The *alphabeta* package

Günter Milde

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Abstract

The *alphabeta* package makes the standard macros for Greek letters in mathematical mode also available in text mode. This way, you can input Greek letters "by name" everywhere in the document. The mode determines whether the characters are taken from the text or math font.

With 8-bit TeX and *greek-inputenc*, literal Unicode charactes can also be used in mathematical mode. [1]

1 Requirements and Conflicts

The *alphabeta* package depends on *textalpha* (both are part of *greek-fontenc*). It can be used under 8-bit TeX as well as XeTeX/LuaTeX (this document is typeset with 8-bit TeX and fontenc with TeX fonts). Depending on the converter and fonts, different limitations apply.

The package conflicts with *unicode-math*.

It also fails, if the `utf8x` input encoding is selected. (The interface to the *ucs* package uses a non-compatible definition of `\DeclareUnicodeCharacter`.)

2 Usage

Load this package in the preamble of your document (after font and math setup) with

```
\usepackage{alphabeta}
```

Now you can write a single Greek symbol (like Ψ or μ) or a λογος in non-Greek text as well as ISO-conforming formulas with upright symbols for constants like $A = \pi r^2$ (instead of $A = \pi r^2$).[2]

Just like Latin letters, the Greek counterparts are by default italic in math mode[3] and upright in text:

[1] This document was compiled using the font encoding T1 (8-bit fonts). For a version using Unicode fonts, see alphabeta-doc-tu.pdf.

[2] The *isomath* documentation describes more alternatives for upright Greek symbols in math mode.

[3] Capital Greek letters are upright in TeX unless a package selects the "ISO" math-style. See the *isomath* documentation for a detailled discussion of math-styles.

Text: L Γ l γ, mathematics: $L\ \Gamma\ l\ \gamma$

See the source of this document `alphabeta-doc.tex` for a setup and usage example.

2.1 options

Package options are passed to the *textalpha* package. Example call with options:

```
\usepackage[normalize-symbols,keep-semicolon]{alphabeta}
```

`normalize-symbols` merges "letter" and "symbol" variants of some Greek letters (cf. next section) to the "letter" character: Without this option, the symbol variant characters cannot be used in text, because they are not supported by 8-bit Greek fonts (LGR encoding). **Attention**: Be careful in cases where the distinction between the symbol variants may be important (e.g. in a mathematical or scientific context). Use XeTeX/LuaTeX with Unicode fonts or the respective characters in mathematical mode (e.g. π vs. ϖ).

The option `keep-semicolon` prevents conversion of the semicolon to an *ano teleia* in 8-bit TeX (see *textalpha-doc*).

Both options are ignored in text set using Unicode fonts.

2.2 symbol variants

Mathematical notation uses variant shapes of some Greek letters as additional symbols. The variations have no syntactic meaning in Greek text and text fonts may use the variant shapes in place of the "regular" ones as a stylistic choice.

Unicode defines separate code points for the symbol variants. TeX supports some of the variant shape symbols in mathematical mode, but its concept of "standard" vs. "variant" symbols differs from the distinction between "GREEK LETTER ..." vs. "GREEK ... SYMBOL" in the Unicode standard.

The *alphabeta* package defines generic macros for these variants that are short forms of the set defined in `tuenc-greek.def` (cf. test-tuenc-greek):

`\<name>` selects the Unicode GREEK LETTER ... variant,

`\<name>symbol` selects the Unicode GREEK ... SYMBOL variant,

`\var<name>` selects the variant shape according to TeX' mathematical mode

See Table 1 for the full list.

3 Limitations

With 8-bit TeX, the limitations described in the textalpha documentation apply. See also the tests in section 8 bit limitations. These limitations do not apply, if

the text language is switched to “greek” with Babel, the text part is wrapped in `\ensuregreek`, or set using Unicode fonts (with XeTeX/LuaTeX).

With XeTeX/LuaTeX and Unicode fonts, literal Unicode characters cannot be used in formulas (the log file reports missing characters) This is a generic TeX limitation which *alphabeta* overcomes if used under 8-bit TeX. Under XeTeX/LuaTeX it may be circumvented using the *unicode-math* package. Mind, that *unicode-math* conflicts with *alphabeta*.

4 Tests and examples

4.1 Greek alphabet

Greek letters via generic “name” macros without language/font-encoding switch (active font encoding T1):

Α Β Γ Δ Ε Ζ Η Θ Ι Κ Λ Μ Ν Ξ Ο Π Ρ Σ Τ Υ Φ Χ Ψ Ω
α β γ δ ε ζ η ϑ ι ϰ λ μ ν ξ ο π ρ σ ς τ υ φ χ ψ ω
ϝ F ϛ ϟ[4] ͱ ͱ[5] ϙ Ϙ Ϻ Ϡ ϡ

Greek letters via Unicode (active font encoding T1):

Α Β Γ Δ Ε Ζ Η Θ Ι Κ Λ Μ Ν Ξ Ο Π Ρ Σ Τ Υ Φ Χ Ψ Ω
α β γ δ ε ζ η ϑ ι ϰ λ μ ν ξ ο π ρ σ ς τ υ φ χ ψ ω
ϝ F ϛ ͱ ͱ ϙ Ϙ Ϻ Ϡ ϡ

4.2 Diacritics

Accent macros are set up for use with the generic macros by definition of “TextComposite” commands.

Diacritics (except the dialytika) should placed before capital letters and dropped with MakeUppercase:

ά ὲ ΐ ῆ ő ΰ ῶ
Ά Έ Ί Ή Ő Ύ Ώ
A E Ϊ H O Υ Ω

4.3 normalize-symbols

The `normalize-symbols` option merges “letters” and “symbol“ variants of some Greek letters to the “letter” character. It is ignored, if the document uses Unicode fonts and is compiled with XeTeX or LuaTeX. (This document is compiled using 8-bit TeX.)

> The source of this quote uses both variants for beta (β|β), epsilon (ε|ε), phi (φ|φ), kappa (ϰ|ϰ), pi (π|π), rho (ϱ|ϱ), theta (ϑ|ϑ), and Theta (Θ|Θ) in the LaTeX source.

[4] There is no separate Unicode code point for a stigma variant symbol, `\varstigma` is not defined with Xe/LuaTeX and similar to `\stigma` in some fonts.

[5] In LGR, there is no separate glyph for uppercase Koppa.

4.4 ῾Ελληνικά (῾Ελληνικά) in PDF strings

With the alphabeta package, you get Greek letters in both, the document body and PDF metadata generated by hyperref if the input uses Unicode literals or macros. Wrapping in `\ensuregreek` ensures the right placement of the accents and breathings (before, not above capital letters). With LICR input (accent macros as well as symbol macros), non-standard diacritics are missing in the PDF data, as hyperref's PU encoding currently does not support polytonic Greek. (Here, the dasia is dropped at the start of the word in parentheses in the PDF toc. The warning "`Glyph not defined in PU encoding, removing '\<' on input line 145.`" is written to the log.)

4.5 Greek in maths $\Gamma = \sin\alpha / \cos\beta$

In the main document, Greek in math mode should work as usual:

$$\Gamma = \frac{\sin\alpha}{\cos\beta}.$$

Greek letters and symbols in math mode,[6] input as macro:

$$\Gamma\Delta\Theta\Lambda\Xi\Pi\Sigma\Upsilon\Phi\Psi\Omega$$
$$\alpha\beta\gamma\delta\epsilon\zeta\eta\theta\iota\kappa\lambda\mu\nu\xi\pi\rho\sigma\varsigma\tau\upsilon\phi\chi\psi\omega$$
$$\vartheta\varphi\varpi\digamma\varrho\varepsilon$$

PDF strings do not know math mode. The content of a formula or equation is evaluated in text mode with non-valid commands discarded (and warnings written to the log). This works resonably well for simple formulas (but not, e.g., for super-/subscripts). With the *alphabeta* package, it works also for Greek letters.

4.6 Greek Unicode characters in math

With 8-bit TeX and *greek-inputenc*, literal Greek Unicode characters are supported also in mathematical mode.

$$Γ = \frac{\sin α}{\cos β}.$$

Greek letters and symbols in math mode, input as Unicode literals:

$$ΓΔΘΛΞΠΣΥΦΨΩ$$
$$αβγδεζηθικλμνξπρστυφχψω$$
$$ϑϕϖϝϱϵ$$

[6] There are no math macros for Greek letters wich exist with similar shape in the Latin alphabet

This does not work with XeTeX/LuaTeX (unless in 8-bit emulation mode). Here, *unicode-math* can be used instead of *alphabeta*.

The "normal" vs. "variant" shape of letters is used so that the output matches the Unicode reference glyph (cf. Table 1). This corresponds to the behaviour of *unicode-math*.

4.7 8-bit limitations

Certain limitations apply if Greek LICRs are used in non-Greek context with 8-bit TeX fonts (this document is typeset using 8-bit fonts).

- Composition of diacritics (like `\>\'`) fails: ά ἐ ΐ ῆ <ο <υ >ω

  Simple diacritics and long names (like `\accdasiaoxia`) work in any font encoding, however they do not select precomposed characters (the difference becomes obvious if you drag-and-drop text from the PDF version of this document): ᾰ ᾰ ᾰ (ΛΓΡ) vs. ᾰ (T1)

- MakeUppercase fails with composite diacritics in other font encodings.[7]

- There is no kerning between Greek letters, if the font encoding does not support Greek: compare AΥA (ΛΓΡ) to AΥA (T1).

The `\ensuregreek` macro ensures that the argument is typeset with a font encoding supporting Greek. This keeps kerning (if the kerning pair is inside the argument, AΫA), and allows combining of accent macros where pre-composed characters are selected (ᾰ). Setting the corrct language for Greek text parts with the *babel* package additionally ensures correct hyphenation and upcasing.

[7] Since the re-implementation 2022/06, MakeUppercase follows the Greek typesetting rules only for text parts given the *babel* language `greek`.

macro	text	math
\beta	β	β
\varbeta	β	⊘
\betasymbol	β	⊘
\epsilon	ε	ϵ
\varepsilon	ε	ε
\epsilonsymbol	ε	ϵ
\phi	φ	ϕ
\varphi	φ	φ
\phisymbol	φ	ϕ
\kappa	ϰ	κ
\varkappa	ϰ	$\varkappa$
\kappasymbol	ϰ	$\varkappa$
\pi	π	π
\varpi	π	ϖ
\pisymbol	π	ϖ
\rho	ρ	ρ
\varrho	ρ	ϱ
\rhosymbol	ρ	ϱ
\sigma	σ	σ
\varsigma	ς	ς
\finalsigma	ς	ς
\theta	ϑ	θ
\vartheta	ϑ	ϑ
\thetasymbol	ϑ	ϑ
\Theta	Θ	Θ
\varTheta	⊘	Θ
\Thetasymbol	Θ	⊘

Table 1: Macros for Greek symbol variants (⊘= symbol only available with additional packages). With 8-bit TeX and the `normalize-symbols` option, the output for both variants in text mode is the same (8-bit Greek text fonts contain only one symbol variant).