

L^AT_EX Workshop

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<http://proditus.com/latex>

Leaders of Tomorrow

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Outline

1. Introduction
2. How to get LATEX and the Basics
3. Typesetting Text
4. Typesetting Mathematics
5. Dealing with Graphics
6. Cross-referencing and Bibliographies
7. Some Examples

I. Introduction

- LATEX is...
 - a markup language/program (think HTML)
 - very powerful, but has a steep learning curve
- LATEX is NOT...
 - a word processor (MS Word)
 - a layout program (Adobe InDesign)

I. Introduction

- Why use LATEX?
 - Beautiful and professional documents
 - Mathematical documents
 - Sections and cross-referencing
 - Bibliographies
 - Scalable

2. How to get LATEX

- Windows
 - proTeXt (www.tug.org/protex)
 - TeXnicCenter (comes with proTeXt)
- Mac
 - MacTeX (www.tug.org/mactex)
 - TeXShop (comes with MacTeX)
 - TextMate (macromates.com)
- Unix/Linux...

2. The Basics

- What you see is NOT what you get
- Two step process
 - Create .tex file
 - Run LaTeX engine
 - Result is a .pdf
 - $.tex \rightarrow \text{LaTeX} \rightarrow .pdf$
- You deal with content, LaTeX deals with formatting

2. The Basics

- Basic .tex file structure

```
\documentclass[letter,11pt]{article}  
  
% This is the preamble  
  
\begin{document}  
  
    This is a short article.  
  
\end{document}
```

- Packages (goes in preamble)

```
\usepackage{subfigure}
```

2. The Basics

- Environments
 - e.g. equation, itemize, figure, table

```
\begin{itemize}  
...  
\end{itemize}
```

- Commands
 - e.g. `\today`, `\ref{label}`

Today is `\today`. \longrightarrow Today is February 9, 2009.

3. Typesetting Text

- LATEX will generally decide where to break lines, and pages but to force it...

`\\` or `\newline`

`\newpage`

- To make text bold, *italic*, or underlined..

`\textbf{}`

`\emph{}`

`\underline{}`

3. Structuring Text

```
\documentclass[letter, 11pt]{article}

\begin{document}
  \section{Introduction}      % Declare section
  \label{sec:introduction}   % Give it a label
                             % content goes here

  \section{Experiment A}
  \label{sec:experiment_a}
    \subsection{Set-Up}      % Declare a subsection
    \label{sub:set_up}

    \subsection{Results}
    \label{sub:results}

  \section{Conclusion}
  \label{sec:conclusion}

\end{document}
```

4. Typesetting Math

- Single equations are wrapped in \$ signs

$$\text{\$}a^2 + b^2 = c^2\text{\$} \longrightarrow a^2 + b^2 = c^2$$

- To create a numbered equation, use...

```
Einstein says  
\begin{equation}  
  E = mc^2 \label{eins}  
\end{equation}
```

So based on `\eqref{eins}`,
the speed of light is the
ultimate limit.

Einstein says

$$E = mc^2 \quad (1)$$

So based on (1), the speed of light
is the ultimate limit.

4. Typesetting Math

- Math can be typed in *text (inline)* or *display mode*

This is text style:

```
 $\lim_{n \to \infty}$   
 $\sum_{k=1}^n \frac{1}{k^2}$   
 $= \frac{\pi^2}{6}$ .
```

And this is display style:

```

$$\lim_{n \to \infty}$$
  

$$\sum_{k=1}^n \frac{1}{k^2}$$
  

$$= \frac{\pi^2}{6}$$

```

This is text style: $\lim_{n \rightarrow \infty} \sum_{k=1}^n \frac{1}{k^2} = \frac{\pi^2}{6}$.

And this is display style:

$$\lim_{n \rightarrow \infty} \sum_{k=1}^n \frac{1}{k^2} = \frac{\pi^2}{6}$$

4. Typesetting Math

- Seemingly difficult formulae are easy to typeset

$$\underbrace{\overbrace{a+b+c}^6 \cdot \overbrace{d+e+f}^9}_{\text{meaning of life}} = 42$$

```
\underbrace{\overbrace{a+b+c}^6  
\cdot \overbrace{d+e+f}^9}  
\text{meaning of life} = 42
```

4. Typesetting Math

- An example of a matrix

$$\mathbf{X} = \begin{pmatrix} x_1 & x_2 & \dots \\ x_3 & x_4 & \dots \\ \vdots & \vdots & \ddots \end{pmatrix}$$

```
\begin{equation*}
\mathbf{X} = \left(
\begin{array}{ccc}
x_1 & x_2 & \dots \\
x_3 & x_4 & \dots \\
\vdots & \vdots & \ddots
\end{array}
\right)
\end{equation*}
```

4. Typesetting Math

- Equation arrays come in handy at times

$$x(k) = \frac{1}{2}x(k-1) + \frac{25x(k-1)}{1+x^2(k-1)} + 8\cos[1.2(k-1)] + w(k) \quad (1)$$

$$z(k) = \frac{1}{20}x^2(k) + v(k) \quad (2)$$

```
\begin{eqnarray}
x(k) & = & \frac{1}{2} x(k-1) + \frac{25 x(k-1)}{1 + x^2}
(k-1)} + 8\cos[1.2(k-1)] + w(k) \label{kitagawa:1} \\
z(k) & = & \frac{1}{20} x^2(k) + v(k) \label{kitagawa:2}
\end{eqnarray}
```

4. Typesetting Math

- Lookup the various math symbols you need...

Table 3.1: Math Mode Accents.

\hat{a}	<code>\hat{a}</code>	\check{a}	<code>\check{a}</code>	\tilde{a}	<code>\tilde{a}</code>
\grave{a}	<code>\grave{a}</code>	\dot{a}	<code>\dot{a}</code>	\ddot{a}	<code>\ddot{a}</code>
\bar{a}	<code>\bar{a}</code>	\vec{a}	<code>\vec{a}</code>	\widehat{AAA}	<code>\widehat{AAA}</code>
\acute{a}	<code>\acute{a}</code>	\breve{a}	<code>\breve{a}</code>	\widetilde{AAA}	<code>\widetilde{AAA}</code>
\mathring{a}	<code>\mathring{a}</code>				

Table 3.2: Greek Letters.

There is no uppercase of some of the letters like `\Alpha`, `\Beta` and so on, because they look the same as normal roman letters: A, B...

α	<code>\alpha</code>	θ	<code>\theta</code>	o	<code>o</code>	v	<code>\upsilon</code>
β	<code>\beta</code>	ϑ	<code>\vartheta</code>	π	<code>\pi</code>	ϕ	<code>\phi</code>
γ	<code>\gamma</code>	ι	<code>\iota</code>	ϖ	<code>\varpi</code>	φ	<code>\varphi</code>
δ	<code>\delta</code>	κ	<code>\kappa</code>	ρ	<code>\rho</code>	χ	<code>\chi</code>
ϵ	<code>\epsilon</code>	λ	<code>\lambda</code>	ϱ	<code>\varrho</code>	ψ	<code>\psi</code>
ε	<code>\varepsilon</code>	μ	<code>\mu</code>	σ	<code>\sigma</code>	ω	<code>\omega</code>
ζ	<code>\zeta</code>	ν	<code>\nu</code>	ς	<code>\varsigma</code>		
η	<code>\eta</code>	ξ	<code>\xi</code>	τ	<code>\tau</code>		
Γ	<code>\Gamma</code>	Λ	<code>\Lambda</code>	Σ	<code>\Sigma</code>	Ψ	<code>\Psi</code>
Δ	<code>\Delta</code>	Ξ	<code>\Xi</code>	Υ	<code>\Upsilon</code>	Ω	<code>\Omega</code>
Θ	<code>\Theta</code>	Π	<code>\Pi</code>	Φ	<code>\Phi</code>		

5. Dealing with Graphics

- Easiest way is to include/import your own figures

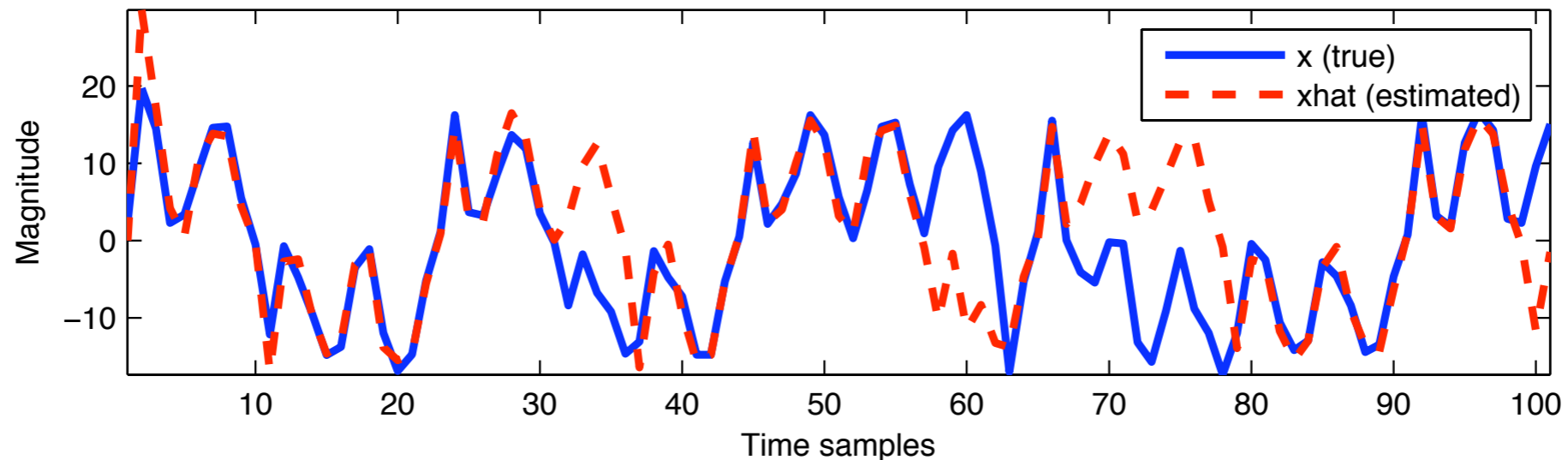
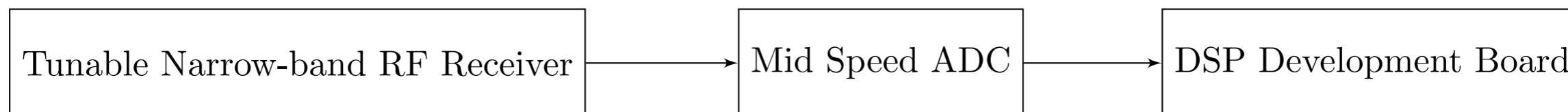


Figure 1: Kitagawa Model - an example Monte-Carlo run

```
\begin{figure}[!htb]
  \centering
  \includegraphics[width=6in]{kitagawa.pdf}
  \caption{Kitagawa Model - an example Monte-Carlo run}
  \label{fig:img_kitagawa}
\end{figure}
```

5. Dealing with Graphics

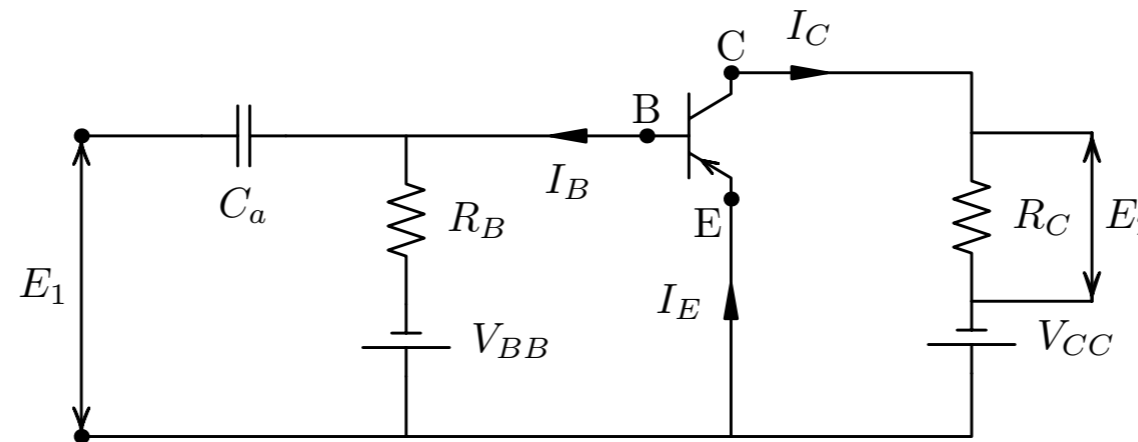
- There are packages for doing graphics within LATEX



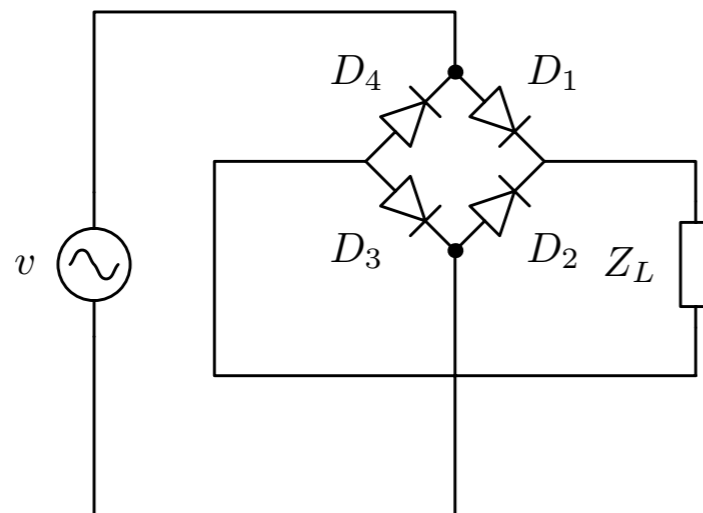
```
\begin{tikzpicture}[auto, node distance=2cm,>=latex']
  \node [block, name=rf] (rf) {Tunable Narrow-band RF Receiver};
  \node [block, right of=rf, node distance=5.7cm] (adc) {Mid
Speed ADC};
  \draw [->] (rf) -- node[name=u] {} (adc);
  \node [block, right of=adc, node distance=4.8cm] (dsp) {DSP
Development Board};
  \draw [->] (adc) -- node[name=v] {} (dsp);
\end{tikzpicture}
```

5. Dealing with Graphics

- There are packages for almost anything in LATEX



Example
4-5-7



```
input makecirc;
initlatrix("\usepackage{amsmath,amssymb}");
source.a(origin,AC,90,"v","");
junction.a(S.a.p+(3cm,1cm),"") (top);
diode.a(J.a,normal,-45,pinA,"D_1","");
diode.b(D.a.K,normal,-135,pinK,"D_2","");
diode.c(D.b.A,normal,135,pinK,"D_3","");
diode.d(D.c.A,normal,45,pinA,"D_4","");
junction.b(D.b.A,"") (bot);
centerto.A(S.a.n,S.a.p) (5cm,imp);
impedance.a(A,90,"Z_L","");
wireU(S.a.p,D.a.A,1.5cm,udsq);
wireU(S.a.n,D.b.A,-1.5cm,udsq);
wire(D.a.K,Z.a.r,rlsq);
wire(Z.a.l,Z.a.l+(0,-4mm),nsq);
wireU(Z.a.l+(0,-4mm),D.d.A,-4cm,rlsq);
```

Example
4-5-8

6. Cross-referencing

- Use markers to cross reference anything in LATEX

```
\label{marker}
```

```
\ref{marker}
```

```
\pageref{marker}
```

```
\section{6. Cross-referencing}  
  \label{sec:this}
```

A reference to this subsection looks like: ``see section `\ref{sec:this}` on slide `\pageref{sec:this}`.''

A reference to this subsection looks like: “see section 6 on slide 20.”

6. Bibliographies

- Power of LATEX lies with BibTeX
 - Can use inline bibliography tools within LATEX if your bibliography is small
 - But BibTeX is much more powerful and effective
- BibTeX is an auxiliary program, that comes with LATEX
 - It uses a .bib database, in which your all your references are stored

6. Bibliographies

- BibTeX also takes care of citation styles
 - Plain, APA, IEEE, Harvard, Chicago, MLA, ACM...
- Example .bib entry

```
@BOOK{knuth:86a,  
  AUTHOR = "Donald E. Knuth",  
  TITLE = {The \TeX{}book},  
  EDITION = "third"  
  PUBLISHER = "Addison-Wesley",  
  ADDRESS = {Reading, MA},  
  YEAR = 1986}
```

6. Bibliographies

- BibTeX front-ends are very useful
 - Windows: JabRef (<http://jabref.sourceforge.net/>)
 - Mac: BibDesk (<http://bibdesk.sourceforge.net/>)

The screenshot shows the BibDesk application window titled "root.bib". The window has a search bar labeled "Search Bibliography" and a toolbar with icons for settings, adding, editing, deleting, and viewing. Below the toolbar is a table with columns: BibTeX, Cite Key, Title, Date, First Author, and Secondary Author. The table contains 18 entries. The second entry is selected, and its preview is shown on the right side of the window. The preview shows a PDF document titled "00847726.pdf" with the subtitle "A new method for the nonli...". The URL "http://dx.doi.org/10.1..." is visible at the bottom of the preview.

BibTeX	Cite Key	Title	Date	First Author	Secondary Author
thesis	Rosen:2005uq	A Framework for Nonlinear Filtering in MATLAB	2005	J. Rosén	
article	847726	A new method for the nonlinear transformation of mea...	Mar 2000	S. Julier	J. U
article	4518385	A new unscented particle filter	May 2008	Q. Cheng	P. B
article	388209	A tutorial on MPEG/audio compression	Feb 1995	D. Pan	
article	978374	A tutorial on particle filters for online nonlinear/non-G...	Feb 2002	M. S. Arulamp...	S. M
article	lascala1996ekf	An extended Kalman filter frequency tracker for high-n...	1996	B. La Scala	R. B
book	gray2004iss	An Introduction to Statistical Signal Processing	2004	R. M. Gray	L. D
article	4378812	Benchmarking Nonlinear Filters	Feb 2006	N. Sirola	S. A
book	ristic2004bkf	Beyond the Kalman Filter: Particle Filters for Tracking A...	2004	B. Ristic	S. A
article	deuschl1998csm	Consensus statement of the Movement Disorder Societ...	1998	G. Deuschl	P. B
article	aliloytty2005ctk	Consistency of three Kalman filter extensions in hybrid...		S. Ali-Loytty	N. S
article	4266868	Discrete-Time Nonlinear Filtering Algorithms Using Ga...	May 2009	I. Arasaratnam	S. H
book	barshalom20...	Estimation with Applications to Tracking and Navigation	2001	Y. Bar-Shalom	X. R
article	910572	Factor graphs and the sum-product algorithm	Feb 2001	F. R. Kschisch...	B. J.
article	parker1990ftn	Frequency tracking of nonsinusoidal periodic signals in...	1990	P. J. Parker	B. A
article	hurtado2000iai	Inter- and intralimb oscillator coupling in Parkinsonian...	2000	J. M. Hurtado	J. P.
inbook	wanmervech7	Kalman Filtering and Neural Networks (chapter 7)	2001	E. A. Wan	R. v
article	timmer1998mnt	Modeling noisy time series: Physiological tremor	1998	J. Timmer	

6. Bibliographies

- How does BibTeX Work?
 - Create an item in your .bib database
 - Use its *key* to cite the item from your LATEX file

```
\cite{key}
```

- Run the following sequence:
 - LATEX – BibTeX – LATEX – LATEX
- This will resolve the references/citations
- Some editors have this as a macro...

Thanks!

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