



Signal Processing

Introduction to L^AT_EX

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What is $\text{\LaTeX}$?

- $\text{\LaTeX}$ is a document preparation system.
- It's not a word processor - you describe content using plain text.
- Produces high-quality, consistent typesetting, ideal for:
 - Scientific papers, reports, theses
 - Presentations (like this one!)
 - CVs and resumes

Why Use $\text{\LaTeX}$?

- Separates content from formatting
- Handles math beautifully
- Built-in references, citations, and lists
- Fully reproducible: just share the .tex file
- Industry and academia standard in engineering fields

Linux:

- Install via package manager:
`sudo apt install texlive-full`

Windows:

- Install MiKTeX

Mac:

- Install MacTeX

Overleaf:

- Cloud-based LaTeX editor — no installation needed.
- Great for collaboration and templates.

VS Code:

- Install LaTeX Workshop extension.
- Works offline

Code

```
\documentclass{article}  
\begin{document}  
Hello, world! This is my first LaTeX document.  
\end{document}
```

Compile using: `pdflatex filename.tex`

```
\documentclass{article}
```

```
\usepackage{amsmath}
```

```
\begin{document}
```

```
\section{Task}
```

You can organize your document in sections.

```
\subsection{Subtask}
```

You can organize each section with subsections.

```
\end{document}
```



```
\textbf{Bold}, \textit{italic}, \underline{underline}  
% This is a comment
```

```
\textbf{Bold}, \textit{italic}, \underline{underline}  
% This is a comment
```

Bold text, *italic*, underline
Comments start with %.

```
\begin{figure}[h]  
  \centering  
  \includegraphics[width=0.7\textwidth]{image.png}  
  \caption{Example figure.}  
  \label{fig:example}  
\end{figure}
```



Figure: Example figure with caption

You can create a reference to a figure or a table using

```
\ref{fig:example}
```

This is my reference to the sample figure 1.

Lists:

```
\begin{itemize}  
  \item Item 1  
  \item Item 2  
\end{itemize}
```

Lists:

```
\begin{itemize}  
  \item Item 1  
  \item Item 2  
\end{itemize}
```

Lists:

- Item 1
- Item 2

Numbered List:

```
\begin{enumerate}  
  \item Item 1  
  \item Item 2  
\end{enumerate}
```

Numbered List:

```
\begin{enumerate}  
  \item Item 1  
  \item Item 2  
\end{enumerate}
```

Numbered List:

- 1 Item 1
- 2 Item 2

Tables:

```
\begin{tabular}{lc}  
Signal & Mean \\  
\hline  
$x[n]$ & 0.5 \\  
$y[n]$ & 0.3 \\  
\end{tabular}
```

Tables:

```
\begin{tabular}{lc}
Signal & Mean \\
\hline
 $x[n]$  & 0.5 \\
 $y[n]$  & 0.3 \\
\end{tabular}
```

	Signal	Mean
Tables:	$x[n]$	0.5
	$y[n]$	0.3

Inline math: $a^2 + b^2 = c^2 \rightarrow a^2 + b^2 = c^2$

Display math:

```
\[  
E = mc^2  
\]
```

$$E = mc^2$$

Convolution (1D continuous):

$$\begin{aligned} \backslash[\\ y(t) &= (x * h)(t) \\ &= \int_{-\infty}^{\infty} x(\tau) h(t - \tau) d\tau \\ \backslash] \end{aligned}$$

$$y(t) = (x * h)(t) = \int_{-\infty}^{\infty} x(\tau) h(t - \tau) d\tau$$

Convolution (1D Discrete):

$$\begin{aligned} \backslash[\\ y[k] &= (x * h)[k] \\ &= \sum_{m=-\infty}^{\infty} x[m] h[k-m] \\ \backslash] \end{aligned}$$

$$y[k] = (x * h)[k] = \sum_{m=-\infty}^{\infty} x[m] h[k - m]$$

Fourier Transform (continuous-time)

$$\begin{aligned} & \int_{-\infty}^{\infty} x(t) e^{-j\omega t} dt \\ X(\omega) &= \end{aligned}$$

$$X(\omega) = \int_{-\infty}^{\infty} x(t) e^{-j\omega t} dt$$

Discrete-Time Fourier Transform (DTFT)

$$\begin{aligned} X(e^{j\omega}) &= \\ &\sum_{k=-\infty}^{\infty} x[k] e^{-j\omega k} \end{aligned}$$

$$X(e^{j\omega}) = \sum_{k=-\infty}^{\infty} x[k] e^{-j\omega k}$$

Discrete-Time Fourier Transform (DTFT)

$$X(e^{j\omega}) = \sum_{k=-\infty}^{\infty} x[k] e^{-j\omega k}$$

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$$\omega \in [-\pi, \pi]$$

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$$\begin{aligned} & \backslash[\\ & \backslash\boldsymbol{y} = \backslash\boldsymbol{H}\backslash\boldsymbol{x} \\ & \backslash] \end{aligned}$$

$$\boldsymbol{y} = \boldsymbol{H}\boldsymbol{x}$$

Where to Learn More

- Overleaf - Learn LaTeX in 30 Minutes
- Overleaf - Mathematical expressions
- A simple guide to LaTeX

Questions?

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