Example Document

Presentation and Example Usage of Yet Another Thesis Template

Alex Povel

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Problemstellung

Für: **Alex Povel** [666]

Thema: **Presentation and Example Usage of Yet Another Thesis Template** (Example Document)

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- First you are doing this,
- then another thing,
- lastly that.

You will be working on this a lot.

Prof. Spam-Ham Eggs *Ort & Datum*

Rest der Seite absichtlich freigelassen.

Erklärung zur Eigenständigkeit

Hiermit bestätige ich, Alex Povel [666], der alleinige und selbstständige Autor der hier vorgelegten Masterarbeit zu sein. Keine anderen als die angegebenen Quellen wurden benutzt. Jeglicher aus externen Quellen direkt oder indirekt bezogene Inhalt ist als solcher markiert. Diese Arbeit wurde weder einer anderen Prüfungsbehörde vorgelegt noch veröffentlicht.

Alex Povel	*Ort & Datum*

Rest der Seite absichtlich freigelassen.

Zusammenfassung

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- we found out this
- and also that!

Inhaltsverzeichnis

Glossar

Hier sind die relevantesten Symbole aufgeführt, zusammen mit der Seitenzahl ihrer erstmaligen Benutzung. Solche Symbole, die zwar im Dokument vorkommen, aber hier nicht aufgeführt sind, erklären sich durch ihren jeweiligen Kontext.

***Buggy:** You will notice that the majority of symbols do not have info on the location of their first use. These are all the symbols which first occurred in **floats**. The way this document was set up, most symbols are affected. Referencing floats is a tricky business and is apparently still faulty at the moment. In an actual document, it is extremely likely you will be introducing symbols in text or math mode, not in floats, negating this issue.*

Symbole

Griech.	Beschreibung	Einführ.	Einheit
Ξ	wastegate position		–
α	flow angle in the absolute system		°, rad
β	flow angle in the relative system		°, rad
γ	ratio of specific heats		–
γ	mass fraction	3	–
ρ	density		$\mathrm{kg\,m^{-3}}$
τ	shear stress		$\mathrm{N\,m^{-2}}$

Röm.	Beschreibung	Einführ.	Einheit
A	area		$\mathrm{m^2}$
$\mathbf{c}$	absolute velocity (magnitude)		$\mathrm{m\,s^{-1}}$
c_p	specific heat capacity at constant pressure		$\mathrm{J\,kg^{-1}\,K^{-1}}$
H	enthalpy		J
H	(specific) heating value	3	$\mathrm{J\,kg^{-1}}$
h	height		m
M	Mach number		–
m	mass		kg
p	pressure	2	Pa

fortgesetzt…

r	radius		m
R	radius ratio		–
R	specific gas constant	2	$\mathrm{J\,kg^{-1}\,K^{-1}}$
T	absolute temperature	2	K
U	internal energy		J
v	specific volume	2	$\mathrm{m^3\,kg^{-1}}$
ϑ	relative temperature		°C

Indizes

Indizes

air	air
exh	exhaust
i	inferior
in	inlet
m	meridional
out	outlet
t	throat
T	turbine
θ	tangential/circumferential/blade

Akronyme

Kurz	Beschreibung	Seite
CI	Continuous Integration	28
HFO	Heavy Fuel Oil	23
IDE	Integrated Development Environment	4
IMO	International Maritime Organization	23
MDO	Marine Diesel Oil	23
PDF	Portable Document Format	5
RE	Rated Engine	18

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Kapitel 1

Text Features

Let us first go through some of the textual features offered by LaTeX and used in this template.

1.1 Fonts

Using high-quality fonts is one goal. This includes the fantastic TeXGyre fonts, of which the *Palatino* (by Hermann Zapf) clone *Pagella* was chosen for this template. It comes with an accompanying math font of the same name. Using both font types in conjunction is made possible through the `unicode-math` package. As such, achieving a better match of text and math fonts is nigh impossible. Both fonts are vector fonts; if LaTeX yields any warnings about font size substitutions, that is bogus.

Not only do the fonts look fantastic on their own and together, they (just as important) also feature an immensely broad support for symbols and characters, as well as font shapes and weights and combinations thereof. The latter is demonstrated in Tabelle 1.1.

Combine all that with `microtype`, and we have absolutely gorgeous typesetting. As Jeremy Clarkson would say, „Behoooold the magnificence“:

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Notice the balanced line endings? How it was incredibly easy on the eyes, therefore easy to read? Nothing gets in the way; there is nothing to stumble over, disturbing the

Tabelle 1.1 / Examples for font features offered by the main roman font. Notice the small vertical white space after the fourth row, nicely separating content that is slightly dissimilar.

Feature	Sample Text
Regular	The quick brown Fox jumps over the lazy Dog 13 times!
Bold	**The quick brown Fox jumps over the lazy Dog 13 times!**
Italics	*The quick brown Fox jumps over the lazy Dog 13 times!*
Bold Italics	***The quick brown Fox jumps over the lazy Dog 13 times!***
Small Capitals	The quick brown Fox jumps over the lazy Dog 13 times!
Bold SC	**The quick brown Fox jumps over the lazy Dog 13 times!**
Italics SC	*The quick brown Fox jumps over the lazy Dog 13 times!*

flow: letters and words are spaced out nicely horizontally, as are lines vertically. There is a minimal number of hyphens. That is how it is meant to be.

1.1.1 Math

What often does not occur at first glance is that many documents use text and math fonts that are very different from one another. As far as I know, Microsoft's Word has usable math typesetting and sensible default fonts for that. Yet, it cannot do what dedicated, fully-fleshed text and math fonts — different fonts, but meant for one another — can achieve. They provide a seamless transition, especially when using actual text in the math environment or vice versa, like when we go for $x \to \infty$ and then also do $\int_1^2 y^2 \, \mathrm{d}y$ or maybe $a^2 + b^2 = c^2$ (the stuff you learn at university huh), all looking rather natural. Toggle the colors in the preamble, highlighting each different font family, to see all the differences. Some more examples follow.

$$pv = RT \tag{1.1}$$

$$e^{i\pi} + 1 = 0 \tag{1.2}$$

$$\lim_{x \to \infty} \frac{\pi(x)}{x / \ln(x)} = 1 \tag{1.3}$$

$$\sum_{k=0}^{n} \binom{n}{k} = 2^n \tag{1.4}$$

$$\left[M \frac{\partial}{\partial M} + \beta(g) \frac{\partial}{\partial g} + n\gamma \right] G^n(x_1, x_2, \dots, x_n; M, g) = 0 \tag{1.5}$$

$$\Delta h_{\text{change}} = 1/2 \left(c^2_{\text{exit}} - c^2_{\text{entry}} \right) \tag{1.6}$$

Symbols Note how the symbols in Gleichung 1.1 are hyperlinks (leading to their definition in the glossary), courtesy of packages **hyperref** and the wonderful **glossaries-extra** working together. Having not specified anything else, they take hyper-link color. That is of course a bit unfortunate. In the final document, all links should be hidden, aka black. This is a given for print output, but I also encourage it for digital output. The visual noise introduced by colored links is quite immense. Their only point is to let users know there is something clickable — they likely figure that out themselves quickly.

Math highlighting In a very unintrusive yet also not ambivalent way, we can highlight important results, as is done in Gleichung 1.3. This feature is a natural part of **tcolorbox**, a very powerful package for anything color and boxes!

Chemical Reactions

Closely related to purely mathematical equations are chemical ones, as shown in Gleichung **R** 1.1.

$$\mathrm{C} + \mathrm{O_2} \longrightarrow \mathrm{CO_2} \qquad [\mathbf{R}\,1.1]$$

This functionality is still very basic and probably poorly executed in parts. We can also use chemical compounds invoking \chcpd, as demonstrated in Gleichung 1.7.

$$\frac{H_\mathrm{i}}{1 \times 10^6} = 35\gamma_\mathrm{C} + 94.3\gamma_\mathrm{H} + 10.4\gamma_\mathrm{S} + 6.3\gamma_\mathrm{N} - 10.8\gamma_\mathrm{O} - 2.44\gamma_w \qquad [1.7]$$

1.1.2 Sans-Serif

Having taken care of the main/roman font, we turn to the others. Fontin is a decent sans-serif font. Quite importantly, and in contrast to almost all other free sans-serif fonts, it comes with all the bells and whistles required for stunts, see Tabelle 1.2. This even includes small-capitals support.

1.1.3 Mono-Spaced

Wanting to display any sort of code in the document will have you looking for a mono-spaced aka typewriter font. Inconsolata, provided by Google, will be our pick here:

```
@something
def get_metadata(table, data_start: int) -> dict:
   """Get some metadata"""
   metadata = {}  # metadata found in file header

   for i, row in enumerate(table):
      if i >= data_start:
```

```
            break
        lrow = row.lower()

    return junk
```

with Python syntax highlighting taken from this GitHub repository. Note that comments are really meant to be *italics* shape (or *slanted*), but Inconsolata does not deliver that. If you don't care, Inconsolata will be good enough. Still, Consolas is much preferred: it has *true* italics and bold italics. As far as I know, it is shipped with Windows but not free; I cannot share it here, but you will be able to get your hands on it rather easily.

So what?

If you don't care for *any* of this, don't quit just yet. The features of LaTeX will do their work silently in the background for you. You won't have to worry about any of this ever again, but can rest assured it is taken care of. **Focus on your content and impress others that way (yet still bedazzling them with your sexy-ass documents).**

1.2 References

Note that using the package **cleveref**, we only ever issue `\cref{label}` commands. The package does the heavy lifting and puts the float type in front, also with correct plural forms if required (see Tabelle 1.1 und Abbildungen 3.3 und 3.8 ← all of that was done automagically). Doing it any other way is just way too laborious and error-prone.

For added convenience, add some info on the type you are attaching the label to, *e.g.* `\label{fig:hello}`. This helps for auto-completion in your Integrated Development Environment (IDE)[1] of choice.

1.2.1 Bibliography

The second most likely need for references are the bibliographical ones. Examples are spread throughout this document. At their basis, they rely on **biblatex** and its back-end **biber**. Forget about **natbib** and similar. Using `\autocite{bibid}`, we can reliably cite sources and have a whole range of features delivered for free. We do not have to worry about the specific citation style (in parentheses, as a superscript, ...) — `\autocite{bibid}` takes care of that, we can then manage its behavior globally.

As such, we can have citations that look like this: [DH14, S. 23; Aun00, S. 29 ff.; Jap85, S. 2–9; Kur11, S. 89 f.; Pam82]. We can add a note to each; if this note is an integer number, it is automatically taken to be the page number. If a following page is to be included in the citation, append `\psq`. Otherwise, `\psqq` for „this page and the following ones". Using `\autocites{}`, we can then chain together as many as we want.

[1] Here, `gls` was used to print this abbreviation from the glossary. *Never, ever **don't*** do that: when there is an abbreviation, put it into the glossary system and have it handle that. You will regret not doing it and end up scratching together all wild, spread-out, manually typed abbreviations. Your document might suffer from inconsistencies.

Tabelle 1.2 / Examples for font features offered by the sans-serif font.

Feature	Sample Text
Regular	The quick brown Fox jumps over the lazy Dog 13 times!
Bold	**The quick brown Fox jumps over the lazy Dog 13 times!**
Italics	*The quick brown Fox jumps over the lazy Dog 13 times!*
Bold Italics	***The quick brown Fox jumps over the lazy Dog 13 times!***
SMALL CAPITALS	THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG 13 TIMES!

Dixon und Hall [DH14][1] do not claim anything, this is just an example for a `\textcite`, used to implement a citation to be a readable part of the sentence. There is also a plural form available.

Language All of this is incredibly convenient, for there is minimal manual work and a lot of elevation. Importantly, this is language-agnostic, and **biblatex** will make use of **polyglossia** (the LuaLaTeX replacement for **babel**) and **csquotes**. Therefore, through changing the desired document language for just these packages, all others including **biblatex** will quickly adjust automatically.

backref Taking a look at the bibliography in the back matter of this document reveals the feature `backref`: the pages where a reference was cited occur after its entry. This is helpful in print, but amazing in digital format, for these page numbers are also links. Your readers will thank you tenfold for allowing them to very swiftly navigate and jump within your document.

Try it out by clicking this reference: [Brä15], leading you to the bibliography. It will say this page's number (Seite 5) at the end of its entry, done by **biblatex**. Clicking it will land you back here exactly.

Manager To generate the `*.bib` file, from which LaTeX pulls the info, in the first place, a citation manager is a good tool. Zotero is a decent pick, but it ultimately does not matter much. Just use *some* manager to keep your actual documents/Portable Document Formats (PDFs) and the automatically derived `*.bib` files in one place, named and structured consistently.

1.3 Lists

In technical publications, using lists (either bullet points or enumerations) is highly encouraged. They should *always* be preferred over doing the same thing in a block of text. Just consider this example list:

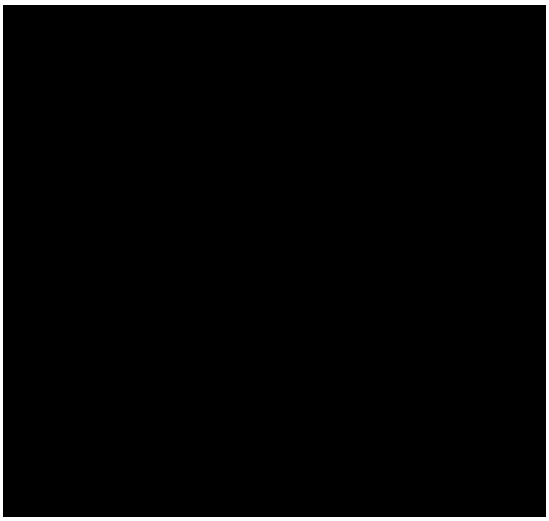

Abbildung 1.1 / Example for a censoring box.

- The presented approach is more complex than the previous one:
  1. more time was spent doing computations,
  2. less was spent effing about,
  3. features were added.
- At the same time, the following simplifications were made:
  1. went from continuous- to discrete-time simulations,
  2. threw out some superfluous stuff.

Processing the very same information from a text block would suddenly be much more challenging. Note the block-like `itemize` symbol (▪)[2] , and the fact that enumerate numbers are part of the sans-serif family and **bold**. That is totally cool and stuff, because it's... different? This was specified and may be changed in the `enumitem` package options.

1.4 Censoring

I am a TO-DO note from `todonotes`. I am also specially highlighted in many editors.

Let me tell you a huge secret: [redacted]. You can also censor float contents, as illustrated in Abbildung 1.1.

[2] This is also a regular Unicode character. When copy-pasting old or outdated LaTeX documents, ever noticed all the funny business going on? A good example is copying German „Umlauts“ like Ä, Ö, Ü. They might turn into „ ¨ A“, since LaTeX only ever put two random dots over the regular ASCII letter A. With `unicode-math` (building onto `fontspec`) and LuaLaTeX, we are fully Unicode! Copy-paste anything correctly: $\delta\sigma \int_1^2 y$.

1.5 Glossaries

The package **glossaries-extra** is an absolute beast. For this document, it is used with its back-end **bib2gls**. This (Java) tool comes with installations of TeXLive and Miktex. You should already have it.

In a format similar to normal bibliographies, we now manage all abbreviations, symbols *etc.* using `*.bib` files. You can see them in a sub-folder for this project as well. Each entry is processed by **bib2gls** and put into an auxiliary file. From it, it reads and inserts all contents when we use `\gls` and its many siblings to insert glossary data. The framework for all of that, also printing of the glossary/nomenclature, was already done for this project.

Using **glossaries-extra** and its many features also for symbols is a fabulous tool. It is absolutely counter-intuitive, for now we have to write `\gls{temperature}` instead of just T. This makes the source code obfuscated and hurts legibility. The advantages are probably worth it: never worry about consistency again. You have one central repository for all data, and any changes there are immediately forwarded to the entire document (provided you are persistent in using `\gls` *etc.*). We can then also go ahead and add a billion other features, like cross-referencing, hyperlinking, additional explanations and much more.

1.6 Indices

For the index at the end, we currently use **splitidx**. It splits the single index LaTeX expects, allowing for multiple indices. In the future, all of this should be replaced by **glossaries-extra**. For now, we can add people like Einstein and Feynman to the index. Terms, like machine learning and artificial intelligence (so hip), may be added as well. We can also nest entries with `\term{parent!child}` .

These are implemented as a custom commands and are vastly inferior to using **glossaries-extra**. For example, these are simple links with no descriptive texts *etc.*

Lastly, we will have to run the tool `splitidx` on our main `*.tex` file/its `*.aux` file. This is another step in the process that could be circumvented using **glossaries-extra**.

1.7 Code

As previously seen in Abschnitt 1.1.3, we have a special code-block environment for code between paragraphs (*i.e.*, not a float). Its big brother Floaty McFloatface is illustrated in algorithm 1.1. Notice how you can very easily select and copy[3] said code without having to worry about line numbers. The line numbers can even be referenced, *e.g.* we find a `return` statement on Zeile 4. This requires escaping the `\label` with the previously specified special command, back-ticks: `` `escaped LaTeX` ``.

Inline code goes like so: `y = [file_patterns[x] for x in ["send", "help"]]`.

[3] steal

Code 1.1 / This is an example for a floating code environment with some interesting LaTeX stuff. The actual code is likely crap, you be the judge.

```
def value_cleanup(raw_in) -> float:
   """Turn dirtied string(s) (e.g. ",233 kg") to float(s)."""
   if isinstance(raw_in, (int, float, datetime)) or raw_in is None:
      return raw_in A useless note: x^2 ≠ x
   elif isinstance(raw_in, list):
      clean_list = []
      for substr in raw_in:
         clean_list.append(value_cleanup(substr))  # Recursion
      return clean_list
   elif not isinstance(raw_in, str):
      raise TypeError(f"Expected type 'str', got '{type(raw_in).__name__}'.")
   else:
      dotted = raw_in.replace(",", ".")  # Decimal representation
      cleaned = dotted.strip()  # Remove surrounding whitespace
      numeric = '0123456789-.'  # Include negatives/decimal sep. in search
      position = None  # Initialize to throw error just in case
      # Append space for search to work
      for position, char in enumerate(cleaned + " "):
         if char not in numeric:
         if position == 0:  # Didn't even start with numerical char
            return None This is interesting
         break
      # Up to just before found nun-numeric char
      return float(cleaned[:position]) -1.5 × 10^-2 is also a float
```

1.7.1 Matlab/Simulink

The basis for this template was laid by a thesis concerned with MATLAB®/Simulink®. As such, we have nice commands like MATLAB®, Simulink®, MATLAB®/Simulink® and Symbolic Math Toolbox™ to print, in a consistent manner, all the different names and also add them to the index. Further, there are funny little vector symbols available, referencing various things MATLAB®/Simulink® has to offer:

Inputs: *Step-Function* *Step-Functions*
Data Dictionaries: *Data Dictionary* *Data Dictionaries*
Workspaces: *Base Workspace* *Model Workspace* *Model Workspaces*
Models: *Model* *Models* *Referenced Model* *Referenced Models* *Library Model* *Library Models* *Library* *Libraries*
Data processing: *Data Logging*
Look-Up Tables: *Look-Up Table* *Look-Up Tables*
Settings: *Configuration*
Variables: `YourVar` *Struct* *Structs* *Table* *Tables* `YourStruct` `YourObj` *Bus* *Buses*

These can probably be improved by handling plural cases/commands automatically. Since plural forms and all that jazz are often not as straightforward as appending an „s“, and regarding the countless exceptions one would have to take into account, automating LaTeX macros that deal with language is a much harder task than what it might seem at first.

1.8 Landscape

Pages in landscape format are rather straightforward to implement. Note that not only are these in landscape orientation; they are also recognized as such by supporting PDF viewers, rotating the page for you and keeping it legible.

Literatur

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