z$` print z.

nozswash* Makes `$z$` print z.

The following options require the complete font set. They select math fonts that are not part of the 'lite' font set, so they are *not* to be used in conjunction with lite:

mtpcal Assigns *MathTimeProfessional* Script to `\mathcal` and `\mathbcal`.

mtpccal Assigns *MathTimeProfessional* Curly to `\mathcal`.

mtpscr Like mtpcal, but puts the fonts into new `\mathscr` and `\mathbscr` alphabets.

mtpfrak Assigns the *MathTimeProfessional* Fraktur font to `\mathfrak`.

mtphrb Assigns the *MathTimeProfessional* Holey Roman Bold font to `\mathbb`.

mtpbb Assigns the *MathTimeProfessional* Blackboard Bold font to `\mathbb`.

mtphbi Assigns the *MathTimeProfessional* Holey Roman Bold Italic font to `\mathbb`.

mtpbbi Assigns the *MathTimeProfessional* Blackboard Bold Italic font to `\mathbb`.

mtphrd Assigns the *MathTimeProfessional* Holey Roman Bold Dark font to `\mathbb`.

mtpbbd Assigns the *MathTimeProfessional* Blackboard Bold Dark font to `\mathbb`.

amssymbols* Makes the AMS symbols available. This option is disabled automatically when lite is specified.

noamssymbols AMS symbols are not defined, thus saving TEX resources.

This package makes a lot of font re-assignments. Normally these generate warning messages on the terminal, however getting so many messages would be distracting, so a further three options control the font tracing. Even more control may be obtained by loading the tracefnt package.

errorshow* Only show font *errors* on the terminal. Warnings are just sent to the log file.

warningshow Show font warnings on the terminal. This corresponds to the usual LATEX behavior.

nofontinfo Suppress all font warnings, even from the log file.

NB: Not all options can be used together: E.g., one can select at most one of the options setting up `\mathcal`; if more than one such option is given, mtpcal will win over mtpluscal, eucal, lucidacal and cmcal.
NB: The options to set up a `\mathscr`, `\mathfrak` or `\mathbb` alphabet should not be used when an additional package is loaded that also declares one of these math alphabets.

5 Using the Curly, Script, Fraktur and doublestroke fonts without the mtpro2 package

☞ Particular font definition files are provided for the Times-compatible script, fraktur and doublestroke fonts described in the sections 2.6, 2.7 and 2.9. Thus, they can be used also without the mtpro2 package. Table 11 provides the information required to set up math alphabets using these fonts.

Encoding	**family**	**series**	**shape**	
Curly				
U	mt2ms	m	n	$\mathfrak{a}, \mathfrak{b} \ldots \mathfrak{Z}$
Script				
U	mt2ms	m	it	$\mathscr{a}, \mathscr{b} \ldots \mathscr{Z}$
U	mt2ms	b	it	$\boldsymbol{\mathscr{a}}, \boldsymbol{\mathscr{b}} \ldots \boldsymbol{\mathscr{Z}}$
Fraktur				
U	mt2mf	m	n	$\mathfrak{a}, \mathfrak{b} \ldots 3$
U	mt2mf	m	it	$\boldsymbol{\mathfrak{a}, \mathfrak{b} \ldots 3}$
Blackboard Bold				
U	mt2bb	m	n	$\mathbb{a}, \mathbb{B} \ldots \mathbb{Z}$
U	mt2bb	m	it	$\mathbb{a}, \mathbb{B} \ldots \mathbb{Z}$
U	mt2bb	b	n	$\mathbb{a}, \mathbb{B} \ldots \mathbb{Z}$
Holey Roman Bold				
U	mt2hrb	m	n	$\mathbb{a}, \mathbb{B} \ldots \mathbb{Z}$
U	mt2hrb	m	it	$\mathbb{a}, \mathbb{B} \ldots \mathbb{Z}$
U	mt2hrb	b	n	$\mathbb{a}, \mathbb{B} \ldots \mathbb{Z}$

Table 11: NFSS classification of the additional Times-compatible math alphabets