A Beginner Friendly LaTeX Tutorial

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1 Getting Started

LaTeX is a high-quality typesetting system; it includes features designed for the production of technical and scientific documentation. It is an open-source project maintained by TeX user group[1]. With LaTeX, unlike other word processors, you don't need to worry about the layout of your document as it does it for you. Typesetting mathematical equations especially become easier with LaTeX.

Overleaf is a cloud-based LaTeX editor that many people in the scientific community use for LaTeX. We will be using it in our tutorial. Follow the steps below to get started:

- Go to overleaf and sign yourself up for it by registering as shown in fig. 1 .
- Then make a new project by clicking on the "New Project" button and selecting "Blank Project"(fig 2).
- You'll find a layout at the beginning shown in fig. 3. You can see the file "main.tex" on the left side and also "file outline" which will show sections and subsections of the documents as you add them.
- To the right of it, you will find the source window where you will do all the work of writing LaTeX code.
- On the very right, you can see the output pdf file which will be generated every time you hit [Recompile] or use the key combination [Ctrl] + [S]. There is also an option to download the pdf file beside the "Recompile" button.

Following is the code from fig. 3. I have added some text under the introduction section. You can copy and paste this into your overleaf editor and play around with it. I will be referring to the overleaf tutorial[2] for most of the things here. You can look into it for more information. Also, for a detailed introduction to LaTeX both with and without using overleaf, you can refer to Ref. [3].

```
\documentclass{article}
\usepackage[utf8]{inputenc}

\title{First \LaTeX file}
\author{Prasad Pawar}
\date{November 2022}
```

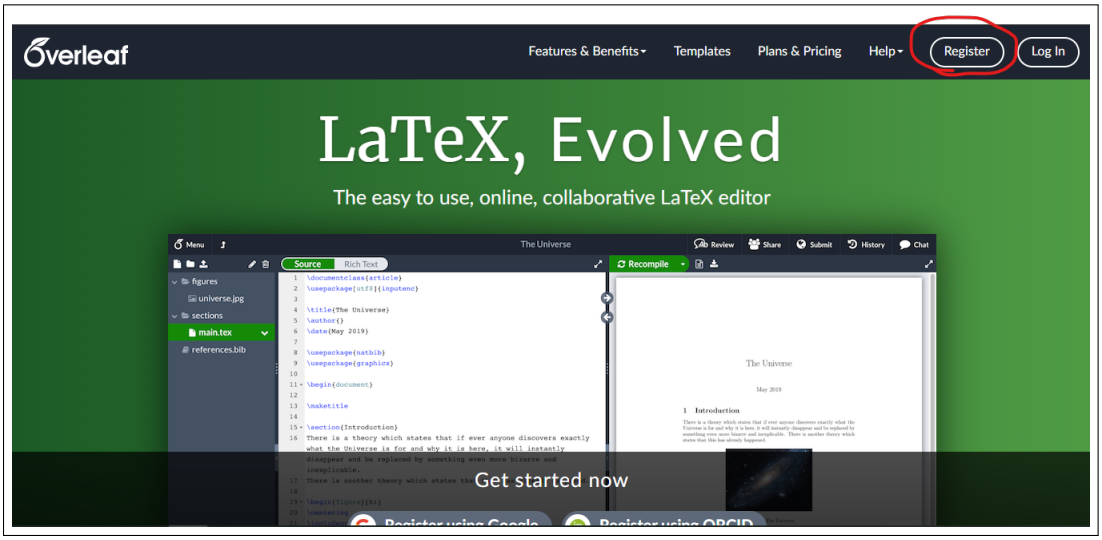


Figure 1: Overleaf Log In page

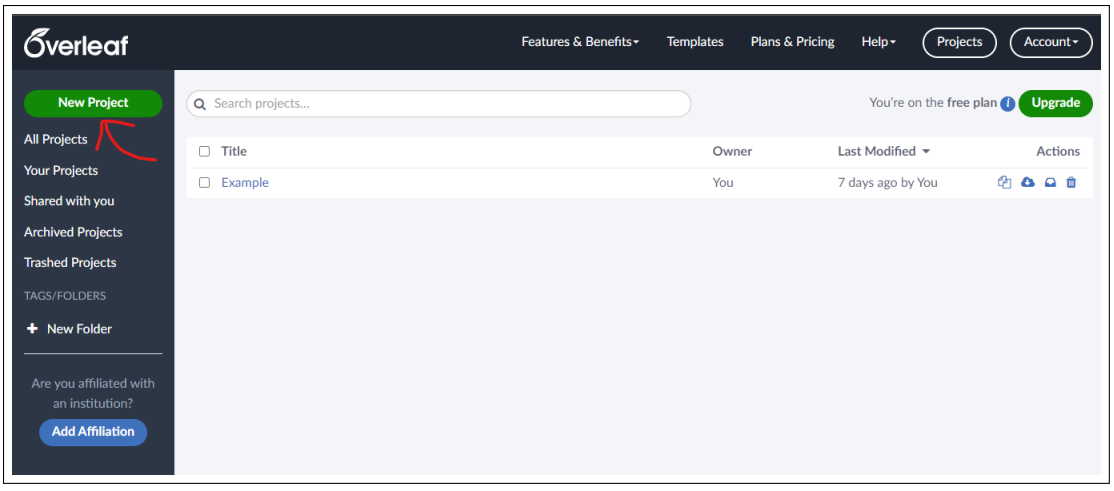


Figure 2: Make a New Project

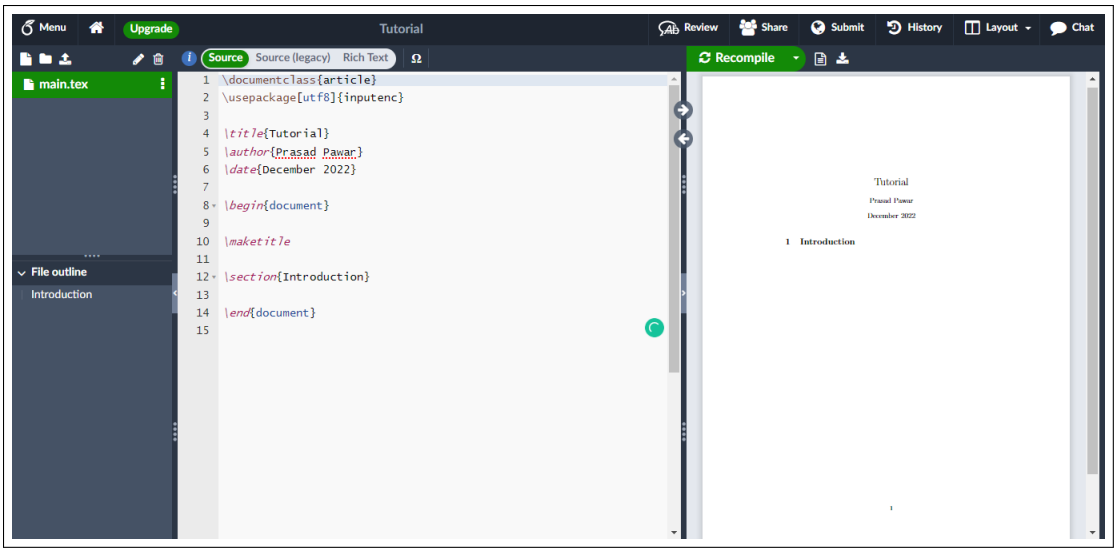


Figure 3: Beginning with Overleaf

```
\begin{document}
\maketitle
\section{Introduction}
First document. This is my first time using \LaTeX. This is simple
    example with no extra packages or parameters included.\\
This is how second paragraph looks like. You can see the second
    paragraph is already indented which is a standard for technical
    writing.
\end{document}
```

After you hit compile, you will see the output shown in fig. 4 in the pdf on the right of overleaf project window. The part before `\begin{document}` is called **Preamble**. The part inside `\begin{document}` and `\end{document}` is **main body**. Notice that the title details won't be there in the output if you remove `\maketitle` in the main body of the document.

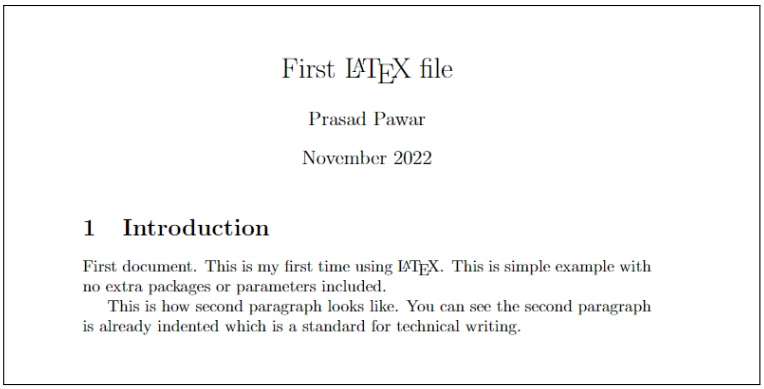


Figure 4: Output of above code

2 Preamble

The preamble is the setup part of a LaTeX file. Note that, by default, the document class for this document is article but you can also have different document classes, for example, slideshows(beamer) and change the font size(11pt, 12pt) and page size(a3, a4, letterpaper) using the format `\documentclass[12pt, a4]{article}`.

There is also an option for adding title, author's name as well as date in the preamble. You can use `\date{\today}`, to put today's date. You need to use `\maketitle` for the title and other information you put in the preamble to be typesetted in the document.

3 Using LaTeX 101

Let us look now at some common useful features of LaTeX.

3.1 Comments

A comment added in the code will not be typesetted into the pdf. This is be useful if one needs to type some notes for future or just explain the line to a collaborator.

You need to type % in front of the line you want to comment out. For example,

```
\documentclass{article}
\usepackage[utf8]{inputenc}
```

```
\title{First \LaTeX file}
\author{Prasad Pawar}
\date{November 2022}

\begin{document}
\maketitle
\section{Introduction}
First document. This is my first time using \LaTeX. This is simple
    example with no extra packages or parameters included.\\
% This line won't appear in the pdf output. This is how second
    paragraph looks like. You can see the second paragraph is
    already indented which is a standard for technical writing.
\end{document}
```

Alternatively, you can select the text you want to comment out and press [Ctrl] + [/]. The output will not contain the commented text.

3.2 Bold, Italic, Underlining

You can make text bold, italic and underlined in LaTeX just like in any word processor.

Bold: You can make the text bold by putting it inside `\textbf{...}`. Alternatively, you can select the text and press [Ctrl]+[B].

Italic: You can make underline the text by putting it inside `\textit{...}`. Alternatively, you can select the text and press [Ctrl]+[I].

Underline: You can make underline the text by putting it inside `\underline{...}`.

```
You can embolden text in {\LaTeX }, you can also \textit{italicize}
    and \underline{underline} it.
```

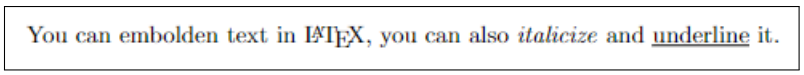


Figure 5: Bold, Italic, Underline

3.3 Lists: Enumerate, Itemize

You can create lists by numbering or by making bullet points in LaTeX using environments like enumerate and itemize. For using enumerate environment,

for example, use `\begin{enumenrate}` and end it with `\end{enumenrate}`. `\item` can be used to add each point in this list.

```
\documentclass{article}
\begin{document}
\begin{enumerate}
    \item First point
    \item Second point
    \item Third point
\end{enumerate}
\end{document}
```

This list will automatically ordered as shown in fig 6.

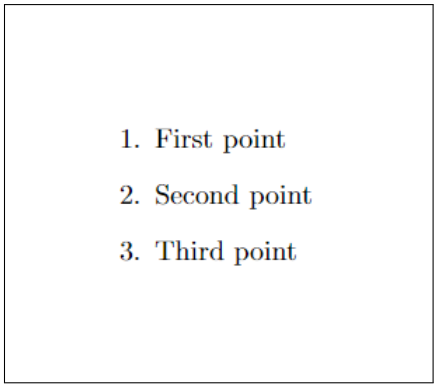


Figure 6: Enumerate

You can also make bullet points instead of an ordered list as follows.

```
\documentclass{article}
\begin{document}
\begin{itemize}
    \item First point
    \item Second point
    \item Third point
\end{itemize}
\end{document}
```

This time we will get the bullet points (fig 7)

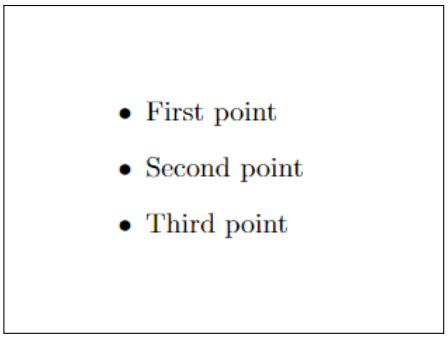


Figure 7: Itemize

You can also put list in another list as follows.

```
\documentclass{article}
\begin{document}
\begin{enumerate}
    \item This is the first item.
    \begin{enumerate}
        \item This is sub-item of the first item.
        \item This is another sub-item of the first item.
    \end{enumerate}
    \item This is the second item.
\end{enumerate}
\end{document}
```

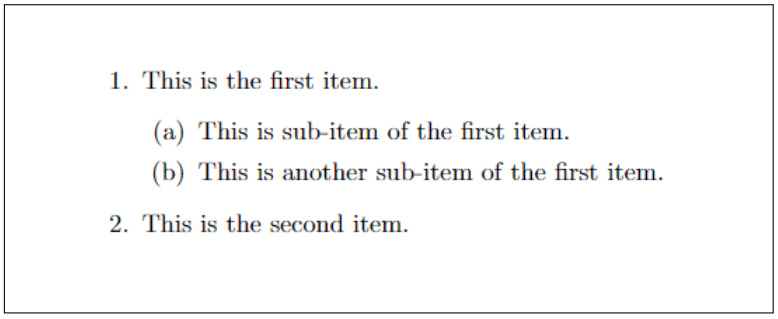


Figure 8: List in list

3.4 Figures

You can add a figure to your document using the "figure" environment. You need to add `\usepackage{graphicx}` to the preamble.

```
\documentclass{article}
\usepackage{graphicx}
\begin{document}
\begin{figure}
    \centering
    \includegraphics[scale=1]{logo.png}
    \caption{Ndeavours}
    \label{fig:my_label}
\end{figure}
\end{document}
```

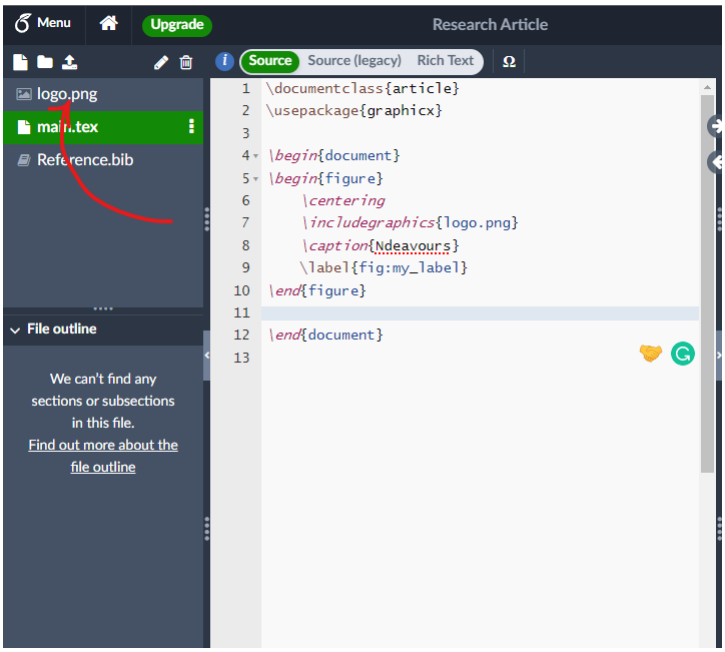


Figure 9: Upload image to the directory

As you can see from the above code, you can add the image "logo.png" in the output pdf file as a figure. You will need to upload the image "logo.png" in the directory as shown in fig 9. "`\includegraphics[scale=1]{logo.png}`" has a scale section using which you can change the figure size. For example, if you put a scale of 0.5, the size of the inserted image would be halved. The output of the above code is given in fig 10. Notice that the figure will automatically be numbered and you can refer to it using `\ref{fig:my_label}`, anywhere in the document.

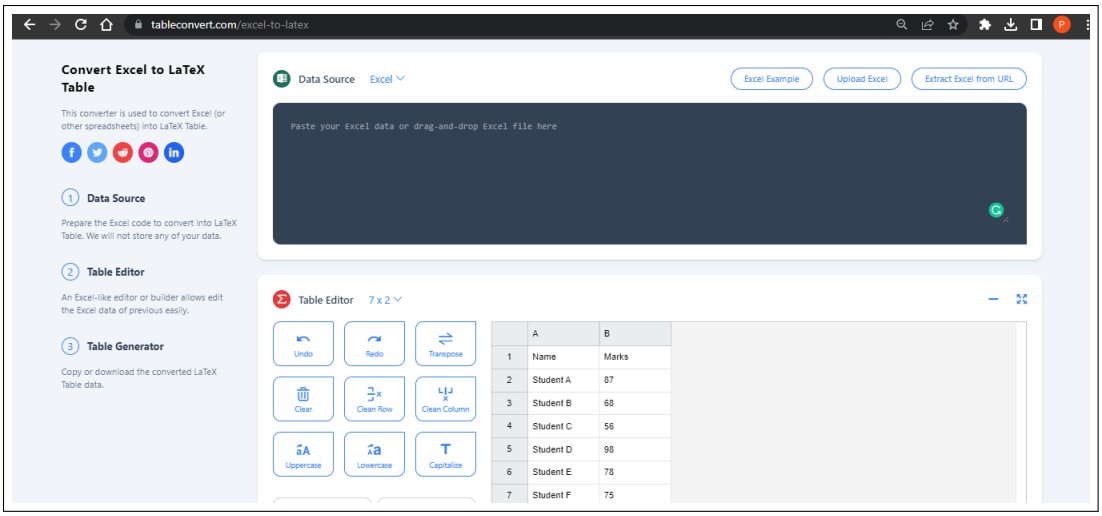


Figure 11: Excel to LaTeX Converter

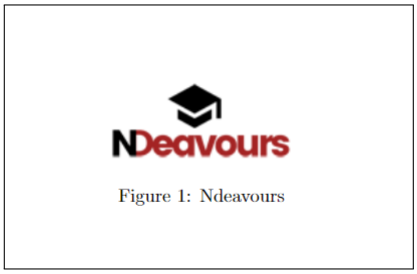


Figure 10: Example of adding a figure in LaTeX

3.5 Tables

Adding table in LaTeXcan be a pain. But fortunately, we have Excel to LaTeX table converter. As you can see in fig 11, you can either upload the excel file, paste the data directly or manually add the data. I have manually added the data after selecting how many rows and columns I want in my table. The output for this is shown in fig 12.

Now, after putting this code in the LaTeX document, we will get the table in the output pdf.

```
\documentclass{article}

\begin{document}
```

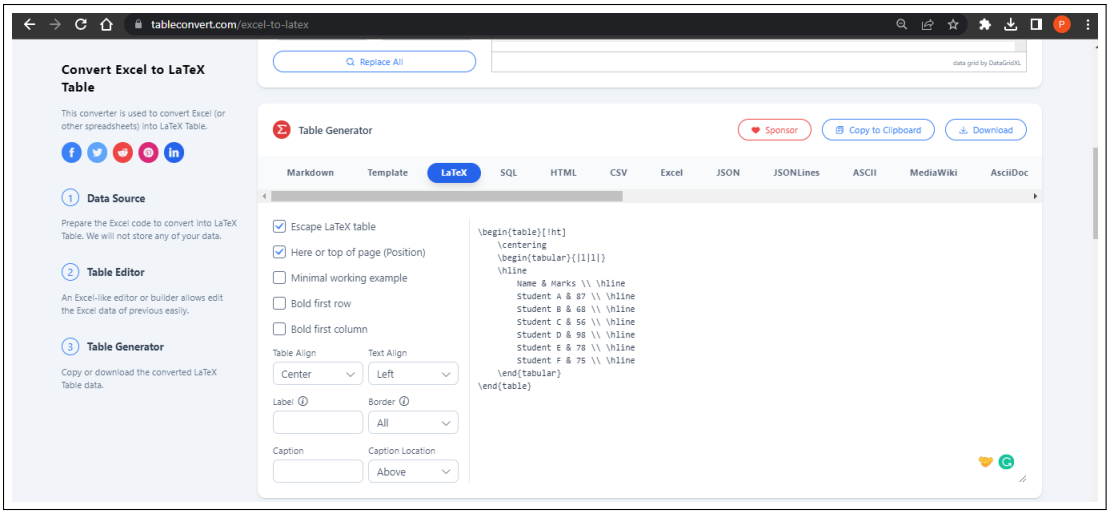
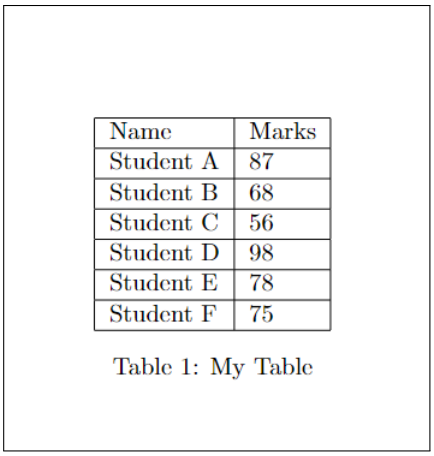


Figure 12: LaTeX code output from the converter

```
\begin{table}[!ht]
    \centering
    \begin{tabular}{|l|l|}
    \hline
        Name & Marks \\ \hline
        Student A & 87 \\ \hline
        Student B & 68 \\ \hline
        Student C & 56 \\ \hline
        Student D & 98 \\ \hline
        Student E & 78 \\ \hline
        Student F & 75 \\ \hline
    \end{tabular}
    \caption{My Table}
    \label{table:my_table}
\end{table}

\end{document}
```

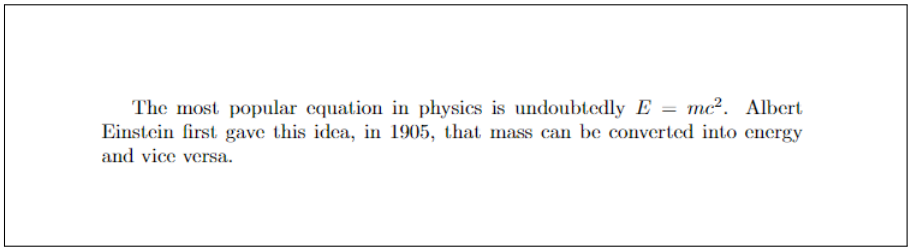
Notice that I have also added a caption as well as a label in the table environment just like in the figure environment. Only after I add a caption, the table will be numbered. The output pdf with the table is shown in fig 13.



Name	Marks
Student A	87
Student B	68
Student C	56
Student D	98
Student E	78
Student F	75

Table 1: My Table

Figure 13: Table in LaTeX



The most popular equation in physics is undoubtedly $E = mc^2$. Albert Einstein first gave this idea, in 1905, that mass can be converted into energy and vice versa.

Figure 14: Inline math mode

3.6 Mathematics

I would say the significant advantage of LaTeX is the ease with which you can typeset any mathematical equation. You can typeset an equation using "inline math mode" as follows. Just add the equation in between the two dollar signs($ eqn $). The output is given in fig 14. Notice that, we have used the caret(^) symbol to raise the powers.

```
\documentclass{article}

\begin{document}
The most popular equation in physics undoubtedly is $E=mc^2$. Albert
    Einstein first gave this idea, in 1905, that mass can be
    converted into energy and vice versa.
\end{document}
```

You can also input equations using "display math mode". The equations can be numbered or unnumbered. Instead of two dollar signs, you just have to

put the equation between 4 dollar signs ($$ eqn $$) to have an unnumbered equation. For example, the following code would display the equation as shown in fig 15.

```
The mass-energy equivalence formula is given by
$$E=mc^2$$
```

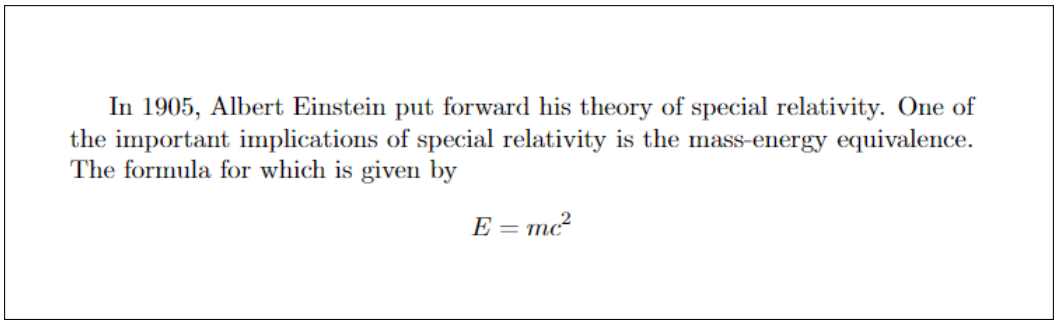


Figure 15: Display math mode: unnumbered

The following are the most common mathematical features you would need.

- **Miscellaneous** These are some common maths symbols and how you can typeset them in LaTeX. For more symbols, you can always search how to typeset them.

  - $\pi \rightarrow$ `\pi`
  - $\geq \rightarrow$ `\geq`
  - $\leq \rightarrow$ `\leq`
  - $\leftarrow \rightarrow$ `\leftarrow`
  - $\infty \rightarrow$ `\infty`
  - $\pm \rightarrow$ `\pm`
  - $\times \rightarrow$ `\times`
  - $\cdot \rightarrow$ `\cdot`

- **Greek Letters:** We people in science use Greek letters a lot. Following is how you typeset some popular Greek letters in LaTeX.

  - $\alpha \rightarrow$ `\alpha`
  - $\beta \rightarrow$ `\beta`
  - $\gamma \rightarrow$ `\gamma`
  - $\delta \rightarrow$ `\delta`
  - $\mu \rightarrow$ `\mu`
  - $\nu \rightarrow$ `\nu`
  - $\lambda \rightarrow$ `\lambda`

Similarly, for capital Greek letters, you just have to capitalize the first letter in the code. But for the capital letters which look the same in both Greek and Latin, we just use the Latin ones.

- $A \rightarrow$ `A`
- $B \rightarrow$ `B`
- $\Gamma \rightarrow$ `\Gamma`
- $\Delta \rightarrow$ `\Delta`
- $M \rightarrow$ `M`
- $N \rightarrow$ `N`
- $\Lambda \rightarrow$ `\Lambda`

- **Superscripts:** You can use the caret symbol (`^`) to superscript anything in math mode. For example, consider the following quadratic equation. We have used `x^2` to make 2 a superscript.

$$x^2 + x + 1 = 0$$

Suppose you have to typeset $x^{21}+x+8=0$. If you try to use `$x^21+x+8=0$`, you will get the output x^21. To superscript 21 as a whole, you would have to put 21 inside a curly bracket as `$x^{21}+x+8=0$` which will give $x^{21} + x + 8 = 0$.

- **Subscripts:** You can use underscore (`_`) to make any text a subscript. Let's take, for example, a chemistry equation.

```
$$
2H_2 + O_2 \rightarrow 2H_2O
$$
```

The output for which is the following:

$$2H_2 + O_2 \rightarrow 2H_2O$$

Similar to superscript, if you try to subscript more than one character, you would have to put curly brackets around it. Take, for example, the Einstein equation in General Relativity.

```
$$
G_{\mu\nu} = \frac{8\pi G}{c^4}T_{\mu\nu}
$$
```

$$G_{\mu\nu} = \frac{8\pi G}{x^4}T_{\mu\nu}$$

- **Fraction:** To typeset fractions, you have to use the format: `\frac{Numerator}{Denominator}`. For example, $\frac{x+y}{x-y}$ is typeset using

```
$$
\frac{x+y}{x-y}
$$
```

- **Trigonometric Functions:** You can try using `$sin(x)$` but it will be italicized as follows $sin(x)$. It will treat s, i and n in sin as variables. So to tell LaTeX that we want to use a trigonometric function and not variables, we have to use `$\sin(x)$` to get $\sin(x)$. Notice that sin is not italicised here.

  Similarly, you can use other trigonometric functions like

  - cos → `$\cos$`
  - tan → `$\tan$`
  - cot → `$\cot$`
  - csc → `$\csc$`

- **Limits** To typeset a limit use `\lim` and use underscore `_{}` to input the $x \to a$ limit under the lim symbol. Use the following format:

```
$$
\lim_{x\rightarrow a} f(x)
$$
```

  The output for which is

$$\lim_{x \to a} f(x)$$

- **Differentiation:** To typeset derivatives or differential equations, it is more convenient to use the physics package rather than not using it. We will add `\usepackage{physics}` to the preamble.

  To write $\frac{\mathrm{d}f(x)}{\mathrm{d}x}$, use the format `$\dv{f(x)}{x}$`.

  Similarly, for partial derivative $\frac{\partial f(x)}{\partial x}$, you just need to add 'p' in front as follows `$\pdv{f(x)}{x}$`.

  You can typeset higher-ordered derivatives as well. For example, the fourth-order derivative of $f(x)$, $\frac{\mathrm{d}^4 f(x)}{\mathrm{d}x^4}$, can be typeset using `$\dv[4]{f(x)}{x}$`.

  You can check ref. [4], for more uses of the physics package.

- **Brackets:** Sometimes you would want to put brackets around some fractions like $\left(\frac{sin(x)}{cos(x)}\right)$. But if you use `$(\frac{sin(x)}{cos(x)})$`, you will get output $(\frac{sin(x)}{cos(x)})$. The brackets do not get big themselves.

  Using the physics package(adding `\usepackage{physics}`), you can just write the content between `$\qty()$` and the bracket size will automatically be adjusted.

  For example,

  ```
  $\qty(\frac{sin(x)}{cos(x)})$
  ```

  gives the output

  $$\left(\frac{sin(x)}{cos(x)}\right)$$

  .

  Similarly, you can also use `$\qty[]$` and `$\qty{}$` for square and curly brackets respectively.

- **Integral** To typeset an integral, use `\int` and use underscore `_{}` to input the lower limit and caret `^{}` to input the upper limit. Use the following format: `\int_{a}^{b}f(x)` which will output

  $$\int_a^b f(x)$$

  .

- **Matrix** Using physics package, you can just put a matrix between `$\mqty()$`. You have to start with first row of the matrix. The first element and second element of the first row can be separated using an ampersand(&) and to start with a new row, you have to close the first row using `\\`.

  For example, to get the following matrix

  $$\begin{pmatrix} 1 & 2 \\ 1 & 4 \end{pmatrix}$$

  you need to write

```
$$\mqty(1 & 2 \\ 1 & 4)$$
```

Similarly, you can use `$\mqty[]$` and `$\mqty{}$` for using square and curly brackets for the matrix.

- **More mathematical and physics features** You can check Ref. [4] and [5] for more mathematical features and notations.

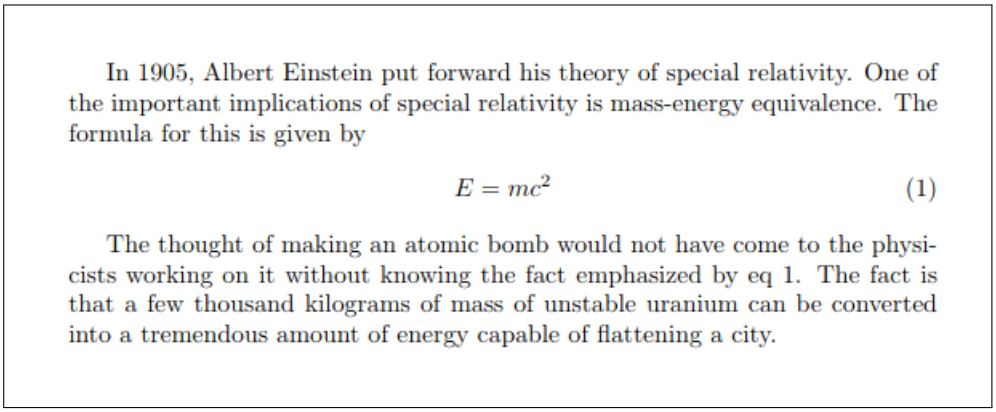
3.6.1 Align Environment

Arguably, the best way to have numbered equations in LaTeX is using the align environment. To use it, first, we need to call the amsmath package. I have also labeled the equation and referred to it in the subsequent line, just like I did for the figures and the table.

```
\documentclass{article}
\usepackage{amsmath}

\begin{document}

In 1905, Albert Einstein put forward his theory of special
    relativity. One of the important implications of special
    relativity is mass-energy equivalence. The formula for this is
    given by
\begin{align}
    E=mc^2 \label{eq:mass-energy}
\end{align}

The thought of making an atomic bomb would not have come to the
    physicists working on it without knowing the fact emphasized by
    eq \ref{eq:mass-energy}. The fact is that a few thousand
    kilograms of mass of unstable uranium can be converted into a
    tremendous amount of energy capable of flattening a city.

\end{document}
```

The output is given by fig 16. Notice how the equation is automatically numbered and to refer to the equation, you just have to use `\ref{keyword}`. The keyword, in this case, was "eq:mass-energy". The keyword can be anything you want which is easy to remember. The advantage of this is that there

would be no need to keep track of equation numbers every time you refer to some equation.



In 1905, Albert Einstein put forward his theory of special relativity. One of the important implications of special relativity is mass-energy equivalence. The formula for this is given by

$$E = mc^2 \tag{1}$$

The thought of making an atomic bomb would not have come to the physicists working on it without knowing the fact emphasized by eq 1. The fact is that a few thousand kilograms of mass of unstable uranium can be converted into a tremendous amount of energy capable of flattening a city.

Figure 16: Using Align Environment

More advantages of align environment include the ability to enter multiple equations, the ability to align these equations, etc. For example, consider that we want to write Maxwell's equations.

```
\documentclass{article}
\usepackage{amsmath}
\usepackage{physics}

\begin{document}

Maxwell's equations:
\begin{align}
    \grad\cdot{\vb{E}} = \frac{\rho}{\epsilon_0}\\
    \grad\cdot{\vb{B}} = 0\\
    \grad\cross{\vb{E}} = -\pdv{\vb{B}}{t}\\
    \grad\cross{\vb{B}} = \mu_0 \vb{J} + \mu_0 \epsilon_0
        \pdv{\vb{E}}{t}
\end{align}

\end{document}
```

I have again used the physics package for convenience. The output for this is given in fig 17. To type a new equation on the new line below, we use \\ after typing the first equation. Notice that the equations are not aligned as per the equal sign. To align the equation, we just put an & sign in front of

the equal sign in the code.

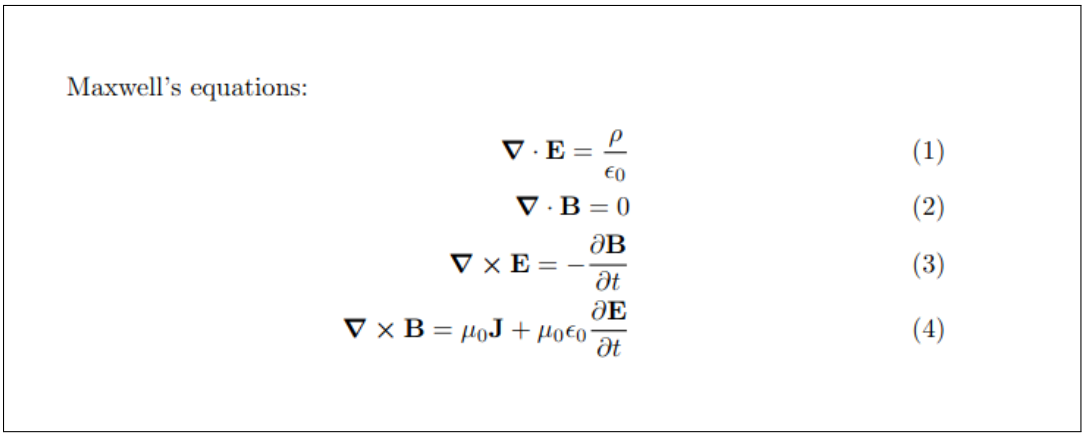


Figure 17: Multiple equations without alignment

In the following code, I have used & to align the equations.

```
\documentclass{article}
\usepackage{amsmath}
\usepackage{physics}

\begin{document}

Maxwell's equations:
\begin{align}
    \grad\cdot{\vb{E}} &= \frac{\rho}{\epsilon_0}\\
    \grad\cdot{\vb{B}} &= 0\\
    \grad\cross{\vb{E}} &= -\pdv{\vb{B}}{t}\\
    \grad\cross{\vb{B}} &= \mu_0 \vb{J} + \mu_0 \epsilon_0
        \pdv{\vb{E}}{t}
\end{align}

\end{document}
```

As shown in fig 18, the equations in the align environment are now aligned. You can also label and then refer to each of these equations by putting `\label{keyword}` before `\\` at the end of each equation.

Maxwell's equations:

$$\nabla \cdot \mathbf{E} = \frac{\rho}{\epsilon_0} \tag{1}$$

$$\nabla \cdot \mathbf{B} = 0 \tag{2}$$

$$\nabla \times \mathbf{E} = -\frac{\partial \mathbf{B}}{\partial t} \tag{3}$$

$$\nabla \times \mathbf{B} = \mu_0 \mathbf{J} + \mu_0 \epsilon_0 \frac{\partial \mathbf{E}}{\partial t} \tag{4}$$

Figure 18: Multiple equations with alignment

3.7 Algorithms

The algpseudocode package provides an algorithmic environment and some useful commands[6]. For example, let's consider the following algorithm.

```
\documentclass{article}
\usepackage{algpseudocode}

\begin{document}

\begin{algorithmic}
\State $i \gets 10$
\If{$i\geq 5$}
    \State $i \gets i-1$
\Else
    \If{$i\leq 3$}
        \State $i \gets i+2$
    \EndIf
\EndIf
\end{algorithmic}

\end{document}
```

The output for which is given in fig. 19.

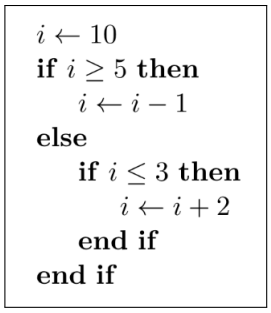


Figure 19: Algorithm

3.8 Verbatim and Code Listing

While making this document, I have used LaTeX codes, which appear in the pdf file as is or verbatim. But if you try to type say `\alpha` in the source window, it will appear as α and also there will be an error as you have not written in math mode. To write it verbatim, you must write it inside

```
\verb|LaTeX code|
```

You can also use the verbatim environment by typing the verbatim text in `\begin{verbatim}` and `\end{verbatim}`.

Aside from writing something verbatim without compiling it, you would also want to write a snippet of code in any programming language using LaTeX. For that, a better environment than verbatim would be lstlisting environment. Following is the preamble and code for using lstlisting. In the environment, I have put some python code that can be replaced with any other code. The output is shown in fig. 20.

```
\documentclass{article}
\usepackage{listings}
\lstset
{
frame=tb,
aboveskip=3mm,
belowskip=3mm,
showstringspaces=false,
columns=flexible,
basicstyle={\small\ttfamily},
numbers=none,
breaklines=true,
breakatwhitespace=true,
```

```
import matplotlib.pyplot as plt
import numpy as np
x=np.arange(0,20,0.1)
y=np.cos(x)
y1=np.exp(-x/10)*np.cos(x)
plt.xlabel("$x$-axis",size=15)
plt.ylabel("$\sin x$",size=15)
plt.plot(x,y,label="Sinusoidal")
plt.plot(x,y1,label="Damped sinusoidal", linewidth=3,color='r',
    linestyle='--'
plt.legend()
plt.show()
```

Figure 20: Using lstlisting Environment

```
tabsize=3
}

\begin{document}
\begin{lstlisting}
import matplotlib.pyplot as plt
import numpy as np
x=np.arange(0,20,0.1)
y=np.cos(x)
y1=np.exp(-x/10)*np.cos(x)
plt.xlabel("$x$-axis",size=15)
plt.ylabel("$\sin x$",size=15)
plt.plot(x,y,label="Sinusoidal")
plt.plot(x,y1,label="Damped sinusoidal", linewidth=3,color='r',
   linestyle='--'
plt.legend()
plt.show()
\end{{remove this}lstlisting}
\end{document}
```

4 Basic research document structure: Abstract, Sections and subsections, References, Appendices

When you will look at a research article, it is generally structured in the following manner. It starts with an **Abstract** which contains the gist of the work presented in the article. Then we have various sections(which can be added by using `\section{section name}`) such as **Introduction** which contains background and literature review for the article, **Methodology**, **Results**, **Discussion and Scope** and **Conclusion**. Each section can also contain subsections. At the end, we have **References** and **Appendices**. LaTeX is very convenient when we want to use this format. For using other formats like a book's or thesis' format of chapters and sections, you can refer to Ref. [7]. Copy and paste the following code in a new overleaf file to make your own research document.

```
\documentclass{article}
\usepackage{appendix}

\title{My Research Article}
\author{Prasad Pawar}
\date{\today}

\begin{document}
\maketitle

\begin{abstract}
    A good abstract should be concise and clearly summarize the
        research premise, context, question(s) and findings, whilst
        outlining the main contributions. It should be succinct and
        informative, avoiding details that are later discussed in the
        main body of the paper. An abstract can be followed by the
        main keywords
\end{abstract}

\section{Introduction}
    State the objective of the work with sufficient details about
        its background. The main research questions should be
        included to clearly draw a bright line around the key
        contributions. This section also explains the context in
        which the paper contributes and labels the main advances. A
```

```
        summary of results should be avoided.

\section{Methodology}
    The section should offer enough details to allow independent
        researchers to understand the study and its framework. It
        should clearly indicate the methods, theory and data used by
        the authors.
    \subsection{method step 1}
    \subsection{method step 2}
\section{Results and conclusion}
    Keep the results clear and concise. Prioritize the main findings
        and all other information, along with the analytical
        techniques can go to an appendix.

\section{Discussion and future work}
    Focusing on the significance of the research and its results,
        the discussion section should avoid excessive reference to
        existing literature, rather on the novelty and possible
        extensions.

    This is how you can cite a website \cite{latexProject}.

    This is how you can cite a book \cite{texbook}.

    This is how you can cite a paper \cite{knuth:1984}.

\bibliography{Reference}
\bibliographystyle{plain}

\begin{appendices}
\section{Appendix 1}
You can add appendices to your article for the work you have done.
    For example, you can put an algorithm here or some derivation
    that need not be there in the main body.
\section{Appendix 2}
You can add more than one appendix.

\end{appendices}

\end{document}
```

The output of the above code is given in fig 21. The first page has the

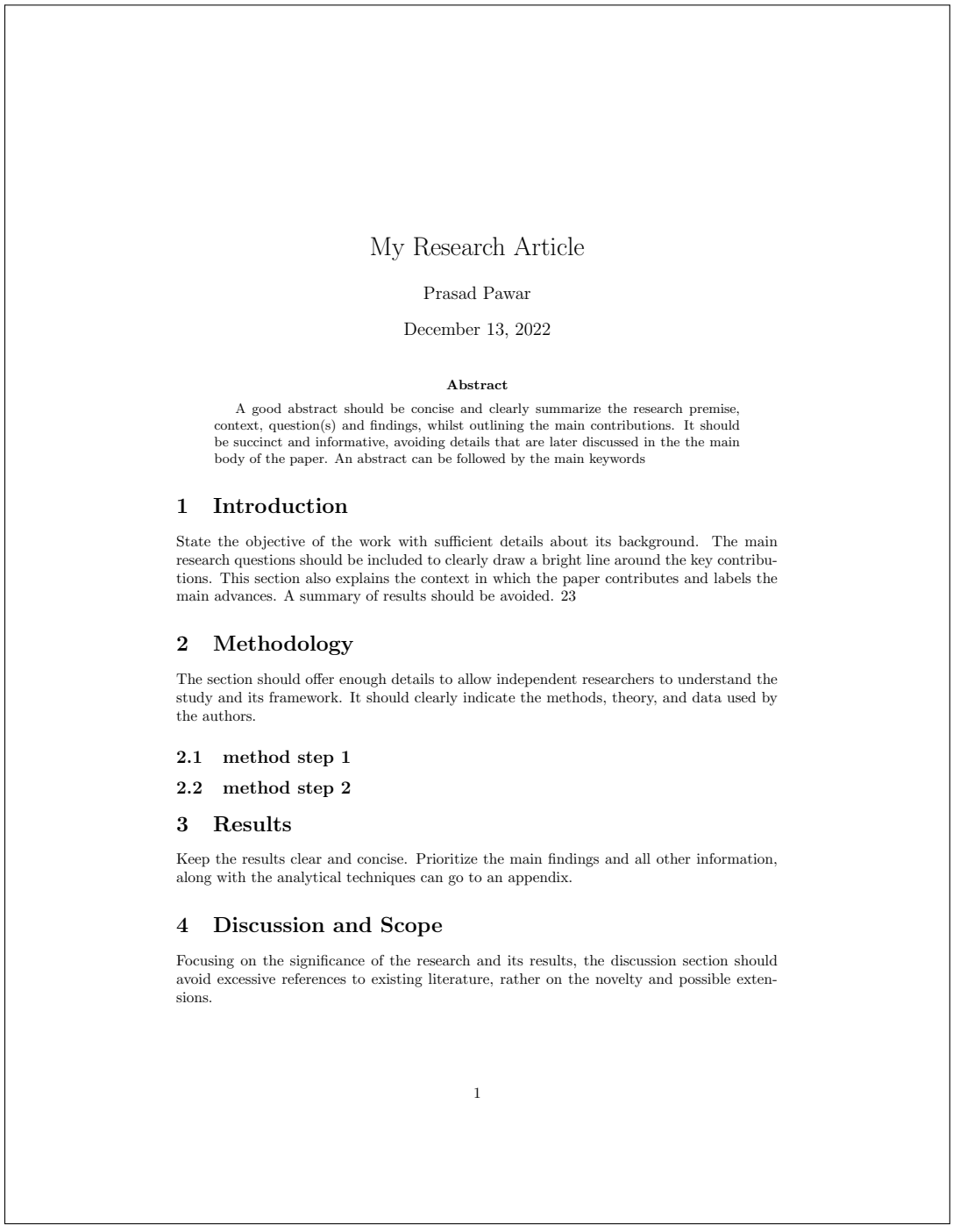
output till the discussion section. Refer to section 5 (fig. 24) for the output of the second page which covers bibliography as well as the appendix.

5 Bibliography, In-text Citations and Appendix

To put in-text citations in your document, you need to make a .bib file shown in fig. 22. You can put various references inside a .bib file. The types of references include article, book, inproceedings, and misc. Any online website or anything miscellaneous can be cited using misc.

Following is a typical content in a .bib file. You can use extensions like Mybib citation generator to cite any page or paper on the internet. You just have to copy the output of the generator in the .bib file.

```
@misc{latexProject,
    title = {Latex: A document preparation system},
    howpublished = {\url{https://www.latex-project.org}}
}

@misc{overleafTutorial,
    title = {Learn LaTeX in 30 minutes},
    howpublished =
        {\url{https://www.overleaf.com/learn/latex/Learn_LaTeX_in_30_minutes}}
}

@book{texbook,
  author = {Donald E. Knuth},
  year = {1986},
  title = {The \TeX{} Book},
  publisher = {Addison-Wesley Professional}
}

@book{latex:companion,
  author = {Frank Mittelbach and Michel Gossens
            and Johannes Braams and David Carlisle
            and Chris Rowley},
  year = {2004},
  title = {The \LaTeX{} Companion},
  publisher = {Addison-Wesley Professional},
  edition = {2}
}
```



My Research Article

Prasad Pawar

December 13, 2022

Abstract

A good abstract should be concise and clearly summarize the research premise, context, question(s) and findings, whilst outlining the main contributions. It should be succinct and informative, avoiding details that are later discussed in the the main body of the paper. An abstract can be followed by the main keywords

1 Introduction

State the objective of the work with sufficient details about its background. The main research questions should be included to clearly draw a bright line around the key contributions. This section also explains the context in which the paper contributes and labels the main advances. A summary of results should be avoided. 23

2 Methodology

The section should offer enough details to allow independent researchers to understand the study and its framework. It should clearly indicate the methods, theory, and data used by the authors.

2.1 method step 1

2.2 method step 2

3 Results

Keep the results clear and concise. Prioritize the main findings and all other information, along with the analytical techniques can go to an appendix.

4 Discussion and Scope

Focusing on the significance of the research and its results, the discussion section should avoid excessive references to existing literature, rather on the novelty and possible extensions.

1

Figure 21: Research article format(first page)

```
@book{latex2e,
  author = {Leslie Lamport},
  year = {1994},
  title = {\LaTeX: a Document Preparation System},
  publisher = {Addison Wesley},
  address = {Massachusetts},
  edition = {2}
}

@article{knuth:1984,
  title={Literate Programming},
  author={Donald E. Knuth},
  journal={The Computer Journal},
  volume={27},
  number={2},
  pages={97--111},
  year={1984},
  publisher={Oxford University Press}
}

@inproceedings{lesk:1977,
  title={Computer Typesetting of Technical Journals on {UNIX}},
  author={Michael Lesk and Brian Kernighan},
  booktitle={Proceedings of American Federation of
             Information Processing Societies: 1977
             National Computer Conference},
  pages={879--888},
  year={1977},
  address={Dallas, Texas}
}
```

Additionally, you also have to put the following snippet of code in the source file before `\end{document}` to print the references in the document.

```
\bibliography{Reference}
\bibliographystyle{plain}
```

I have used plain IEEE's style to list and cite references here. But you can use styles like APA (`\bibliographystyle{apalike}`), IEEE's (`\bibliographystyle{ieeetr}`) or many more [8].

You can cite any item in the .bib file (fig 22) using its keyword (fig 23) given in its bibtex citation. Let's try citing some website, paper or a book,

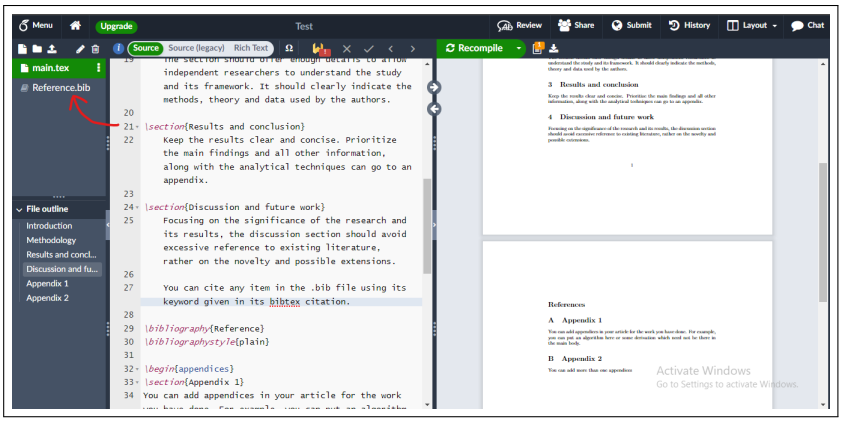


Figure 22: Create and navigate to .bib file

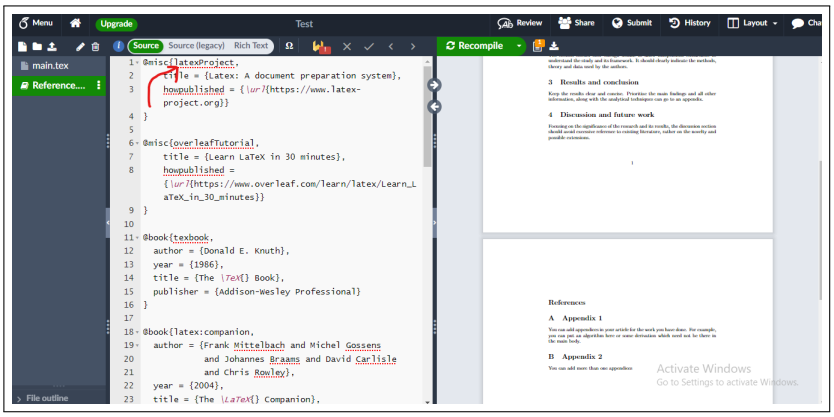


Figure 23: Choosing the Keyword

the information for which is already be in the .bib file.

To cite the LaTeX project website `\cite{latexProject}` has to be used in the source window besides the text you want to give in-text citation to. Here, latexProject is the keyword for citing the LaTeX project website(see fig. 23). Similarly, other references in the .bib file can be cited using the corresponding keywords.

Following is an example of using in-text citations.

```
\LaTeX{} \cite{latex2e} is a set of macros built atop \TeX{}
    \cite{texbook}.
```

Output: LaTeX [9] is a set of macros built atop TeX [10].

5 Conclusion

This section should be short and avoid repetition. It can be included in the discussion or results section too.

This is how you can cite a website [1]. This is how you can cite a book [3]. This is how you can cite a paper [2].

References

[1] Latex - a document preparation system. `https://www.latex-project.org/`.

[2] Donald E. Knuth. Literate programming. *The Computer Journal*, 27(2):97–111, 1984.

[3] Donald E. Knuth. *The TEX Book*. Addison-Wesley Professional, 1986.

A Appendix 1

You can add appendices to your article for the work you have done. For example, you can put an algorithm here or some derivation that need not be there in the main body.

B Appendix 2

You can add more than one appendix.

Figure 24: Research article format(second page)

To put appendix, you have to put in the preamble `\usepackage{appendix}` and `\usepackage{hyperref}`. Hyperref package enables us to put websites in the document. Anywhere in the document, you can write `\href{www.google.com}{google}` to have the link "www.google.com" embedded in the word "google" as google. We need it as we have a few websites in the .bib file which will be printed in the references.

Now to start with the appendix, you need to put the appendix sections in `\begin{appendix}` and `\end{appendix}`. All the sections after `\begin{appendix}` will appear as "A First Appendix Title" , "B Second Appendix Title" and so on.

References

[1] "Latex - a document preparation system." https://www.latex-project.org/.

[2] Overleaf, "Learn latex in 30 minutes - overleaf, online latex editor." https://www.overleaf.com/learn/latex/Learn_LaTeX_in_30_minutes.

[3] M. Krummel, "Latex tutorials (featuring texmaker)." https://www.youtube.com/playlist?list=PL1D4EAB31D3EBC449, 2020.

[4] S. De La Barrera, "The physics package." https://mirror.niser.ac.in/ctan/macros/latex/contrib/physics/physics.pdf, 2012.

[5] Oeiswiki, "List of latex mathematical symbols - oeiswiki2020." https://oeis.org/wiki/List_of_LaTeX_mathematical_symbols, 2020.

[6] Overleaf, "Algorithms - overleaf, online latex editor." https://www.overleaf.com/learn/latex/Algorithms.

[7] Overleaf, "Sections and chapters - overleaf, online latex editor." https://www.overleaf.com/learn/latex/Sections_and_chapters.

[8] "Choosing a bibtex style - reed college." https://www.reed.edu/it/help/LaTeX/bibtexstyles.html.

[9] L. Lamport, *LaTeX: a Document Preparation System*. Massachusetts: Addison Wesley, 2 ed., 1994.

[10] D. E. Knuth, *The TeX Book*. Addison-Wesley Professional, 1986.