LaTeX in Different Environments

Modularizing your Documents
and Working in Different IDEs

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November 19, 2022

Contents

List of Figures

List of Tables

1 Introduction

1.1 Tikz

1.1.1 Vector Graphics Vs Raster Graphics

A Cockroft-Walton voltage multiplier (CWVM) is a useful device. The second time though, the CWVM is just more of the same.

A good thing to understand is the difference between a raster graphic or a vector graphic. Ever notice how when you zoom in on a pdf the letters don't start to pixelize? or in an image as you zoom in all you're doing is making the pixels bigger? well this is the difference beteen vectos and raster. That means that if you want nice plots that let you resize as needed, getting them as a vector graphics is a must. Handily enough latex has a very powerful and popular packages called Tikz that lets you create vector images withing latex. Doing this requires you to have a mental image of the end product, but getting used to this will be extremely helpful.

Of the many great aspects to tikz, one of my favourites is the consistency of font, and the ability to even include those symbols as discussed previously.

Maybe you'd like to plot some data in a csv file?

1.2 standalone

For simplification, you can have your tikz pictures in separate files for easy compilation and verification of the tikz picture.

2 input Command

- Reusing your preambles (without copying and pasting)
- Reusing glossaries

3 Import Package

4 Standalone Package

- Breaking your document into mular parts
- TikZ Images

5 catchfilebetweentags Package

5.1 catchfilebetweentags

This handy package allows you to store a bunch of different things (say for example, equations) and pull them in to your document. This is really nice because it makes your document's code more easily read. It also makes it that you can reuse the equations in another place, say for example an associated presentations

$$\Delta E_B \equiv \sum E_D(Reactants) - \sum E_D(Products) \tag{1}$$
$$\Delta E_B = (E_D(^2\mathrm{H}) + E_D(^2\mathrm{H})) - (E_D(^3\mathrm{He}) + E_D(\mathrm{n}^0))$$
$$\Delta E_B = (13.135\mathrm{MeV} + 13.135\mathrm{MeV}) - (14.931\mathrm{MeV} + 8.071\mathrm{MeV})$$
$$\Delta E_B = 3.27\mathrm{MeV}$$

$$\Delta = \begin{cases} \delta, & \text{for } A \text{ and } N \text{ both even} \\ 0, & \text{for } A + N \text{ odd} \\ -\delta, & \text{for } A \text{ and } N \text{ both odd} \end{cases} \tag{2}$$

$$E_B(Z,N) = \alpha_1 A - \alpha_2 A^{2/3} - \alpha_3 \frac{Z(Z-1)}{A^{1/3}} - \alpha_4 \frac{(N-Z)^2}{A} + \Delta \tag{3}$$

Table 1: Table of specified parameters and achieved values

Parameter	**Target**	**Calculated**	**Simulated**
NF_{dsb}	≤ 4	11.17	5.95
$IIP3$	≥ -22	≥ -2.73	-4.98
1 dB Compression	≥ -32	≥ -12.73	-14.2
Gain	≥ 16	≥ -3.26	-4.58
I_{bias}			
I_{buf}			
I_{ref}		1	1
R_D	≤ 10	570	600
V_{lo}	≤ 1		
V_{rf}	≤ 1		

So this is cool right, even the gls code is applied and you can have your axis labels be the symbols you defined earlier. Portability rules. But remember our little gif that was created from the video? Well thats not a function of beamer but instead a function of pdfs. So lets bring it all together and use our lua code, with tikz, to create an animation of the process of the attractors being formed.

$$\frac{\mathrm{d}x}{\mathrm{d}t} = \sigma(y - x) \tag{4}$$
$$\frac{\mathrm{d}y}{\mathrm{d}t} = x(\rho - z) - y \tag{5}$$
$$\frac{\mathrm{d}z}{\mathrm{d}t} = xy - \beta z \tag{6}$$
$$\tag{7}$$

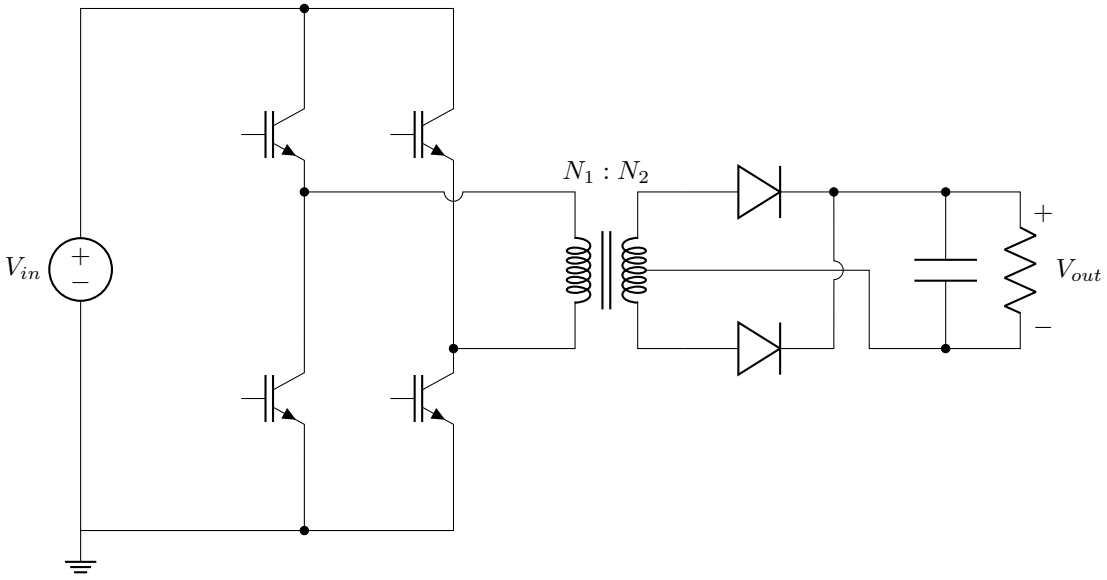

Figure 1: An Example of a circuit (an isolated boost converter) done in circuit TikZ

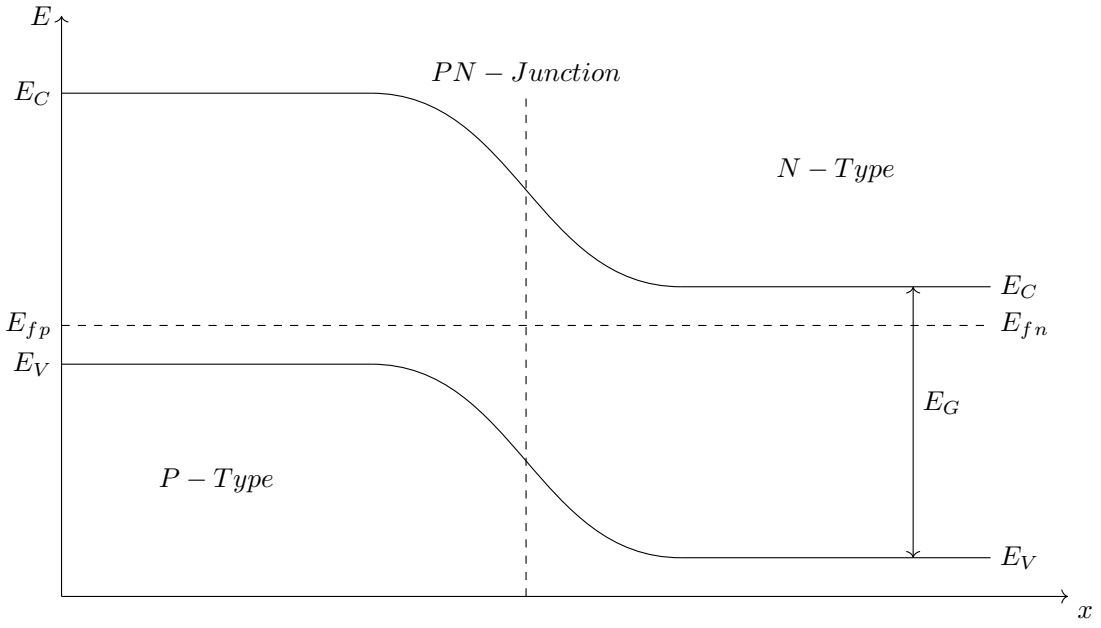

Figure 2: A simple Example TikZ showing the band diagram of a PN-junction

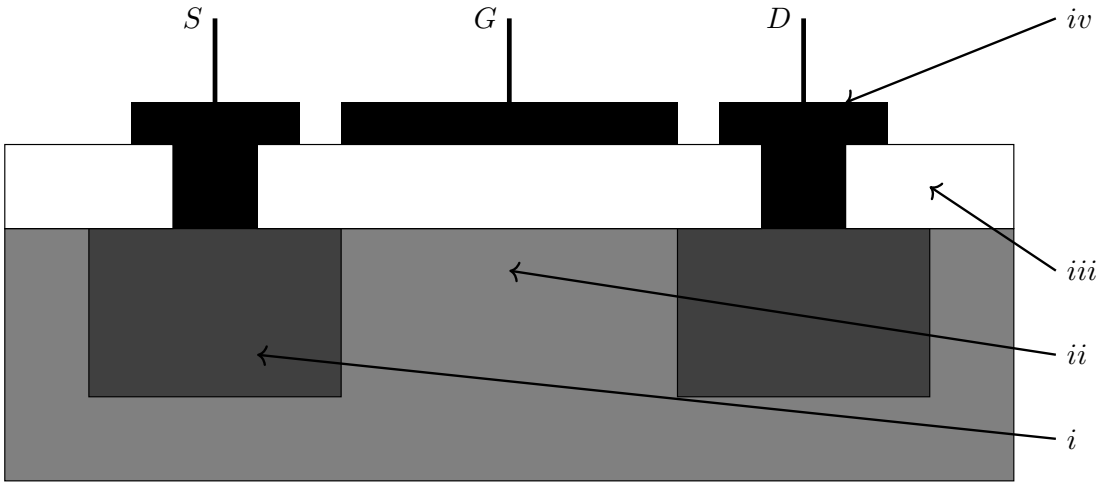

Figure 3: A simple TikZ diagram showing a MOSFET

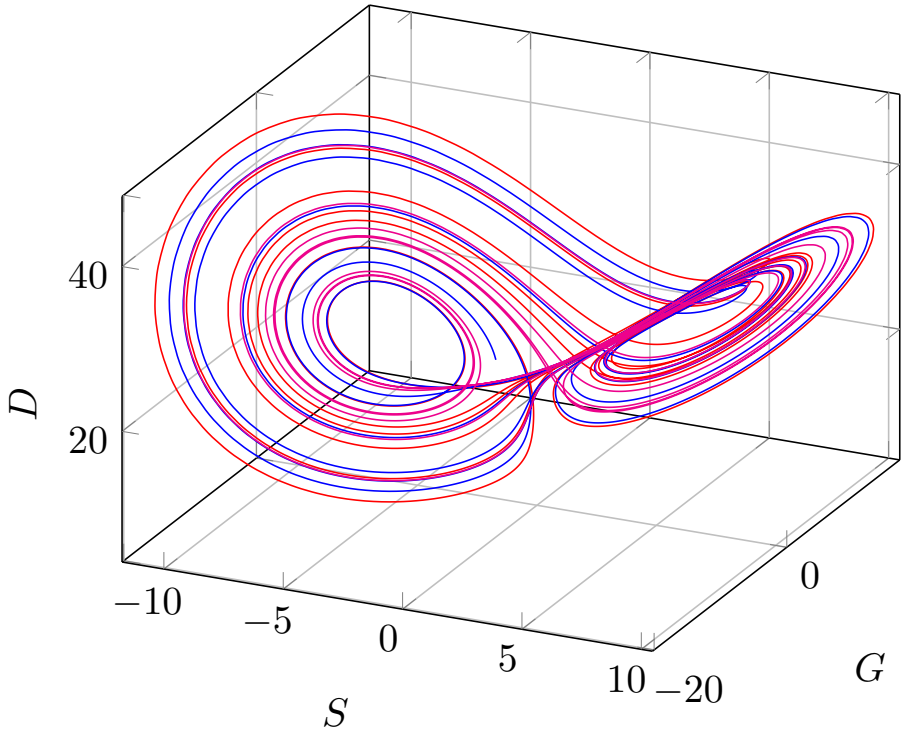

Figure 4: Lorenz Double Scroll Produced in LuaLatex

6 The LaTeX Family Tree

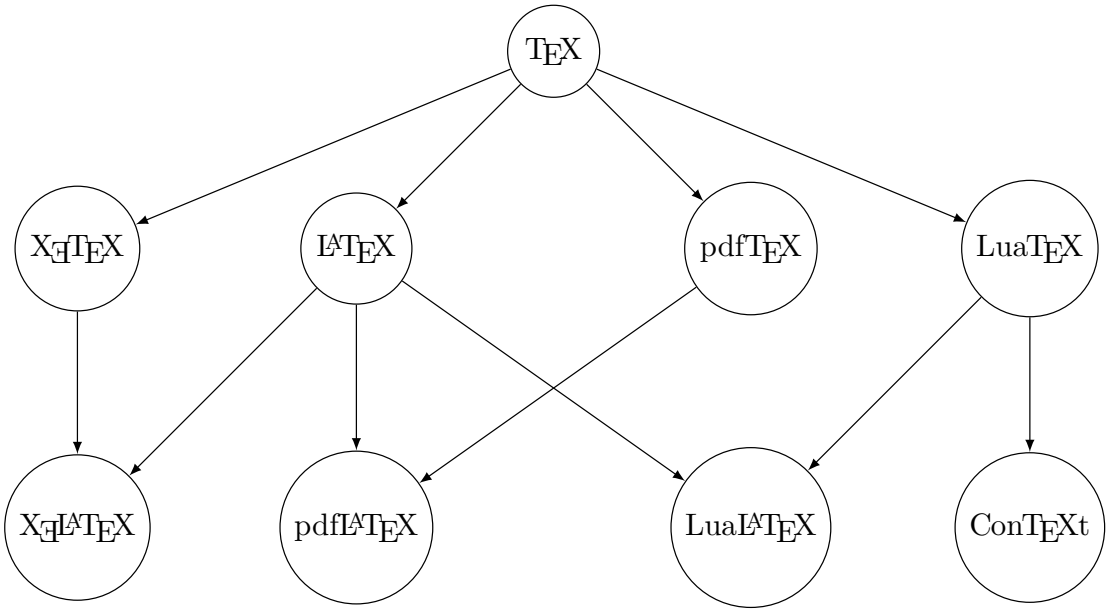

Figure 5: The most commonly used portions of the TeX family tree

6.1 TeX

6.2 PdfTeX

6.3 LaTeX

6.4 LuaTeX

6.5 XeTeX

7 Processing TeX Files

7.1 Manually Processing Files

Processing a TeX file typically just means running the right programs in a certain order. Because of the sizing, number, and ordering work LaTeX is doing during the compilation, it needs to be run at least twice. Typically if our document includes a bibliography (and other elements like glossaries or indices), the compilation procedure would mean executing each of the commands shown in Listing 1.

```
pdflatex -shell-escape -interaction=nonstopmode report
biber report
makeglossaries report
pdflatex -shell-escape -interaction=nonstopmode report
pdflatex -shell-escape -interaction=nonstopmode report
```

Listing 1: Shell commands needed to compile a report directly

A neat detail of these commands is that they can accept any LaTeX commands. This gives the possibility of changing variables in a document during the execution (see Listing 3).

```
lualatex -shell-escape -interaction=nonstopmode
↪  "\\providecommand{\\iswhichmode}{draft}\\input{report}"
biber report
makeglossaries report
lualatex -shell-escape -interaction=nonstopmode
↪  "\\providecommand{\\iswhichmode}{draft}\\input{report}"
lualatex -shell-escape -interaction=nonstopmode
↪  "\\providecommand{\\iswhichmode}{final}\\input{report}"
```

Listing 2: Shell commands compiling a document with addition commands provided at compile time

7.2 latexmk

latexmk is a tool that tries to automate the latex compilation process by reading in the log files and figuring out what additional programs need to be run, and when to rerun the compilation. It is a very effective tool and in most cases the defacto LaTeX compiler.

```
latexmk -pdf report.tex
```

Listing 3: Shell command for compiling with latexmk

7.3 arara

Sometimes however, latexmk doesn't know of some additional tool or new intermediate program that needs to be run, and this can create issues. It is also at times trying to be too smart, and ends up creating issues. For these reasons my go-to for a number of years has been ARARA, a compilation tool that allows you to define the compilation process at the beginning of your document. Listing **??** shows the directive syntax for arara, with Listing 5 showing the actual command.

```
% arara: lualatex: { shell: true, interaction: nonstopmode }
% arara: makeglossaries
% arara: biber
% arara: lualatex: { shell: true, interaction: nonstopmode }
% arara: lualatex: { synctex: true, shell: true, interaction: nonstopmode }
```

Listing 4: Shell command for compiling with Arara

```
arara -v report.tex
```

Listing 5: Shell command for compiling with Arara

8 TEX Distributions

TEX and LATEX is a very large collection of programs and files, and installing them each individually would be a huge hassle. Thankfully the programs and packages are available bundled together as a single distribution. The distribution of choice where possible is TeXLive. On Linux systems it is always available in the systems package manager. For Mac and Windows systems, there are a few different options because sometimes it can be challenging to get TeXLive to operate (though I have no personal experience with these).

8.1 Mac

- TeXLive
- MacTeX

8.2 Windows

- TeXLive
- MiKTeX
- ProTeXt

Glossary

CWVM Cockroft-Walton voltage multiplier (CWVM) is a voltage multiplier that can be cascaded to give an output voltage of nV_{p-p} with n being the number of stages. 1

Acronyms

CWVM Cockroft-Walton voltage multiplier. 1, *Glossary:* CWVM

HV High Vacuum. *Glossary:* HV

PIG Penning Ion Generator. *Glossary:* PIG

PTFE Polytetraflouroethylene. *Glossary:* PTFE

Symbols

A total number of nucleons in nucleus (unitless). 2

D Mosfet Drain. 4

E_B nuclear binding energy (eV). 2

E_C Conduction band energy level. 3

E_D mass defect (eV). 2

E_G Bandgap. 3

E_V Valence band energy level. 3

E_f Fermi Energy of a Material. 3

E Energy. 3

G Mosfet Gate. 4

N number of neutrons in nucleus (unitless). 2

S Mosfet Source. 4

V_{in} Input voltage. 3

V_{out} Output voltage. 3

Z number of protons in nucleus (atomic mass number - unitless). 2

ΔE_B change in nuclear binding energy i.e. energy released in reaction (eV). 2

Δ pairing energy parameter (eV). 2

β Lorenz Parameter. 2

ρ Lorenz Parameter. 2

σ Lorenz Parameter. 2