Writing papers in LaTeX

9 steps to better TeXing and a better paper!

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What we'll cover...

1. The structure of a document
2. `tex`, `latex`, `pdflatex`, `xelatex`, `lualatex`, etc
3. LaTeX workflows for your paper
4. git and version control
5. Journal style
6. On writing
7. Dos and Don'ts
8. On bibtex
9. On figures
10. Handy tools

1. The structure of a document

see 1_structure

- **Document style**
  - Your journal's formatting
- **Preamble**
  - Define fonts, graphics handling, math symbols, etc.
  - Custom settings, such as macros, adding color to the section titles, defining environments
- **Document text**
  - section, subsection, subsubsection
- **Bibliography**
  - more on this later

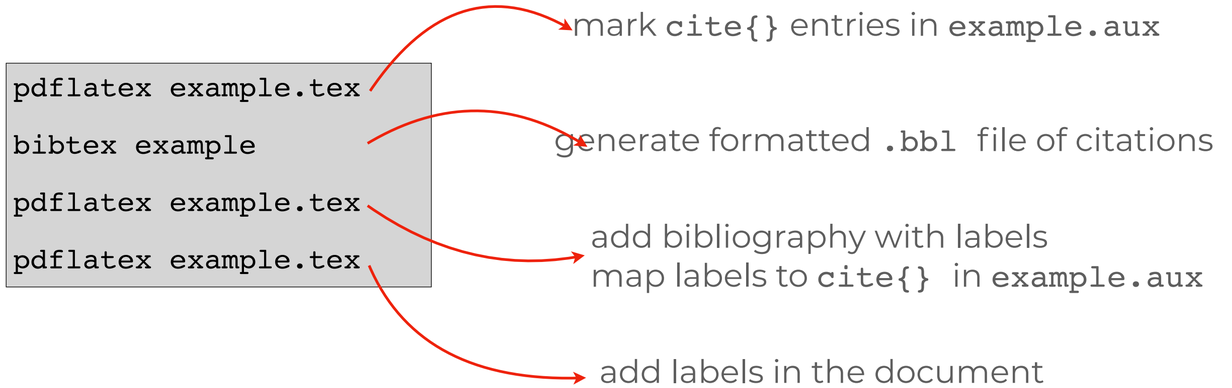
```
\documentclass[10pt,letterpaper]{article}

\usepackage{amsmath}
\usepackage{graphicx}

\newcommand{\sequence}[3]{#1$\rightarrow$#2$\rightarrow$#3}

\begin{document}

This is a test.  From \sequence{A}{B}{C} to \sequence{X}{Y}{Z}.

\section{Introduction}

Reference to~\cite{ChOlSe_2021_lsrbm}.

\section{Background}
\section{Algorithm}
\section{Numerical Results}
\subsection{Experiment \# 1}
\subsection{Experiment \# 2}
\section{Conclusion}

\bibliographystyle{plain}
\bibliography{refs_example.bib}

\end{document}
```

2. `tex`, `latex`, `pdflatex`, etc

...basic gist

see `2_texflavors`

- `tex`: a program that typesets TeX directives or macros
  - `pdftex`: a program that generates a PDF (instead of DVI)
- `latex`: a program that typesets a pile of LaTeX macros to make things easier
  - `pdflatex`: a program that generates a PDF
- `xelatex`: support for a wide variety of fonts and characters
- `lualatex`: extends latex more of a programming language (via Lua)
- **Two take-aways:**
  1. always use LaTeX: very rarely (if ever) should you need to dip into TeX
  2. always use PDF output (`pdflatex`) and PDF figures (or PNG ... more on this later)



- `pdflatex` takes several passes
- Tools like `latexmk` automate this!

3. LaTeX workflows

see `3_workflows`

- **Directory structure:** Zen of Python
  Simple is better than complex.
  Complex is better than complicated.
  Flat is better than nested.
- **Commit to something**
- **Separate:**
  - Data collection or raw data (e.g. `data1.db`, … `datan.db`)
  - Parsed or processed data (e.g. `data_merged_filtered.db`)
  - Plotting data (e.g. `temp_vs_time.csv`)
  - Plotting script (e.g. `temp_vs_time.py`)
- **One Figure <—> One Script**
  - `temp_vs_time.pdf` <—> `temp_vs_time.py`
- **LaTeX labelling:** `\label{fig:temp_vs_time}`

Copy&Paste

```
paper_topic_name                          #  string used for repo, tex, and bib files
+   requirements.txt                      # document number of pages, does that include refs,
etc
+-- 1_submitted_paper
|   +-- paper_topic_name.tex
|   +-- refs_topic_name.bib
|   +-- journal_class.cls                 # any files needed for the journal latex style
|   +-- figures
|   |   +-- temp_vs_time.pdf              # descriptive names for figures (not fig1.pdf, etc)
|   |   +-- error_vs_stepsize.pdf
|   |   `-- ...
|   +-- data                              # data files that generate the figures
|   |   +-- Makefile                      # Makefile that will re-generate all figures
|   |   +-- temp_vs_time.csv              # use the same name as the resulting figure
|   |   +-- plot_temp_vs_time.py          # plotting scripts, use names like plot_.py
|   |   `-- ...
|   `-- submitted_paper_topic_name.pdf    # actual PDF file submitted
+-- 2_reviews
|   +-- review_1.pdf                      # individual reviews
|   +-- review_2.pdf
|   `-- editor_statement.pdf              # instructions and summary from editor
+-- 3_response_to_reviews
|   +-- response_topic_name.tex
|   `-- sent_response_topic_name.pdf      # actual PDF file sent to editor
`-- 4_revised_paper
    +-- paper_topic_name_revised.tex
    +-- refs_topic_name_revised.bib
    +-- journal_class.cls                 # copy here any other files needed
    +-- figures                           # copy here all the figures again
    |   +-- temp_vs_time.pdf              # edit figures as needed
    |   +-- error_vs_stepsize.pdf
    |   `-- ...
    +-- data                              # copy all data again and edit as needed
    |   `-- ...
    `-- submitted_paper_topic_name_revised.pdf  # actual PDF submitted
```

Reference: Matt West @ https://lagrange.mechse.illinois.edu/latex_quick_ref/

4. git version control

see `4_git`

Use it!

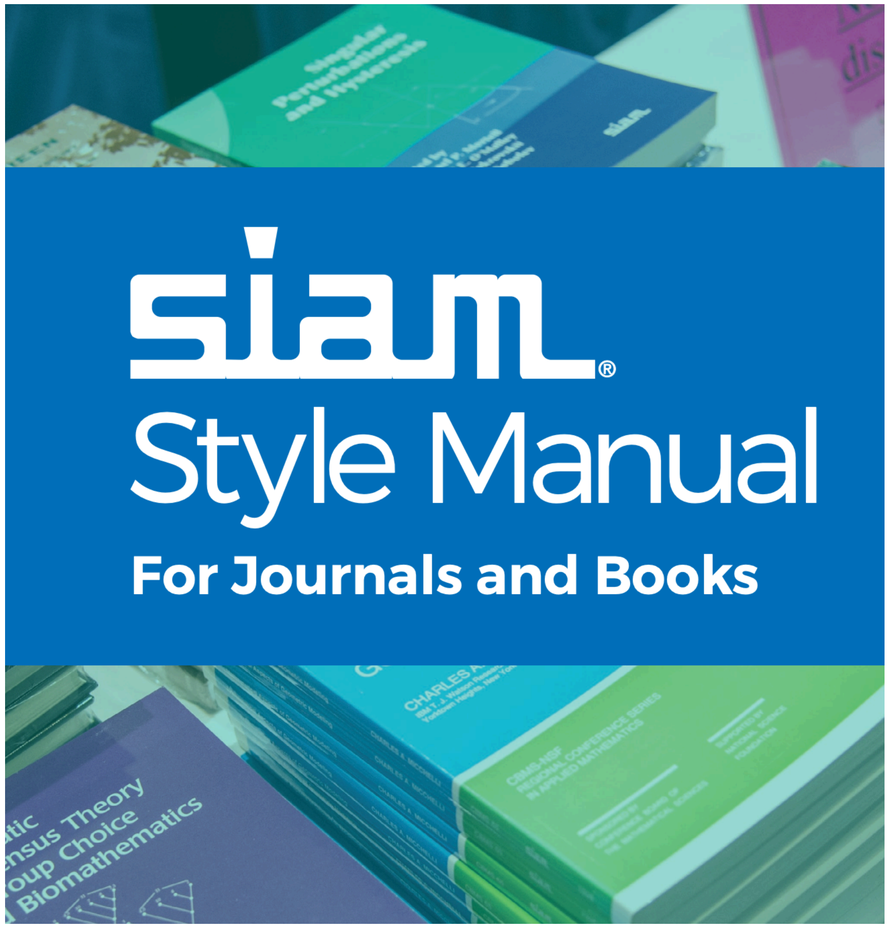
- **What to track:**
  - Your `.tex` file :)
  - The `.bib` file
  - Figures -> `./figures/*.pdf`
  - Scripts for the figures ->`./data/*.py`
  - Data for the figures -> `./data/*.csv`
- **What not to track:**
  - The pdf of the paper -> `paper_randnoise.pdf`
  - Any typesetting output -> `*.log, *.bbl, *.aux,` etc

- **Tips:**
  - Agree with your co-authors on one of
    - one sentence per line
    - hard wrapping at say 80 characters
    - nothing, free for all
  - Commit *often*
  - For large edits, take sections at a time, to reduce merge conflicts

5. Journal Style

see 5_style

- **The journal will have a style file**
  - Example: https://www.siam.org/publications/journals/about-siam-journals/information-for-authors#dnn_ctr2112_ContentPane
- **The journal will also have a style *guide***
  - Example: https://www.siam.org/Portals/0/Publications/Journals/stylemanual/SIAM_STYLE_GUIDE_2019.pdf
- **Following both of these will speed up the review and copy editing.**



6. On Writing

More of an interlude...

see `6_linting`

- Use linters (what?)
- Mark open items and second pass items with `%TODO`
  - `grep TODO paper_randnoise.tex`
- Clear contributions, Outline, Write/Revise
- Polish and make it look visually appealing to read
- **Remember:** Peer reviewed publications are critically important to science — treat your presentation with care
- **Remember:** Peer reviewed publications take reviewer/editor time — treat your presentation with care
- **Remember:** (Hopefully) Many people will read your publication — treat your publication with care

7. LaTeX dos and don’ts

see 7_dos

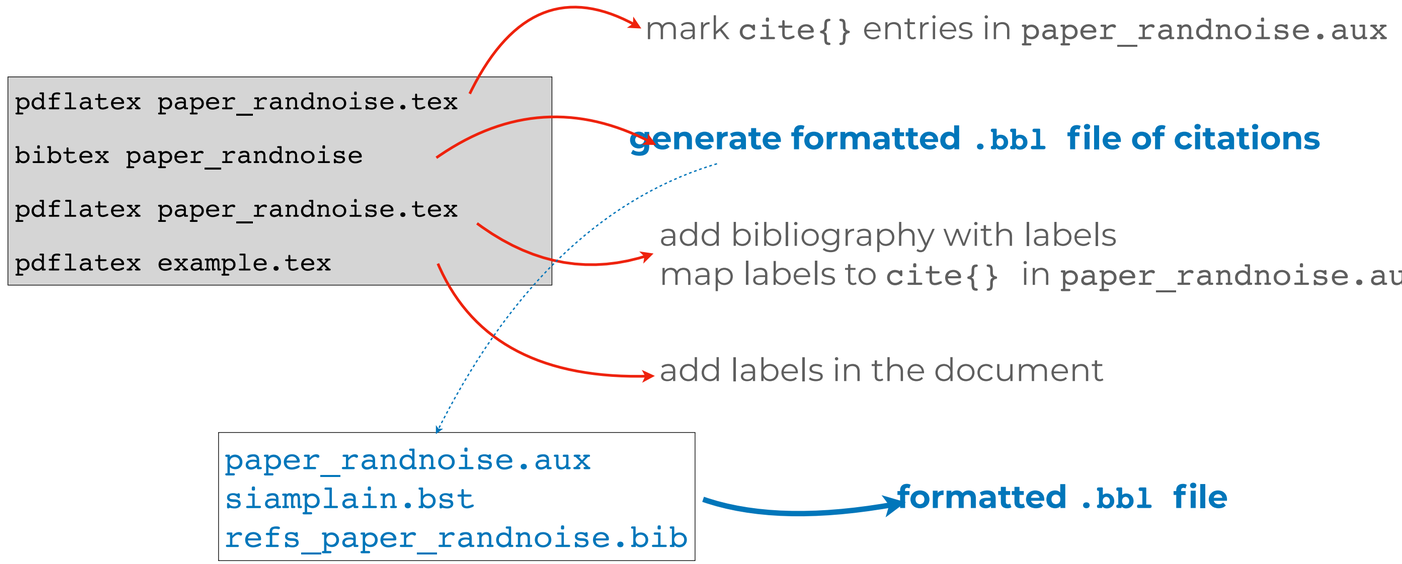
Fact, not opinion! :)

- **DO** keep your LaTeX readable!
  - Block indent equations
  - Align tabular data
  - Limited whitespace
- **DON’T** overuse macros
  - Intended for complex arrangements with repeated use
  - Things that might change.
- **DO** attach a float environment after the paragraph of first reference
  - Generally use `[!ht]`
    - `!`: tex will ignore area restrictions
    - `h`: place it “here” if it fits in the area
    - `t`: place it at the “top” otherwise and if it fits
    - otherwise create a new page
- **DON’T** use `\FloatBarrier` and other tricks to for spacing
  - ~~`\newpage, \vspace, \hspace`~~
- **DO** use packages for consistent layouts
  - `booktabs`: clean tabular
  - `siunitx`: large numbers and notation
- **DON’T** use `align` for everything
  - `equation`: base
  - `align`: multiple equations
  - `split`: one equation split with alignment
  - `multline`: one equation split with no alignment
- **DO** use consistent fonts throughout (more on this...)
- Label figures with `\label{fig:*}`
- Label equations with `\label{eq:*}`
- Label sections with `\label{sec:*}`
- Label tables with `\label{tb:*}`

8. On bibtex

see 2_bibtex

- Bibtex: a program and a format for specifying bibliography entries
- Journals specifying the formatting rules
- Several types
  - By id: [7]
  - By name [Olson 2021] or [Ol21]
  - Can be unsorted or listed by order of reference in the paper
- The journal `.bst` defines the <u>required</u> fields
- General workflow:
  - Grab full citation online at citation's journal
  - Clean up entry (removing abstracts or other fields)
  - Format cleanly. Use `{ }` vs " "
- `{ }` also force capitalization:
  - `title = {All about {Krylov} methods}`



9. On Figures

see `9_figures`

- Fonts in figures should match the fonts in the float/article.
- `\includegraphics[width=0.3\textwidth]{./figures/myfig.pdf}` also scales the fonts — be careful!
- Use consistent color schemes throughout the paper
- Label everything
- Do not introduce new notation in a figure or its caption
- The figure caption should describe, not discuss.

1. Introduction. Random noise is an important concept and is best described as a combination of random frequencies. Take for example Figure 1. Here we see random noise on an exponential.

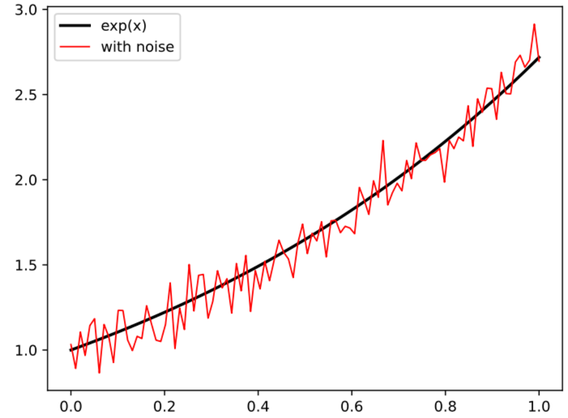


FIG. 1. *An exponential function with random noise.*

An example of a random paper is here [1].

A terrible figure!

10. Helpful tools

- `titk`: sharp figures and schematics in LaTeX
- `tikzpdf`: build/rebuild tikzpictures
  - https://github.com/lukeolson/tikzpdf
- `latexrun`: compile and summarize warnings
- `chktex`: a LaTeX linter
- `betterbib`: automatically format/update your bib entries
  - https://github.com/nschloe/betterbib
- `illinois-letterhead`: a letterhead in LaTeX
  - https://github.com/lukeolson/illinois-letterhead
- scrub your LaTeX and submit to Arxiv:
  - https://github.com/lukeolson/clean-latex-to-arxiv.git

- `booktabs`: nice looking tables
- `sinunitx`: nice looking numbers and units
- `algorithm2e`: algorithm environment
- `cleveref`: \cref{} referencing for all
- `hyperref`: hyper linkes to figures, etc
  - `backref`: add page numbers to the bib
- `microtype`
  - http://www.khirevich.com/latex/microtype/
- `enumitem`
  - full control of itemize environments