# Arev Sans for TEX and LATEX

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## 1 Introduction

Bitstream Vera was designed by Jim Lyles of Bitstream, Inc., in cooperation with the Gnome Foundation as a high quality scalable free font for use with free open-source software [4]. The Bitstream Vera family includes serif, sans serif, and monospaced fonts,[1] and all three fonts have normal, oblique, bold, and bold oblique faces. Bitstream Vera is primarily intended as a screen font (though it also works well as a print font) and has hinting for display on low-resolution devices such as computer monitors and projectors. All three fonts have large *x* height, wide letters and spacing, and "open" letters,[2] resulting in fonts that are extremely easy to read at small sizes or on projected displays.

Tavmjong Bah created Arev Sans[3] by extending Bitstream Vera Sans to include Greek, Cyrillic, and many mathematical symbols [1]. The new glyphs added by Bah accurately capture the feel of the Latin letters and so seamlessly integrate into the font. Bah's intention was to add symbols that are useful for technical writing, and hence the Greek letters are typical of those used in mathematics and science and not of the letters used in writing the Greek language.[4] At the author's request, Bah also added several alternate glyphs for some of the Latin and Greek letters. This was mainly done so that all of the letters can be clearly distinguished when in mathematics and not surrounded by other letters or even aligned with the baseline.[5] Additionally, several alternate glyphs were added that are "warmer" or more "humanist" than the strict "geometric" glyphs.[6] These extra glyphs add a degree of warmth to mathematics written in Arev Sans that is not achieved with other sans serif fonts.

Figure 1 shows a sample of Arev Sans being used for text and mathematics. The primary use that the author sees for Arev Sans in LATEX is for presentations, and especially for those that are displayed with a computer projector. The attributes of Bitstream Vera and Arev mentioned above make Arev particularly suited for this purpose. Besides Arev, there are only a few other options for sans serif fonts in LATEX, and none of them are entirely satisfactory. Computer Modern sans serif and the SliTEX sans serif[7] fonts can be used for text, but Computer Modern roman is still used for mathematics. Walter Schmidt's Computer Modern Bright[8] (`cmbright`[5]) is a sans serif family that includes both text and

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[1] The text of this document is set in Bera Serif and Mono [3], a repackaging of Bitstream Vera for TEX.

[2] For instance, compare the lowercase "e" of Arev Sans with that of Helvetica.

[3] Per the license for Bitstream Vera, any derivative fonts must have a different name.

[4] Specifically, alpha is not the same as lowercase "a," nu is not the same as lowercase "v," and Upsilon is not the same as uppercase "Y."

[5] The lowercase "l" and the uppercase "I" in particular are almost identical in Bitstream Vera Sans. The lowercase phi and original uppercase Phi in Arev Sans are also difficult to distinguish without a baseline.

[6] The extra glyphs include "a," "i," "l," "u," "v," "w," "x," and uppercase Pi and Phi. The florin is used as an alternate "f."

[7] Arev Sans is actually very similar to SliTEX sans serif (`lcmss`) in that both have large *x* height, have wide letters and spacing, and have "open" letters. Arev Sans is heavier than SliTEX sans serif though, which makes it more suitable for computer projectors.

[8] Harald Halders created Type 1 Postcript font versions of the `cmbright` fonts called `hfbright`. The fonts were created by tracing high resolution bitmaps, and so are not perfect. However, scalable Type 1 fonts greatly improve the quality of Postscript and `.pdf` files on computer screens and projectors.

**Theorem 1 (Residue Theorem).** Let $f$ be analytic in the region $G$ except for the isolated singularities $a_1, a_2, \dots, a_m$. If $\gamma$ is a closed rectifiable curve in $G$ which does not pass through any of the points $a_k$ and if $\gamma \approx 0$ in $G$ then

$$\frac{1}{2\pi i}\int_\gamma f = \sum_{k=1}^{m} n(\gamma; a_k)\operatorname{Res}(f; a_k).$$

Another nice theorem from complex analysis is

**Theorem 2 (Maximum Modulus).** Let $G$ be a bounded open set in $\mathbb{C}$ and suppose that $f$ is a continuous function on $G^-$ which is analytic in $G$. Then

$$\max\{|f(z)| : z \in G^-\} = \max\{|f(z)| : z \in \partial G\}.$$

ABCDEFGHIJKLMNOPQRSTUVWXYZ $ABCDEFGHIJKLMNOPQRSTUVWXYZ$
abcdefghijklmnopqrstuvwxyz $abcdefghijklmnopqrstuvwxyz$ $\ell\wp\aleph\infty\propto\emptyset\nabla\partial$
$\Gamma\Delta\Theta\Lambda\Xi\Pi\Sigma\Upsilon\Phi\Psi\Omega$ $\alpha\beta\gamma\delta\epsilon\varepsilon\zeta\eta\theta\vartheta\iota\kappa\lambda\mu\nu\xi o\pi\varpi\rho\sigma\varsigma\tau\upsilon\phi\varphi\chi\psi\omega$ 01234567890

Figure 1: Font sample of Arev Sans text and math.

mathematics, but is very thin and does not display well on a computer projector. Kerkis Sans[9] is based on Avant Garde and includes Greek sans serif glyphs, but is also very thin. Helvetica and other PostScript sans serif fonts can be used for text and for Latin letters in mathematics, but they do not have matching Greek letters or the proper weight for geometric mathematical symbols.

The `arev` package works well with the LaTeX package `beamer`[2] with the `professionalfonts` option.

Figures 2-7 show examples of `beamer` with the font options mentioned above where each slide is scaled to 90% of its default size, and Figures 8-13 show side-by-side examples scaled to 50%. SliTeX sans serif is loaded into `beamer` using TeXPower's `tpslifonts.sty` [13].

## 2 Implementation

With internationalization of computer software and the growing use of Unicode, many free scalable fonts are available that include both Latin and Greek letters. However, making use of these fonts for mathematics in LaTeX is a nontrivial task: not only are there many subtleties to using fonts in LaTeX, but the documentation is scattered among many sources and there are few examples to consult. The author hopes that the `arev` package can serve as a template for others who wish to create new math font packages for LaTeX.

The excellent GPLed font editor FontForge [6] was used by Bah to create Arev Sans and was used by the author for creating PostScript `pfb`, `afm` , and TeX `tfm` files. The Bash shell script `afmtoglyphlist` was used to extract the glyph names from the `afm` file into a list that a `fontinst` script used for renaming glyphs. The magic of `fontinst` was used to create virtual fonts and font metrics, LaTeX font definition files, and the `dvips` map file.

The vertical placement of math accents requires the accents to be appropriately placed for characters 1 ex high. The accents also need to have a zero depth, which is set by the file `fixot1accents.mtx` (based on their bounding boxes, the accents naturally have negative depths). Horizontal placement of math accents is done by centering the accent over the character, and then adjusting the position by

## Characterization of the Imaginary Forms

**Theorem.**
Let $S = \{v_1, v_2, \ldots, v_k\}$ be a set of vectors in $\mathbb{R}^n$.

Consider $\mathcal{F}(S) = \sum_{i=1}^{k} \delta(v_i v_j w)\sigma_{i,j}$.

If $\mathcal{F}(S) \leq \varepsilon$, then

$$\phi(S,\alpha) = \frac{1}{2\pi i}\int_{-\infty}^{753} \frac{\tilde{W}_n(\gamma)\cos\left(\sqrt{x^2}\right)}{f'(x)R/a}dx = \det\begin{pmatrix} \alpha^2 & \Pi \\ \omega & x\otimes y \end{pmatrix}$$

*Note*: If $\beta \in \Gamma$, then the form is undefined at the points in $S \cap \Gamma$, and the integral $I_l(i_1)$ diverges as $\varepsilon \to 0$. This pathological behavior can be handled by taking $\Gamma \subseteq S$.

Figure 2: Arev Sans

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Figure 3: SliTEX font (`lcmss`)

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Figure 4: Computer Modern sans serif (`cmss`)

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*Note*: If $\beta \in \mathit{\Gamma}$, then the form is undefined at the points in $S \cap \mathit{\Gamma}$, and the integral $I_l(i_1)$ diverges as $\varepsilon \to 0$. This pathological behavior can be handled by taking $\mathit{\Gamma} \subseteq S$.

Figure 5: CM Bright

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*Note*: If $\beta \in \Gamma$, then the form is undefined at the points in $S \cap \Gamma$, and the integral $I_l(i_1)$ diverges as $\varepsilon \to 0$. This pathological behavior can be handled by taking $\Gamma \subseteq S$.

Figure 6: Kerkis Sans

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*Note*: If $\beta \in \Gamma$, then the form is undefined at the points in $S \cap \Gamma$, and the integral $I_l(i_1)$ diverges as $\varepsilon \to 0$. This pathological behavior can be handled by taking $\Gamma \subseteq S$.

Figure 7: Helvetica

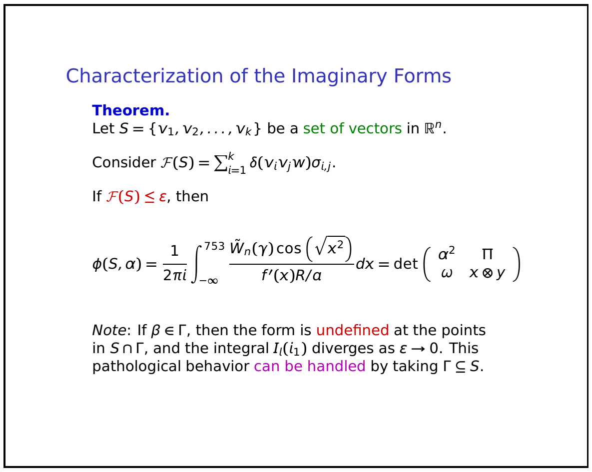


Figure 8: Arev Sans

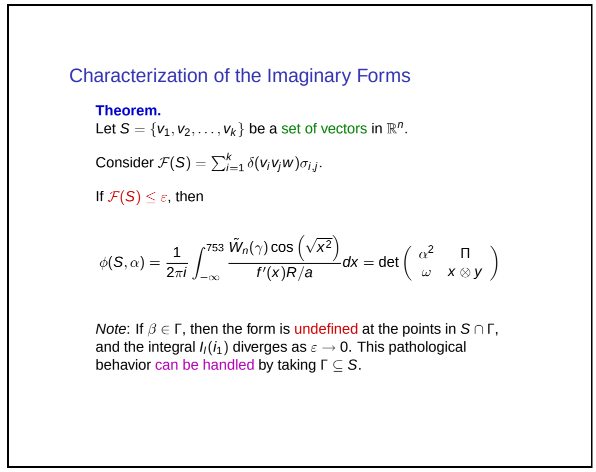


Figure 9: Helvetica

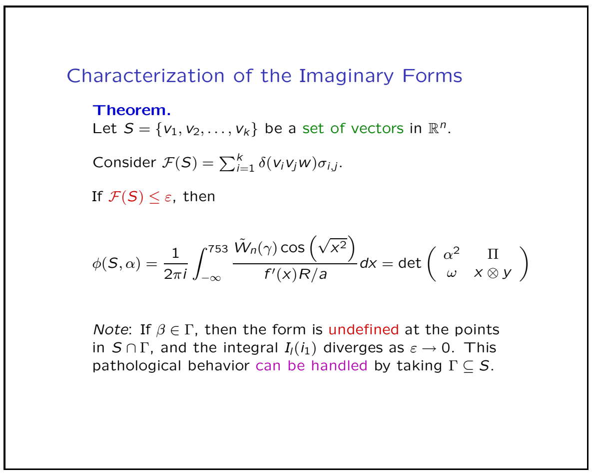


Figure 10: SliTEX font (lcmss)

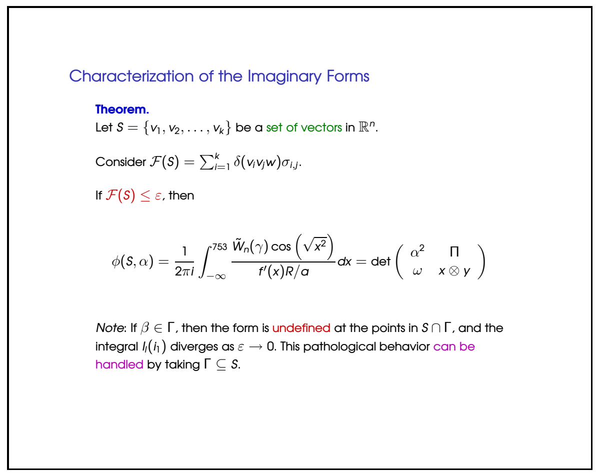


Figure 11: Kerkis Sans

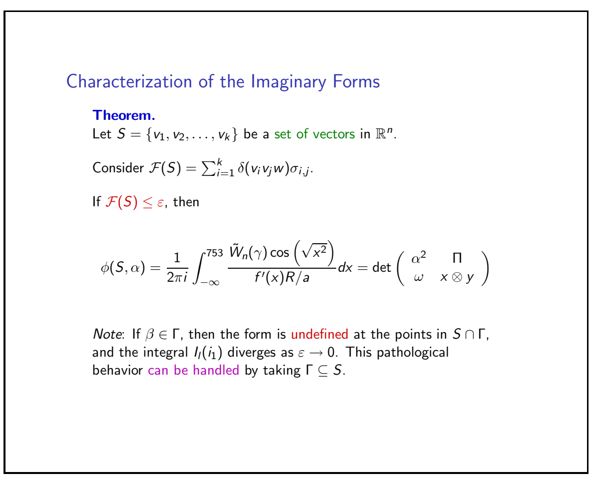


Figure 12: Computer Modern sans serif (cmss)

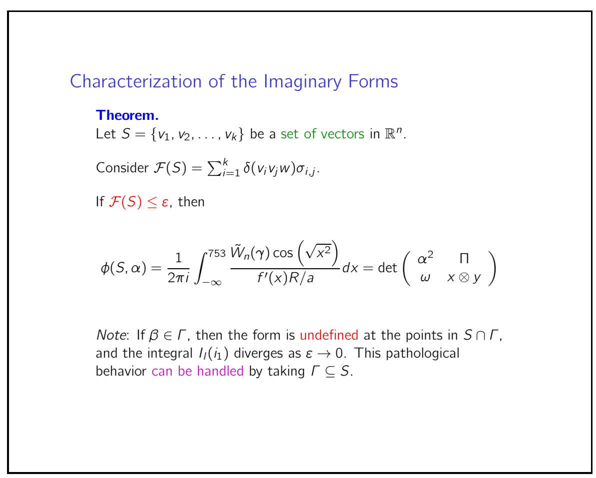


Figure 13: CM Bright

the kern between the character on the left and a special character called the *skewchar*. To better visualize the placement of the accents, the graphical kerning dialog box in FontForge was used, and then the script `afmtokernaccent` extracts this kern information from the `afm` file and creates `mtx` files that calculate the appropriate kern. The one difficulty in implementing this in `fontinst` is that the kerning data must be reglyphed before applied to the font metrics.

Arev Sans is used for all letter-like symbols, including Latin and Greek letters. Arev Sans includes many mathematical symbols, but not the full range of symbols included in Computer Modern or the AMS symbol fonts. The Math Design Bitstream Charter [10] bold math font comes very close to the weight of Arev Sans, and so is used for the majority of geometric symbols[9]. Computer Modern is used for the default calligraphic font, Fourier-GUTenberg [8] for blackboard bold (since the letters are sans serif), Ralph Smith Formal Script for script, and the AMS font for fraktur. One disadvantage of using so many different fonts for mathematics is that TEX can only have sixteen simultaneously loaded fonts, and the Arev package comes very close to this limit.

The file `mathtesty.tex` is a combination of the file `mathtestx.tex` from the `mathptmx` package [11] and the `symbols.tex` file of David Carlisle. It is very useful for testing all of the math styles and symbols for a given font setup.

There are three LATEX packages for use with Arev Sans: `arev`, `arevtext`, and `arevmath`. The `arev` package simply loads both `arevtext` and `arevmath`. `arevtext` changes the default text font (both roman and sans serif) to Arev Sans. `arevtext` also changes the default typewriter font to Bera Mono, a repackaging of Bitstream Vera Mono for TEX. `arevmath` sets the math fonts as described above. In addition to the normal styles, the `\mathbm` command changes the math font to bold italic.

Variant letters defined by `arevmath`:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| *a* | `\origa` | *a* | `\vara` | *I* | `\origI` | *I* | `\varI` |
| *i* | `\origi` | *i* | `\vari` | *I* | `\origIota` | *I* | `\varIota` |
| *ı* | `\origimath` | *ı* | `\varimath` | Π | `\origPi` | Π | `\varPi` |
| *f* | `\origf` | *ƒ* | `\varf` | Φ | `\origPhi` | Φ | `\varPhi` |
| *l* | `\origl` | *l* | `\varl` | | | | |
| *u* | `\origu` | *u* | `\varu` | | | | |
| *v* | `\origv` | *v* | `\varv` | | | | |
| *w* | `\origw` | *w* | `\varw` | | | | |
| *x* | `\origx` | *x* | `\varx` | | | | |

Extra symbols defined by `arevmath`:

| | | | |
|---|---|---|---|
| ♤ | `\varspade` | ♩ | `\quarternote` |
| ♥ | `\varheart` | ♪ | `\eighthnote` |
| ♦ | `\vardiamond` | ♬ | `\sixteenthnote` |
| ♧ | `\varclub` | ♨ | `\steaming` |

All of the variant letters are selected by default except for the variant "f" (which is a florin symbol). The user can choose which variants to use by selecting the package option `origletters`, and then choosing the variants from the options `vara`, `vari`, `varf`, `varl`, `varu`, `varv`, `varw`, `varx`, `varI`, `varPi`, and `varPhi`. Note that there is no `varimath` option, which follows the `vari` selection, or `varIota` option, since Iota is treated the same as "I." For example, if a user selected

```
\usepackage[origletters,vara,varf,varPi]{arevmath}
```

the following letters would be used:

[9]The Math Design Bitstream Charter math fonts have a few minor flaws: for instance, in the formation of square root symbols and overbraces. However, most of the symbols are of fine quality, and the range of symbols is impressive.

$ai\imath fluvwxI\Pi\Phi$ `$ai\imath fluvwxI\Pi\Phi$`

A possible future capability of the `arevmath` package is the ability to choose either italic or upright Greek letters. This would require modification of the variant letters code as well.

## 3 Licenses

Bitstream Vera is released under a special license that allows free distribution. The fonts may also be modified and extended, as long as the resulting fonts are released under a different name. Arev Sans is released under the same license as Bitstream Vera. However, Arev's creator Tavmjong Bah requests that TrueType versions of Arev be obtained from his website at [1] instead of being converted from the Postscript fonts included with the LaTeX package. FontForge source files may also be obtained at his website.

The virtual fonts, font definitions, LaTeX packages and other supporting files of the `arev` package are released under the LaTeX Project Public License (LPPL), version 1.2. The one exception is the file `ams-mdbch.sty`, which was taken from the Math Design Bitstream Charter package. This file is released under the GNU General Public License (GPL), version 2.

## 4 Acknowledgments

The author would like to thank Tavmjong Bah for his willingness to add characters to Arev Sans; George Williams for a prompt response and patch on the FontForge mailing list; and Lars Hellström for help with math accents and `fontinst` on the `tex-fonts` and `fontinst` mailing lists.

## References

[1] Arev Sans by Tavmjong Bah, `http://tavmjong.free.fr/FONTS`.

[2] LaTeX class `beamer` by Till Tantau, `http://latex-beamer.sourceforge.net`.

[3] Bera Postscript Type 1 fonts by Malte Rosenau (converted from Bitstream Vera fonts, which necessitated the name change) and LaTeX support files by Walter Schmidt, CTAN:`/fonts/bera`.

[4] Bitstream Vera by Jim Lyles of Bitstream, Inc., released in cooperation with the Gnome Foundation, `http://www.gnome.org/fonts`.

[5] Computer Modern Bright fonts and `cmbright` LaTeX package by Walter Schmidt, CTAN:`/fonts/cmbright`.

[6] FontForge font editor by George Williams, `http://fontforge.sourceforge.net`.

[7] `fontinst` TeX font installation utility by Alan Jeffrey, Sebastian Rahtz, Ulrik Vieth, Lars Hellström, and Rowland McDonnell, CTAN:`/fonts/utilities/fontinst`.

[8] Fourier-GUTenberg fonts and LaTeX package by Michel Bovani, CTAN:`/fonts/fourier-GUT`.

[9] Kerkis font by Antonis Tsolomitis, CTAN:`/fonts/greek/kerkis`.

[10] Math Design fonts for Bitstream Charter by Paul Pichaureau, CTAN:`/fonts/mathdesign`.

[11] `mathptmx` by Walter Schmidt, part of the `psnfss` package, CTAN:`/fonts/psfonts/psnfss-source`.

[12] Ralph Smith Formal Script (`rsfs`) font by Ralph Smith, Postscript Type 1 version by Taco Hoekwater, CTAN:`/fonts/rsfs`.

[13] TeXPower LaTeX style files by Stephan Lehmke, `http://texpower.sourceforge.net`.