GUIDE TO USING SIAM'S LaTeX STYLE*

DIANNE DOE†, PAUL T. FRANK‡, AND JANE E. SMITH‡

Abstract. Documentation is given for use of the SIAM LaTeX macros. Instructions and suggestions for compliance with SIAM style standards are also included. Familiarity with standard LaTeX commands is assumed.

Key words. LaTeX, BibTeX, SIAM Journals

AMS subject classifications.

1. Introduction.

This file is documentation for the SIAM LaTeX style, including how to typeset the main document, the BibTeX file, and any supplementary material. More information about SIAM's editorial style can be found in the style manual, available at `http://www.siam.org/journals/pdf/stylemanual.pdf`. The major changes in the SIAM class are summarized in Appendix A. The SIAM LaTeX files can be found at `http://www.siam.org/journals/auth-info.php`. The files are that are distributed are given below.

- `siamart.cls` (required): Main LaTeX class file.
- `siamplain.bst` (required): Bibliographic style file for BibTeX.
- `docsiamart.tex`: Produces this documentation.
- `references.bib`: BibTeX database for this documentation and examples.
- `ex_article.tex`: Template for article.
- `ex_supplement.tex`: Template for supplement.
- `ex_shared.tex`: Template for shared information for article and supplement.

To use these files, put `siamart.cls` and `siamplain.bst` in the directory with your paper or, alternatively, into your LaTeX and BibTeX paths, respectively. The outline of a SIAM LaTeX article is shown in Example 1.

Example 1: Document outline

```
\documentclass{siamart}

% Packages and macros definitions go here.
% Define title, authors, metadata

\begin{document}
\maketitle
% Other front matter goes here: abstract, etc.
% Main body goes here.
% Appendices goes here (optional).
% Acknowledgements go here (optional).
% Bibliography goes here.

\end{document}
```

Class options can be included in the bracketed argument of the command, separated by commas. The possible class options are:

*Acknowledgments such as funding go here.

†Imagination Corp., Chicago, IL (ddoe@imag.com).

‡Department of Applied Mathematics, Fictional University, Boise, ID (ptfrank@fictional.edu, jesmith@fictional.edu).

- `review` — Creates line numbers using the `lineno` package and adds a note in red at the bottom of each page that says "This manuscript is for review purposes only." Recommended for submitting your manuscript to a SIAM journal.
- `final` — By default, lines which extend past the margin will have black boxes next to them to help authors identify lines that they need to fix, by rewriting or inserting breaks. Enabling this option turns these boxes off, so that very small margin breaks which are not noticible will not cause boxes to be generated.
- `supplement` — Specifies that the file is a supplement and not the main document, causing changes in the appearance of the title and numbering; see section 10 for details.
- `hidelinks` — Turns off colors on hyperlinks. The hyperlinks still exist, but there is no color to differentiate them. The final published version will have this option on.

2. Front matter. The title and author parts are formatted using the standard `\title`, `\author`, and `\maketitle` commands as described in Lamport [6]. The title and author should be declared in the preamble. If there is more than one author, the authors should be separated by the `\and` command. The addresses and support acknowledgments are added via `\thanks`. Each author's thanks should specify their address. The support acknowledgment should be put in a thanks for the title, unless specific support needs to be specified for individual authors, in which case it should follow the author address. The header for this file was produced by the code in Example 2, including an example of a shared footnote.

Example 2: Title and authors in preamble

```
\title{Guide to Using SIAM's \LaTeX\ Style%
  \thanks{Acknowledgments such as funding go here.}}

\author{Dianne Doe%
  \thanks{Imagination Corp., Chicago, IL (\email{ddoe@imag.com}).}%
  \and
  Paul T. Frank%
  \thanks{Department of Applied Mathematics, Fictional University, Boise,
    ID
    (\email{ptfrank@fictional.edu}, \email{jesmith@fictional.edu}).}
  \and
  Jane E. Smith%
  \footnotemark[3]
}
```

Example 3 shows how to specify the page headings and the PDF title and authors via the `\siammetadata{title}{authors}` command, with the title (possibly shortened to fit) and the authors names.

Example 3: Page headers in preamble

```
\siammetadata{Guide to Using  SIAM'S \LaTeX\ Style}
{Dianne Doe, Paul T. Frank, and Jane E. Smith}
```

Following the author and title is the abstract, key words listing, and AMS subject classifications, designated using the `abstract`, `keywords`, and `AMS` environments.

Authors are responsible for providing AMS numbers which can be found on the AMS web site [1]. The abstract, keywords, and AMS subject classifications for this document were specified in Example 4.

Example 4: Abstract, keywords, and AMS classifications

```
\newcommand{\BibTeX}{{\scshape Bib}\TeX\xspace} % <- Preamble
\begin{abstract}
  Documentation is given for use of the SIAM \LaTeX\ macros.
  Instructions and suggestions for compliance with SIAM style
  standards are also included. Familiarity with standard \LaTeX\
  commands is assumed.
\end{abstract}

\begin{keywords}
  \LaTeX, \BibTeX, SIAM Journals
\end{keywords}

\begin{AMS}
\end{AMS}
```

The example template is discussed in section 11.

3. Cross-references and hyperlinks. SIAM now supports cross-references and hyperlinks via the `cleveref` and `hyperef` packages, which are loaded by the class file.

3.1. Cleveref. SIAM strongly recommends using the commands provided by the `cleveref` package for cross-referencing. The package is automatically loaded and already customized to adhere to SIAM's style guidelines. To create a cross reference, use the commands `\cref` (inside sentence) and `\Cref` (beginning of a sentence) in place of the object name and `\ref`. The `cleveref` package enhances LaTeX's cross-referencing features, allowing the format of cross-references to be determined automatically according to the "type" of cross-reference (equation, section, etc.) and the context in which the cross-reference is used. So, the package *automatically* inserts the object name as well as the appropriate hyperlink; see Example 5. It may require two LaTeX compilations for the references to show up correctly. Additional examples are shown in the sections below for equations, tables, figures, sections, etc.

Example 5: Advantage of using cleveref

```
The normal way to get a cross-reference with a hyperlink requires a
lot of typing: \hyperref[thm:mvt]{Theorem~\ref*{thm:mvt}}.
The \texttt{cleveref} package gets both the name and hyperlink
automatically using a single macro: \cref{thm:mvt}.
It also handles multiple references with the same macro, such as
\cref{thm:mvt,fig:tikz,fig:testfig}.
```

The normal way to get a cross-reference with a hyperlink requires a lot of typing: Theorem 1. The `cleveref` package gets both the name and hyperlink automatically using a single macro: Theorem 1. It also handles multiple references with the same macro, such as Theorem 1 and Figures 1 and 2.

3.2. Hyperef. Hyperlinks are created with the `\href` and `\url` commands, as shown in Example 6. SIAM has also defined the `\email` command, as shown in

Example 2. You can hide links (i.e., turn off link colors) with the `hidelinks` option.

Example 6: Creating hyperlinks

```
The \href{http://www.siam.org}{SIAM homepage} has general
information. Note that the link  will \emph{not} appear in the print
version, so the writer may want to specify the location explicitly
instead by using \url{http://www.siam.org}.
```

The SIAM homepage has general information. Note that the link will *not* appear in the print version, so the writer may want to specify the location explicitly instead by using http://www.siam.org.

Note that homepage links in the `\thanks` environment require special formatting for the tilde (~) character. The formatting should be as shown in Example 25.

4. Math and equations. Here we show some example equations, with numbering, and examples of referencing the equations. SIAM now includes the package `amsmath` by default, and we include some of its features as well, although the reader should consult the package user manual for further guidance. Several of the example are adapted from Mittlebach and Goossen's guide to LaTeX [7]. Example 7 is a straightforward example of in-line mathematics equations that does not use any special packages or features.

Example 7: In-line math

```
The following shows an example of math in text:
Let $S=[s_{ij}]$ ($1\leq i,j\leq n$) be a $(0,1,-1)$-matrix of order $n$.
```

The following shows an example of math in text: Let $S = [s_{ij}]$ $(1 \leq i, j \leq n)$ be a $(0, 1, -1)$-matrix of order n.

In Example 8, we show the recommended method for getting blackboard fonts using the `amsfonts` package. This is not loaded by default and must be included in the preamble.

Example 8: Blackboard math

```
\usepackage{amsfonts} % <- Preamble
Blackboard bold characters, such as $\mathbb{C}$ and $\mathbb{R}$,
should be created with the \texttt{amsfonts} package, although this
is not included by default.
```

Blackboard bold characters, such as $\mathbb{C}$ and $\mathbb{R}$, should be created with the `amsfonts` package, although this is not included by default.

Example 9 shows the `smallmatrix` environment for an in-line matrix from the `amsmath` package, which is included by default.

Example 9: In-line matrix

```
Matrices of no more than two rows appearing in text can be created
as shown in the next example:
$B = \bigl[ \begin{smallmatrix} B_{11} & B_{12} \\
  B_{21} & B_{22} \end{smallmatrix} \bigr]$.
```

Matrices of no more than two rows appearing in text can be created as shown in the next example: $B = \left[\begin{smallmatrix} B_{11} & B_{12} \\ B_{21} & B_{22} \end{smallmatrix}\right]$.

Bigger matrices can be rendered environments from the `amsmath` package, such as `bmatrix` and `pmatrix` used in Example 10.

Example 10: Creating matrices

```
Display matrices can be rendered using environments from \texttt{amsmath}:
\begin{equation}\label{eq:matrices}
  S=\begin{bmatrix}1&0\\0&0\end{bmatrix}
  \quad\text{and}\quad
  C=\begin{pmatrix}1&1&0\\1&1&0\\0&0&0\end{pmatrix}.
\end{equation}
\Cref{eq:matrices} shows some example matrices.
```

Display matrices can be rendered using environments from `amsmath`:

$$S = \begin{bmatrix} 1 & 0 \\ 0 & 0 \end{bmatrix} \quad \text{and} \quad C = \begin{pmatrix} 1 & 1 & 0 \\ 1 & 1 & 0 \\ 0 & 0 & 0 \end{pmatrix}. \tag{1}$$

Equation (1) shows some example matrices.

The SIAM LaTeX class defines the following macros: `\const`, `\diag`, `\grad`, `\Range`, `\rank`, and `\supp`. Each macro works by rendering the text as a `mathop`. Example 11 shows the usage of the `\Range` macro. (This example also uses the `braket` package for the `\set` macro, but this is not necessarily recommended by SIAM.)

Example 11: Using SIAM-defined macros

```
\usepackage{braket,amsfonts} % <- Preamble
An example of a SIAM macro:
\begin{equation}\label{eq:range}
  \Range(A) = \set{ y \in \mathbb{R}^n | y = Ax }.
\end{equation}
```

An example of a SIAM macro:

$$\operatorname{Range}(A) = \{\, y \in \mathbb{R}^n \mid y = Ax \,\}. \tag{2}$$

Example 12 shows how to use the `align` environment from `amsmath` to easily align multiple equations.

Example 12: Aligned equations

```
\Cref{eq:a,eq:b,eq:c} show three aligned equations.
\begin{align}
  f &= g, \label{eq:a} \\
  f' &= g', \quad\text{and} \label{eq:b} \\
  \mathcal{L}f &= \mathcal{L}g \label{eq:c}.
\end{align}
```

Equations (3)–(5) show three aligned equations.

$$f = g, \tag{3}$$

$$f' = g', \quad \text{and} \tag{4}$$

$$\mathcal{L}f = \mathcal{L}g. \tag{5}$$

Another way to number a set of equations is the `subequations` environment from `amsmath`, as shown in Example 13.

Example 13: Subequations

```
We calculate the Fr\'{e}chet derivative of $F$ as follows:
\begin{subequations}
\begin{align}
  F'(U,V)(H,K)
  &= \langle R(U,V),H\Sigma V^{T} + U\Sigma K^{T} -
  P(H\Sigma V^{T} + U\Sigma K^{T})\rangle \label{eq:aa} \\
  &= \langle R(U,V),H\Sigma V^{T} + U\Sigma K^{T}\rangle
  \nonumber \\
  &= \langle R(U,V)V\Sigma^{T},H\rangle +
  \langle \Sigma^{T}U^{T}R(U,V),K^{T}\rangle. \label{eq:bb}
\end{align}
\end{subequations}
\Cref{eq:aa} is the first line, and \cref{eq:bb} is the last line.
```

We calculate the Fréchet derivative of F as follows:

$$
\begin{aligned}
F'(U,V)(H,K) &= \langle R(U,V), H\Sigma V^T + U\Sigma K^T - P(H\Sigma V^T + U\Sigma K^T)\rangle && \text{(6a)}\\
&= \langle R(U,V), H\Sigma V^T + U\Sigma K^T\rangle \\
&= \langle R(U,V)V\Sigma^T, H\rangle + \langle \Sigma^T U^T R(U,V), K^T\rangle. && \text{(6b)}
\end{aligned}
$$

Equation (6a) is the first line, and (6b) is the last line.

For an equation split over multiple lines, Example 14 shows the usage of the `multline` environment provided by `amsmath`.

Example 14: Equation split across lines

```
We claim that the projection $g(U,V)$ is given by the pair of matrices:
\begin{multline} \label{eq:ml}
  g(U,V) = \biggl( \frac{R(U,V)V\Sigma^{T}U^{T} -
      U\Sigma V^{T}R(U,V)^{T}}{2}U,\\
    \frac{R(U,V)^{T}U\Sigma V^{T}-V
      \Sigma^{T}U^{T}R(U,V)}{2}V \biggr).
\end{multline}
```

We claim that the projection $g(U,V)$ is given by the pair of matrices:

$$
g(U,V) = \left(\frac{R(U,V)V\Sigma^T U^T - U\Sigma V^T R(U,V)^T}{2} U, \right. \\
\left. \frac{R(U,V)^T U\Sigma V^T - V\Sigma^T U^T R(U,V)}{2} V \right). \tag{7}
$$

5. Theorem-like environments. SIAM loads `ntheorem` package and uses it to define the following theorem-like environments: `theorem`, `lemma`, `corollary`, `definition`, and `proposition`. SIAM also defines a `proof` environment that automatically inserts a □ at the end of any proof, even if it ends in an equation environment. *Note that the document may need to be compiled twice for the mark to appear.* Some of the calculus examples were adapted from [3].

Example 15 shows usage of the `theorem` environment. Note that SIAM now numbers theorems in sequence, independent of the section number. An optional argument can be used to name the theorem. Example 16 illustrates show a corollary, without a name, and the proof environment.

Example 15: Theorem

```
\begin{theorem}[Mean Value Theorem]\label{thm:mvt}
  Suppose $f$ is a function that is continuous on the closed interval
  $[a,b]$.  and differentiable on the open interval $(a,b)$.
  Then there exists a number $c$ such that $a < c < b$ and
  \begin{displaymath}
    f'(c) = \frac{f(b)-f(a)}{b-a}.
  \end{displaymath}
  In other words,
  \begin{displaymath}
    f(b)-f(a) = f'(c)(b-a).
  \end{displaymath}
\end{theorem}
```

THEOREM 1 (Mean Value Theorem). *Suppose f is a function that is continuous on the closed interval $[a,b]$. and differentiable on the open interval (a,b). Then there exists a number c such that $a < c < b$ and*

$$f'(c) = \frac{f(b) - f(a)}{b - a}.$$

In other words,

$$f(b) - f(a) = f'(c)(b - a).$$

Example 16: Corollary and proof

```
\begin{corollary}
  Let $f(x)$ be continuous and differentiable everywhere. If $f(x)$
  has at least two roots, then $f'(x)$ must have at least one root.
\end{corollary}
\begin{proof}
  Let $a$ and $b$ be two distinct roots of $f$.
  By \cref{thm:mvt}, there exists a number $c$ such that
  \begin{displaymath}
    f'(c) = \frac{f(b)-f(a)}{b-a} = \frac{0-0}{b-a} = 0.
  \end{displaymath}
\end{proof}
```

COROLLARY 2. *Let $f(x)$ be continuous and differentiable everywhere. If $f(x)$ has at least two roots, then $f'(x)$ must have at least one root.*

Proof. Let a and b be two distinct roots of f. By Theorem 1, there exists a number c such that

$$f'(c) = \frac{f(b) - f(a)}{b - a} = \frac{0 - 0}{b - a} = 0.$$

∎

SIAM also defines commands to create your own theorem- and remark-like environments:

- `newsiamthm` - Small caps header, italized body.
- `newsiamremark` - Italics header, roman body.

There are formatted as described in [11]. These commands should be used instead of `\newtheorem`. Examples 17 to 19 shows how to use the commands above.

Example 17: New theorem-like environment

```
\newsiamthm{claim}{Claim} % <- Preamble
\begin{claim}\label{cl:constant}
  If $f'(x) = 0$ for all $x \in (a,b)$ then $f(x)$ is constant on $(a,b)$.
\end{claim}
\begin{proof}
  Left to reader.
\end{proof}
```

CLAIM 3. *If $f'(x) = 0$ for all $x \in (a,b)$ then $f(x)$ is constant on (a,b).*

Proof. Left to reader. ∎

Example 18: New remark-like environment

```
\newsiamremark{expl}{Example} % <- Preamble
\begin{expl}[Trivial note]\label{ex:a}
  Let $f(x) = 2$. Since $f'(x) = 0$ for all $x$, $f$ is constant
  everywhere.
\end{expl}
```

Example 4 (Trivial note). Let $f(x) = 2$. Since $f'(x) = 0$ for all x, f is constant everywhere.

Example 19: References

```
We can reference multiple types of objects with a single reference:
\cref{ex:a,cl:constant,thm:mvt}.
```

We can reference multiple types of objects with a single reference: Example 4, Claim 3, and Theorem 1.

6. Tables. Table captions should go above the tables. Example 20 shows the code to generate Table 1. This example uses subfloats via the `subfig` package, as well as special column options from the `array` package.

Example 20: Example table with subtables.

```
\usepackage{array,subfig} % <- Preamble
\newcolumntype{R}{>{$}r<{$}}  %
\newcolumntype{V}[1]{>{[\;}*{#1}{R@{\;\;}}R<{\;]}} %
\begin{table}[htbp]
  \caption{Example table adapted from Kolda and Mayo \cite{KoMa14}.}
  \label{tab:KoMa14}
  \centering
  \subfloat[$\beta=1$]{
    \begin{tabular}{|c|R|V{3}|c|r@{\,$\pm$\,}l|} \hline
occ. & \multicolumn{1}{c|}{$\lambda$} & \multicolumn{4}{c|}{$\mathbf{x}$} &
fevals &  \multicolumn{2}{c|}{time (sec.)}\\ \hline
 718 & 11.3476 &  0.5544 &  0.3155 &  1.2018 &  0.0977 &   45 & 0.17 & 0.06 \\ \hline
 134 &  3.7394 &  0.2642 & -1.1056 &  0.2657 & -0.3160 &   31 & 0.12 & 0.05 \\ \hline
 144 &  2.9979 &  1.0008 &  0.4969 & -0.0212 & -0.4817 &   31 & 0.12 & 0.05 \\ \hline
   4 & \multicolumn{6}{c|}{\emph{--- Failed to converge ---}} & 0.21 & 0.10 \\ \hline
 \end{tabular}}

  \subfloat[$\beta=-1$]{
    \begin{tabular}{|c|R|V{3}|c|r@{\,$\pm$\,}l|} \hline
occ. & \multicolumn{1}{c|}{$\lambda$} & \multicolumn{4}{c|}{$\mathbf{x}$} &
fevals &  \multicolumn{2}{c|}{time (sec.)}\\ \hline
  72 & -1.1507 &  0.2291 &  0.6444 &  0.3540 & -0.8990 &   34 & 0.14 & 0.06 \\ \hline
 150 & -3.2777 &  0.8349 & -0.7603 & -0.3532 & -0.2635 &   33 & 0.14 & 0.07 \\ \hline
 148 & -3.5998 &  1.0486 &  0.6046 &  0.3736 &  0.3971 &   41 & 0.16 & 0.08 \\ \hline
 624 & -6.3985 &  0.1003 &  0.1840 &  0.5305 &  1.2438 &   48 & 0.19 & 0.08 \\ \hline
   4 & \multicolumn{6}{c|}{\emph{--- Converged to wrong solution ---}} & 0.10 & 0.11 \\ \hline
   2 & \multicolumn{6}{c|}{\emph{--- Failed to converge ---}} & 0.23 & 0.02 \\ \hline
 \end{tabular}}
\end{table}
```

Table 1: Example table adapted from Kolda and Mayo [5].

(a) $\beta = 1$

occ.	λ	$\mathbf{x}$	fevals	time (sec.)
718	11.3476	$[\ 0.5544 \quad 0.3155 \quad 1.2018 \quad 0.0977\ ]$	45	0.17 ± 0.06
134	3.7394	$[\ 0.2642 \quad -1.1056 \quad 0.2657 \quad -0.3160\ ]$	31	0.12 ± 0.05
144	2.9979	$[\ 1.0008 \quad 0.4969 \quad -0.0212 \quad -0.4817\ ]$	31	0.12 ± 0.05
4	*— Failed to converge —*			0.21 ± 0.10

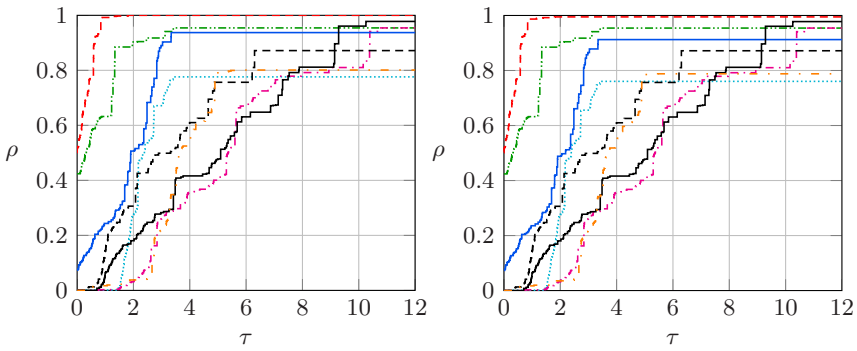
(b) $\beta = -1$

occ.	λ	$\mathbf{x}$	fevals	time (sec.)
72	-1.1507	$[\ 0.2291 \quad 0.6444 \quad 0.3540 \quad -0.8990\ ]$	34	0.14 ± 0.06
150	-3.2777	$[\ 0.8349 \quad -0.7603 \quad -0.3532 \quad -0.2635\ ]$	33	0.14 ± 0.07
148	-3.5998	$[\ 1.0486 \quad 0.6046 \quad 0.3736 \quad 0.3971\ ]$	41	0.16 ± 0.08
624	-6.3985	$[\ 0.1003 \quad 0.1840 \quad 0.5305 \quad 1.2438\ ]$	48	0.19 ± 0.08
4	*— Converged to wrong solution —*			0.10 ± 0.11
2	*— Failed to converge —*			0.23 ± 0.02

7. Figures. It is recommended that all figures be generated as encapsulated postscript (EPS) format, since this will be used in final production. Since most people work in `pdflatex`, we recommend the package `epstopdf` to automatically convert EPS images to PDF for inclusion in PDF documents created by `pdflatex`. Example 21 shows the code to generate Figure 1. This example uses the `graphicx` package for the `\includegraphics` command.

Example 21: Example figure with subfigures and external files

```
\usepackage{graphicx,epstopdf,subfig} % <- Preamble
\begin{figure}[htbp]
  \centering
  \subfloat[$\epsilon_{\max}=5$]{\label{fig:a}\includegraphics{lexample_fig1}}
  \subfloat[$\epsilon_{\max}=0.5$]{\label{fig:b}\includegraphics{lexample_fig2}}
  \caption{Example figure using external image files.}
  \label{fig:testfig}
\end{figure}
```



(a) $\epsilon_{\max} = 5$ (b) $\epsilon_{\max} = 0.5$

Fig. 1: Example figure using external image files.

Another option is to use a graphics-generator that is platform- and format-independent. PGF is a TeX macro package for generating such graphics and works together with the most important TeX backend drivers, including pdftex and dvips. It comes with a user-friedly syntax layer called TikZ. More details can be found at http://sourceforge.net/projects/pgf/, and detailed instructions are available in the manual. Example 22 shows the code to generate Figure 2, which uses TikZ/PGF. This example was written by Henri Menke at http://texwelt.de/wissen/fragen/4912/skizze-zur-illustration-linearer-regression.

Example 22: Example TikZ/PGF for platform-independent graphics.

```
\usetikzlibrary{arrows,intersections} % <- Preamble
\begin{figure}[htbp]
  \centering
  \begin{tikzpicture}[
    thick,
    >=stealth',
    dot/.style = {
      draw,
      fill = white,
      circle,
      inner sep = 0pt,
      minimum size = 4pt
    }
    ]
    \coordinate (O) at (0,0);
    \draw[->] (-0.3,0) -- (8,0) coordinate[label = {below:$x$}] (xmax);
    \draw[->] (0,-0.3) -- (0,5) coordinate[label = {right:$f(x)$}] (ymax);
    \path[name path=x] (0.3,0.5) -- (6.7,4.7);
    \path[name path=y] plot[smooth] coordinates {(-0.3,2) (2,1.5) (4,2.8) (6,5)};
    \scope[name intersections = {of = x and y, name = i}]
    \fill[gray!20] (i-1) -- (i-2 |- i-1) -- (i-2) -- cycle;
    \draw      (0.3,0.5) -- (6.7,4.7) node[pos=0.8, below right] {Sekante};
    \draw[red] plot[smooth] coordinates {(-0.3,2) (2,1.5) (4,2.8) (6,5)};
    \draw (i-1) node[dot, label = {above:$P$}] (i-1) {} -- node[left]
    {$f(x_0)$} (i-1 |- O) node[dot, label = {below:$x_0$}] {};
    \path (i-2) node[dot, label = {above:$Q$}] (i-2) {} -- (i-2 |- i-1)
    node[dot] (i-12) {};
    \draw           (i-12) -- (i-12 |- O) node[dot,
    label = {below:$x_0 + \varepsilon$}] {};
    \draw[blue, <->] (i-2) -- node[right] {$f(x_0 + \varepsilon) - f(x_0)$}
    (i-12);
    \draw[blue, <->] (i-1) -- node[below] {$\varepsilon$} (i-12);
    \path       (i-1 |- O) -- node[below] {$\varepsilon$} (i-2 |- O);
    \draw[gray]      (i-2) -- (i-2 -| xmax);
    \draw[gray, <->] ([xshift = -0.5cm]i-2 -| xmax) -- node[fill = white]
    {$f(x_0 + \varepsilon)$}  ([xshift = -0.5cm]xmax);
    \endscope
  \end{tikzpicture}
  \caption{Example TikZ figure by Henri Menke.}
  \label{fig:tikz}
\end{figure}
```

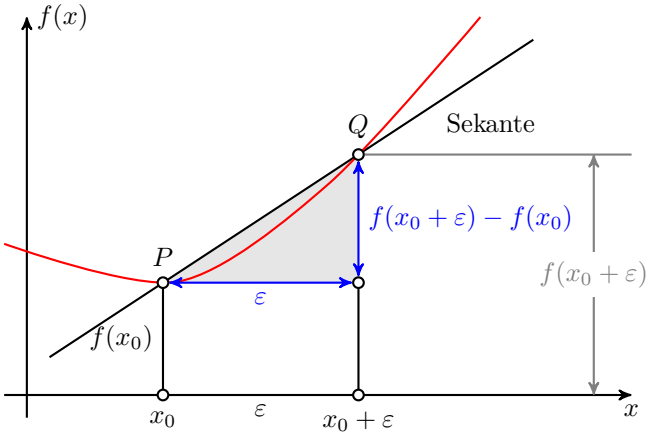


Fig. 2: Example TikZ figure by Henri Menke.

8. Algorithms. SIAM automatically includes the `algorithm` package in the class definition. Users have the choice of `algpseudocode`, `algorithmic`, and other packages for formatting the algorithm. For example, Algorithm 1 is produced by the code in Example 23. In order to reference lines within the algorithm, we need to tell the `cleveref` package how to do the referencing, which is the second line of Example 23. Then we can use the code `\cref{line3}` to produce Line 3.

From TGK: SIAM wants the algorithm caption to be small caps, but I'm not sure why because this does not match the table and figures.

Example 23: Example algorithm

```
\usepackage{algorithmic} % <- Preamble
\Crefname{ALC@unique}{Line}{Lines} % <- Preamble
\begin{algorithm}
\caption{Build tree}
\label{alg:buildtree}
\begin{algorithmic}[1]
\STATE{Define $P:=T:=\{ \{1\},\ldots,\{d\}$\}}
\WHILE{$\#P > 1$}
\STATE\label{line3}{Choose $C^\prime\in\mathcal{C}_p(P)$ with $C^\prime :=
     \operatorname{argmin}_{C\in\mathcal{C}_p(P)} \varrho(C)$}
\STATE{Find an optimal partition tree $T_{C^\prime}$ }
\STATE{Update $P := (P{\setminus} C^\prime) \cup \{ \bigcup_{t\in C^\prime} t \}$}
\STATE{Update $T := T \cup \{ \bigcup_{t\in\tau} t : \tau\in T_{C^\prime}{\setminus}
     \mathcal{L}(T_{C^\prime})\}$}
\ENDWHILE
\RETURN $T$
\end{algorithmic}
\end{algorithm}
```

Algorithm 1 Build tree

1: Define $P := T := \{\{1\}, \ldots, \{d\}\}$
2: **while** $\#P > 1$ **do**
3: Choose $C' \in \mathcal{C}_p(P)$ with $C' := \operatorname{argmin}_{C\in\mathcal{C}_p(P)} \varrho(C)$
4: Find an optimal partition tree $T_{C'}$
5: Update $P := (P\backslash C') \cup \{\bigcup_{t\in C'} t\}$
6: Update $T := T \cup \{\bigcup_{t\in\tau} t : \tau \in T_{C'}\backslash\mathcal{L}(T_{C'})\}$
7: **end while**
8: **return** T

9. Sections. Sections are denoted using standard LaTeX section commands, i.e., `\section`, `\subsection`, etc. The appendices are defined the same way except that the first one is preceded by the `\appendix` command. The acknowledgments section comes immediately before the references and after any appendices. It should be declared by `\section*{Acknowledgments}`. Any numbered, labeled sections can be referenced using `\cref`.

10. Supplemental material. For several SIAM journals, authors are encouraged to submit Supplementary Materials to complement their articles. This might include additional figures or examples, animations, data sets used in the paper, computer code used to generate figures or tables, or other materials that are necessary to fully document the research contained in the paper or to facilitate the readers' ability to understand and extend the work.

The class option `supplement` must be decared. The supplement should have the same title and authors as the main document. (Note that the title is modified

automatically by the SIAM class file so that it is preceeded by the text "Supplementary Materials:".) A supplement does have sections but does not have an abstract, keywords, AMS classifications, or appendices. The main document and supplement can cross-reference sections, equations, theorem-like declarations, figures, tables, algorithms, etc. However, there is no sharing of references. The references are optional for a supplement. An template is provide, as discussed in section 11.

11. Template. The included files, `ex_article.tex`, `ex_shared.tex`, and `ex_supplement.tex`, provide a template that can be used for creating a LaTeX document with an optional supplement.

Example 24 gives the outline of an article. In this case we assume that the title and authors are defined in the `ex_shared.tex` file.

Cross-referencing between the main document and the supplement is enabled using the `xr-hyperref` package (included by the classfile). Use `\externaldocument` to specify the external document to search for external references.

Example 24: Document outline with supplement

```
\documentclass{siamart}

\input{ex_shared}
\externaldocument{ex_supplement}

\begin{document}
\maketitle
% Other front matter: abstract, keywords, subject classifications.
% Main body goes here.
% Appendices and/or acknowledgments.
% Bibliography
\end{document}
```

Example 25 (from `ex_shared.tex`) shows how the "shared" title and authors may be defined across the main document and a supplement. Note the use of the `\string` command in the URL for the tilde; this is only necessary inside the `\thanks` command.

Example 25: Example of shared title and author macros

```
% Declare title and authors, without \thanks
\newcommand{\TheTitle}{An Example Article}
\newcommand{\TheAuthors}{D. Doe, P. T. Frank, and J. E. Smith}

% Sets running headers as well as PDF title and authors
\siammetadata{\TheTitle}{\TheAuthors}

% Title. If the supplement option is on, then "Supplementary Material"
% is automatically inserted before the title.
\title{{\TheTitle}\thanks{This work was funded by the Fog Research
    Institute under contract no.~FRI-454.}}

% Authors: full names plus addresses.
\author{
  Dianne Doe\thanks{Imagination Corp., Chicago, IL
    (\email{ddoe@imag.com}, \url{http://www.imag.com/\string~ddoe/}).}
  \and
  Paul T. Frank\thanks{Department of Applied Mathematics, Fictional
    University, Boise, ID (\email{ptfrank@fictional.edu},
    \email{jesmith@fictional.edu}).}
  \and
  Jane E. Smith\footnotemark[3]
}
```

Example 26 shows the general outline of a supplement file that used a shared file for defining the title and authors (see Example 25). The `supplement` class option changes the appearance of the title (preceeded by "Supplementary Materials") and the numbering so that all sections, equations, figures, tables, algorithms, and so on to start with "S". As mentioned above, the title and authors should be identical to the main document, which is assured by using the shared file.

Example 26: Supplement document outline

```
\documentclass[supplement]{siamart}

\input{ex_shared}
\externaldocument{ex_article}

\begin{document}
\maketitle
% No abstract, keywords, subject classifications.
% Main body goes here.
% No appendices or acknowledgments.
% Optional bibliography goes here.
\end{document}
```

12. Bibliography. The SIAM BibTeX style file, now called `siamplain.bst`, has been updated to include the new keys listed below:

- `doi`: Digital object identifier, a unique alphanumeric string
- `url`: Web address, usually impermanent
- `urldate`: Date that the web address was last accessed
- `eprint`: Archive identifier, a unique alphanumeric string
- `eprintclass`: Archive class
- `archive`: Archive URL, defaults to `http://arXiv.org/abs`
- `archivepreprint`: Archive name, defaults to "arXiv".
- `eid`: Article ID, if there are no page numbers
- `pagetotal`: Total number of pages, for use with article ID

Every entry type has been modified to include an optional link to a DOI, a URL, and/or an archive preprint reference. Additionally, the `article` entry now supports an Article ID, `eid`, and number of pages, `pagetotal`. To use this, include the following code in your LaTeX source code: `\bibliographystyle{siamplain}`.

12.1. DOI. A digital object identifier (DOI) is a unique alphanumeric string that provides a persistent link to its location on the Internet. The publisher assigns a DOI when your article is published and made available electronically. Using the `doi` field in BibTeX to specify it, as shown for [5] in Example 27; observe the new `doi` field which produces a hyperlink in the citation. Do not include the full URL, i.e., `http://dx.doi.org/` preceding the DOI.

Example 27: Example article in BibTeX

```
@Article{KoMa14,
  title =        {An Adaptive Shifted Power Method for Computing
                  Generalized Tensor Eigenpairs},
  author =       {Tamara G. Kolda and Jackson R. Mayo},
  doi =          {10.1137/140951758},
  journal =      {SIAM Journal on Matrix Analysis and Applications},
  number =       4,
  volume =       35,
  year =         2014,
  month =        dec,
  pages =        {1563--1581},
}
```

12.2. URL. There is also now support for the `url` field. Generally, the DOI is preferred to the URL, since the DOIs should be a permanent references. For that reason. it is good practice to specify the last date that the URL was accessed, which is specified by the optional `urldate` field. Reference [4] produced by Example 28 shows an example of using these fields.

Example 28: Example with the URL field in BibTeX

```
@Misc{Hi14,
  author =       {Nick Higham},
  title =        {A Call for Better Indexes},
  howpublished = {SIAM Blogs},
  year =         2014,
  month =        nov,
  url =          {http://blogs.siam.org/a-call-for-better-indexes/},
  urldate =      {2015-04-05}
}
```

12.3. Preprint servers such as arXiv. More and more manuscripts on available on preprint servers. In fact, SIAM's publication policy explicitly allows the final accepted version of any article to be posted on a preprint server such as arXiv.

For an arXiv paper, the `eprint` field is used to specify identifier. The optional `eprintclass` field specifies the class. Example 29 shows the BibTeX for [9].

Example 29: Example arXiv reference in BibTeX

```
@Misc{PeKoPi14,
  title = {Accelerating Community Detection by Using {K}-core Subgraphs},
  author =       {Chengbin Peng and Tamara G. Kolda and Ali Pinar},
  eprint =       {1403.2226},
  year =         2014,
  month =        mar,
  eprintclass =  {math.NA}
}
```

Other preprint servers are supported as well, but these require specification of the `archive` and `archiveprefix`. In this case, the target URL is formed by concatenating the `archive`, a forward slash (/), and the `eprint`; and the text for the hyperlink is formed by concatenating the `archiveprevix`, a color (:), and the `eprint`. Example 30 shows the code to generate [10], including the preprint from PubMed. Note that this example has both the journal citation as well as the link for the preprint.

Example 30: Example PubMed reference in BibTeX

```
@Article{WoZhMeSh05,
  author =       {Woessner, Donald E. and Zhang, Shanrong and
                  Merritt, Matthew E. and Sherry, A. Dean},
  title = {Numerical Solution of the {Bloch} Equations Provides Insights
                  into the Optimum Design of {PARACEST} Agents for {MRI}},
  journal =      {Magnetic Resonance in Medicine},
  doi =          {10.1002/mrm.20408},
  volume =       53,
  number =       4,
  month =        apr,
  year =         2005,
  pages =        {790--799},
  archiveprefix = {PubMed},
  archive =      {http://www.ncbi.nlm.nih.gov/pubmed},
  eprint =       {15799055}
}
```

12.4. Article ID. Some journals use an article ID rather than page numbers. The field `eid` specifies the article ID. The optional field `pagetotal` can say the number of pages in the document. An example of an article using these fields is shown in Example 31 for citation [8].

Example 31: Example article ID reference in BibTeX

```
@Article{Ne03,
  title =        {Properties of Highly Clustered Networks},
  author =       {Newman, M. E. J.},
  doi =          {10.1103/PhysRevE.68.026121},
  journal =      {Phys. Rev. E},
  volume =       {68},
  year =         {2003},
  eid =          {026121},
  pagetotal =    6,
  month =        aug,
}
```

12.5. Software citations. SIAM encourages software citations, both related technical publications as well as the software itself. A citation to a software package may look something like what is shown in Example 32 for citation [2]. Notice the double braces around the `author` key; else, it would appear as "C. D. Team".

Example 32: Example software reference in BibTeX

```
@misc{clawpack,
  title =        {Clawpack Software},
  author =       {{Clawpack Development Team}},
  url =          {http://www.clawpack.org},
  urldate =      {2015/05/14},
  note =         {Version 5.2.2},
  year =         2015
}
```

A. Summary of Major Changes. Here we briefly summarize the major changes in the latest version of the SIAM LaTeX and BibTeX classes:

- Hyperlinking in cross references via the `cleveref` package, including customizations to adhere to SIAM conventions.
- Support for supplemental PDF files, including cross-references between the supplement and the main document.
- New fields for BibTeX, as listed in section 12.
- Colored hyperlinks (red for external, green for internal)
- Change in file names: `siamltex.cls` is replaced by `siamart.cls`, and `siam` is replaced by `siamplain.bst`.

B. Special Modifications. To number theorem-like environments by section, e.g., Theorem 5.1 would indicate the first theorem in Section 5, put the code from Example 33 into the document preamble.

Example 33: Labeling theorems by section

```
\theoremstyle{plain}
\theoremheaderfont{\normalfont\sc}
\theorembodyfont{\normalfont\itshape}
\theoremseparator{.}
\theoremsymbol{}
\renewtheorem{theorem}{Theorem}[section]
```

REFERENCES

[1] American Mathematical Society, *Mathematics Subject Classification*, 2010, http://www.ams.org/mathscinet/msc/msc2010.html (accessed 2015/03/29).

[2] Clawpack Development Team, *Clawpack software*, 2015, http://www.clawpack.org (accessed 2015/05/14). Version 5.2.2.

[3] Paul Dawkins, *Paul's online math notes: Calculus I — notes*, http://tutorial.math.lamar.edu/Classes/CalcI/MeanValueTheorem.aspx (accessed 2015-07-08).

[4] Nick Higham, *A call for better indexes*. SIAM Blogs, Nov. 2014, http://blogs.siam.org/a-call-for-better-indexes/ (accessed 2015-04-05).

[5] Tamara G. Kolda and Jackson R. Mayo, *An adaptive shifted power method for computing generalized tensor eigenpairs*, SIAM Journal on Matrix Analysis and Applications, 35 (2014), pp. 1563–1581, doi:10.1137/140951758.

[6] Leslie Lamport, *LaTeX: A Document Preparation System*, Addison–Wesley, Reading, MA, 1986.

[7] Frank Mittlebach and Michel Goossens, *The LaTeX Companion*, Addison–Wesley, 2nd ed., 2004.

[8] M. E. J. Newman, *Properties of highly clustered networks*, Phys. Rev. E, 68 (2003), 026121 (6 pages), doi:10.1103/PhysRevE.68.026121.

[9] Chengbin Peng, Tamara G. Kolda, and Ali Pinar, *Accelerating community detection by using K-core subgraphs*, Mar. 2014, arXiv:1403.2226 [math.NA].

[10] Donald E. Woessner, Shanrong Zhang, Matthew E. Merritt, and A. Dean Sherry, *Numerical solution of the Bloch equations provides insights into the optimum design of PARACEST agents for MRI*, Magnetic Resonance in Medicine, 53 (2005), pp. 790–799, doi:10.1002/mrm.20408, PubMed:15799055.

[11] *SIAM style manual: For journals and books*, 2013, https://www.siam.org/journals/pdf/stylemanual.pdf.