LaTeX- Advanced Topics

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Outline

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Think big

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

LaTeX code

```
\part
\chapter
\section
\subsection
\subsubsection
\paragraph
\subparagraph
```

Once your document is ready and organized, invoke:

LaTeX code

```
\tableofcontents
\listoffigures
\listoftables
```

You can easily control the table-of-contents depth:

LaTeX code

```
\setcounter{tocdepth}{1}
```

Result

Contents

You can easily control the table-of-contents depth:

LaTeX code

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

Result

Contents

You can easily control the table-of-contents depth:

LaTeX code

```
\setcounter{tocdepth}{3}
```

Result

Contents

"Don't Put All Your Eggs In One Basket"

LaTeX code

```
\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}
```

Customizing line spacing

Tip!

Line spacing can be easily altered using **setspace** *package.*

LaTeX is most widely used by mathematicians, scientists, engineers, philosophers, economists and other scholars in academia and the commercial world.

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:

LaTeX code

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

LaTeX code

```
\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 $\mathcal{AMS}$):

LaTeX code

```
\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

$$a^2 + b^2 = c^2 \tag{1}$$

$$a = b \tag{2}$$

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

$$c = \sqrt{2}a \tag{3}$$

Numbering...

Tip!

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

LaTeX code

```
\numberwithin{equation}{section}
```

Result

$$\int_{-\infty}^{\infty} e^{jxy}\,dy = 2\pi\delta\left(x\right) \tag{1.4}$$

Page numbering

Tip!

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

Example

```
\pagenumbering{arabic}
```

BibTeX

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

```
\bibliographystyle{IEEEtran}
```

Why prefer BibTeX over manually created references?

- BibTeX will automatically insert only the references you have cited into the document bibliography.
- BibTeX will place the references in order of appearance, regardless of their order in the BibTeX file you have created.
- 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:

LaTeX code

```
\cite{refCode}
```

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

LaTeX code

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

Tip!

Tip: when changing your BibTeX file, compile the document 4

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

[1] B. Rafaely, "Plane-wave decomposition of the sound field on a sphere by spherical convolution," *J. Acoust. Soc. Am.*, vol. 116, no. 4, pp. 2149–2157, 2004.

[2] ——, "Analysis and design of spherical microphone arrays," *IEEE Trans. on Speech and Audio Processing*, vol. 13, no. 1, pp. 135–143, 2005.

[3] M. Agmon and B. Rafaely, "Beamforming for a spherical-aperture microphone," in *IEEE 25th convention of Electrical and Electronics Engineers in Israel (IEEEI 2008)*, Eilat, Israel, December 2008, pp. 227–230.

[4] H. L. Van Trees, *Optimum Array Processing (Detection, Estimation, and Modulation Theory, Part IV)*, 1st ed. New York, NY: Wiley-Interscience, 2002.

Tip!

```
\usepackage{cite}
```

Without **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 **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

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.

Format	Lossless	Vector graphics
.eps (the good)	✓	✓
.png (the bad)	✓	X
.jpg (the ugly)	X	X

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

```
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

```
set(0,'DefaulttextFontSize', 16);
set(0,'DefaultaxesFontSize', 16);
```

Tweaking .eps figures

Matlab is very limited in annotating plots, especially mathematical formulas in axis labels and legend. Use **PSfrag** package to remove existing labels and replace them with LaTeX:

LaTeX code

```
\usepackage{psfrag}
```

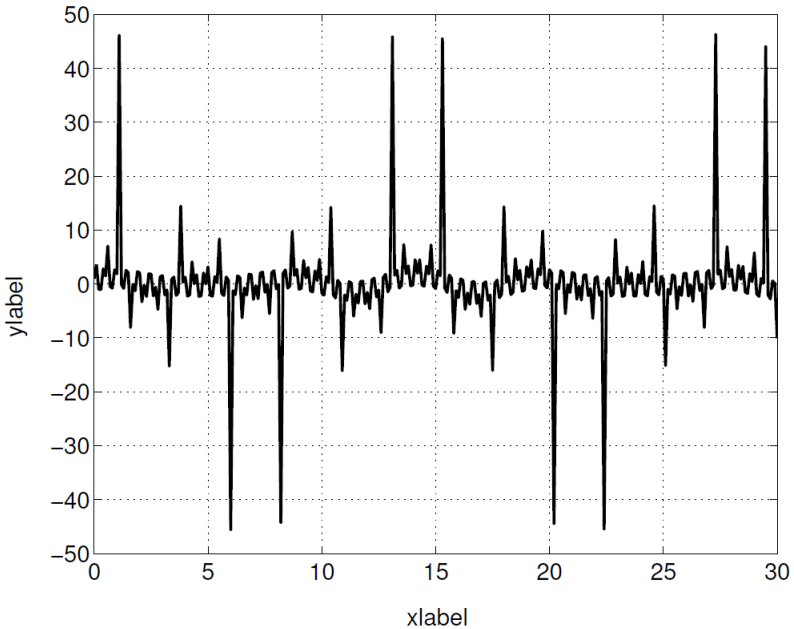
Then use the following code in conjunction with the figure code:

LaTeX code

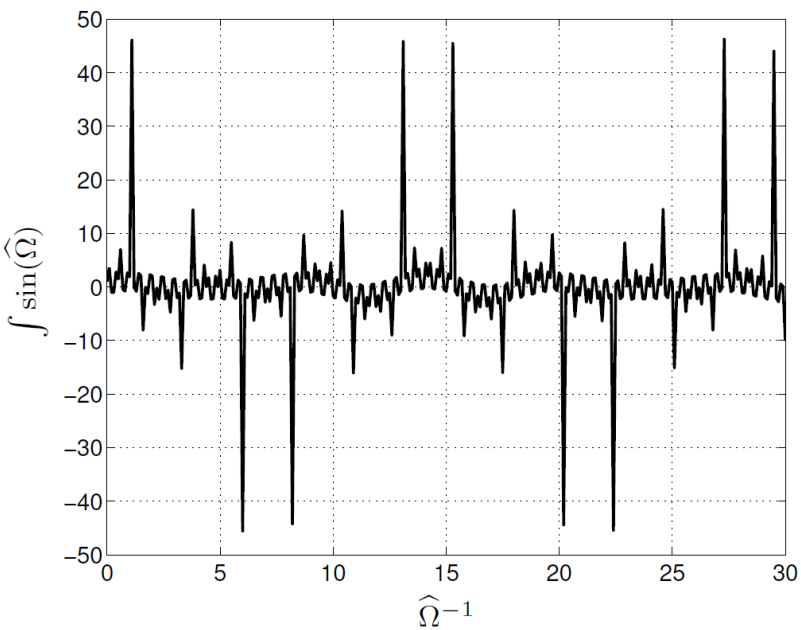
```
\begin{figure}
  \begin{psfrags}
    \psfragscanon
    \psfrag{xlabel}{\footnotesize $\widehat{\Omega}^{-1}$}
    \psfrag{ylabel}{\footnotesize $\int{\sin(widehat{\Omega})}$}
  \includegraphics{figure.eps}
  \caption{Some caption...}
  \label{fig:fig1}
  \end{psfrags}
\end{figure}
```

PSfrag example:

Before



After



Using sub-figures

Tip!

You can easily display several figures as "sub-figures" with the **subfig** *package.*

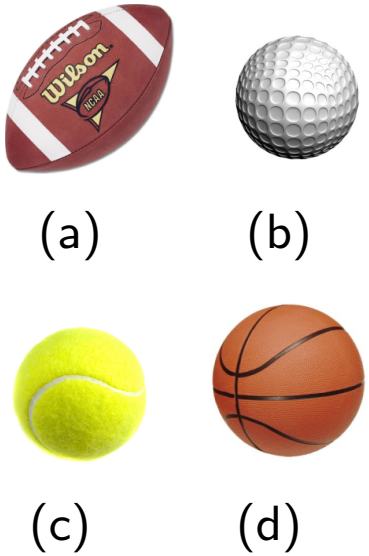


Figure: Four sub-figures

Outline

Writing new commands

The following code looks pretty much unreadable:

LaTeX code

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

Result

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

You can easily implement new commands in LaTeX.

Let's create new commands for common LaTeX sequences:

LaTeX code

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

Rewriting the equation code:

LaTeX code

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

Result

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

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\left\{#1\right\}}
\newcommand{\im}[1]{\mathcal{I}m\left\{#1\right\}}
\newcommand{\ej}{e^{j\varphi}}
\newcommand{\abs}[1]{\left|#1\right|}
\newcommand{\norm}[1]{\left\|#1\right\|}
...
```

Outline

Hey, I like your slides!

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

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.

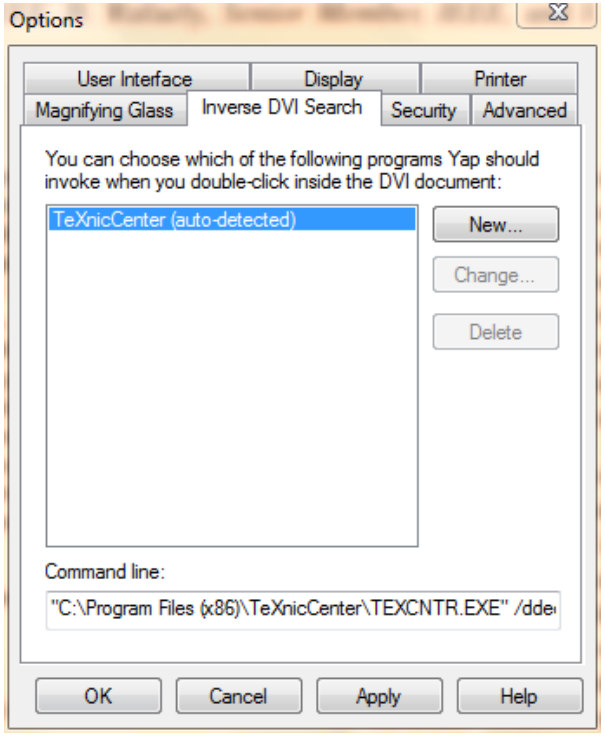


Figure: Yap Options window

LaTeX package problems

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 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!