GUIDE TO USING SIAM'S LaTeX STYLE*

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Abstract. Documentation is given for use of the SIAM LaTeX and BibTeX 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, Documentation

AMS subject classifications. 00A20

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. Templates are provided and discussed in more detail in section 12.

Example 1: Document outline

```
\documentclass{siamart}

% Packages and macro definitions go here.
% Define title, authors, headers

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

\end{document}
```

*Acknowledgments such as funding go here.

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

- `review` — Recommended for submitting your manuscript to a SIAM journal. Adds line numbers as well as the statement "This manuscript is for review purposes only" to the bottom of each page.
- `final` — Turns off the black boxes that help authors identify lines that are too long. The final published version will have this option on.
- `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 11 for details.
- `hidelinks` — Turns off colors on hyperlinks; see **??**. The hyperlinks still exist, but there is no color to differentiate them. The final published version will have this option on.

3. Front matter. The title and author parts are formatted using the standard `\title`, `\author`, and `\maketitle` commands as described in Lamport [8]. The title and author should be declared in the preamble. The title and author names are automatically converted to uppercase in the document. If there is more than one author, each additional author should be preceded 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 the title thanks, 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. Each thanks produces a footnote, so the footnote of the second author is #3. The command `\headers{title}{authors}` command, with the title (possibly shortened to fit) and the authors' names, creates the page headers, automatically converted to uppercase.

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 Math, Fictional University, Boise, ID
    (\email{ptfrank@fictional.edu}, \email{jesmith@fictional.edu}).}
  \and
  Jane E. Smith%
  \footnotemark[3]
}

% Custom SIAM macro to insert headers
\headers{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 [2]. The abstract, keywords, and AMS subject classifications for this document are specified in Example 3.

Example 3: Abstract, keywords, and AMS classifications

```
\newcommand{\BibTeX}{{\scshape Bib}\TeX\xspace} % <- Preamble
\begin{abstract}
  Documentation is given for use of the SIAM \LaTeX\ and \BibTeX\
  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, Documentation
\end{keywords}

\begin{AMS}
  00A20
\end{AMS}
```

A more complete example, including a PDF supplement, that uses the included files `ex_article.tex`, `ex_supplement.tex`, and `ex_shared.tex` is discussed in section 12. The example files can be used as a starting point for producing a document.

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

4.1. 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 command `\cref` (inside sentence) or `\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 4. 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 4: 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.

4.2. Hyperef. Hyperlinks are created with the `\href` and `\url` commands, as shown in Example 5. 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 5: Creating hyperlinks

```
The \href{http://www.siam.org}{SIAM homepage} has general information.
Note that the colored text will \emph{not} appear in the print version
nor will the hyperlink be active, 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 colored text will *not* appear in the print version nor will the hyperlink be active, so the writer may want to specify the location explicitly instead by using http://www.siam.org.

Note that homepage links via `\url` in the `\thanks` environment require special formatting for the tilde (~) character. The formatting is used in the template and shown in Example 25.

5. 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 [1, 5]. Several of the example are adapted from Mittlebach and Goossen's guide to LaTeX [9].

Example 6 is a straightforward example of inline mathematics equations that does not use any special packages or features.

Example 6: Inline 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 7, 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 7: 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 8 shows the `smallmatrix` environment for an inline matrix from the `amsmath` package, which is included by default.

Example 8: Inline 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 9.

Example 9: 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.

Example 10 shows how to use the `\DeclareMathOperator` command from the `amsopn` package to declare the `\Range` macro. (This example also uses the `braket` package for the `\set` macro, but this is not necessarily recommended by SIAM.)

Example 10: Declaring math operators

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

An example of a math operator:

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

Example 11 shows how to use the `align` environment from `amsmath` to easily align multiple equations.

Example 11: 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 12.

Example 12: 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:

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

$$= \langle R(U,V)V\Sigma^T, H\rangle + \langle \Sigma^T U^T R(U,V), K^T\rangle. \tag{6b}$$

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

For an equation split over multiple lines, Example 13 shows the usage of the `multline` environment provided by `amsmath`.

Example 13: 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:

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

6. 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 the symbol "□" 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 [4]. Example 14 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 15 illustrates show a corollary, without a name, and the proof environment.

Example 14: 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, $f(b)-f(a) = f'(c)(b-a)$.
\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 15: 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.

Each command takes two arguments. The first is the environment name, and the second is the name to show in the document. These commands should be used instead of `\newtheorem`. Examples 16 and 17 shows how to use the commands above, including how to specify the plural version for `cleveref` if it is unusual.

Example 16: New theorem-like environment

```
\newsiamthm{claim}{Claim} % <- Preamble
\newsiamremark{hypothesis}{Hypothesis} % <- Preamble
\crefname{hypothesis}{Hypothesis}{Hypotheses} % <- 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{hypothesis}\label{hyp1}
The function $f$ is continuously differentiable.
\end{hypothesis}
\begin{hypothesis}\label{hyp2}
The random variable is normally distributed.
\end{hypothesis}
```

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

Hypothesis 4. The function f is continuously differentiable.

Hypothesis 5. The random variable is normally distributed.

Example 17: References

```
We can reference multiple types of objects with a single reference:
\cref{cl:constant,thm:mvt,hyp1,hyp2}.
```

We can reference multiple types of objects with a single reference: Claim 3, Theorem 1, and Hypotheses 4 and 5.

7. Tables. Table captions should go above the tables. Example 18 shows the code to generate a Table 1. A more complicated example is shown in Example 19, which generates Table 2. This example uses subfloats via the `subfig` package, as well as special column options from the `array` package.

Example 18: Example table.

```
\begin{table}[tbhp]
  \caption{Example table}
  \label{tab:simpletable}
  \centering
  \begin{tabular}{|c|c|c|} \hline
   Species & \bf Mean & \bf Std.~Dev. \\ \hline
    1 & 3.4 & 1.2 \\
    2 & 5.4 & 0.6 \\ \hline
  \end{tabular}
\end{table}
```

TABLE 1
Example table

Species	**Mean**	**Std. Dev.**
1	3.4	1.2
2	5.4	0.6

Example 19: Example table with subtables.

```
\usepackage{array} % <- Preamble
\usepackage[caption=false]{subfig} % <- Preamble
\newcolumntype{R}{>{$}r<{$}}  %
\newcolumntype{V}[1]{>{[\;}*{#1}{R@{\;\;}}R<{\;]}} %
\begin{table}[tbhp]
  \caption{Example table adapted from Kolda and Mayo \cite{KoMa14}.}
  \label{tab:KoMa14}
  \centering
  \subfloat[$\beta=1$]{
    \begin{tabular}{|r|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
   4 & \multicolumn{6}{c|}{\emph{--- Failed to converge ---}} & 0.21 & 0.10 \\ \hline
 \end{tabular}}

  \subfloat[$\beta=-1$]{
    \begin{tabular}{|r|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
 624 & -6.3985 &  0.1003 &  0.1840 &  0.5305 &  1.2438 &   48 & 0.19 & 0.08 \\ \hline
   2 & \multicolumn{6}{c|}{\emph{--- Failed to converge ---}} & 0.23 & 0.02 \\ \hline
 \end{tabular}}
\end{table}
```

TABLE 2
Example table adapted from Kolda and Mayo [7].

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
4	— *Failed to converge* —			0.21 ± 0.10

(a) $\beta = 1$

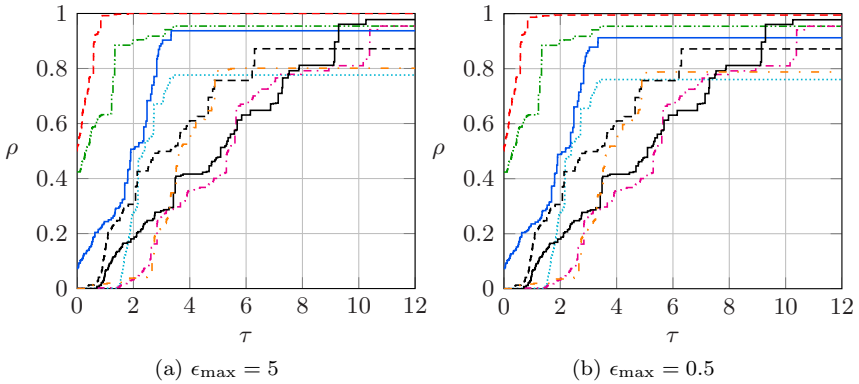
occ.	λ	$\mathbf{x}$	fevals	time (sec.)
72	-1.1507	$[\,0.2291 \quad 0.6444 \quad 0.3540 \quad -0.8990\,]$	34	0.14 ± 0.06
624	-6.3985	$[\,0.1003 \quad 0.1840 \quad 0.5305 \quad 1.2438\,]$	48	0.19 ± 0.08
2	— *Failed to converge* —			0.23 ± 0.02

(b) $\beta = -1$

8. Figures. It is recommended that all figures be generated in high resolution. In the past, SIAM has required encapsulated postscript (EPS) format for final production. This is still an acceptable format, but SIAM also now allows high-resolution PDF, JPEG, and PNG figures. If working with EPS images and using `pdflatex`, we recommend the package `epstopdf` to automatically convert EPS images to PDF for inclusion in PDF documents created by `pdflatex`. Example 20 shows the code to generate Figure 1. This example uses the `graphicx` package for the `\includegraphics` command.

Example 20: Example figure with subfigures and external files

```
\usepackage{graphicx,epstopdf} % <- Preamble
\usepackage[caption=false]{subfig} % <- Preamble
\begin{figure}[tbhp]
  \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 for figures is 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 21 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 21: Example TikZ/PGF for platform-independent graphics.

```
\usetikzlibrary{arrows,intersections} % <- Preamble
\begin{figure}[tbhp]  \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] {};
    \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}
```

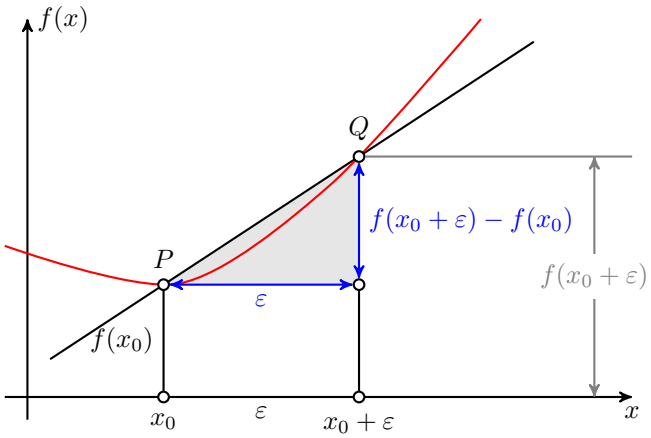


FIG. 2. *Example TikZ figure by Henri Menke.*

9. Algorithms. SIAM automatically includes the `algorithm` package in the class definition. This provides the float environment. Users have the choice of `algpseudocode`, `algorithmic`, and other packages for actually formatting the algorithm. For example, Algorithm 1 is produced by the code in Example 22. 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 22. Then we can use the code `\cref{line3}` to produce Line 3.

Example 22: 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

10. Sections. Sections are denoted using standard LaTeX section commands, i.e., `\section`, `\subsection`, etc.

Appendices are created with the normal sectioning commands, following the command `\appendix`. Titles of appendices created with `\section` are preceded by the word "Appendix," but not the subsections or appendices created with `\section*`. Unlike normal sections, appendix sections cannot have any blank lines following the declaration or else the text will start a new paragraph rather than immediately following the appendix title. Any numbered, labeled sections can be referenced using `\cref`, including those without a title.

The acknowledgments section comes immediately before the references and after any appendices. It should be declared by `\section*{Acknowledgments}`.

11. 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` should be used in the supplemental LaTeX file. The supplement should have the same title and authors as the main document. The title is modified automatically by the SIAM class file so that it is preceded by the text "Supplementary Materials", followed by a colon. The numbering is modified so that all sections, equations, figures, tables, algorithms, and so on to start with "S". 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. A template is provide, as discussed in section 12.

12. Template. The 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. Examples 23 and 24 give the outline of an article and the supplement. In this case we assume that the title and authors are defined in the `ex_shared.tex` file, shown in Example 25. Cross referencing between the main document and the supplement is enabled using the `xr-hyperref` package (included by the SIAM class file). Use `\externaldocument` to specify the external document to search for external references.

Example 23: 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 24: 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}
```

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
\headers{\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]
}
```

13. 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}`.

13.1. 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 [7] in Example 26; 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. Authors are required to provide DOIs; if they are not provided, they will be requested during the copyediting process.

Example 26: 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},
}
```

13.2. 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 [6] produced by Example 27 shows an example of using these fields.

Example 27: 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}
}
```

13.3. Preprint servers such as arXiv. More and more manuscripts are 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 the identifier. The optional `eprintclass` field specifies the class. Example 28 shows the BibTeX for [11].

Example 28: 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 fields `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 colon (:), and the `eprint`. Example 29 shows the code to generate [12], including the preprint from PubMed. Note that this example has both the journal citation as well as the link for the preprint.

Example 29: 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}
}
```

13.4. 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 30 for citation [10].

Example 30: 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,
}
```

13.5. 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 31 for citation [3]. Notice the double braces around the `author` key; else, it would appear as "C. D. Team".

Example 31: 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
}
```

Appendix A. Summary of major changes.

Here we summarize the major changes in the latest version of the SIAM LaTeX and BibTeX classes:

- Change in file names: `siamltex.cls` is replaced by `siamart.cls`, and the `siam.bst` bibliography style file is replaced by `siamplain.bst`; see section 1.
- Hyperlinking in cross references via the `cleveref` package, including customizations to adhere to SIAM conventions. Automatic PDF bookmarks enabled for sections, appendices, and references. See subsection 4.1.
- Colored hyperlinks (red for external, green for internal). Can be disabled with class options `hidelinks`; see subsection 4.2.
- New fields for BibTeX, as listed in section 13.
- Support for supplemental PDF files, including cross references between the supplement and the main document; see section 11.
- New command for setting headers: `\headings`; see section 3.
- Updated theorem-like and proof environments using `ntheorem` package; see section 6.
- Fixed handling of appendices to adhere to SIAM style guidelines; see section 10.

- Added `review` class option; see section 2.
- Includes the following packages by default: `algorithm` `amsmath`, `breakurl`, `cleveref`, `hypcap`, `hyperef`, `ifpdf`, `ntheorem`, `xcolor`, and `xr-hyperef`. Adds the `lineno` package if the `review` class option is enabled.

Appendix B. Special modifications.

B.1. Special macros. In past versions, the SIAM LaTeX class defined the following macros: `\const`, `\diag`, `\grad`, `\Range`, `\rank`, and `\supp`. These are no longer declared; however, they can be redefined using the `\DeclareMathOperator` command from the `amsopn` package as demonstrated in Example 10.

B.2. Labeling objects according to the section number. SIAM recommends numbering objects sequentially. However, if you prefer to number objects by section, e.g., Theorem 5.1 would indicate the first theorem in Section 5, put the code from Example 32 into the document preamble.

Example 32: Labeling theorems by section

```
\renewcommand{\thetheorem}{\thesection.\arabic{theorem}}
    \renewcommand{\theequation}{\thesection.\arabic{equation}}
\renewcommand{\thefigure}{\thesection.\arabic{figure}}
\renewcommand{\thetable}{\thesection.\arabic{table}}
\renewcommand{\thealgorithm}{\thesection.\arabic{algorithm}}
```

B.3. Appendices with no title. The SIAM style manual [13] allows for an appendix that is numbered (by a letter) but has no title. We have a special command to create such an appendix: `\appendixnotitle`. This is equivalent to a `\section` command in the appendix except that it has no arguments.

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

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

[12] 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.

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