A Survey of Free Math Fonts for TEX and LATEX*

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May 5, 2006

Contents

An initial version of this article appeared in *The PracTEX Journal*, 1, 2006, http://www.tug.org/pracjourn/2006-1/hartke/.
The permanent home of this article is http://ctan.tug.org/tex-archive/info/Free_Math_Font_Survey.
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1 Introduction

One of the biggest challenges in selecting a font for TEX or LATEX is that there are not very many math fonts that match the plethora of available text fonts. It's reasonably easy to use an arbitrary Postscript Type 1 font in TEX for text (see Philipp Lehman's Font Installation Guide [1]), but obtaining and configuring a matching math font from scratch is a demanding task. Thus, there are few math fonts for TEX, and in particular very few free ones. However, in the past few years, several very nice free fonts have been released. The goal of this article is to list all of the free math fonts and to provide examples.

"Free" here means fonts that are free to use (both commercially and non-commercially) and free to distribute, but not necessarily free to modify. I also am biased towards listing fonts that have outline versions in PostScript Type 1 format suitable for embedding in Postscript PS or Adobe Acrobat PDF files. Donald E. Knuth originally designed the METAFONT system for producing fonts for TEX in bitmap format. PS or PDF files that have embedded bitmap fonts do not display well in Adobe Acrobat Reader,[1] to the point of being almost unreadable on the screen, and are also noticeable when printing at extremely high resolutions (on photo-setters, for instance). Since outline fonts contain mathematical descriptions of the curves used in each glyph, they can be scaled to any resolution while retaining image quality.

The fonts listed here are categorized according to their origin: whether originally designed for TEX, related to the standard Postscript fonts, or other free fonts. A font's origin does not particularly bear on its quality or suitability for typesetting mathematics. No recommendations or evaluations of the fonts are given here, as people's tastes in fonts vary greatly. The goal of this survey is simply to make authors aware of all their options.

Most of the fonts can be selected by including a single package in the preamble of the user's LATEX file (the *preamble* is the section after "`\documentclass{}`" and before "`\begin{document}`"). The line or lines to include for each font are listed in the caption of the sample figure. For example "`\usepackage{fourier}`" uses Utopia and FourierGUTenberg, as shown in the sample LATEX file in Section 6.

Walter A. Schmidt also has a survey in German of math fonts [3] that concentrates more on commercial fonts. Schmidt's survey has several examples that show different pairings between text fonts and math fonts.

2 Fonts Originally Designed for TEX

These fonts were originally designed for use with TEX, using either METAFONT or MetaType1 [2].

Computer Modern: Knuth created Computer Modern [5] as the default font for TEX. The font set includes serif, sans serif, and monospaced text faces, and corresponding math fonts. The math symbol set is very complete. Computer Modern is *the* font for TEX, which leads some to claim that the font is overused. The characters are fairly thin and light, and

[1] Starting with version 6, Adobe Acrobat Reader displays bitmap fonts fine. The free PDF viewers Ghostview and xpdf have always displayed bitmap fonts accurately.

Figure 1: Computer Modern (using the Blue Sky and Y&Y Type 1 fonts; no package necessary).

Theorem 1 (Residue Theorem). Let f be analytic in the region G except for the isolated singularities $a_1, a_2, \ldots, a_m$. If γ 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

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

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*

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

AΛΔ∇BCDΣEFΓGHIJKLMNOΘΩ℧PΦΠΞQRSTUVWXYϒΨZ 1234567890
$a\alpha b\beta c\partial d\delta e\epsilon\varepsilon f\zeta\xi g\gamma h\hbar\hbar\imath i\jmath jk\kappa\varkappa l\ell\lambda mn\eta\theta\vartheta o\sigma\varsigma\phi\varphi\wp p\rho\varrho qrst\tau\pi u\mu\nu v\upsilon w\omega\varpi x\chi y\psi z \infty \propto \emptyset\varnothing \mathrm{d}\eth \ni$

so are not as readable on screen in small sizes or from high-resolution laser printers.[2] In a comparison by Raph Levien [6], the printing in Knuth's *Digital Typography* [7] is heavier than the digital version or from a laser printer.

Type 1 versions of Computer Modern from Blue Sky Research and Y&Y, Inc. have been made freely available by the American Mathematical Society (AMS) and a collection of publishers and other technical companies [8, 4]. Basil K. Malyshev has also released a free Type 1 version of Computer Modern [9], originally for use with his TEX system BaKoMa TEX.

Computer Modern has been extended to include more characters, particularly for non-English European languages. These fonts include European Computer Modern by Jörg Knappen and Norbert Schwarz (METAFONT only) [10]; Tt2001 by Szabó Péter (converted into Type 1 format from METAFONT sources using `textrace`; Tt2001 has been superseded by CM-Super, which Péter recommends) [12, 11]; CM-Super by Vladimir Volovich (also converted using `textrace`) [14, 13]; and Latin Modern by Bogusław Jackowski and Janusz M. Nowacki (extended from the Blue Sky AMS fonts using MetaType1) [16, 15].

The SliTEX font (`lcmss`) is a sans serif text face that has wide letters and high x height. Its high readability makes it extremely suitable for slide presentations. However, there is no matching math font. SliTEX sans serif can be set as the primary text font using TEXPower's `tpslifonts.sty` [17].

Computer Modern Bright: This a sans serif font with corresponding math font derived from Computer Modern by Walter A. Schmidt [18]. CM-Super contains Type 1 versions

[2]When on screen, the fonts are usually anti-aliased, often into a gray blur because the stems are not thick enough to fill a pixel. When printed with a high-resolution laser printer, the fonts are shown accurately, but I think are too thin. With a medium-resolution printer like an inkjet, there's enough resolution to show the form of the letters (unlike on screen), but the low-resolution "bulks up" the letters compared to a high-resolution laser printer, with the letters thus appearing darker.

Figure 2: CM Bright (`\usepackage{cmbright}`; output uses the `hfbright` fonts).

Theorem 1 (Residue Theorem). Let f be analytic in the region G except for the isolated singularities $a_1, a_2, \ldots, a_m$. If γ 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

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AΛΔ∇BCDΣEFΓGHIJKLMNOΘΩϑPΦΠΞQRSTUVWXYϒΨZ 1234567890
$a\alpha b\beta c\partial d\delta e\epsilon\varepsilon f\zeta\xi g\gamma h\hbar\hbar\imath i\jmath jk\kappa\varkappa l\ell\lambda mn\eta\theta\vartheta o\sigma\varsigma\phi\varphi p\varpi p\varrho qrst\tau\pi u\mu\nu v\upsilon w\omega\varpi x\chi y\psi z$ $\infty \propto \emptyset\varnothing \mathrm{d}\eth$ ə

of the text fonts in T1 encoding, and Harald Harders created Type 1 versions of the text and math fonts called `hfbright` [19] using `mftrace`.

Concrete and Euler or Concrete Math: The Concrete font was created by Knuth for his book *Concrete Mathematics* [20]. Hermann Zapf was commissioned by the AMS to create the math font Euler for use in *Concrete Mathematics*. Type 1 versions of Concrete in T1 encoding are available in the CM-Super collection [13], and Type 1 versions of Euler are available in the Blue Sky collection from the AMS [8] and in the BaKoMa collection [9]. The `eulervm` package by Walter Schmidt [23, 24] implements virtual fonts for Euler that are more efficient to use with LaTeX. Ulrik Vieth created the Concrete Math fonts [21] to match the Concrete text fonts; the only free versions are implemented in METAFONT. The `ccfonts` package by Walter Schmidt [22] changes the text font to Concrete and changes the math font to the Concrete Math fonts if `eulervm` is not loaded.

Iwona and Kurier: The fonts Iwona and Kurier were created by J. M. Nowacki [25, 26] using the MetaType1 system based on typefaces by the Polish typographer Małgorzata Budyta. The two fonts are very similar, except that Kurier avoids "ink traps" with gaps in its strokes. The packages have complete math support in both TeX and LaTeX.

Antykwa Półtawskiego: J. M. Nowacki created the font Antykwa Półtawskiego [27] using the MetaType1 system based on a typeface by Polish typographer Adam Półtawski. The package `antpolt` has no math support at this time, and requires the encoding to be set to QX or OT4.

Antykwa Toruńska: The font Antykwa Toruńska was created by J. M. Nowacki [29, 28] using the MetaType1 system based on a typeface by the Polish typographer Zygfryd Gardzielewski. The package `anttor` has complete math support in both TeX and LaTeX.

Figure 3: Concrete text with Euler math (`\usepackage{ccfonts,eulervm}` `\usepackage[T1]{fontenc}`). Note that Concrete does not have a bold font, so Computer Modern is used instead. Non-bold text output uses the CM-Super Concrete fonts.

Theorem 1 (Residue Theorem). Let f be analytic in the region G except for the isolated singularities $a_1, a_2, \ldots, a_m$. If γ 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

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AΛΔ∇BCDΣEFΓGHIJKLMNOΘΩϑPΦΠΞQRSTUVWXYϒΨZ 1234567890
aαbβcðdδeϵεfζξgγhℏħıiȷjkκϰlℓλmnηθϑoσsφφϕpϱρqrstτπuμννvwωϖxχyψz ∞ ∝ ∅∅dð ə

Figure 4: Concrete text with Concrete math (`\usepackage{ccfonts}` `\usepackage[T1]{fontenc}`). Note that Concrete does not have a bold font, so Computer Modern is used instead. Non-bold text output uses the CM-Super Concrete fonts.

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AΛΔ∇BCDΣEFΓGHIJKLMNOΘΩϑPΦΠΞQRSTUVWXYϒΨZ 1234567890
$a\alpha b\beta c\eth d\delta e\epsilon\varepsilon f\zeta\xi g\gamma h\hbar\hbar\imath i\jmath jk\kappa\varkappa l\ell\lambda mn\eta\theta\vartheta o\sigma\varsigma\phi\varphi\wp p\varrho\rho qrst\tau\pi u\mu\nu\nu vw\omega\varpi x\chi y\psi z$ ∞ ∝ ∅∅dð ə

Figure 5: Iwona text and math (\usepackage[math]{iwona}).

Theorem 1 (Residue Theorem). Let f be analytic in the region G except for the isolated singularities $a_1, a_2, \ldots, a_m$. If γ 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

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$$\max\{|f(z)| : z \in G^-\} = \max\{|f(z)| : z \in 6G\}.$$

AΛΔ∇BCDΣEFΓGHIJKLMNOΘΩϑPΦΠΞQRSTUVWXYΥΨZ 1234567890
$a\alpha b\beta c6d\delta e\epsilon\varepsilon f\zeta\xi g\gamma h\hbar\hbar\imath ijk\kappa\varkappa l\ell\lambda mn\eta\theta\vartheta o\sigma\varsigma\phi\varphi\wp pp\varrho qrst\tau\pi u\mu\nu\upsilon vw\omega\varpi x\chi y\psi z\ \infty \propto \emptyset\varnothing \mathrm{d}\eth\ \ni$

Figure 6: Kurier text and math (\usepackage[math]{kurier}).

Theorem 1 (Residue Theorem). Let f be analytic in the region G except for the isolated singularities $a_1, a_2, \ldots, a_m$. If γ 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

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AΛΔ∇BCDΣEFΓGHIJKLMNOΘΩϑPΦΠΞQRSTUVWXYΥΨZ 1234567890
$a\alpha b\beta c\partial d\delta e\epsilon\varepsilon f\zeta\xi g\gamma h\hbar\hbar\imath ijk\kappa\varkappa l\ell\lambda mn\eta\theta\vartheta o\sigma\varsigma\phi\varphi\wp pp\varrho qrst\tau\pi u\mu\nu\upsilon vw\omega\varpi x\chi y\psi z\ \infty \propto \emptyset\varnothing \mathrm{d}\eth\ \ni$

Figure 7: Antykwa Półtawskiego text (`\usepackage{antpolt}` and `\usepackage[QX]{fontenc}`).

Theorem 1 (Residue Theorem). Let f be analytic in the region G except for the isolated singularities $a_1, a_2, \ldots, a_m$. If γ 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

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AΛΔ∇BCDΣEFΓGHIJKLMNOΘΩ℧PΦΠΞQRSTUVWXYϒΨZ 1234567890
$a\alpha b\beta c\partial d\delta e\epsilon\varepsilon f\zeta\xi g\gamma h\hbar\hbar\imath i\jmath jk\kappa\varkappa l\ell\lambda mn\eta\theta\vartheta o\sigma\varsigma\phi\varphi\wp p\rho\varrho qrst\tau\pi u\mu\nu v\upsilon w\omega\varpi x\chi y\psi z$ $\infty \propto \emptyset\varnothing \mathrm{d}\eth$ ə

Figure 8: Antykwa Toruńska text and math (`\usepackage[math]{anttor}`).

Theorem 1 (Residue Theorem). Let f be analytic in the region G except for the isolated singularities $a_1, a_2, \ldots, a_m$. If γ 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

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AΛΔ∇BCDΣEFΓGHIJKLMNOΘΩ℧PΦΠΞQRSTUVWXYϒΨZ 1234567890
$a\alpha b\beta c\partial d\delta e\epsilon\varepsilon f\zeta\xi g\gamma h\hbar\hbar\imath ijk\kappa\varkappa l\ell\lambda mn\eta\theta\vartheta o\sigma\varsigma\phi\varphi\wp p\rho\varrho qrst\tau\pi u\mu\nu v\upsilon w\omega\varpi x\chi y\psi z$ $\infty \propto \emptyset\varnothing \mathrm{d}\eth$ ə

Adobe Postscript	URW++/Ghostscript	# of fonts	package
Avant Garde	URW Gothic L	4	`avant`
Bookman	URW Bookman L	4	`bookman`
Courier	Nimbus Mono L	4	`courier`
Helvetica	Nimbus Sans L	8	`helvet`
New Century Schoolbook	Century Schoolbook L	4	`newcent`
Palatino	URW Palladio L	4	`palatino`
Symbol	Standard Symbols L	1	—
Times	Nimbus Roman No. 9 L	4	`times`
Zapf Chancery	URW Chancery L	1	`chancery`
Zapf Dingbats	Dingbats	1	—

Table 1: Core Postscript fonts and URW++/Ghostscript equivalents.

3 Core Postscript Fonts

When Adobe introduced Postscript in 1984, they defined 35 core fonts (in 10 typefaces) that must be present in all Postscript interpreters. In 1996, URW++ released a replacement set for the core fonts under the GNU General Public License. The URW++ fonts were primarily released for use with Ghostscript, a free Postscript interpreter. Table 1 lists the original Postscript fonts, along with the URW++/Ghostscript equivalents. Each font can be used as the default text font by selecting the indicated LaTeX package from the PSNFSS distribution [30].

Avant Garde and Kerkis Sans: The font Kerkis Sans was created by Antonis Tsolomitis [31, 32] by extending Avant Garde to include Greek and additional Latin characters. The resulting fonts are stand-alone and can be used by applications outside of TeX. The package `kerkis` sets the sans serif font to Kerkis Sans; there is no package option to set Kerkis Sans to be the primary text font.

Bookman and Kerkis: The font Kerkis was created by Antonis Tsolomitis [31, 32] by extending URW Bookman L to include Greek and additional Latin characters. The resulting fonts are stand-alone and can be used by applications outside of TeX. A font of math symbols is included, but not used by the LaTeX package. The package `kmath` uses txfonts for math symbols and uppercase Greek letters.

New Century Schoolbook and Millennial or fouriernc: The Millennial math font of the current author contains Greek letters and other letter-like mathematical symbols. A set of virtual fonts is provided that uses New Century Schoolbook for Latin letters in math, Millennial for Greek and other letter-like symbols, and txfonts and Computer Modern for all other symbols, including binary operators, relations, and large symbols. This

Figure 9: Kerkis text and math (\usepackage{kmath,kerkis}; the order of the packages matters, since kmath loads the txfonts package which changes the default text font).

Theorem 1 (Residue Theorem). Let f be analytic in the region G except for the isolated singularities $a_1, a_2, \ldots, a_m$. If γ 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

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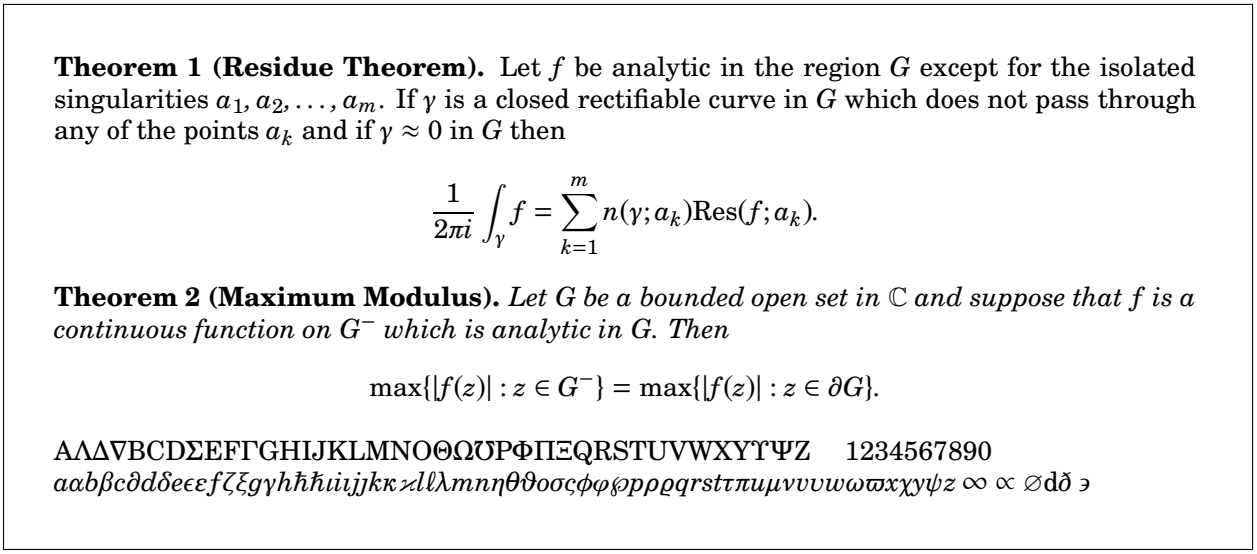
AΛΔ∇BCDΣEFΓGHIJKLMNOΘΩ℧PΦΠΞQRSTUVWXYϒΨZ 1234567890
aαbβcðdδeϵεfζξgγhℏℏıiȷjkκϰlℓ⅃mnηθϑoσςφϕ℘pρϱqrstτπuμνυυwωϖxχyψz ∞ ∝ ∅∅dð ∍

font is still in development, but will hopefully be released in 2006. The fouriernc package of Michael Zedler [33] uses New Century Schoolbook for text and Latin letters in mathematics, and the Greek and symbol fonts from the Fourier-GUTenberg package for the remaining mathematical symbols.

Palatino and pxfonts, Pazo, or mathpple: Young Ryu created the pxfonts collection [34], which contains Greek and other letter-like symbols, as well as a complete set of geometric symbols, including the AMS symbols. Diego Puga created the Pazo math fonts, which include the Greek letters and other letter-like symbols in a style that matches Palatino. The LaTeX package mathpazo (now part of PSNFSS [30]) uses Palatino for Latin letters, Pazo for Greek and other letter-like symbols, and Computer Modern for geometric symbols. The LaTeX package mathpple (also part of PSNFSS [30]) uses Palatino for Latin letters and slanted Euler for Greek and other symbols. Since Hermann Zapf designed both Palatino and Euler, the designs mesh well. An alternate use of Euler is using the eulervm package. Ralf Stubner added small caps and old-style figures to URW Palladio L in the FPL package [36], and Walter Schmidt extended these fonts in the FPL Neu package [37].

Times and txfonts, Belleek, mathptmx, or mbtimes: Young Ryu created the txfonts collection [38], which contains Greek and other letter-like symbols, as well as a complete set of geometric symbols, including the AMS symbols. The txfonts package also includes a very nice typewriter font, txtt. Belleek was created by Richard Kinch [39, 40] and is a drop-in replacement for the commercial fonts required by the mathtime package (now part of PSNFSS [30]). The LaTeX package mathptmx (also part of PSNFSS [30]) uses Times for Latin letters and Symbol for Greek and other symbols. Michel Bovani created the mbtimes package by using Omega Serif for text and Latin and Greek letters in mathematics. mbtimes also includes symbol fonts and a set of calligraphic letters. Omega Serif is

Figure 10: New Century Schoolbook with Millennial math(\usepackage{millennial}).



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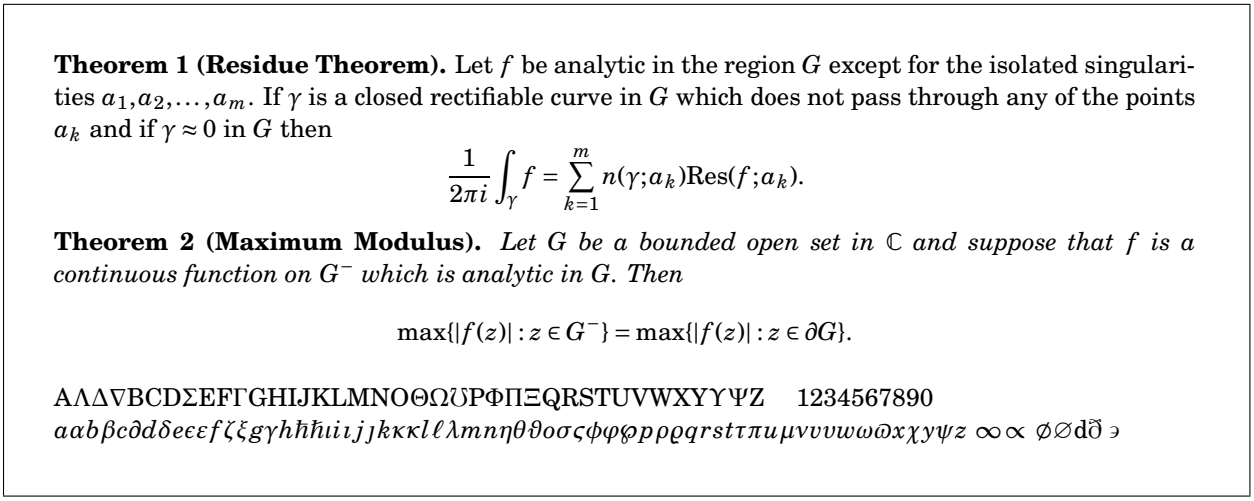
AΛΔ∇BCDΣEFΓGHIJKLMNOΘΩ℧PΦΠΞQRSTUVWXYϒΨZ 1234567890
aαbβcðdδeєεfζξgγhℏħiıjjkκ≁lℓλmnηθϑoσςϕφℊpprϱqrstτπuμvvuwωϖxχyψz ∞ ∝ ∅ðð ɜ

Figure 11: New Century Schoolbook with Fourier math(\usepackage{fouriernc}).



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AΛΔ∇BCDΣEFΓGHIJKLMNOΘΩ℧PΦΠΞQRSTUVWXYϒΨZ 1234567890
aαbβcðdδeєεfζξgγhℏħiıjjkκκlℓλmnηθϑoσςϕφℊpprϱqrstτπuμvvuwωϖxχyψz ∞ ∝ ∅∅ðð ɜ

Figure 12: Palatino text with pxfonts math (\usepackage{pxfonts}).

Theorem 1 (Residue Theorem). Let f be analytic in the region G except for the isolated singularities $a_1, a_2, \ldots, a_m$. If γ 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

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AΛΔ∇BCDΣEFΓGHIJKLMNOΘΩ℧PΦΠΞQRSTUVWXYϒΨZ 1234567890
aαbβcϑdδeϵεfζξgγhℏħıijjkκϰlℓλmnηθϑoσςϕφφpρϱqrstτπuμνvvwωϖxχyψz ∞ ∝ ∅∅dð ɜ

Figure 13: Palatino text with Pazo math (\usepackage{mathpazo}).

Theorem 1 (Residue Theorem). Let f be analytic in the region G except for the isolated singularities $a_1, a_2, \ldots, a_m$. If γ 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

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AΛΔ∇BCDΣEFΓGHIJKLMNOΘΩ℧PΦΠΞQRSTUVWXYϒΨZ 1234567890
aαbβcϑdδeϵεfζξgγhℏħıijjkκϰlℓλmnηθϑoσςϕφφpρϱqrstτπuμνvvwωϖxχyψz ∞ ∝ ∅∅dð ɜ

Figure 14: Palatino text with Euler math (`\usepackage{mathpple}`).

Theorem 1 (Residue Theorem). Let f be analytic in the region G except for the isolated singularities $a_1, a_2, \ldots, a_m$. If γ 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

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

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*

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

AΛΔ∇BCDΣEFΓGHIJKLMNOΘΩϑPΦΠΞQRSTUVWXYϒΨZ 1234567890
aαbβcϑdδeεεfζξgγhℏħiıjȷkκϰlℓλmnηθϑoσσφφϕpρϱqrstτπuμννυwωϖxχyψz ∞ ∝ ∅∅dð ɘ

the primary font for Omega, a 16-bit extension of TEX by John Plaice and Yannis Haralambous [43].

The STIX fonts project [41] is a collaboration of several academic publishers to create a set of Times-compatible fonts containing every possible glyph needed for mathematical and technical publishing. These fonts are still in development, with a scheduled release in the middle of 2006.

Note that Adobe Reader 7.0 replaces Times with Adobe Serif MM if Times or the Ghostscript equivalent Nimbus Roman No. 9 L is not embedded in the PDF file. Adobe Serif MM only has an oblique version, not a real italics, and thus, the primary text and Latin letters in mathematics will not match letters taken from additional fonts. This problem can be avoided by embedding Times or the Ghostscript equivalent Nimbus Roman No. 9 L into the PDF file. Also, I have heard (but not personally verified) that the Windows version of Adobe Reader displays Times New Roman when Times is not embedded. The upright versions of the two typefaces are very similar, but the italics are noticeably different (consider the z, for instance).

Helvetica, Courier, and Zapf Chancery do not have matching math fonts. Courier and Zapf Chancery are inappropriate for mathematics anyway, but Helvetica is sometimes used for presentations and posters. The free fonts MgOpenModerna [44] and FreeSans [45] would be natural choices for the Greek letters in a Helvetica mathematics font.

4 Other Free Fonts

Several other fonts have been released for use with free open-source software. LATEX packages have been created for most of these fonts.

Figure 15: Times text with txfonts math (`\usepackage[varg]{txfonts}`).

Theorem 1 (Residue Theorem). Let f be analytic in the region G except for the isolated singularities $a_1, a_2, \ldots, a_m$. If γ 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

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

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*

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

AΛΔ∇BCDΣEFΓGHIJKLMNOΘΩϑPΦΠΞQRSTUVWXYϒΨZ 1234567890
aαbβcϑdδeϵεfζξgγhℏħıijȷkκϰlℓλmnηθϑoσςϕφϱppϱqrstτπuμνυυwωϖxχyψz ∞ ∝ ∅∅dð ɜ

Figure 16: Times text with Belleek math (`\usepackage{mathtime}`; output uses the Belleek fonts).

Theorem 1 (Residue Theorem). Let f be analytic in the region G except for the isolated singularities $a_1, a_2, \ldots, a_m$. If γ 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

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

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*

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

AΛΔ∇BCDΣEFΓGHIJKLMNOΘΩϑPΦΠΞQRSTUVWXYϒΨZ 1234567890
aαbβcϑdδeϵεfζξgγhℏħıijȷkκϰlℓλmnηθϑoσςϕφϱppϱqrstτπuμνυυwωϖxχyψz ∞ ∝ ∅∅dð ɜ

Figure 17: Times text with Symbol math (\usepackage{mathptmx}).

Theorem 1 (Residue Theorem). Let f be analytic in the region G except for the isolated singularities $a_1, a_2, \ldots, a_m$. If γ 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

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

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*

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

AΛΔ∇BCDΣEFΓGHIJKLMNOΘΩϒPΦΠΞQRSTUVWXYϒΨZ 1234567890
$a\alpha b\beta c\partial d\delta e\varepsilon\varepsilon f\zeta\xi g\gamma h\hbar\hbar\imath\imath j j k\varkappa\varkappa l\ell\lambda m n\eta\theta\vartheta o\sigma\varsigma\phi\varphi\wp p\rho\varrho qrst\tau\pi u\mu\nu\nu\upsilon w\omega\varpi x\chi y\psi z\infty\propto\emptyset\varnothing\mathrm{d}\eth\ni$

Figure 18: Omega Serif text with Omega math (\usepackage{mbtimes}).

Theorem 1 (Residue Theorem). Let f be analytic in the region G except for the isolated singularities $a_1, a_2, \ldots, a_m$. If γ 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

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

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*

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

AΛΔ∇BCDΣEFΓGHIJKLMNOΘΩϒPΦΠΞQRSTUVWXYϒΨZ 1234567890
$a\alpha b\beta c\partial d\delta e\varepsilon\varepsilon f\zeta\xi g\gamma h\hbar\hbar\imath\imath j j k\varkappa\varkappa l\ell\lambda m n\eta\theta\vartheta o\sigma\varsigma\phi\varphi\wp p\rho\varrho qrst\tau\pi u\mu\nu\nu\upsilon w\omega\varpi x\chi y\psi z\infty\propto\emptyset\varnothing\mathrm{d}\eth\ni$

Figure 19: Arev Sans text with Arev math (\usepackage{arev}).

Theorem 1 (Residue Theorem). Let f be analytic in the region G except for the isolated singularities $a_1, a_2, \ldots, a_m$. If γ 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

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

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*

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

AΛΔ∇BCDΣEFΓGHIJKLMNOΘΩƱPΦΠΞQRSTUVWXYϒΨZ 1234567890
aɑbβcɔdδeɛɛfζξgγhℏħiıjjkκʞlℓλmnηθϑoσςφφℊpprϱqrstτπuμννυwωϖxχyψz
∞ ∝ ØØdð ɜ

Bitstream Vera Sans and Arev Sans: Bitstream Vera was released by Bitstream in cooperation with the Gnome Foundation [46] as a high quality scalable free font for use with free open-source software. Bitstream Vera serif, sans serif, and sans mono are available in text using the `bera` package by Malte Rosenau and Walter A. Schmidt [47]. Tavmjong Bah created Arev Sans [49] by extending Bitstream Vera Sans to include Greek, Cyrillic, and many mathematical symbols. The current author created the LaTeX package `arev` [48] using Arev Sans for text and math letters and bold Math Design fonts for Bitstream Charter for symbols.

Bitstream Charter and Math Design: Bitstream Charter [50] was donated by Bitstream for use with X Windows. The Math Design fonts for Bitstream Charter created by Paul Pichaureau [51] are very complete, including Greek letters, symbols from Computer Modern, and the AMS symbols. Charis SIL [52] might be an alternate source for Greek letters that match Bitstream Charter more closely. Another possibility for a math font is to use the Euler fonts with the `charter` and `eulervm` packages.

Comic Sans: Comic Sans is one of Microsoft's core web fonts that is freely available [53]. The `comicsans` package by Scott Pakin [54] implements Comic Sans as both the primary text font and the Latin and Greek letters in mathematics. Computer Modern is used for geometric symbols that are not present in Comic Sans. Comic Sans is hard to read for large blocks of text, but might be nice to use for short comments in a handwriting style.

URW Garamond and Math Design: URW Garamond No. 8 [55] is available under the Aladdin Free Public License as part of the GhostPCL project. The Math Design fonts for URW Garamond created by Paul Pichaureau [51] are very complete, including Greek letters, symbols from Computer Modern, and the AMS symbols.

Figure 20: Bitstream Charter text with Math Design math (`\usepackage[charter]{mathdesign}`).

Theorem 1 (Residue Theorem). Let f be analytic in the region G except for the isolated singularities $a_1, a_2, \ldots, a_m$. If γ 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

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

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*

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

AΛΔ∇BCDΣEFΓGHIJKLMNOΘΩϑPΦΠΞQRSTUVWXYϒΨZ 1234567890
$a\alpha b\beta c\partial d\delta e\epsilon\varepsilon f\zeta\xi g\gamma h\hbar\hbar\imath\imath j\jmath k\kappa x l\ell\lambda m n\eta\theta\vartheta o\sigma\varsigma\phi\varphi\wp p\rho\varrho q r s t\tau\pi u\mu\nu\upsilon w\omega\varpi x\chi y\psi z \infty \propto \emptyset\varnothing \mathrm{d}\eth \ni$

Figure 21: Comic Sans text and math (`\usepackage{comicsans}`).

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

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

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*

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

AΛΔ∇BCDΣEFΓGHIJKLMNOΘΩϑPΦΠΞQRSTUVWXYϒΨZ 1234567890
$a\alpha b\beta c\partial d\delta e\epsilon\varepsilon f\zeta\xi g\gamma h\hbar\hbar\imath\imath j\jmath k\kappa x l\ell\lambda m n\eta\theta\vartheta o\sigma\varsigma\phi\varphi\wp p\rho\varrho q r s t\tau\pi u\mu\nu\upsilon w\omega\varpi x\chi y\psi z \infty \propto \emptyset\varnothing \mathrm{d}\eth \ni$

Figure 22: URW Garamond text with Math Design math
(`\usepackage[garamond]{mathdesign}`).

Theorem 1 (Residue Theorem). Let f be analytic in the region G except for the isolated singularities $a_1, a_2, \ldots, a_m$. If γ 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

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

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*

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

ΑΛΔ∇ΒCDΣΕFΓGΗΙJΚLΜΝΟΘΩ℧ΡΦΠΞQRSTUVWΧΥϒΨΖ 1234567890
$a\alpha b\beta c\partial d\delta e\epsilon\varepsilon f\zeta\xi g\gamma h\hbar\hbar\imath\imath\jmath k\varkappa l\ell\lambda m n\eta\theta\vartheta o\sigma\varsigma\phi\varphi\wp p\rho\varrho q r s t\tau\pi u\mu\nu\upsilon w\omega\varpi x\chi y\psi z$
$\infty\propto\emptyset\varnothing\mathrm{d}\eth\ni$

Utopia and Fourier or Math Design: Utopia [56] was donated by Adobe for use with X Windows. Michel Bovani created Fourier-GUTenberg [57] as an accompaniment to Utopia and is very complete, containing both Greek letters and standard and AMS symbols. The Math Design fonts for Utopia of Paul Pichaureau [51] are also very complete, including Greek letters and AMS symbols.

Using METAFONT, Achim Blumensath created the package `MnSymbol` [58], which contains geometric symbols (no Greek or other letter-like symbols) in varying optical sizes that match the commercial font Adobe MinionPro. The `MnSymbol` package also contains traced Type 1 versions. `MnSymbol` is free; however the package `MinionPro` of Achim Blumensath, Andreas Bühmann, and Michael Zedler [59] which uses `MnSymbol` requires a license from Adobe for the font MininonPro.

5 Comparison of Features

Table 2 shows a comparison of the different features in each package. The only packages that have optical sizes are Computer Modern, CM Bright, Concrete, Euler, and MnSymbol. Except for when the `eulervm` package is used, Latin math letters are taken from the italic text font. An asterisk after a font name indicates that the package has a version of that style in its own font files.

The only sans serif fonts with matching math fonts are CM Bright and Arev Sans. Both work well for presentations. Computer Modern sans serif, CM Bright, Arev Sans, Bera Sans, Kerkis Sans, Helvetica, and Avant Garde all work well as sans serif fonts that accompany a primary roman font. Computer Modern typewriter, `txtt` (from txfonts), Luxi Mono [61], and Bera Mono all work well as typewriters fonts.

There are several other free fonts easily used in LaTeX, notably the Bera fonts, Luxi Mono, and efont-serif [62]. Malte Rosenau converted the Bitstream Vera fonts into Type 1

Figure 23: Utopia text with Fourier-GUTenberg math (`\usepackage{fourier}`).

Theorem 1 (Residue Theorem). Let f be analytic in the region G except for the isolated singularities $a_1, a_2, \ldots, a_m$. If γ 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

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

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*

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

AΛΔ∇BCDΣEFΓGHIJKLMNOΘΩ℧PΦΠΞQRSTUVWXYϒΨZ 1234567890
$a\alpha b\beta c\partial d\delta e\epsilon\varepsilon f\zeta\xi g\gamma h\hbar\hbar\imath\jmath k\kappa\varkappa l\ell\lambda m n\eta\theta\vartheta o\sigma\varsigma\phi\varphi\wp p\rho\varrho q r s t\tau\pi u\mu v\upsilon w\omega\varpi x\chi y\psi z \infty\propto \emptyset\varnothing \mathrm{d}\eth \ni$

Figure 24: Utopia text with Math Design math(`\usepackage[utopia]{mathdesign}`).

Theorem 1 (Residue Theorem). Let f be analytic in the region G except for the isolated singularities $a_1, a_2, \ldots, a_m$. If γ 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

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

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*

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

AΛΔ∇BCDΣEFΓGHIJKLMNOΘΩ℧PΦΠΞQRSTUVWXYϒΨZ 1234567890
$a\alpha b\beta c\partial d\delta e\epsilon\varepsilon f\zeta\xi g\gamma h\hbar\hbar\imath\jmath k\kappa\varkappa l\ell\lambda m n\eta\theta\vartheta o\sigma\varsigma\phi\varphi\wp p\rho\varrho q r s t\tau\pi u\mu v\upsilon w\omega\varpi x\chi y\psi z$
$\infty\propto \emptyset\varnothing \mathrm{d}\eth \ni$

Package	Text	Greek	CM sym	AMS sym	Calligr	Blkbd	boldmath
computer modern	cm	cm	cm	ams	cm	ams	yes
cmbright	cmbright	cmbright	cm*	cm*	cm*	ams	no
ccfonts,eulervm	concrete	euler	euler	ams	euler	ams	yes
concmath	concrete	concrete	concmath	concmath	concmath	concmath	no
iwona	iwona	iwona	iwona	iwona	cm*	ams	yes
kurier	kurier	kurier	kurier	kurier	cm*	ams	yes
anttor	anttor	anttor	anttor	anttor	anttor	ams	yes
kmath,kerkis	kerkis	kerkis	txfonts	txfonts	txfonts	txfonts	yes
millennial	nc schlbk	millennial	txfonts	txfonts	txfonts	ams	no
fouriernc	nc schlbk	fourier	fourier	fourier	fourier	fourier	yes
pxfonts	palatino	pxfonts	txfonts*	txfonts*	txfonts*	pxfonts	yes
mathpazo	palatino	pazo	cm	ams	cm	pazo	yes
mathpple	palatino	euler	euler	ams	cm	ams	yes
txfonts	times	txfonts	txfonts	txfonts	txfonts	txfonts	yes
mathtime (Belleek)	times	belleek	belleek	ams	cm	ams	no
mathptmx	times	symbol	cm	ams	rsfs	ams	no
mbtimes	omega	omega	mbtimes	ams	rsfs*	esstix	yes
arev	arev	arev	md charter	md charter	cm	fourier	yes
mathdesign (Charter)	charter	md charter	md charter	md charter	rsfs*	ams	yes
comicsans	comicsans	comicsans	cm	cm	cm	cm	yes
mathdesign (Garamond)	garamond	md garamond	md garamond	md garamond	rsfs*	ams*	yes
fourier	utopia	fourier	fourier	fourier	fourier	fourier	yes
mathdesign (Utopia)	utopia	md garamond	md utopia	md utopia	rsfs*	ams*	yes

Table 2: Comparison of the features of different packages.

```
\documentclass{article}
\include{sampleformat}
  \usepackage{fourier}
\begin{document}
  \include{textfragment}
\end{document}
```

Figure 25: Sample LaTeX file for `fourier`. The file `sampleformat.tex` contains page layout commands, such as setting the margins and removing the page numbers. The file `textfragment.tex` contains the text and mathematics fragment to be displayed. Both included files are used by every sample LaTeX file. The line "`\usepackage{fourier}`" was changed for each sample to the package listed in the sample's caption.

format, renaming the fonts to Bera [47]. Bera includes serif, sans, and mono. Bera Serif does not have a matching italic font, but the DejaVu fonts [60] are an extension of Bitstream Vera that include a true serif italic, as well as Greek and Cyrillic for all three styles. Except for Bera Sans and Arev Sans, none of the previous fonts have matching math fonts.

6 Creation of this Survey

It might be technically feasible to create a font survey such as this article as a single TeX document. This document, however, was not created in that fashion for two reasons. First, it would be an inordinate amount of work to switch between fonts within the same document. The authors of the LaTeX packages put in a considerable amount of effort to set up the fonts for a document, and it would be silly to duplicate their work. Second, we want to show to a reader exactly what he or she will get by using that package.

In order to accomplish these goals, a small LaTeX file (see Figure 25 for an example) was made for each font that loaded the appropriate packages and then loaded a common text fragment for display. Each file was LaTeXed and then converted to an EPS file using `dvips` with the -E option. The -E option creates a tight bounding box around the text. The main file `survey.tex` then included each of these graphics, and was compiled with `pdflatex`. For some reason, `dvips` created an unusable one-page PS file when including `mbtimes.eps`. HeVeA was used to convert `survey.tex` directly to HTML.

Acknowledgements

Thanks to Michael Zedler, Ulrik Vieth, Karl Berry, William Slough, and the anonymous referees for helpful comments.

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[54] Scott Pakin, Comic Sans LaTeX package on CTAN:/macros/latex/contrib/comicsans.

[55] URW Garamond on CTAN:/fonts/urw/garamond.

[56] Adobe Utopia on CTAN:/fonts/utopia.

[57] Michel Bovani, Fourier-GUTenberg on CTAN:/fonts/fourier-GUT.

[58] Achim Blumensath, MnSymbol on CTAN:/fonts/mnsymbol.

[59] Achim Blumensath, Andreas Bühmann, and Michael Zedler, MinionPro on CTAN:/fonts/minionpro.

[60] DejaVu fonts, http://dejavu.sourceforge.net.

[61] Luxi Mono on CTAN:/fonts/LuxiMono.

[62] efont-serif at http://openlab.jp/efont/serif/.