LATEX- Advanced Topics

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1 Modular documents
2 Figures
3 Shortcuts and tricks
4 Slides and posters
5 MiKTeX and Technical Issues
Think big

Always carefully partition and organize your documents with the proper sectioning commands:

\begin{verbatim}
\part
\chapter
\section
\subsection
\subsubsection
\paragraph
\subparagraph
\end{verbatim}

Once your document is ready and organized, invoke:

\begin{verbatim}
\tableofcontents
\listoffigures
\listoftables
\end{verbatim}
You can easily control the table-of-contents depth:

\begin{verbatim}
\setcounter{tocdepth}{1}
\end{verbatim}

Result

\begin{verbatim}
\begin{table}[h]
\centering
\begin{tabular}{ll}
\hline
\textbf{Contents} & \\
1 Introduction & 1 \\
2 Literature Review & 2 \\
3 Research Proposal & 12 \\
4 Initial Results & 13 \\
A Graduate Courses & a \\
B Derivation of the real MVDR beamformer & a \\
C 2008 IEEEEI Conference paper & b \\
\hline
\end{tabular}
\end{table}
\end{verbatim}
You can easily control the table-of-contents depth:

LaTeX code

```
\setcounter{tocdepth}{2}
```

Result

```
\begin{knitrout}
\small
\begin{table}
\centering
\begin{tabular}{ll}
\hline
\textbf{Contents} & \\
\hline
1 Introduction & 1 \\
2 Literature Review & 2 \\
2.1 Linear, circular and planar arrays & 2 \\
2.2 Spherical arrays & 4 \\
2.3 Beamforming techniques & 9 \\
2.4 EMFi and flat sensors & 10 \\
2.5 Electrode design for flat sensors & 11 \\
3 Research Proposal & 12 \\
4 Initial Results & 13 \\
\hline
\end{tabular}
\end{table}
\end{knitrout}
```
You can easily control the table-of-contents depth:

**LaTeX** code

\setcounter{tocdepth}{3}

**Result**

```
Contents

1 Introduction ........................................... 1

2 Literature Review ........................................
   2.1 Linear, circular and planar arrays ................. 2
   2.2 Spherical arrays ...................................... 4
   2.2.1 Spherical Fourier transform ..................... 4
   2.2.2 Spherical-aperture microphone .................. 6
   2.2.3 Array performance - Directivity Index and WNG ... 7
   2.3 Beamforming techniques ............................ 9
   2.3.1 Conventional beamformer ......................... 9
   2.3.2 Capon’s beamformer (MVDR) ...................... 10
   2.4 EMFi and flat sensors .............................. 10
```
“Don’t Put All Your Eggs In One Basket”

\documentclass[a4paper,12pt]{article}
\input{Front}
\newpage\input{Abstract}
\newpage\tableofcontents
\newpage\input{Introduction}
\input{Literature}
\input{Proposal}
\input{Results}
\input{Simulation}
\input{Future}
\input{Bibliography}
\input{Appendix}
\end{document}
LaTeX is most widely used by mathematicians, scientists, engineers, philosophers, economists and other scholars in academia and the commercial world.
Everything can be labeled, and then used in a reference:

- Sections, subsections etc.
- Figures
- Tables
- Equations

Labeling examples:

\begin{equation}
\label{eq:fourier}
...
\end{equation}

\section{Simulation example}
\label{sec:simul}
...

\section{Simulation example}
\label{sec:simul}
...
Referencing example:

**LaTeX** code

\LaTeX\{} figures topic is covered in Section \ref{sec:figures}, stay tuned!

**Result**

**LaTeX** figures topic is covered in Section 2, stay tuned!
Equation referencing example (requires $\mathcal{AMS}$):

\begin{equation}
\label{eq:pythagoras}
a^2 + b^2 = c^2
\end{equation}

\begin{equation}
\label{eq:sides}
a = b
\end{equation}

By substituting \eqref{eq:sides} in \eqref{eq:pythagoras} we get:

\begin{equation}
\label{eq:relation}
c = \sqrt{2}a
\end{equation}

Result

\begin{equation}
a^2 + b^2 = c^2 \tag{1}
\end{equation}

\begin{equation}
a = b \tag{2}
\end{equation}

By substituting (2) in (1) we get:

\begin{equation}
c = \sqrt{2}a \tag{3}
\end{equation}
Tip!

You can number your equations, tables, figures, etc. in respect to any part/section of your document.

\texttt{LaTeX} code

\numberwithin{equation}{section}

Result

\[
\int_{-\infty}^{\infty} e^{i\lambda y} dy = 2\pi \delta (\lambda) \quad (1.4)
\]
Page numbering

Tip!

Pages can also be numbered in any style - Roman (I, II, ...), Arabic (1, 2, ...) or Alphabet (A, B, ...).

Example

\pagernumbering{arabic}
\bibTeX is a Reference management software for formatting lists of references.

You can create the \bibTeX records yourself, but to be consistent and avoid errors – use the IEEE-based \bibTeX records.

Unless you have been given a specific style or styling constraints, use the standard IEEE transaction style:

\LaTeX code
\begin{verbatim}
\bibliographystyle{IEEEtran}
\end{verbatim}
Why prefer \texttt{BibTeX} over manually created references?

- \texttt{BibTeX} will automatically insert only the references you have cited into the document bibliography.

- \texttt{BibTeX} will place the references in order of appearance, regardless of their order in the \texttt{BibTeX} file you have created.

- \texttt{BibTeX} will maintain a strict uniform bibliography formatting.

- No need to re-format your bibliographies for different journals/conferences.
So, how do I start using BibTeX?

1. Create an empty BibTeX file, e.g. myBibTeX.bib
2. Copy & Paste BibTeX records into your BibTeX file
3. When a reference is needed, cite it with:

\cite{refCode}

4. Append the following code into your main .TeX file:

\bibliographystyle{IEEEtran}
\bibliography{IEEEabrv,myBibTeX}

Tip!

Tip: when changing your BibTeX file, compile the document 4 times to process the changes completely.
Example

Spherical microphone arrays, that have been extensively studied in the recent years [1, 2, 3], are employing known spatial signal processing techniques previously given by [4].

References


**Tip!**

\usepackage{cite}

**Without **\textbf{cite}:

**Example**

Spherical microphone arrays, that have been extensively studied in the recent years [1, 2, 3], are employing known spatial signal processing techniques previously given by [4].

**With **\textbf{cite}:

**Example**

Spherical microphone arrays, that have been extensively studied in the recent years [1–3], are employing known spatial signal processing techniques previously given by [4].
Outline

1. Modular documents
2. Figures
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4. Slides and posters
5. MiKTeX and Technical Issues
Figures: The good, the bad, and the ugly

Tip!

Vector graphics will always look the same, whether printed on a poster or a post-it note.

<table>
<thead>
<tr>
<th>Format</th>
<th>Lossless</th>
<th>Vector graphics</th>
</tr>
</thead>
<tbody>
<tr>
<td>.eps (the good)</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>.png (the bad)</td>
<td>✓</td>
<td>X</td>
</tr>
<tr>
<td>.jpg (the ugly)</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>
**Tip!**

*Maintain a standard fixed aspect ratio for all your figures throughout the document.*

Use the following code in **Matlab** to set a fixed figure size:

**Example**

```matlab
figure('Position', [240 212 800 600]);
```

**Tip!**

*Set the figure font size according to the final figure size.*

Use the following code in **Matlab** to set the font size:

**Example**

```matlab
set(0, 'DefaulttextFontSize', 16);
set(0, 'DefaultaxesFontSize', 16);
```
Matlab is very limited in annotating plots, especially mathematical formulas in axis labels and legend. Use \texttt{PSfrag} package to remove existing labels and replace them with $\LaTeX$:

\begin{verbatim}
\usepackage{psfrag}
\begin{figure}
\begin{psfrags}
\psfragscanon
\psfrag{xlabel}{\footnotesize $\widehat{\Omega}^{-1}$}
\psfrag{ylabel}{\footnotesize $\int{\sin(\widehat{\Omega})}$}
\includegraphics{figure.eps}
\caption{Some caption...}
\label{fig:fig1}
\end{psfrags}
\end{figure}
\end{verbatim}
PSfrag example:

Before

After
Using sub-figures

Tip!

You can easily display several figures as “sub-figures” with the `subfig` package.

Figure: Four sub-figures
Outline

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Writing new commands

The following code looks pretty much unreadable:

\[
\int_{-\infty}^{\infty} \left[ x(t) \right] \left[ x(t) \right]^* dt = \int_{-\infty}^{\infty} \left[ X(f) \right] \left[ X(f) \right]^* df
\]

You can easily implement new commands in LATEX.
Let’s create new commands for common \LaTeX sequences:

\begin{verbatim}
\newcommand{\inty}{\int_{-\infty}^{\infty}}
\newcommand{\p}[1]{\left(#1\right)}
\newcommand{\pp}[1]{\left[#1\right]}
\end{verbatim}

Rewriting the equation code:

\begin{verbatim}
\[ \inty{\pp{x\p{t}}\pp{x\p{t}}^*dt} = \inty{\pp{X\p{f}}\pp{X\p{f}}^*df} \]
\end{verbatim}

\begin{align*}
\int_{-\infty}^{\infty} [x(t)] [x(t)]^* dt &= \int_{-\infty}^{\infty} [X(f)] [X(f)]^* df
\end{align*}
Tip!

Create a new-commands file with all your common sequences and include it in all your projects. Existing commands can be overwritten with \renewcommand{}{}. 

Example

\newcommand{\p}[1]{\left(#1\right)}
\newcommand{\pp}[1]{\left[#1\right]} 
\newcommand{\be}[1]{\begin{equation}\label{EQ:#1}} 
\newcommand{\ee}{\end{equation}} 
\newcommand{\ba}{\begin{array}} 
\newcommand{\ea}{\end{array}} 
\renewcommand{\u}[1]{\mathbf{#1}} 
\newcommand{\re}[1]{\mathcal{R}e\{#1\}} 
\newcommand{\im}[1]{\mathcal{I}m\{#1\}} 
\newcommand{\ej}{e^{j\varphi}} 
\newcommand{\abs}[1]{\left|#1\right|} 
\newcommand{\norm}[1]{\left\|#1\right\|} 
...
Outline

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\LaTeX\ can be used to produce high quality slides and posters.

- **Beamer** is a \LaTeX\ document-class for producing slides.
- The default output is a PDF file which is suitable for on-screen viewing.
- Can create anything from the simplest static slides to those with dynamic effects.

**Tip!**

*Use beamerposter package to create high quality \LaTeX\ posters.*

Poster example link
Outline

1. Modular documents
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5. MiKTeX and Technical Issues
The internal DVI viewer included in **MiKTeX**, called **Yap**, contains a unique feature that enables inverse DVI search.

Double-clicking anywhere in the previewed DVI file will lead you back to the corresponding line in the TeX file.

![Yap Options window]

**Figure:** Yap Options window
LaTeX is mainly based on contributions (packages) by various code writers and associations.
If you are having problems compiling a TeX document such as compilation errors, warnings, missing symbols in the output document, update the package repository:

1. Update MiKTeX package repository (use “Update” menu item)
2. Repeat step 1 until the update tool does not discover new updates.
3. Update the MiKTeX File Name Data Base and Formats (use “settings menu item).

Tip!

Make sure that “Install missing packages on-the-fly: Yes” is selected in the MiKTeX Settings tool.
How can I do that in LaTeX?

If you are wondering how to do something in LaTeX consult the following:

- Your editor Help
- LaTeX manuals and ebooks (I recommend to begin with “The Not So Short Introduction to LaTeX” available online for free)
- Browse for packages and documentation in http://ctan.org/
- Consult expert friends or forums
- Just Google it – “How do I ... in LaTeX?”
Summary

- There’s nothing you can’t do with \LaTeX.
- No, really, there isn’t.
- And it will always be better looking and more professional than other WYSIWYG applications such as Word, Powerpoint, etc.

Thank you for your time!