

# **L<sup>A</sup>T<sub>E</sub>X Thesis Template of The University of Waterloo**

by

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### **Author's Declaration**

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

I understand that my thesis may be made electronically available to the public.



## **Abstract**

This is a short brochure on how to write your thesis by using this  $\text{\LaTeX}$  template. It's easy, efficient and straightforward. What you need to do, no matter you are familiar with  $\text{\LaTeX}$  or not, is to have a try.



## **Acknowledgements**

This work would not be done without the numerous excellent online resources. Many thanks to those who ever contributed or will contribute their knowledge to the open source community.





*Dedication (included if necessary)*



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# Nomenclature

## Characters

Symbol	Description	Unit
$R$	the gas constant	$\text{m}^2 \cdot \text{s}^{-2} \cdot \text{K}^{-1}$
$C_v$	specific heat capacity at constant volume	$\text{m}^2 \cdot \text{s}^{-2} \cdot \text{K}^{-1}$
$C_p$	specific heat capacity at constant pressure	$\text{m}^2 \cdot \text{s}^{-2} \cdot \text{K}^{-1}$
$E$	specific total energy	$\text{m}^2 \cdot \text{s}^{-2}$
$e$	specific internal energy	$\text{m}^2 \cdot \text{s}^{-2}$
$h_T$	specific total enthalpy	$\text{m}^2 \cdot \text{s}^{-2}$
$h$	specific enthalpy	$\text{m}^2 \cdot \text{s}^{-2}$
$k$	thermal conductivity	$\text{kg} \cdot \text{m} \cdot \text{s}^{-3} \cdot \text{K}^{-1}$
$T$	temperature	K
$t$	time	s
$p$	thermodynamic pressure	$\text{kg} \cdot \text{m}^{-1} \cdot \text{s}^{-2}$
$\hat{p}$	hydrostatic pressure	$\text{kg} \cdot \text{m}^{-1} \cdot \text{s}^{-2}$
$f_b$	body force	$\text{kg} \cdot \text{m}^{-2} \cdot \text{s}^{-2}$
$S$	boundary surface	$\text{m}^2$
$V$	volume	$\text{m}^3$
$\mathbf{V}$	velocity vector	$\text{m} \cdot \text{s}^{-1}$
$u$	x component of velocity	$\text{m} \cdot \text{s}^{-1}$
$v$	y component of velocity	$\text{m} \cdot \text{s}^{-1}$
$w$	z component of velocity	$\text{m} \cdot \text{s}^{-1}$
$c$	speed of sound	$\text{m} \cdot \text{s}^{-1}$
$\mathbf{r}$	position vector	m
$\mathbf{n}$	unit normal vector	1
$\hat{\mathbf{t}}$	unit tangent vector	1

$\tilde{\mathbf{t}}$	unit bitangent vector	1
$C_R$	coefficient of restitution	1
$Re$	Reynolds number	1
$Pr$	Prandtl number	1
$Ma$	Mach number	1
$\alpha$	thermal diffusivity	$\text{m}^2 \cdot \text{s}^{-1}$
$\mu$	dynamic viscosity	$\text{kg} \cdot \text{m}^{-1} \cdot \text{s}^{-1}$
$\nu$	kinematic viscosity	$\text{m}^2 \cdot \text{s}^{-1}$
$\gamma$	heat capacity ratio	1
$\rho$	density	$\text{kg} \cdot \text{m}^{-3}$
$\sigma_{ij}$	stress tensor	$\text{kg} \cdot \text{m}^{-1} \cdot \text{s}^{-2}$
$S_{ij}$	deviatoric stress tensor	$\text{kg} \cdot \text{m}^{-1} \cdot \text{s}^{-2}$
$\tau_{ij}$	viscous stress tensor	$\text{kg} \cdot \text{m}^{-1} \cdot \text{s}^{-2}$
$\delta_{ij}$	Kronecker tensor	1
$I_{ij}$	identity tensor	1

## Operators

Symbol	Description
$\Delta$	difference
$\nabla$	gradient operator
$\delta^\pm$	upwind-biased interpolation scheme

## Abbreviations

Acronym	Description
ANFO	Ammonium Nitrate Fuel Oil
CFD	Computational Fluid Dynamics
CFL	Courant-Friedrichs-Lewy
CJ	Chapman-Jouguet
EOS	Equation of State
JWL	Jones-Wilkins-Lee
TVD	Total Variation Diminishing
WENO	Weighted Essentially Non-oscillatory
ZND	Zel'dovich-von Neumann-Doering

# Chapter 1

## A Brief Guide

### 1.1 What is L<sup>A</sup>T<sub>E</sub>X

L<sup>A</sup>T<sub>E</sub>X (pronounced "Lah-tech" or "Lay-tech") is a macro package created by Leslie Lamport based on T<sub>E</sub>X. As a document preparation system for high-quality typesetting in almost any forms of publishing, L<sup>A</sup>T<sub>E</sub>X is not the name of a particular editing program, but refers to the encoding or tagging conventions that are used in L<sup>A</sup>T<sub>E</sub>X documents [1, 2]. The best resource to learn L<sup>A</sup>T<sub>E</sub>X is "L<sup>A</sup>T<sub>E</sub>X Wikibook", which is available online.

### 1.2 Why use L<sup>A</sup>T<sub>E</sub>X?

There are a lot of good reasons why you need to use L<sup>A</sup>T<sub>E</sub>X, the most significant one is the following:

- Allows you to clearly separate the content from the format of your document.
- Let you concentrate on your ideas, not visual appearance.

You can concentrate purely on the structure and contents of your document, not superficial layout issues. You don't need to manually adjust fonts, text sizes, line heights, or text flow for readability, as L<sup>A</sup>T<sub>E</sub>X takes care of them automatically. [3]

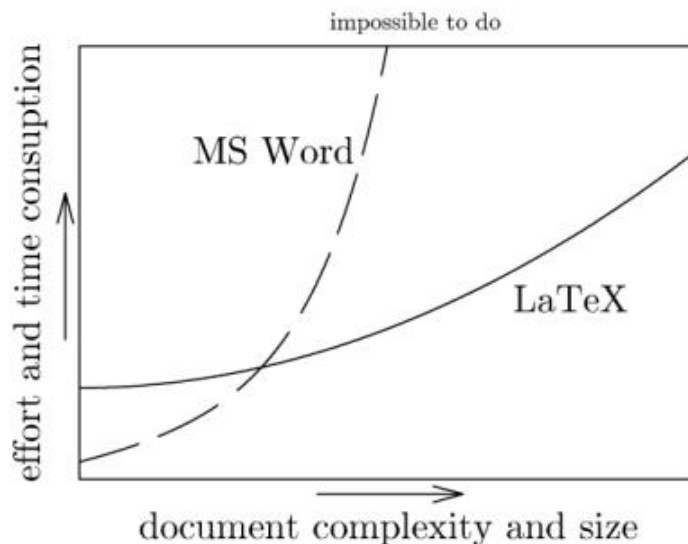


Figure 1.1 Comparison between Microsoft Word and L<sup>A</sup>T<sub>E</sub>X [From Google Images]

## 1.3 How to use?

### 1.3.1 Installation

LaTeX is based on open-source code, so it is available on most computing platforms as free software. If encounter some compiling problems after installation, please Google it. For example, MikTeX may complain about "mathtools.sty", a solution given on "StackExchange" is "The problem is that the package manager has somehow "desynchronized" (even though it's a fresh install). To fix it, run MikTeX Package Manager as administrator—"Package Manager (Admin)". Go to Repository—Synchronize. When that completes, your TexWorks should automatically find the needed style files again."

- Linux: TeXLive distribution.
- MacOS: Mactex or TeXLive.
- Windows: MikTeX or TeXLive.

Note: to use L<sup>A</sup>T<sub>E</sub>X, you need a text editor for writing and editing ".tex" files. To open the ".tex" files in this template, you need a text editor which supports "UTF-8" encoding. Free options for different platforms are the following:

- Linux: vim.
- MacOS: TeXShop, Macvim.
- Windows: Texmaker, Gvim, Notepad++.



### 1.3.2 Include math

L<sup>A</sup>T<sub>E</sub>X realization of Equation 1.1 is something like this:

```
\begin{equationa}\label{eq:N-S_equation}
\frac{\partial (\rho \mathbf{v})}{\partial t} +
\nabla \cdot (\rho \mathbf{v} \mathbf{v}) =
-\nabla p + \nabla \cdot \mathbf{T} + \mathbf{f}.
\end{equationa}
```

$$\frac{\partial(\rho \mathbf{v})}{\partial t} + \nabla \cdot (\rho \mathbf{v} \mathbf{v}) = -\nabla p + \nabla \cdot \mathbf{T} + \mathbf{f}. \quad (1.1)$$

### 1.3.3 Include Graphics

Note: including figures may seem to be scary by looking at the codes. However, the fact is that you only need to modify the names in each part, the rest are simply copy and paste. These codes are all available in the file "Useful Commands.txt".

Figure 1.2 is an example for including a single figure.

```
\begin{figure}[!htbp]
\centering
\includegraphics[width=0.45\textwidth]{ITC_Q_Criteria}
\caption{An Example for including a single figure}
\label{fig:ITC_Q_Criteria}
\end{figure}
```

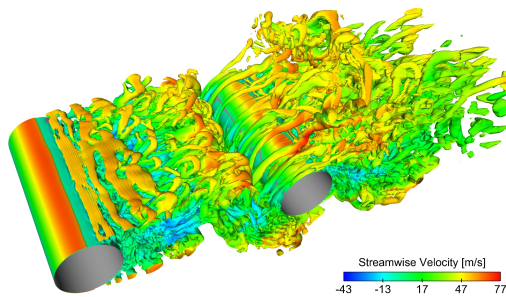


Figure 1.2 An Example for including a single graph

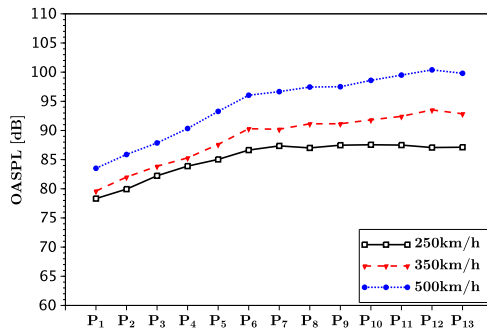
Figure 1.3 is an example for including multiple figures.

```
\begin{figure}[!htbp]
  \centering
  \begin{subfigure}[b]{0.45\textwidth}
    \includegraphics[width=\textwidth]{HC_OASPL_A}
    \caption{}
    \label{fig:HC_OASPL_A}
  \end{subfigure}%
  ~% add a small space
  \begin{subfigure}[b]{0.45\textwidth}
    \includegraphics[width=\textwidth]{HC_OASPL_B}
    \caption{}
    \label{fig:HC_OASPL_B}
  \end{subfigure}%
  \\% change line
  \begin{subfigure}[b]{0.45\textwidth}
    \includegraphics[width=\textwidth]{HC_OASPL_C}
    \caption{}
    \label{fig:HC_OASPL_C}
  \end{subfigure}%
  ~% add a small space
  \begin{subfigure}[b]{0.45\textwidth}
    \includegraphics[width=\textwidth]{HC_OASPL_D}
    \caption{}
    \label{fig:HC_OASPL_D}
  \end{subfigure}%
  \caption{An Example for including multiple figures}
  \label{fig:HC_OASPL}
\end{figure}
```

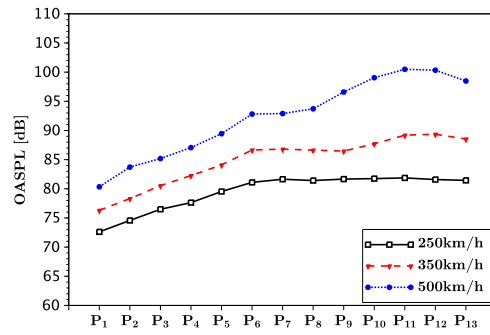
### 1.3.4 Include a citation

Suppose you are going to cite an article named "Document Preparation System", the procedures are:

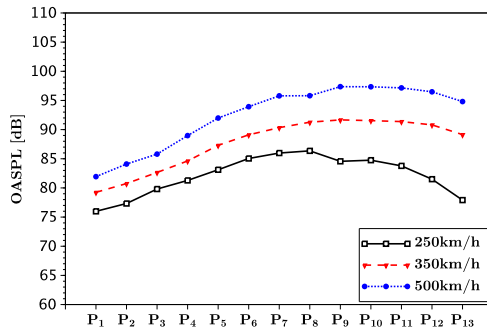
- Use Google Scholar search "Document Preparation System".
- Open "Cite" and choose "Import to Bibtex" under the target item.
- Copy the citation information of this article into the file "Myrefs.bib"



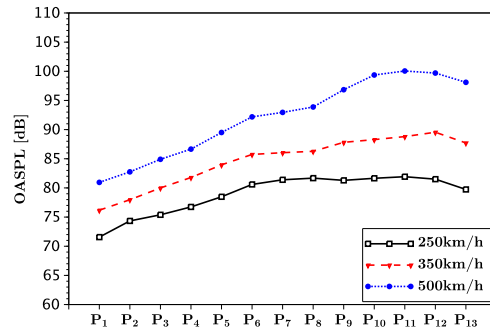
(a)



(b)



(c)



(d)

Figure 1.3 An Example for including multiple figures

- Research dominant: cite this article by `\citep{lamport1986document}` like here [4]
- Citation dominant: cite this article by `\citet{lamport1986document}` like here Lamport [4]
- References list is generated automatically.

### 1.3.5 Generate nomenclature

In this template, a simple command for adding nomenclatures is provided. Therefore, packages for automatical nomenclature generation are not included. From my point of view, there is no need to use those packages and make things complicated. However, if you insist, there are a lot of available packages for creating nomenclatures. Recommended options are (Please Google the one you want to know):

- listofsymbols
- nomenc1

## 1.4 File Tree of Current Template

- Thesis.tex: main tex file, which acts like the main function in C++.
- Style: Store template configuration files, which act like subfunctions.
- Tmp: Store files generated by compilation.
- Biblio: Store information of references.
- Img: Store images.
- Tex: Store files for your content, this is the working directory.
  - Frontpages: content of front pages, like authorship, abstract, etc.
  - Prematter: content of nomenclature, etc.
  - Main\_Content: index for chapters you want to include into your current content.
  - Chap\_\*\*\*: your content for each chapters.
  - Appendix: appendix.
  - Useful Commands: collection of useful commands.

Note: this template can be easily adapted to other writing purposes such as articles. What you need to do is to change and adjust a few items in the "Thesis.tex" file, which would be very easy after you are a little familiar with using L<sup>A</sup>T<sub>E</sub>X. Like :

Change `\documentclass{uwaterloothesis}` to `\documentclass{article}`

## 1.5 Feedback and Problems

Please feel free to send me emails for any related problems:

huangrui.mo@uwaterloo.ca



# **Appendix A**

## **Other Information**





# References

- [1] Wikipedia, LaTeX, <http://en.wikipedia.org/wiki/LaTeX> .
- [2] LaTeX, LaTeX – A document preparation system, <http://www.latex-project.org/> .
- [3] Wikibook, LaTeX, <http://en.wikibooks.org/wiki/LaTeX> .
- [4] L. Lamport, Document Preparation System, Addison-Wesley Reading, MA, 1986.