SAMPLE THESIS CREATED BY USING LyX

By
Ahmed Mohamed Rashed Desoki

A Thesis Submitted to the
Faculty of Engineering at Cairo University
in Partial Fulfillment of the
Requirements for the Degree of

MASTER OF SCIENCE
in
Aerospace Engineering

FACULTY OF ENGINEERING, CAIRO UNIVERSITY
GIZA, EGYPT
July, 2017

Proudly created by

Except for the figures created by Matlab[1], this thesis has been created by *open source software* (OSS) packages. Special thanks go to the numerous generous developers behind the following projects:

GNU project free software, mass collaboration project aiming to give users freedom

LaTeX document markup language

TeX Live cross-platform LaTeX distribution

MiKTeX LaTeX distribution for Windows

LyX cross-platform LaTeX-based document preparation system

Beamer LaTeX class for creating presentation slides and handouts

Inkscape cross-platform vector graphics editor

TeX Text Inkscape plugin for creating and editing LaTeX formulae

Other great projects I failed to mention ...

Other software packages

Other software packages that greatly helped me during this research include:

Areca cross-platform incremental backup package

pdfcrop a Perl program for removing white margins of a pdf file; indispensable for exported Matlab figures

GoldenDict cross-platform feature-rich dictionary lookup program

[1] For your information, NumPy + SciPi + Matplotlib + Spyder offer very competitive alternative to Matlab. For Windows, all these packages and more are distributed by *Python(x,y)*.

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Approved by the Examining Committee

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SAMPLE THESIS CREATED BY USING LyX

Key Words:

Keyword1; Keyword2; Keyword3; Keyword4; Keyword5; Keyword6; Keyword7; Keyword8; Keyword9; Keyword9; Keyword10.

Summary:

I'm Ahmed Mohamed Rashed Desoki, an assistant professor at Aerospace Engineering Department, Cairo University.

This abstract is brief. For the complete abstract, refer to the abstract on page i.

I created this thesis template to help you how you can create a professional thesis using OSS. I tried to cite all the sources that helped me create this sample.

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Abstract

I'm Ahmed Mohamed Rashed Desoki, an assistant professor at Aerospace Engineering Department, Cairo University.

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This template is hosted at github.com at https://github.com/ahmed-rashed/ThesisTemplate. Usage of this template is licensed under GNU GPLv3[1]. If you just want to use this template, then download it as a zip file[2]. If you plan to improve/debug/extend this template, then clone[3] the repository using Git and kindly share[4] your modifications by contributing to the template by issuing a "pull request". Chapter 10 presents introduction to revision control using git.

Finally, foreign languages usually causes some problems to LaTeX documents. Arabic is not an exception. So if you faced a strange problem that you cannot solve, try disabling the Arabic parts of this thesis to check if the problem is related to the Arabic language[5]. To do so, just use the "Thesis_English.lyx" file. If disabling Arabic solved your problem, please try hard to find a solution and reactivate the Arabic again. **Arabic scientists cannot help their nations using any language other than Arabic.**

[1] https://www.gnu.org/licenses/quick-guide-gplv3.en.html

[2] The zip file should be available at https://github.com/ahmed-rashed/ThesisTemplate/archive/master.zip.

[3] Or checkout in case you use SVN instead of Git.

[4] In fact, you have to share your improvements according to the GNU GPLv3 license.

[5] Mostly the problem is not specific to Arabic, but to several other languages as well.

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Acknowledgments

Thanks to the Allah who helped me completing this template. I ask him to accept it from me for the sake of his mercy.

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Table of Contents

List of Tables

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List of Figures

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List of Codes

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Nomenclature

IDE Integrated Development Environment, page 6

IRF Impulse Response Function, page 15

MS Microsoft, page 1

ode ordinary differential equation, page 13

OSS Open Source Software, page i

SDOF Single Degree Of Freedom, page 12

TF Transfer Function, page 14

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Chapter 1

Word Processors; LaTeX vs MS Word

Usually there are two categories of word processing software packages; table 1.1

- What You See Is What You Get (WYSIWYG)
- What You See Is What You Mean (WYSIWYM)

Roughly, you can compare LaTeX to Word as you compare Matlab to Excel. Figure 1.1 visualizes the effort and time consumption needed.

By the way, if you are annoyed by the existence of table 1.1 and figure 1.1 at the following page, this is explained in http://tex.stackexchange.com/questions/66293/strange-behaviour-with-figure-on-chapter-first-page

WYSIWYG	WYSIWYM
Microsoft Word LibreOffice Writer AbiWord Calligra Words	LaTeX LyX

Table 1.1: LaTeX vs Microsoft Word

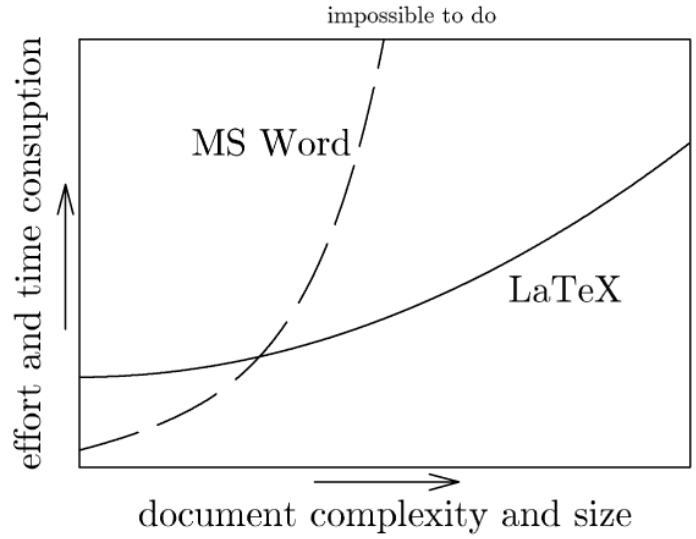


Figure 1.1: Effort and time consumption of MS Word as compared to LaTeX.

Chapter 2

LaTeX; a Document Markup Language

LaTeX is a document markup language.

- Simply you can think of it as similar to HTML[1]
- In order to create a document in LaTeX, a **.tex** file must be created using some **text editor**
- The **.tex** file is then **compiled** to produce the document
- LaTeX can generate several document formats including "pdf"

LaTeX is Free

Although being free is an advantage, but it is a drawback at the same time! Free implies:

- Slow download server
- No clean official documentation
- Several alternatives to do the same thing

However; LaTeX is very mature and widely used by professional/enterprise publishers

- Also it has a big user community
  - when you encounter a problem, google it. Most likely you will find others had encountered it and found a solution

2.1 LaTeX Editors

- To write C/C++ code, any text editor can be used
  - But using a good IDE can greatly ease your job
- LaTeX is similar
  - Any text editor is OK, but a dedicated LaTeX editor is strongly recommended
- A dedicated LaTeX editor

[1] (HyperText Markup Language)

LaTeX 2_ε Cheat Sheet

Document classes

`book`	Default is two-sided.
`report`	No `\part` divisions.
`article`	No `\part` or `\chapter` divisions.
`letter`	Letter (?).
`slides`	Large sans-serif font.

Used at the very beginning of a document: `\documentclass{`*class*`}`. Use `\begin{document}` to start contents and `\end{document}` to end the document.

Common `documentclass` options

`10pt/11pt/12pt`	Font size.
`letterpaper/a4paper`	Paper size.
`twocolumn`	Use two columns.
`twoside`	Set margins for two-sided.
`landscape`	Landscape orientation. Must use `dvips -t landscape`.
`draft`	Double-space lines.

Usage: `\documentclass[`*opt,opt*`]{`*class*`}`.

Packages

`fullpage` Use 1 inch margins.
`anysize` Set margins: `\marginsize{`*l*`}{`*r*`}{`*t*`}{`*b*`}`.
`multicol` Use *n* columns: `\begin{multicols}{`*n*`}`.
`latexsym` Use LaTeX symbol font.
`graphicx` Show image: `\includegraphics[width=`*x*`]{`*file*`}`.
`url` Insert URL: `\url{`*http://...*`}`.

Use before `\begin{document}`. Usage: `\usepackage{`*package*`}`

Title

`\author{`*text*`}`	Author of document.
`\title{`*text*`}`	Title of document.
`\date{`*text*`}`	Date.

These commands go before `\begin{document}`. The declaration `\maketitle` goes at the top of the document.

Miscellaneous

`\pagestyle{empty}`	Empty header, footer and no page numbers.
`\tableofcontents`	Add a table of contents here.

Document structure

`\part{`*title*`}`
`\chapter{`*title*`}`
`\section{`*title*`}`
`\subsection{`*title*`}`
`\subsubsection{`*title*`}`
`\paragraph{`*title*`}`
`\subparagraph{`*title*`}`

Use `\setcounter{secnumdepth}{`*x*`}` suppresses heading numbers of depth $> x$, where `chapter` has depth 0. Use a `*`, as in `\section*{`*title*`}`, to not number a particular item—these items will also not appear in the table of contents.

Text environments

`\begin{comment}`	Comment (not printed). Requires `verbatim` package.
`\begin{quote}`	Indented quotation block.
`\begin{quotation}`	Like `quote` with indented paragraphs.
`\begin{verse}`	Quotation block for verse.

Lists

`\begin{enumerate}`	Numbered list.
`\begin{itemize}`	Bulleted list.
`\begin{description}`	Description list.
`\item` *text*	Add an item.
`\item[`*x*`]` *text*	Use *x* instead of normal bullet or number. Required for descriptions.

References

`\label{`*marker*`}`	Set a marker for cross-reference, often of the form `\label{sec:item}`.
`\ref{`*marker*`}`	Give section/body number of marker.
`\pageref{`*marker*`}`	Give page number of marker.
`\footnote{`*text*`}`	Print footnote at bottom of page.

Floating bodies

`\begin{table}[`*place*`]`	Add numbered table.
`\begin{figure}[`*place*`]`	Add numbered figure.
`\begin{equation}[`*place*`]`	Add numbered equation.
`\caption{`*text*`}`	Caption for the body.

The *place* is a list valid placements for the body. `t`=top, `h`=here, `b`=bottom, `p`=separate page, `!`=place even if ugly. Captions and label markers should be within the environment.

Text properties

Font face

Command	*Declaration*	*Effect*
`\textrm{`*text*`}`	`{\rmfamily` *text*`}`	Roman family
`\textsf{`*text*`}`	`{\sffamily` *text*`}`	Sans serif family
`\texttt{`*text*`}`	`{\ttfamily` *text*`}`	`Typewriter family`
`\textmd{`*text*`}`	`{\mdseries` *text*`}`	Medium series
`\textbf{`*text*`}`	`{\bfseries` *text*`}`	**Bold series**
`\textup{`*text*`}`	`{\upshape` *text*`}`	Upright shape
`\textit{`*text*`}`	`{\itshape` *text*`}`	*Italic shape*
`\textsl{`*text*`}`	`{\slshape` *text*`}`	*Slanted shape*
`\textsc{`*text*`}`	`{\scshape` *text*`}`	Small Caps shape
`\emph{`*text*`}`	`{\em` *text*`}`	*Emphasized*
`\textnormal{`*text*`}`	`{\normalfont` *text*`}`	Document font
`\underline{`*text*`}`		Underline

The command (`ttt`) form handles spacing better than the declaration (*ttt*) form.

Font size

`\tiny`	tiny	`\Large`	Large
`\scriptsize`	scriptsize	`\LARGE`	LARGE
`\footnotesize`	footnotesize	`\huge`	huge
`\small`	small	`\Huge`	Huge
`\normalsize`	normalsize		
`\large`	large		

These are declarations and should be used in the form `{\small ...}`, or without braces to affect the entire document.

Verbatim text

`\begin{verbatim}`	Verbatim environment.
`\begin{verbatim*}`	Spaces are shown as ␣.
`\verb!text!`	Text between the delimiting characters (in this case '`!`') is verbatim.

Justification

Environment	*Declaration*
`\begin{center}`	`\centering`
`\begin{flushleft}`	`\raggedright`
`\begin{flushright}`	`\raggedleft`

Miscellaneous

`\linespread{`*x*`}` changes the line spacing by the multiplier *x*.

Text-mode symbols

Symbols

&	`\&`	_	`\_`	...	`\ldots`	•	`\textbullet`
$	`\$`	^	`\^{}`	|	`\textbar`	\	`\textbackslash`
%	`\%`	~	`\~{}`	#	`\#`	§	`\S`

Accents

ò	`\‘o`	ó	`\’o`	ô	`\^o`	ō	`\^o`	ō	`\=o`
ȯ	`\.o`	ö	`\"o`	o̧	`\c o`	ǒ	`\v o`	ő	`\H o`
ç	`\c c`	o̤	`\d o`	o͟	`\b o`	o͡o	`\t oo`	œ	`\oe`
Œ	`\OE`	æ	`\ae`	Æ	`\AE`	å	`\aa`	Å	`\AA`
ø	`\o`	Ø	`\O`	ł	`\l`	Ł	`\L`	ı	`\i`
ȷ	`\j`	¡	`~‘`	¿	`?‘`				

Delimiters

‘	‘	“	‘‘	{	\{	[	[	(	(	<	`\textless`
’	’	”	’’	}	\}	]	]	)	)	>	`\textgreater`

Dashes

Name	*Source*	*Example*	*Usage*
hyphen	-	X-ray	In words.
en-dash	--	1–5	Between numbers.
em-dash	---	Yes—or no?	Punctuation.

Line and page breaks

`\\`	Begin new line without new paragraph.
`\\*`	Prohibit pagebreak after linebreak.
`\kill`	Don't print current line.
`\pagebreak`	Start new page.
`\noindent`	Do not indent current line.

Miscellaneous

`\today`	February 25, 2014.
`$\sim$`	Prints ∼ instead of `\~{}`, which makes ˜.
`~`	Space, disallow linebreak (`W.J.~Clinton`).
`\@.`	Indicate that the `.` ends a sentence when following an uppercase letter.
`\hspace{`*l*`}`	Horizontal space of length *l* (Ex: $l =$ `20pt`).
`\vspace{`*l*`}`	Vertical space of length *l*.
`\rule{`*w*`}{`*h*`}`	Line of width *w* and height *h*.

Tabular environments

`tabbing` environment

`\=` Set tab stop. `\>` Go to tab stop.

Tab stops can be set on "invisible" lines with `\kill` at the end of the line. Normally `\\` is used to separate lines.

(a) Page 1

Figure 2.1: LaTeX cheat sheet *(continued in the next page)*

tabular environment

```
\begin{array}[pos]{cols}
\begin{tabular}[pos]{cols}
\begin{tabular*}{width}[pos]{cols}
```

tabular column specification

`l`	Left-justified column.
`c`	Centered column.
`r`	Right-justified column.
`p{`*width*`}`	Same as `\parbox[t]{`*width*`}`.
`@{`*decl*`}`	Insert *decl* instead of inter-column space.
`|`	Inserts a vertical line between columns.

tabular elements

`\hline`	Horizontal line between rows.
`\cline{`x-y`}`	Horizontal line across columns x through y.
`\multicolumn{`n`}{`*cols*`}{`*text*`}`	A cell that spans n columns, with *cols* column specification.

Math mode

For inline math, use `\(...\)` or `$...$`. For displayed math, use `\[...\]` or `\begin{equation}`.

Superscript x^y	`^{x}`	Subscript x_y	`_{x}`
$\frac{x}{y}$	`\frac{x}{y}`	$\sum_{k=1}^{n}$	`\sum_{k=1}^n`
$\sqrt[n]{x}$	`\sqrt[n]{x}`	$\prod_{k=1}^{n}$	`\prod_{k=1}^n`

Math-mode symbols

$\leq$	`\leq`	$\geq$	`\geq`	$\neq$	`\neq`	$\approx$	`\approx`
$\times$	`\times`	$\div$	`\div`	$\pm$	`\pm`	$\cdot$	`\cdot`
$\circ$	`^{\circ}`	$\circ$	`\circ`	$\prime$	`\prime`	$\cdots$	`\cdots`
∞	`\infty`	$\neg$	`\neg`	$\wedge$	`\wedge`	$\vee$	`\vee`
$\supset$	`\supset`	$\forall$	`\forall`	$\in$	`\in`	$\rightarrow$	`\rightarrow`
$\subset$	`\subset`	$\exists$	`\exists`	$\notin$	`\notin`	$\Rightarrow$	`\Rightarrow`
$\cup$	`\cup`	$\cap$	`\cap`	$\mid$	`\mid`	$\Leftrightarrow$	`\Leftrightarrow`
$\dot{a}$	`\dot a`	$\hat{a}$	`\hat a`	$\bar{a}$	`\bar a`	$\tilde{a}$	`\tilde a`
α	`\alpha`	β	`\beta`	γ	`\gamma`	δ	`\delta`
ϵ	`\epsilon`	ζ	`\zeta`	η	`\eta`	ε	`\varepsilon`
θ	`\theta`	ι	`\iota`	κ	`\kappa`	ϑ	`\vartheta`
λ	`\lambda`	μ	`\mu`	ν	`\nu`	ξ	`\xi`
π	`\pi`	ρ	`\rho`	σ	`\sigma`	τ	`\tau`
υ	`\upsilon`	ϕ	`\phi`	χ	`\chi`	ψ	`\psi`
ω	`\omega`	Γ	`\Gamma`	Δ	`\Delta`	Θ	`\Theta`
Λ	`\Lambda`	Ξ	`\Xi`	Π	`\Pi`	Σ	`\Sigma`
Υ	`\Upsilon`	Φ	`\Phi`	Ψ	`\Psi`	Ω	`\Omega`

Bibliography and citations

When using BibTeX, you need to run `latex`, `bibtex`, and `latex` twice more to resolve dependencies.

Citation types

`\cite{`*key*`}`	Full author list and year. (Watson and Crick 1953)
`\citeA{`*key*`}`	Full author list. (Watson and Crick)
`\citeN{`*key*`}`	Full author list and year. Watson and Crick (1953)
`\shortcite{`*key*`}`	Abbreviated author list and year. ?
`\shortciteA{`*key*`}`	Abbreviated author list. ?
`\shortciteN{`*key*`}`	Abbreviated author list and year. ?
`\citeyear{`*key*`}`	Cite year only. (1953)

All the above have an `NP` variant without parentheses; Ex. `\citeNP`.

BibTeX entry types

`@article`	Journal or magazine article.
`@book`	Book with publisher.
`@booklet`	Book without publisher.
`@conference`	Article in conference proceedings.
`@inbook`	A part of a book and/or range of pages.
`@incollection`	A part of book with its own title.
`@misc`	If nothing else fits.
`@phdthesis`	PhD. thesis.
`@proceedings`	Proceedings of a conference.
`@techreport`	Tech report, usually numbered in series.
`@unpublished`	Unpublished.

BibTeX fields

`address`	Address of publisher. Not necessary for major publishers.
`author`	Names of authors, of format ....
`booktitle`	Title of book when part of it is cited.
`chapter`	Chapter or section number.
`edition`	Edition of a book.
`editor`	Names of editors.
`institution`	Sponsoring institution of tech. report.
`journal`	Journal name.
`key`	Used for cross ref. when no author.
`month`	Month published. Use 3-letter abbreviation.
`note`	Any additional information.
`number`	Number of journal or magazine.
`organization`	Organization that sponsors a conference.
`pages`	Page range (`2,6,9--12`).
`publisher`	Publisher's name.
`school`	Name of school (for thesis).
`series`	Name of series of books.
`title`	Title of work.
`type`	Type of tech. report, ex. "Research Note".
`volume`	Volume of a journal or book.
`year`	Year of publication.

Not all fields need to be filled. See example below.

Common BibTeX style files

`abbrv`	Standard	`abstract`	`alpha` with abstract
`alpha`	Standard	`apa`	APA
`plain`	Standard	`unsrt`	Unsorted

The LaTeX document should have the following two lines just before `\end{document}`, where `bibfile.bib` is the name of the BibTeX file.

```
\bibliographystyle{plain}
\bibliography{bibfile}
```

BibTeX example

The BibTeX database goes in a file called *file*`.bib`, which is processed with `bibtex file`.

```
@String{N = {Na\-ture}}
@Article{WC:1953,
  author  = {James Watson and Francis Crick},
  title   = {A structure for Deoxyribose Nucleic Acid},
  journal = N,
  volume  = {171},
  pages   = {737},
  year    = 1953
}
```

Sample LaTeX document

```
\documentclass[11pt]{article}
\usepackage{fullpage}
\title{Template}
\author{Name}
\begin{document}
\maketitle

\section{section}
\subsection*{subsection without number}
text \textbf{bold text} text. Some math: $2+2=5$
\subsection{subsection}
text \emph{emphasized text} text. \cite{WC:1953}
discovered the structure of DNA.

A table:
\begin{table}[!th]
\begin{tabular}{|l|c|r|}
\hline
first  &  row  &  data \\
second &  row  &  data \\
\hline
\end{tabular}
\caption{This is the caption}
\label{ex:table}
\end{table}

The table is numbered \ref{ex:table}.
\end{document}
```


(b) Page 2

Figure 2.1: *(continued)* LaTeX cheat sheet

  - can highlight and auto complete LaTeX keywords
  - has several LaTeX templates for several types of documents
  - facilitates compiling and debugging
  - ...

- Sample LaTeX editors are:

  Texstudio; cross-platform

  Kile; for Linux

  and many others

2.2 Porting a LaTeX Document

Usually LaTeX source files reference images and other external files. Hence, if you want to move/copy your LaTeX document to another computer, you have to move/copy all the referenced files as well.

2.3 Arabic Support

Thanks to[1] the "Arabi" package, Arabic and Farsi languages are supported with the "Babel" package.

However, since Arabic users are few, "Arabi" package is not mature enough and some minor bugs do exist. Googling about these bugs, usually you find the similar bugs do exist in other languages as well, and hence you can infer solutions/workarounds. During preparing this thesis, I have done my best to solve/work-around all the bugs I have faced.

2.4 Installing LaTeX

To install and use LaTeX, basically you need two things; (1) LaTeX implementation and (2) Integrated Development Environment (IDE).

For MS Windows users, proText[2] is a TeX/LaTeX distribution that includes:

- MiKTeX: LaTeX Implementation for MS Windows
- TexStudio: cross-platform TeX/LaTeX IDE

For Linux and MAC OS, TeX Live is a cross platform LaTeX implementation[3], and there is a wide range of IDE's including TexStudio.

Keep Concentrating

Due to its WYSIWYM nature, I feel more concentrating while using **LaTeX** as compared to **Ms-Word**

[1] Thanks to GOD at first of course.

[2] https://www.tug.org/protext/

[3] That is, it is a cross-platform alternative to MiKTeX.

Chapter 3

LyX; a Graphical Front-End to LaTeX

LyX is a graphical front-end to LaTeX

- You can think of the LyX-LaTeX relationship as similar to the Visual Studio-C++ compiler relationship
- Unlike LaTeX, LyX comes with tidy and very good documentation
- Also it has a big community, i.e.,
  - it is mature enough
  - when you encounter a problem, google it. Most likely you will find others had encountered it and found a solution

Keep your concentration

Due to its WYSIWYM nature, I feel very concentrating while using **LyX** as compared to **Ms-Word**.

3.1 Installing LyX

Windows installer is available at www.lyx.org/

There are two installer variants:

1. Installer (recommended)
   This needs a pre-installed LaTeX distribution
2. Bundle
   It includes a minimal LaTeX distribution

I recommend installing as follows:

1. Install Inkscape
   - Confirm path to inkscape.exe is added to the "PATH" environment variable
2. Install MiKTeX (or TeX Live)

3. Install LyX (Installer option)
4. Modify LyX configurations to use Inkscape as graphics translator, as explained in figure 3.1. That is, Tools ▷ Preferences ▷ Converters

   SVG -> EPS: `inkscape --export-area-drawing $$i --export-eps=$$o`

   SVG -> PDF (graphics): `inkscape --export-area-drawing $$i --export-pdf=$$o`

   SVG -> PNG: `inkscape --export-area-drawing $$i --export-png=$$o`
5. Enable continuous spell checking

   Tools ▷ Preferences ▷ Language Settings ▷ Spellchecker ▷ Spellcheck continuously

Linux packages are usually available in most Linux distributions' repositories

3.2 Learning LyX

Explore style-list, menus and toolbars

Help menu includes very good manuals

- Manuals themselves are LyX documents
  - So they are essentially very good LyX examples
- You may begin with:
  1. Introduction
  2. Tutorial
- Then if needed, read necessary sections of:
  1. User's Guide
  2. rest of manuals ...

lyx\examples folder contains wide variety of very good examples

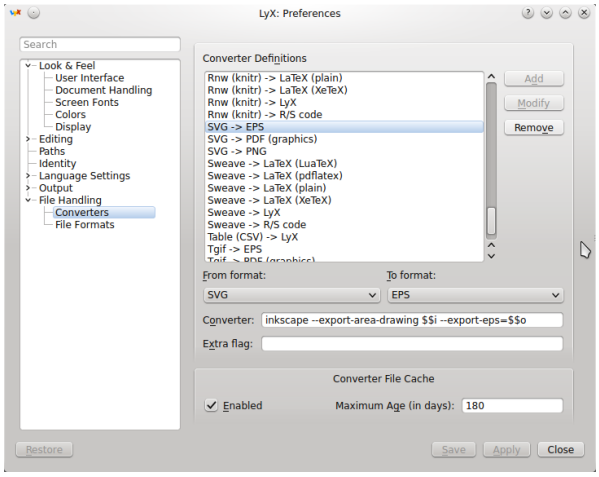
3.3 Porting a LyX Document

Similar to LaTeX files, LyX files usually reference images and other external files. Hence, if you want to move/copy your LyX document to another computer, you have to move/copy all the referenced files as well.

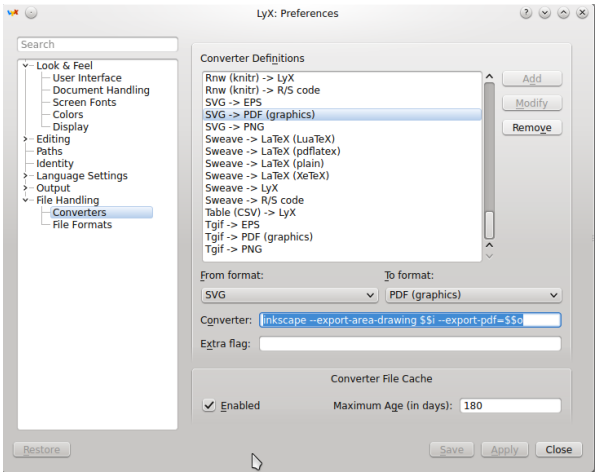
LyX greatly simplifies collecting the referenced files by the command LyX ▷ File ▷ Export ▷ LyX Archive

3.4 Arabic Support

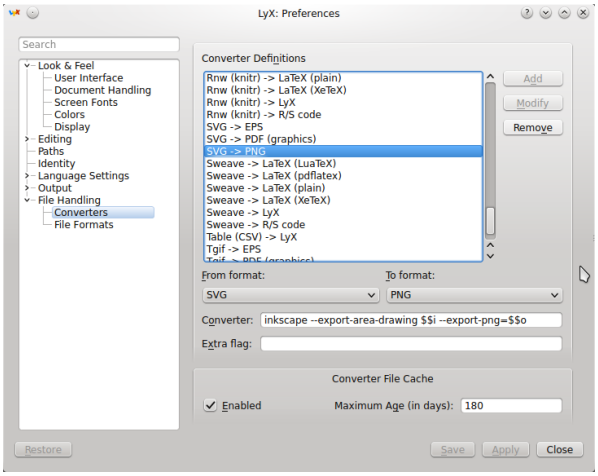
Arabic is supported in LyX, as shown in the following. For more details, refer to section 2.3.



(a) To convert svg to eps



(b) To convert svg to pdf



(c) To convert svg to png

Figure 3.1: Correcting svg converters in Inkscape

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Chapter 4

Floats, Figures, Tables and Equations

4.1 Concept of Floating Graphics, Tables

For those users familiar with MS World, they expect figures and tables are placed where you put them. This however does not look professional. Therefore, LaTeX, and consequently LyX, uses floats for placing figures and tables. Sample simple floating figures are figures 1.1, 7.1

For more information about this topic, refer to [1] and [2, sec. 4.6].

4.2 Compound Figures

Figures composed of sub-figures can be created in by using the subcaption LaTeX package. Sample compound figures are figures 2.1, 3.1, 4.1, 6.1, 6.2, 7.2 and 7.3.

4.2.1 Subfigure and Subtable

Have a look to figure 4.1.

4.3 Continued Floats

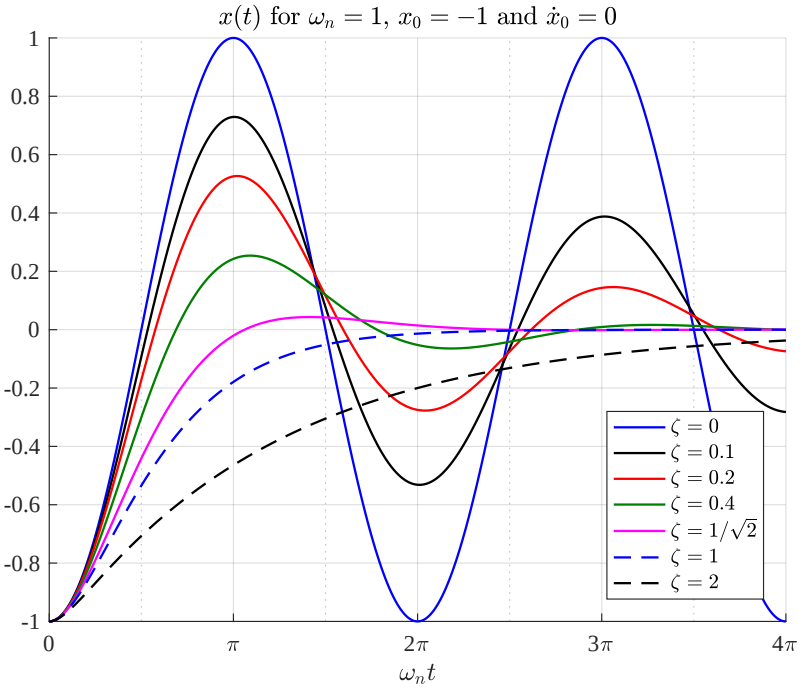
Figure 2.1 shows a sample float continued from a float to another.

4.4 Landscape Floats

Have a look to figure 2.1.

4.5 Side-by-Side Facing Floats

Have a look to figures 6.1 and 6.2.



(a) Free vibration of a SDOF system

ρ_{ij}	$i = 1$	$i = 2$	$i = 3$	$i = 4$
$j = 1$	1.0000	-0.0000	-0.8328	-0.0010
$j = 2$	-0.0000	1.0000	-0.0000	-0.8328
$j = 3$	-0.8328	-0.0000	1.0000	-0.0000
$j = 4$	-0.0010	-0.8328	-0.0000	1.0000

(b) Correlation coefficient matrix

Figure 4.1: Figure composed of a subfigure and subtable

4.6 Tables

Table 4.1 shows a sample simple table, while table 4.2 shows a more complex table. Additional details are available in [2, sec. 4.5] and [1, chapter 2].

4.7 Equations

For details about equations, refer to [3]. The following is sample text with various types of equations.

4.7.1 SDOF Mass Spring System

Table 4.1: Table caption

	Conventional Transducer	This Transducer
Price	word word	word word
Size	word word	word word
Weight	word word	word word
Coupling	word word	word word
Material	word word	word word
Generation	word word	word word
Suitability	word word	word word
Restrictions	word word	word word
Action type	word word	word word

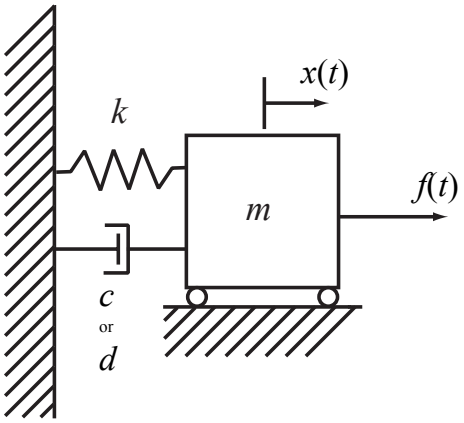


Figure 4.2: SDOF Mass Spring System

Governing Ordinary Differential Equation (ode)

$$m\ddot{x}(t) + c\dot{x}(t) + kx(t) = f(t) \tag{4.1}$$

Taking Laplace transform, the *ode* is transformed to the algebraic equation

$$m\left(s^2X(s) - sx_0 - \dot{x}_0\right) + c\left(sX(s) - x_0\right) + kX(s) = F(s)$$

where $x_0 \equiv x(t=0)$ and $\dot{x}_0 \equiv \dot{x}(t=0)$.

Rearranging yields

$$\left(ms^2 + cs + k\right)X(s) - \left(ms + c\right)x_0 - m\dot{x}_0 = F(s) \tag{4.2}$$

Dividing by m yields

$$\left(s^2 + 2\zeta\omega_{\text{n}}s + \omega_{\text{n}}^2\right)X(s) - \left(s + 2\zeta\omega_{\text{n}}\right)x_0 - \dot{x}_0 = \frac{F(s)}{m} \tag{4.3}$$

where the non-dimensional parameters ω_{n} and ζ are the ***natural frequency*** and ***damping ratio*** defined as

$$\boxed{\omega_{\text{n}} \equiv \sqrt{\frac{k}{m}}} \qquad \& \qquad \boxed{\zeta \equiv \frac{c}{c_{\text{c}}}} \tag{4.4}$$

Table 4.2: Comparison between somethings

	Type 1	Type 2	Type 3	Type 4
Feature 1	words words words words words words words	words words words words words words words	words words words words words words words	words words words words words words words
Feature 2	words words words words words words words	words words words words words words words	words words words words words words words	words words words words words words words
Feature 3	words words words words words words words	words words words words words words words	words words words words words words words	words words words words words words words
Feature 4	words words words words words words words	words words words words words words words	words words words words words words words	words words words words words words words

where c_c is the ***critical damping*** defined as

$$\boxed{c_\mathrm{c} \equiv 2\sqrt{km}} \tag{4.5}$$

By solving the algebraic equation (4.3), the response $X(s)$ is obtained as

$$\begin{aligned} X(s) &= \frac{F(s)}{m\left(s^2 + 2\zeta\omega_\mathrm{n}s + \omega_\mathrm{n}^2\right)} \\ &\quad + \frac{sx_0}{s^2 + 2\zeta\omega_\mathrm{n}s + \omega_\mathrm{n}^2} + \frac{2\zeta\omega_\mathrm{n}x_0 + \dot{x}_0}{s^2 + 2\zeta\omega_\mathrm{n}s + \omega_\mathrm{n}^2} \end{aligned}$$

or

$$X(s) = F(s)\,H(s) + \frac{sx_0}{s^2 + 2\zeta\omega_\mathrm{n}s + \omega_\mathrm{n}^2} + \frac{2\zeta\omega_\mathrm{n}x_0 + \dot{x}_0}{s^2 + 2\zeta\omega_\mathrm{n}s + \omega_\mathrm{n}^2} \tag{4.6}$$

where $H(s)$ is the *Transfer Function* (TF) defined as

$$H(s) \equiv \frac{X(s)|_{\text{zero initial conditions}}}{F(s)} \tag{4.7}$$

$$= \frac{1}{ms^2 + cs + k} \tag{4.8}$$

$$= \frac{1}{m\left(s^2 + 2\zeta\omega_\mathrm{n}s + \omega_\mathrm{n}^2\right)} \tag{4.9}$$

$$= \frac{1}{m\left(s - \left(-\zeta\omega_\mathrm{n} + \omega_\mathrm{n}\sqrt{\zeta^2 - 1}\right)\right)\left(s - \left(-\zeta\omega_\mathrm{n} - \omega_\mathrm{n}\sqrt{\zeta^2 - 1}\right)\right)} \tag{4.10}$$

Assuming the roots of $H(s)$ are complex, the TF is written as

$$H(s) = \frac{1}{m\left(s - \left(-\zeta\omega_\mathrm{n} + i\omega_\mathrm{n}\sqrt{1 - \zeta^2}\right)\right)\left(s - \left(-\zeta\omega_\mathrm{n} - i\omega_\mathrm{n}\sqrt{1 - \zeta^2}\right)\right)} \tag{4.11}$$

or

$$\boxed{H(s) = \frac{1}{m\left(s - \left(-\zeta\omega_{\mathrm{n}} + i\omega_{\mathrm{d}}\right)\right)\left(s - \left(-\zeta\omega_{\mathrm{n}} - i\omega_{\mathrm{d}}\right)\right)}} \tag{4.12}$$

where

$$\boxed{\omega_{\mathrm{d}} \equiv \omega_{\mathrm{n}}\sqrt{1-\zeta^2}} \tag{4.13}$$

Thus the response $x(t)$ can be obtained from equation (4.6) as

$$x(t) = \mathcal{L}^{-1}\left[X(s)\right] \tag{4.14}$$

where $\mathcal{L}^{-1}$ denotes inverse Laplace transform.

Assuming the TF roots are complex, i.e., $\zeta < 1$, inverse Laplace transform tables yield

$$\begin{aligned} x(t) =& \mathcal{L}^{-1}\left[F(s)\,H(s)\right] \\ &+ x_0 e^{-\zeta\omega_{\mathrm{n}}t}\left(\cos\left(\omega_{\mathrm{d}}t\right) - \frac{\zeta\omega_{\mathrm{n}}}{\omega_{\mathrm{d}}}\sin\left(\omega_{\mathrm{d}}t\right)\right) \\ &+ \left(2\zeta\omega_{\mathrm{n}}x_0 + \dot{x}_0\right)\, e^{-\zeta\omega_{\mathrm{n}}t}\frac{\sin\left(\omega_{\mathrm{d}}t\right)}{\omega_{\mathrm{d}}} \end{aligned} \tag{4.15}$$

Rearranging yields

$$\boxed{\begin{aligned} x(t) =& \mathcal{L}^{-1}\left[F(s)\,H(s)\right] \\ &+ e^{-\zeta\omega_{\mathrm{n}}t}\left[x_0\cos\left(\omega_{\mathrm{d}}t\right) + \left(\zeta\omega_{\mathrm{n}}x_0 + \dot{x}_0\right)\frac{\sin\left(\omega_{\mathrm{d}}t\right)}{\omega_{\mathrm{d}}}\right] \end{aligned}} \tag{4.16}$$

or from the convolution property

$$\begin{aligned} x(t) =& \left(f * h\right)(t) \\ &+ e^{-\zeta\omega_{\mathrm{n}}t}\left[x_0\cos\left(\omega_{\mathrm{d}}t\right) + \left(\zeta\omega_{\mathrm{n}}x_0 + \dot{x}_0\right)\frac{\sin\left(\omega_{\mathrm{d}}t\right)}{\omega_{\mathrm{d}}}\right] \end{aligned} \tag{4.17}$$

where

$$\boxed{h(t) \equiv \mathcal{L}^{-1}\left[H(s)\right] = \frac{e^{-\zeta\omega_{\mathrm{n}}t}}{m}\frac{\sin\left(\omega_{\mathrm{d}}t\right)}{\omega_{\mathrm{d}}}} \tag{4.18}$$

is the Impulse Response Function (IRF), and

$$\left(f * h\right)(t) \equiv \int_{-\infty}^{\infty} f(\tau)h(t-\tau)\,d\tau \tag{4.19}$$

$$= \int_{0}^{t} f(\tau)h(t-\tau)\,d\tau \quad ,: f(t) = h(t) = 0\ \forall t < 0 \tag{4.20}$$

is the convolution of $f(t)$ and $h(t)$, assuming stable, linear, physically possible and time invariant system.

4.7.2 Inverse Laplace Transform Derivation

Using Laplace transform property, inverse Laplace can be obtained as

$$\frac{\Omega\, s}{\left(s^2 + \Omega^2\right)\left(s^2 + 2\zeta\omega_{\mathrm{n}}s + \omega_{\mathrm{n}}^2\right)} \overset{\mathcal{L}}{\Longleftrightarrow} \dot{y}(t) + y(0) \tag{4.21}$$

where $y(t)$ is the inverse Laplace transform of

$$\frac{\Omega}{\left(s^2+\Omega^2\right)\left(s^2+2\zeta\omega_{\mathrm{n}}s+\omega_{\mathrm{n}}^2\right)}$$

previously derived as

$$y(t)=\frac{-2\zeta r\,\cos\left(\Omega t\right)+\left(1-r^2\right)\sin\left(\Omega t\right)+r\,e^{-\zeta\omega_{\mathrm{n}}t}\left[2\zeta\,\cos\left(\omega_{\mathrm{d}}t\right)+\omega_{\mathrm{n}}\left(2\zeta^2-\left(1-r^2\right)\right)\frac{\sin(\omega_{\mathrm{d}}t)}{\omega_{\mathrm{d}}}\right]}{\omega_{\mathrm{n}}^2\left(\left(1-r^2\right)^2+\left(2\zeta r\right)^2\right)} \tag{4.22}$$

Thus

$$y(0)=\frac{-2\zeta r+2\zeta r}{\omega_{\mathrm{n}}^2\left(\left(1-r^2\right)^2+\left(2\zeta r\right)^2\right)}=0 \tag{4.23}$$

and

$$\begin{aligned}
\dot{y}(t)=&\frac{\Omega}{\omega_{\mathrm{n}}^2}\,\frac{2\zeta r\,\sin\left(\Omega t\right)+\left(1-r^2\right)\cos\left(\Omega t\right)}{\left(1-r^2\right)^2+\left(2\zeta r\right)^2}+\frac{r}{\omega_{\mathrm{n}}^2\left(\left(1-r^2\right)^2+\left(2\zeta r\right)^2\right)}\\
&\times\left[\omega_{\mathrm{d}}e^{-\zeta\omega_{\mathrm{n}}t}\left(-2\zeta\,\sin\left(\omega_{\mathrm{d}}t\right)+\omega_{\mathrm{n}}\left(2\zeta^2-\left(1-r^2\right)\right)\frac{\cos\left(\omega_{\mathrm{d}}t\right)}{\omega_{\mathrm{d}}}\right)\right.\\
&\qquad\left.-\zeta\omega_{\mathrm{n}}e^{-\zeta\omega_{\mathrm{n}}t}\left(2\zeta\,\cos\left(\omega_{\mathrm{d}}t\right)+\omega_{\mathrm{n}}\left(2\zeta^2-\left(1-r^2\right)\right)\frac{\sin\left(\omega_{\mathrm{d}}t\right)}{\omega_{\mathrm{d}}}\right)\right]\\
=&\frac{r}{\omega_{\mathrm{n}}}\,\frac{\left(1-r^2\right)\cos\left(\Omega t\right)+2\zeta r\,\sin\left(\Omega t\right)}{\left(1-r^2\right)^2+\left(2\zeta r\right)^2}+\frac{r}{\omega_{\mathrm{n}}^2\left(\left(1-r^2\right)^2+\left(2\zeta r\right)^2\right)}\\
&\times\left[\left(\omega_{\mathrm{n}}\left(2\zeta^2-\left(1-r^2\right)\right)-2\zeta^2\omega_{\mathrm{n}}\right)\cos\left(\omega_{\mathrm{d}}t\right)\right.\\
&\qquad\left.+\left(-2\zeta\omega_{\mathrm{d}}-\frac{\zeta\omega_{\mathrm{n}}^2\left(2\zeta^2-\left(1-r^2\right)\right)}{\omega_{\mathrm{d}}}\right)\sin\left(\omega_{\mathrm{d}}t\right)\right]\\
=&\frac{r}{\omega_{\mathrm{n}}}\,\frac{\left(1-r^2\right)\cos\left(\Omega t\right)+2\zeta r\,\sin\left(\Omega t\right)}{\left(1-r^2\right)^2+\left(2\zeta r\right)^2}+\frac{re^{-\zeta\omega_{\mathrm{n}}t}}{\omega_{\mathrm{n}}^2\left(\left(1-r^2\right)^2+\left(2\zeta r\right)^2\right)}\\
&\times\left[-\omega_{\mathrm{n}}\left(1-r^2\right)\,\cos\left(\omega_{\mathrm{d}}t\right)\right.\\
&\qquad\left.+\left(-2\zeta\omega_{\mathrm{d}}^2-\zeta\omega_{\mathrm{n}}^2\left(2\zeta^2-\left(1-r^2\right)\right)\right)\frac{\sin\left(\omega_{\mathrm{d}}t\right)}{\omega_{\mathrm{d}}}\right]\\
=&\frac{r}{\omega_{\mathrm{n}}}\,\frac{\left(1-r^2\right)\cos\left(\Omega t\right)+2\zeta r\,\sin\left(\Omega t\right)}{\left(1-r^2\right)^2+\left(2\zeta r\right)^2}+\frac{re^{-\zeta\omega_{\mathrm{n}}t}}{\omega_{\mathrm{n}}^2\left(\left(1-r^2\right)^2+\left(2\zeta r\right)^2\right)}\\
&\times\left[-\omega_{\mathrm{n}}\left(1-r^2\right)\,\cos\left(\omega_{\mathrm{d}}t\right)\right.\\
&\qquad\left.+\zeta\omega_{\mathrm{n}}^2\left(-2\left(1-\zeta^2\right)-2\zeta^2+\left(1-r^2\right)\right)\frac{\sin\left(\omega_{\mathrm{d}}t\right)}{\omega_{\mathrm{d}}}\right]\\
=&\frac{r}{\omega_{\mathrm{n}}}\,\frac{\left(1-r^2\right)\cos\left(\Omega t\right)+2\zeta r\,\sin\left(\Omega t\right)}{\left(1-r^2\right)^2+\left(2\zeta r\right)^2}+\frac{re^{-\zeta\omega_{\mathrm{n}}t}}{\omega_{\mathrm{n}}^2\left(\left(1-r^2\right)^2+\left(2\zeta r\right)^2\right)}\\
&\times\left[-\omega_{\mathrm{n}}\left(1-r^2\right)\,\cos\left(\omega_{\mathrm{d}}t\right)+\zeta\omega_{\mathrm{n}}^2\left(-2+\left(1-r^2\right)\right)\frac{\sin\left(\omega_{\mathrm{d}}t\right)}{\omega_{\mathrm{d}}}\right]\\
=&\frac{r}{\omega_{\mathrm{n}}}\,\frac{\left(1-r^2\right)\cos\left(\Omega t\right)+2\zeta r\,\sin\left(\Omega t\right)}{\left(1-r^2\right)^2+\left(2\zeta r\right)^2}+\frac{re^{-\zeta\omega_{\mathrm{n}}t}}{\omega_{\mathrm{n}}\left(\left(1-r^2\right)^2+\left(2\zeta r\right)^2\right)}
\end{aligned}$$

$$\times \left[-\left(1-r^2\right)\,\cos\left(\omega_{\mathrm{d}}t\right) - \zeta\omega_{\mathrm{n}}\left(1+r^2\right)\frac{\sin\left(\omega_{\mathrm{d}}t\right)}{\omega_{\mathrm{d}}} \right] \tag{4.24}$$

Substituting equations (4.23) and (4.24) in (4.21) yields

$$\boxed{\begin{aligned} &\frac{\Omega\, s}{\left(s^2+\Omega^2\right)\left(s^2+2\zeta\omega_{\mathrm{n}}s+\omega_{\mathrm{n}}^2\right)} \overset{\mathcal{L}}{\Longleftrightarrow} \\ &\frac{r}{\omega_{\mathrm{n}}}\,\frac{\left(1-r^2\right)\cos\left(\Omega t\right)+2\zeta r\,\sin\left(\Omega t\right)-e^{-\zeta\omega_{\mathrm{n}}t}\left[\left(1-r^2\right)\,\cos\left(\omega_{\mathrm{d}}t\right)+\zeta\omega_{\mathrm{n}}\left(1+r^2\right)\frac{\sin(\omega_{\mathrm{d}}t)}{\omega_{\mathrm{d}}}\right]}{\left(1-r^2\right)^2+\left(2\zeta r\right)^2} \end{aligned}} \tag{4.25}$$

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Chapter 5

Reference Management Software

Reference management software [4] is citation management software or personal bibliographic management software is software for scholars and authors to use for recording and utilising bibliographic citations (references) [5]. Once a citation has been recorded, it can be used time and again in generating bibliographies, such as lists of references in scholarly books, articles and essays. The development of reference management packages has been driven by the rapid expansion of scientific literature. Among poular refence management software are:

JabRef, a BibTeX management cross-platform software for use with LaTeX/LyX.

Endnote, a management software suitable for use with MS Word

Zotero, a cross-platform web-based management software suitable for LaTeX/LyX, MS Word, LibreOffice and others.

Comparisons of these software are available in [6].

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Chapter 6

Vector Graphics

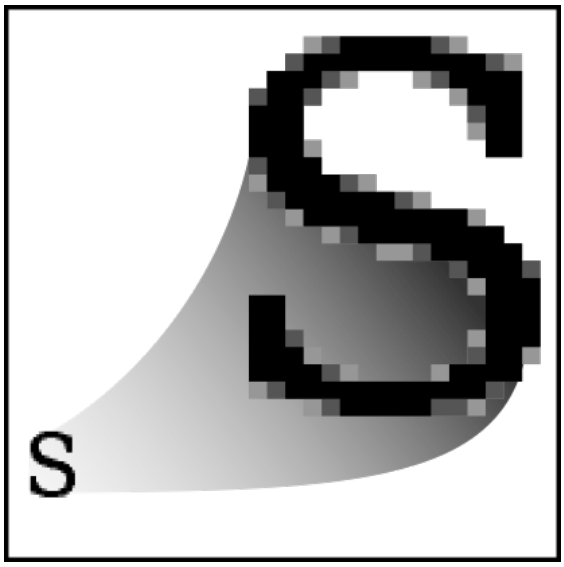
6.1 Raster vs Vector Graphics

Graphics Formats

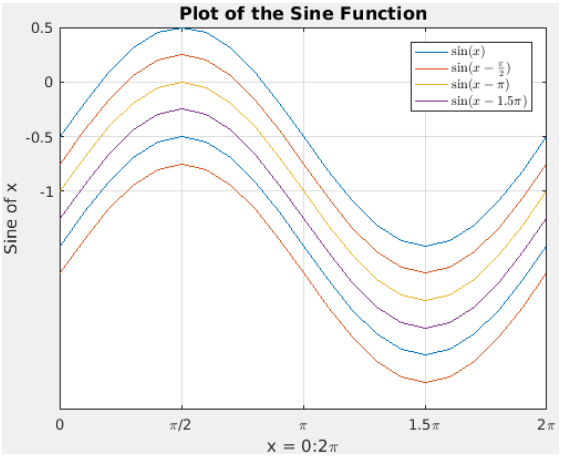
Raster		Vector	
.bmp	Uncompressed	.pdf	Compressed
.png	Loose-less compression	.eps	
.jpg	Lossy compression	.emf	Compatible with MS office
		.svg	
⋮		⋮	

6.2 Vector Graphics Editors

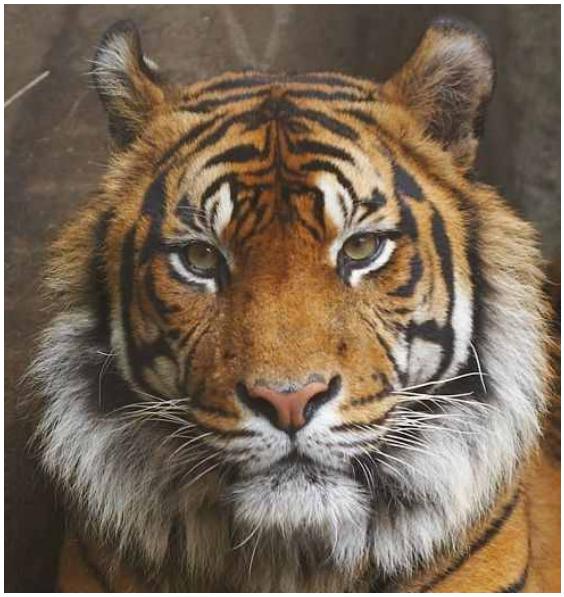
- Adobe Illustrator (*de facto* standard; bloated)
- Corel Draw (bloated)
- Inkscape (light, free, open source, cross-platform and popular; my favorite)
- LibreOffice Draw
- …



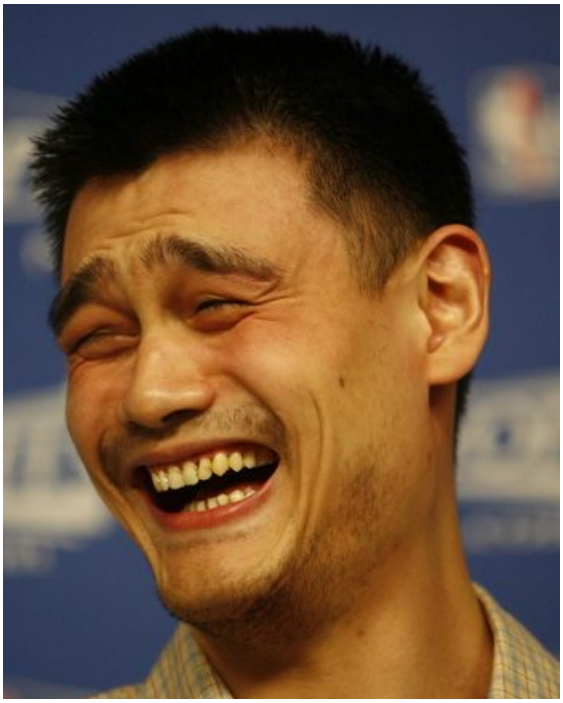
(a) Letter



(b) Matlab figure

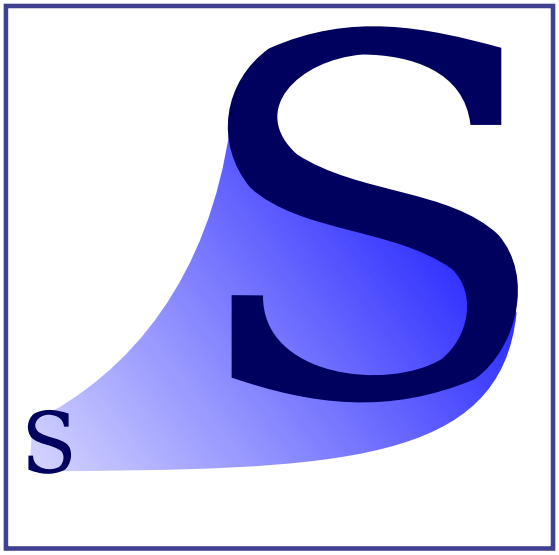


(c) Tiger

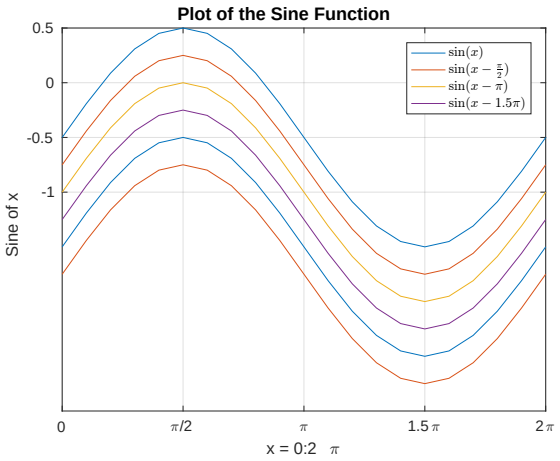


(d) Face

Figure 6.1: Sample raster graphics. This figure is forced to be on a left page for easier comparison with figure 6.2 on the opposite page.

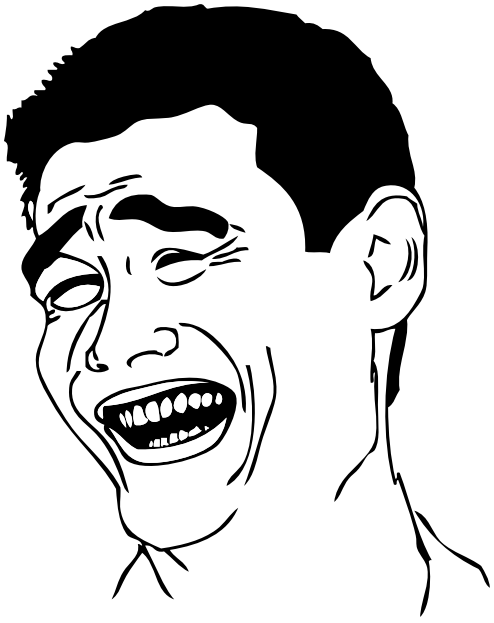


(a) Letter



(b) Matlab figure

(c) Tiger



(d) Face

Figure 6.2: Vector graphics version of figure 6.1

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Chapter 7

Inkscape; Free and Open Source Vector Graphics Editor

Inkscape Features

- Open source
- Cross platform
- Free
- Has a big community, i.e.,
  - it is mature enough
  - when you encounter a problem, google it. Most likely you will find others had encountered it and found a solution
- Much much powerful than Ms-Word or Ms-Power point sketching capabilities
- Has several plugins that greatly expand its capabilities

Inkscape Capabilities

Inkscape is based on brazier curves. That is, a curve is defined using four information, **start**, **end**, **start tangent** and **end tangent**.

- Additionally, you can draw and edit:
  - straight lines
  - circles/arcs/ellipses
  - text
  - LaTeX formulas
  - function curves
  - ...

7.0.1 Import Graphics from pdf

You can import vector graphics from pdf files, and even edit them, as shown in 7.1.

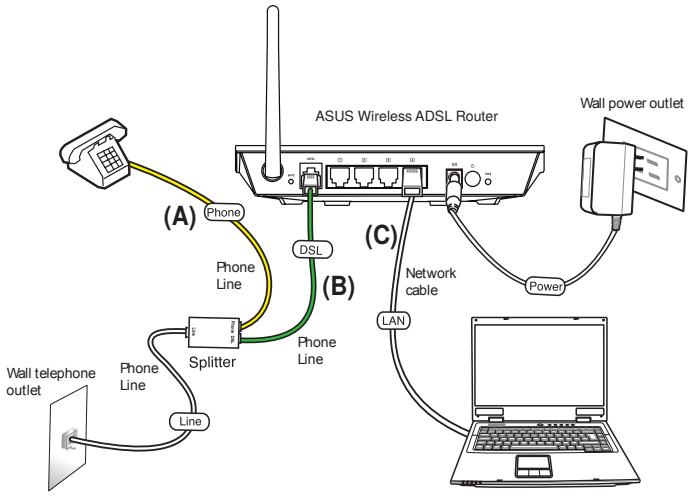


Figure 7.1: Vector graphic imported from the user guide of a home use ADSL router

7.1 Interesting Plug-ins

7.1.1 Function Plotter

- It is a built in plugins
- It uses brazier curves, same as Inkscape
- It calculates the function derivative and use it to adjust the curve slope
  - It produces very smooth curves using much less points than Matlab
  - You can still adjust/correct the curve manually

Figure 7.2 shows the plugin user interface, and the resulting curve. Figure 7.3 shows a more comprehensive example.

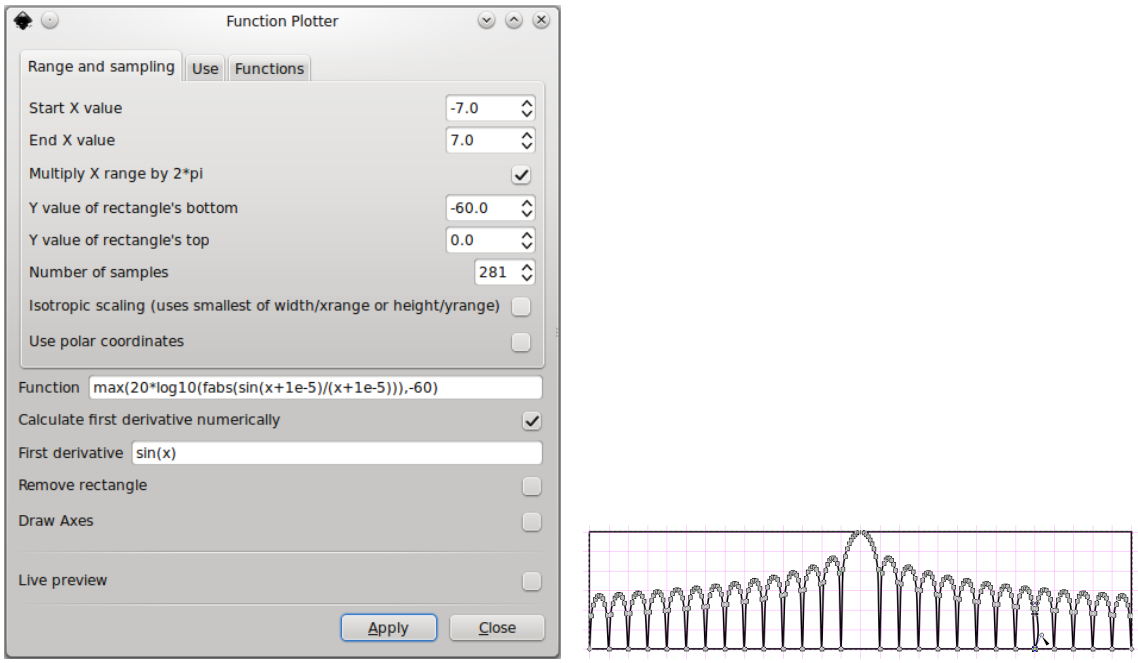
7.1.2 TexText

It allows you to write/edit LaTeX formulas inside Inkscape.

7.1.2.1 Installing TexText on MS Windows (all versions, including 32 & 64 bit)

Follow the instructions of http://people.orie.cornell.edu/jmd388/design/guides/textext.pdf. That is:

1. Install Inkscape (the 32-bit version)
2. Install TexText from https://pav.iki.fi/_downloads/textext-0.4.4.exe
3. Install 32 or 64 bit versions of ghostscript, imagemagick, pstoedit
4. Make sure the following paths are added to the the "Path" environment variable:
   - C:\Program Files\gs\gs9.xx\lib



(a) Function Plotter user interface

(b) Curve generated by Function Plotter

Figure 7.2: The Function Plotter plugin

- C:\Program Files\gs\gs9.xx\bin
- C:\Program Files\ImageMagick
- C:\Program Files\ghostgum\pstoedit

5. Download the file http://people.orie.cornell.edu/jmd388/design/guides/textext.zip
   (a) Replace the "C:\Program Files (x86)\Inkscape\share\extensions\textext.py" file with the file in the textext.zip file
   (b) Extract[1] the "site-packages.zip" file in the textext.zip file to "C:\Program Files (x86)\Inkscape\python\Lib\site-packages"

7.1.2.2 Installing TexText on Linux

Installation on Linux is too easy and straight forward. Just follow the instructions at TexText web page; https://pav.iki.fi/software/textext/.

7.2 Learning Inkscape

- **Explore** menus and toolbars
- **Official manual** [7] is very good and detailed
  - Chapters 2 includes 10 examples
    - The first 3 examples are enough for a good start

[1] You must have administrator privileges to to this.

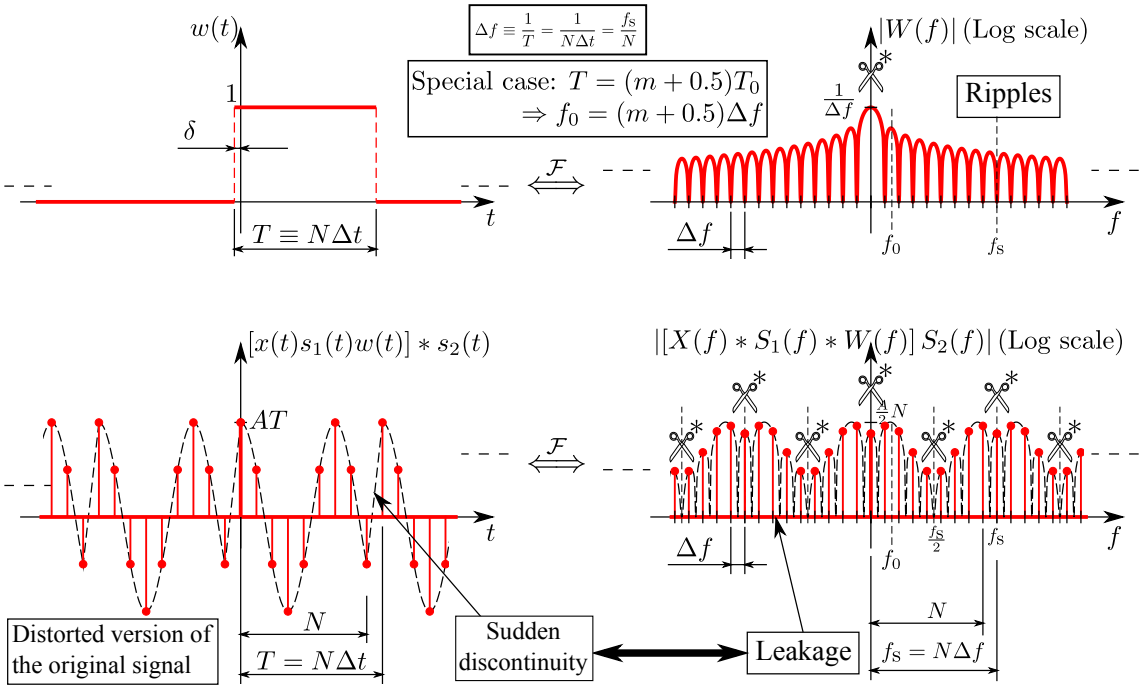


Figure 7.3: Figure illustrating the capabilities of “Function Plotter” and “TexText” plug ins.

  - Chapters 5 explains editing
    - Surf it fast

- **Help menu** includes tutorials, FAQ, ...
- http://inkscapetutorials.org/

Chapter 8

Including Program Codes

There is the listings LaTeX package which greatly simplifies adding program codes. Details are available in [1, chapter 8]. For example, codes A.1 and A.2 are used to plot figure 4.1(a).

Code A.3 on the other hand exports a Matlab figure a pdf file and crops it by removing white margins. Cropping is accomplished by calling a Perl program called "`pdfcrop`". This program, ships with both MiKTeX and TeX Live LaTeX implementations. To use this program, Perl is needed to be installed[1].

[1] "Strawberry Perl" is a sample open-source Perl implementation for Microsoft Windows.

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Chapter 9

Nomenclature

If you defined a nomenclature entry twice, it results in an error (Lonely \item–perhaps a missing list environment.).

9.1 Problems with Arabic

Nomenclature (and may be index too) sometimes causes problems in Arabic documents. As a workaround (assuming your thesis file name is "Thesis"):

1. pdflatex the Thesis.tex file twice (or as needed)
2. manually edit the *.nlo file and modify as follows

   modify lines similar to this

   ```
   \nomenclatureentry{aVI@[{VI}]\begingroup Visual
   Inspection\nomeqref {1.0}|nompageref}{\if@rlmain \I {1}\else
   \textLR {1}\fi }
   ```

   to this

   ```
   \nomenclatureentry{aVI@[{VI}]\begingroup Visual
   Inspection\nomeqref {1.0}|nompageref}{1}
   ```

3. Run the command

   ```
   makeindex 'Thesis.nlo' -s nomencl.ist -o 'Thesis.nls'
   ```

4. pdflatex the Thesis.tex file once more (or as needed)

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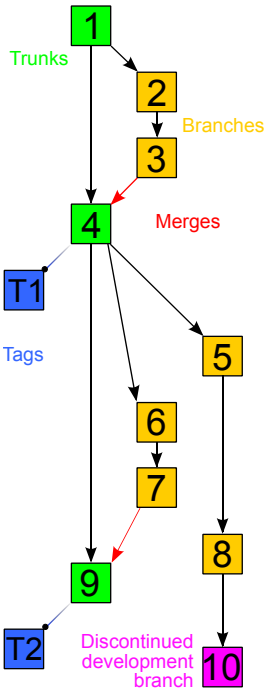
Chapter 10

Revision Control System

Revision control systems are examples of tools that help centrally manage the source code files and the changes to those files for a software project.

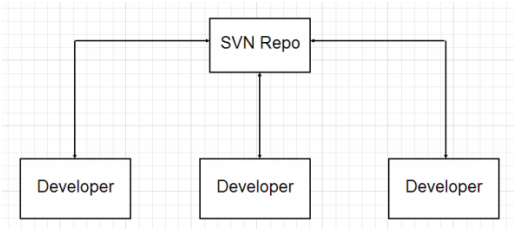
- It may be integrated with the IDE[1]
- Examples are:
  - Concurrent Versions System[2] (CVS)
  - Subversion (SVN)
  - Git
- For information about git vs svn, visit (www.findbestopensource.com/article-detail/git-vs-subversion).

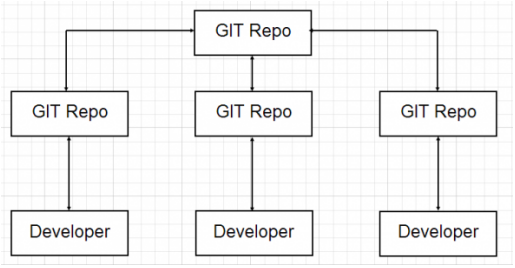


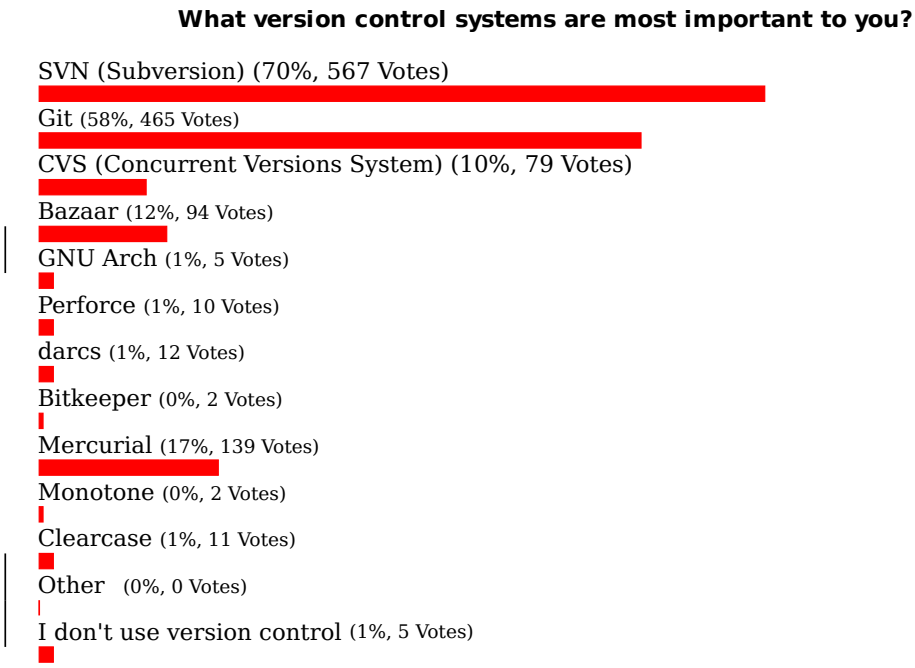
10.1 Centralized vs Decentralized Revision Control

Centralized	Decentralized
CVS	Git
SVN	HG
...	...

[1] http://en.wikipedia.org/wiki/Comparison_of_revision_control_software
[2] Very old, widespread, but not so good







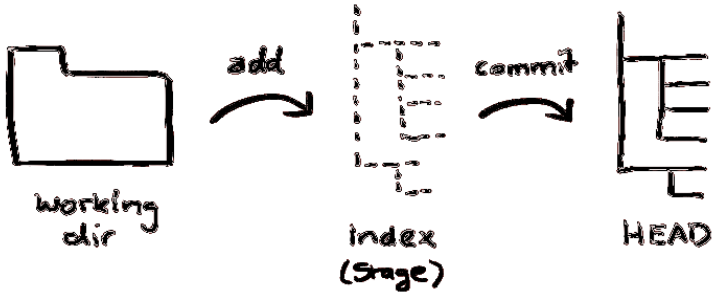
10.2 Git Roadmap

Reference: [http://rogerdudler.github.io/git-guide/]

10.2.1 Project-Owner: Create a Repository

- For an open source project, a central[1] repository is created by `$ git init`
- The repository consists of three "trees" maintained by git:
  1. **Working Directory:** holds the actual files
  2. **Index:** acts as a staging area
  3. **HEAD:** points to the last commit made

[1] Also called "mainstream", "remote", "origin", ...



- Project files need to be added to the "**Index**" so that they are monitored by git
  - Git does not monitor the files within the repository folder by default
  - To add one file, `$ git add <filename>`
  - To add all files, `$ git add *`
  - To remove/delete a file `$ git rm <filename>`

10.2.2 Contributor: Clone Repository

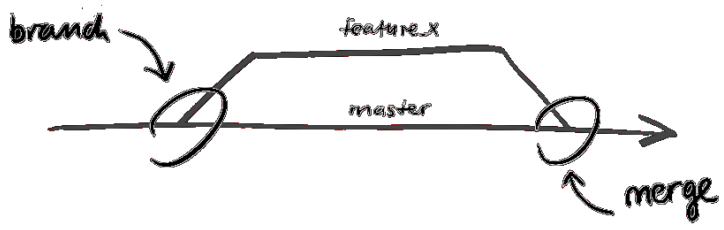
- The project owner can now work and modify the **central repository** files
- Contributors, on the other hand, do not work on the files of the **central repository**
  - A contributor rather **clone**s the central repository to his ***local*** machine to create a **local repository**[1] of the project
  - To clone local repository: `$ git clone /path/to/repository`
  - To clone repository on another computer: `$ git clone username@host:/path/to/repository`
  - To connect an existing local repository to a **remote** repository, `$ git remote add origin <server>`
- Start updating/modifying the project files

10.2.3 Project-Owner/contributor: Commit

- After completing files updating/modifications, **commit**[2] them to the **HEAD** of the **local** repository
  - `$ git commit -m "Commit␣message"`

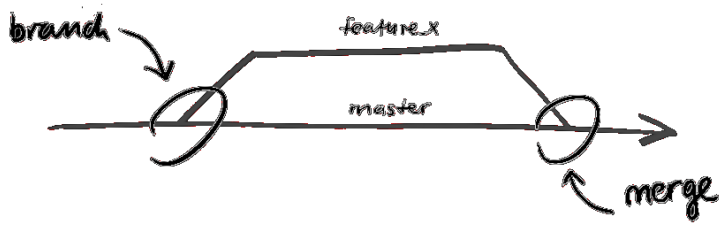
[1] Also called "working copy"
[2] Also called "check in"

10.2.4 Project-Owner/contributor: Branch



- When you want to develop several features, it is better to create branches to isolate the development of each feature
  - The default branch is called "**master**"
  - To create a new branch named "feature_x" and switch to it, `$ git checkout -b feature_x`
  - To switch back to "**master**" `$ git checkout master`

10.2.5 Project-Owner/contributor: Merge

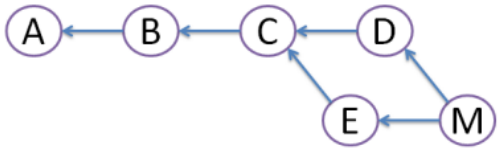


- After completing a feature, merge its branch to the "**master**" branch by `$ git merge <branch>`
  - Git tries to auto-merge changes. Unfortunately, this is not always possible and results in conflicts. You are responsible to merge those conflicts manually.
- Before merging a branch, you can check its differences by using `$ git diff <source_branch> <target_branch>`

10.2.6 Contributor: Pull

- As time passes, the contributor may update[1] his **local repository** with changes of the **origin** repository by either one of the following:
- `$ git pull`. This performs two operations:
  1. Fetch changes from a remote branch by `$ git fetch`
  2. Merge changes into the current branch by `$ git merge`

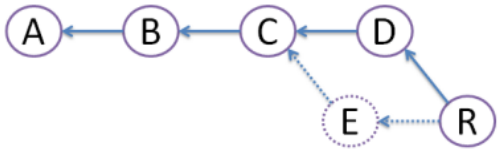
[1] Also called "pull"



  - This is suitable for updating after a long time.
  - However, this creates diamond shape, which many people find very confusing.

- `$ git pull --rebase`. This performs two operations:

  1. Fetch changes from a remote branch by `$ git fetch`
  2. Rebase the latest local commit on top of the remote branch by `$ git rebase`



  - This is suitable for updating after a short time.
  - The diamond shape is avoided, and history stays nice straight line.
  - Most developers love that!
  - Before a contributor can push his feature, he needs to fetch the updated central commits and **rebase** his changes on top of them. This is like saying, "I want to add my changes to what everyone else has already done." The result is a perfectly linear history, just like in traditional SVN workflows.

10.2.7 Contributor: Push

- To **push** (submit) the ***local*** committed changes to the **origin** repository:
  - To push **master** branch to **origin** `$ git push origin master`
  - To push "feature_x" branch to **origin** `$ git push origin feature_x`

10.2.8 Pull request

Source: [http://oss-watch.ac.uk/resources/pullrequest]

- The owner of a local repository, after pushing his changes, requests the owner of the central repository to pull the pushed changes by issuing a "pull request"
- Pull requests are an announcing method, and are not a feature of the version control system itself. So it depends on the hosting website and has no git command.

10.3 Try Git

To learn/practice Git in your browser for free, visit http://try.github.io/.

10.4 Free Git GUI

Check https://git-scm.com/downloads/guis for the complete list. But I[1] prefer GitKraken since it is free, cross platform and seems good.

[1] I'm still beginner in using git!

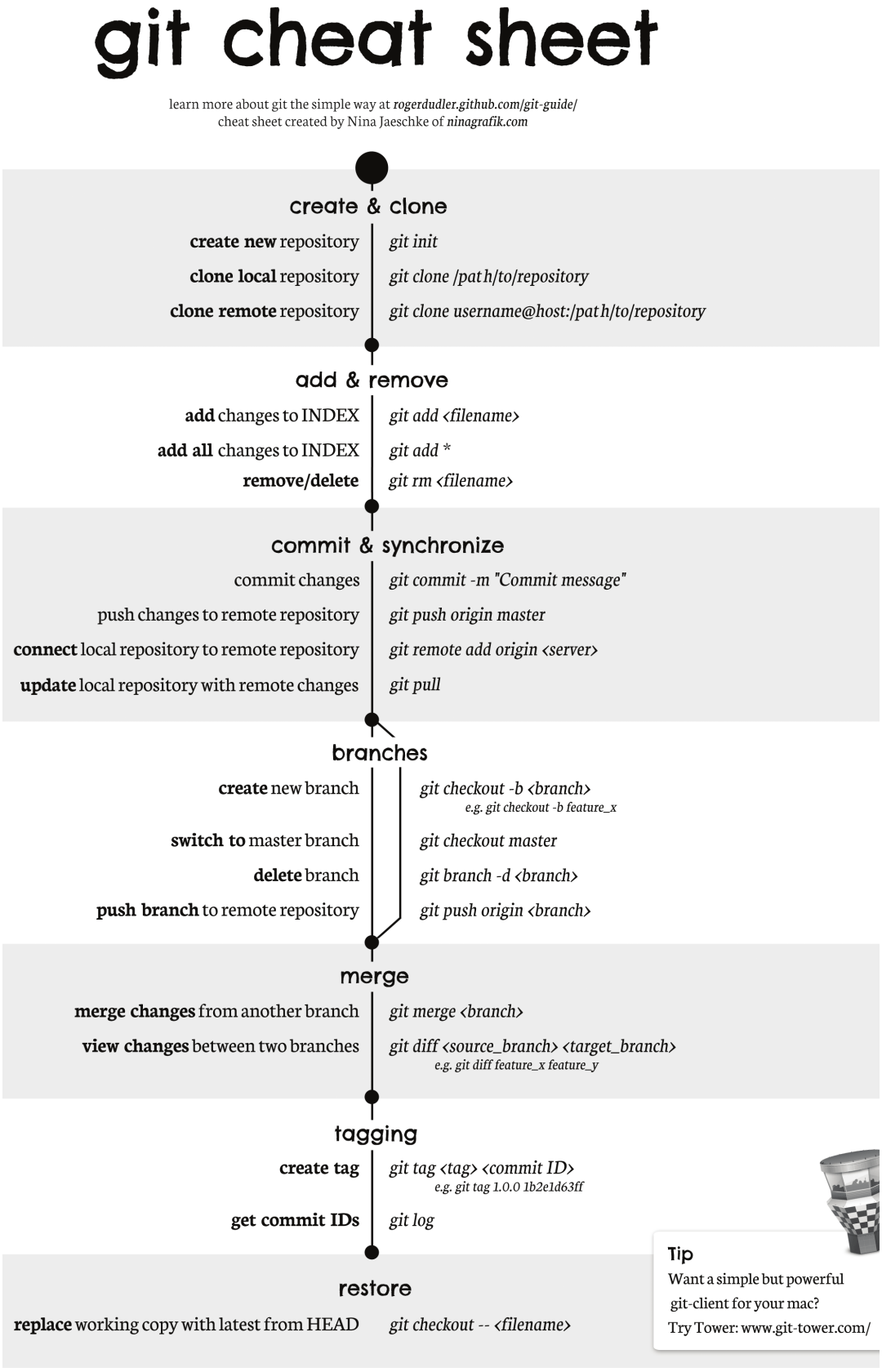


Figure 10.1: Git Cheat Sheet; [http://rogerdudler.github.io/git-guide/]

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Appendix A

Matlab Codes

Code A.1: SDOF_Free_Response_Visc_main

```
function SDOF_Free_Response_Visc_main()
clc
close all

set(groot,'DefaultAxesColorOrder',[0,0,1;0,0,0;1,0,0;0,0.5,0;1,0,1])
set(groot,'DefaultAxesLineStyleOrder','-|--|-.')
set(groot,'DefaultLineLineWidth',1);
set(groot,'DefaultAxesFontName','Times')

w_n=1;
x0=-1;
v0=0;

zeta_vec=[0,.1,.2,.4,1/sqrt(2),1,2];
legend_string={'$\zeta = 0$','$\zeta = 0.1$','$\zeta = 0.2$','$\zeta = 0.4$','$\zeta=1/\sqrt{2}$','$\zeta = 1$','$\zeta = 2$'};

t_vec=linspace(0,4*pi,500);

figure
hold on
for n=1:length(zeta_vec)
    x_vec=SDOF_Free_Response_Visc(w_n,zeta_vec(n),x0,v0,t_vec);
    plot(w_n*t_vec,x_vec)
end

title('$x(t)$ for $\omega_{n}=1$, $x_{0}=-1$ and $\dot{x}_{0}=0$','interpreter','latex');
xlabel('$\omega_{n} t$','interpreter','latex');
legend(legend_string,'interpreter','latex','Location','SouthEast');

grid on
ax=gca;
ax.XTick=0:pi:4*pi;
```

```
ax.XTickLabel={'0','\pi','2\pi','3\pi','4\pi'};
ax.XAxis.MinorTickValues=setdiff(0:pi/2:4*pi,0:pi:4*pi);
ax.XMinorGrid='on';
ax.XLim=[0,4*pi];

set(groot,'DefaultAxesColorOrder','remove')
set(groot,'DefaultAxesLineStyleOrder','remove')
set(groot,'DefaultLineLineWidth','remove');
set(groot,'DefaultAxesFontName','remove')

export_figure(gcf,'',{'SDOF_FreeResponse'})
```

Code A.2: function SDOF_Free_Response_Visc.m

```
function x_vec=SDOF_Free_Response_Visc(w_n, zeta, x0, x_dot_0, t_vec)

if zeta~=1
    w_d=w_n*sqrt(1-zeta^2);
    x_vec=exp(-zeta*w_n*t_vec).*(x0*cos(w_d*t_vec)+(zeta*w_n*x0+
       x_dot_0)*sin(w_d*t_vec)/w_d);
else
    x_vec=exp(-w_n*t_vec).*(x0+(w_n*x0+x_dot_0)*t_vec);
end
```

Code A.3: function export_figure

```
function export_figure(fig_handle_vec, ...
                  Expand,filenames,resolution,pictureFormat) %
                     Optional arguments

if nargin<2
    Expand='';
end

if nargin<4
    resolution=600;
elseif isempty(resolution)
    resolution=600;
end

if nargin<5
    pictureFormat={'pdf'};
else
    if ~iscell(pictureFormat)
        error('pictureFormat must be cell array of strings.')
    end
end

```

```
printFlag=cell(size(pictureFormat));
for n=1:length(pictureFormat)
    if strcmpi(pictureFormat{n},'emf')
        if ispc
            printFlag{n}='meta';
        else
            error('Matlab cannot export emf except under Windows.');
        end
    else
        printFlag{n}=lower(pictureFormat{n});
    end
end

if min(size(fig_handle_vec,1),size(fig_handle_vec,2))~=1,
    error('h must be 1 D vector'),
end

if ~iscellstr(filenames)
    error('filenames must be a cell string of the same length as
       h_vec');
end

if nargin>2
    if length(fig_handle_vec)~=length(filenames)
        error('h & filenames must be of the same length');
    end
end

if ~isempty(Expand)
    if ischar(Expand)
        if (~strcmpi(Expand,'||') && ~strcmpi(Expand,'=='))
            error('you must input ''||'' or ''=='')
        end
    end
end

for i=1:length(fig_handle_vec)
    f_OriginalUnit=get(fig_handle_vec(i),'Units');
    set(fig_handle_vec(i),'papertype','A4');
    if ~isempty(Expand)
        if ischar(Expand)
            if strcmpi(Expand(1:2),'||')
                 set(fig_handle_vec(i), 'PaperOrientation', 'portrait'
                    );
            elseif strcmpi(Expand(1:2),'==')
               set(fig_handle_vec(i), 'PaperOrientation', 'landscape')
                  ;
            end
```

```
67          end
68
69          if ischar(Expand)
70              if strcmpi(Expand,'||') || strcmpi(Expand,'==')
71                  a=get(fig_handle_vec(i),'papersize');
72                  set(fig_handle_vec(i), 'PaperPositionMode', 'manual');
73                  set(fig_handle_vec(i),'PaperPosition',[0 0 a(1) a(2)])
                        ;
74                  set(fig_handle_vec(i),'Units',get(fig_handle_vec(i),'
                        PaperUnits'));
75                  set(fig_handle_vec(i),'Position',[0 0 a(1) a(2)]);
76                  set(fig_handle_vec(i),'Units',f_OriginalUnit);
77                  set(0,'CurrentFigure',fig_handle_vec(i)),
78                  drawnow
79              else
80                  set(fig_handle_vec(i), 'PaperPositionMode', 'auto');
81              end
82          elseif isnumeric(Expand)
83              pos=get(fig_handle_vec(i),'PaperPosition');
84              set(fig_handle_vec(i), 'PaperPositionMode', 'manual');
85              set(fig_handle_vec(i),'PaperPosition',[pos(1:2),pos(3:4)*
                    Expand]);
86
87          end
88      end
89  end
90
91  for i=1:length(fig_handle_vec),
92      for n=1:length(printFlag)
93          if nargin<3
94             print(['-r',int2str(resolution)], '-painters', ['-d',
                  printFlag{n}],['-f',int2str(double(fig_handle_vec(i)))
                  ]);
95             %print(['-r',int2str(resolution)], '-painters', ['-d',
                  printFlag{n}],['-f',int2str(get(fig_handle_vec(i),'
                  Number'))]);
96          else
97             print(['-r',int2str(resolution)], '-painters', ['-d',
                  printFlag{n}],['-f',int2str(double(fig_handle_vec(i)))
                  ],[filenames{i},['.',pictureFormat{n}]]);
98  % print(['-r',int2str(resolution)], '-painters', ['-d',printFlag{n
      }],['-f',int2str(get(fig_handle_vec(i),'Number'))],[filenames{i
      },['.',pictureFormat{n}]]);
99          end
100     end
101 end
102
103 % %If "strawberry perl" and Miketex is installed
```

```
104 if nargin>=3 %&& ispc
105     temp_env=getenv('LD_LIBRARY_PATH');
106     setenv('LD_LIBRARY_PATH', '')
107     for n=1:length(pictureFormat)
108         if strcmpi(pictureFormat{n},'pdf')
109            for i=1:length(fig_handle_vec),
110                system(['pdfcrop␣"',filenames{i},'.pdf"␣"',filenames{i
                       },'.pdf"']);
111            end
112 
113            break;
114         end
115     end
116     setenv('LD_LIBRARY_PATH', temp_env)
117 end
```

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References

[1] The LyX Team, *LyX's detailed Figure, Table, Floats, Notes, Boxes and External Material manual*, 2nd ed., accessible from LyX's help menu as "Embedded Objects".

[2] ——, *The LyX User's Guide*, 2nd ed., accessible from LyX's help menu.

[3] ——, *LyX's detailed Math manual*, 2nd ed., accessible from LyX's help menu as "Math".

[4] Wikipedia, "Reference management software — wikipedia, the free encyclopedia," 2016, [Online; accessed 7-October-2016]. [Online]. Available: https://en.wikipedia.org/w/index.php?title=Reference_management_software&oldid=743035115

[5] E. Francese, "Usage of reference management software at the university of torino," vol. 1, no. 4, 2013. [Online]. Available: http://leo.cineca.it/index.php/jlis/article/view/8679

[6] Wikipedia, "Comparison of reference management software — wikipedia, the free encyclopedia," 2016, [Online; accessed 17-November-2016]. [Online]. Available: https://en.wikipedia.org/w/index.php?title=Comparison_of_reference_management_software&oldid=749999200

[7] T. Bah, *Inkscape: Guide to a Vector Drawing Program*, 4th ed. Pearson Education, 2011.

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