

BlueBook Descent and Landing Analysis Toolkit - Manual

# **Descent and Landing Analysis Toolkit - Manual**

**Users and Developers guide to the Descent and Landing Analysis  
Toolkit**

Max Braun

June 12, 2019

### **Disclaimer**

You can edit this page to suit your needs. For instance, here we have a no copyright statement, a colophon and some other information. This page is based on the corresponding page of Ken Arroyo Ohori's thesis, with minimal changes.

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### **Colophon**

This document was typeset with the help of KOMA-Script and L<sup>A</sup>T<sub>E</sub>X using the kaobook class.

The source code of this book is available at:

<https://github.com/maxxonair/BlueBook-DaLAT-3DoF>

(You are welcome to contribute!)

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# Preface

I am of the opinion that every  $\text{\LaTeX}$  geek, at least once during his life, feels the need to create his or her own class: this is what happened to me and here is the result, which, however, should be seen as a work still in progress. Actually, this class is not completely original, but it is a blend of all the best ideas that I have found in a number of guides, tutorials, blogs and [tex.stackexchange.com](http://tex.stackexchange.com) posts. In particular, the main ideas come from two sources:

- ▶ [Ken Arroyo Ohori's Doctoral Thesis](#), which served, with the author's permission, as a backbone for the implementation of this class;
- ▶ The [Tufte-Latex Class](#), which was a model for the style.

The first chapter of this book is introductive and covers the most essential features of the class. Next, there is a bunch of chapters devoted to all the commands and environments that you may use in writing a book; in particular, it will be explained how to add notes, figures and tables, and references. The second part deals with the page layout and design, as well as additional features like coloured boxes and theorem environments.

I started writing this class as an experiment, and as such it should be regarded. Since it has always been intended for my personal use, it may not be perfect but I find it quite satisfactory for the use I want to make of it. I share this work in the hope that someone might find here the inspiration for writing his or her own class.

*Max Braun*

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## 1.1 The Main Ideas

This document is intended to provide the physical and mathematical background concerning this simulation tool kit. It will provide the necessary information to operate the tool, tailor it to specific use cases, and develop the source code to augment it.

The first chapter will give a brief introduction in the physical and mathematical background required to build a three degree of freedom or a six degree of freedom simulation respectively. Compiling this tool lessons have been learned how to address certain problems, how to implement mathematical models in software in order to keep the code flexible and performant alike. This section will partly be a best picks from the available literature, partly methods defined within and for this particular project

## 1.2 Background

## 1.3 What This Toolkit Does

The kaobook class focuses more about the document structure than about the style. Indeed, it is a well-known L<sup>A</sup>T<sub>E</sub>X principle that structure and style should be separated as much as possible (see also Section ?? on page ??). This means that this class will only provide commands, environments and in general, the opportunity to do things, which the user may or may not use. Actually, some stylistic matters are embedded in the class, but the user is able to customise them with ease.

The main features are the following:

**Page Layout** The text width is reduced to improve readability and make space for the margins, where any sort of elements can be displayed.

**Chapter Headings** As opposed to Tufte-Latex, we provide a variety of chapter headings among which to choose; examples will be seen in later chapters.

**Page Headers** They span the whole page, margins included, and, in twoside mode, display alternatively the chapter and the section name.<sup>1</sup>

**Matters** The commands `\frontmatter`, `\mainmatter` and `\backmatter` have been redefined in order to have automatically wide margins in the main matter, and narrow margins in the front and back

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1: This is another departure from Tufte's design.

2: Sidenotes (like this!) are numbered while marginnotes are not



**Figure 1.1:** The Mona Lisa.

[https://commons.wikimedia.org/wiki/File:Mona\\_Lisa,\\_by\\_Leonardo\\_da\\_Vinci,\\_from\\_C2RMF\\_retouched.jpg](https://commons.wikimedia.org/wiki/File:Mona_Lisa,_by_Leonardo_da_Vinci,_from_C2RMF_retouched.jpg)

matters. However, the page style can be changed at any moment, even in the middle of the document.

**Margin text** We provide commands `\sidenote` and `\marginnote` to put text in the margins.<sup>2</sup>

**Margin figs/tabs** A couple of useful environments is `marginfigure` and `marginfigure`, which, not surprisingly, allow you to put figures and tables in the margins (*cfr.* Figure 1.1).

**Margin toc** Finally, since we have wide margins, why don't add a little table of contents in them? See `\margintoc` for that.

**Hyperref** `hyperref` is loaded and by default we try to add bookmarks in a sensible way; in particular, the bookmarks levels are automatically reset at `\appendix` and `\backmatter`. Moreover, we also provide a small package to ease the hyperreferencing of other parts of the text.

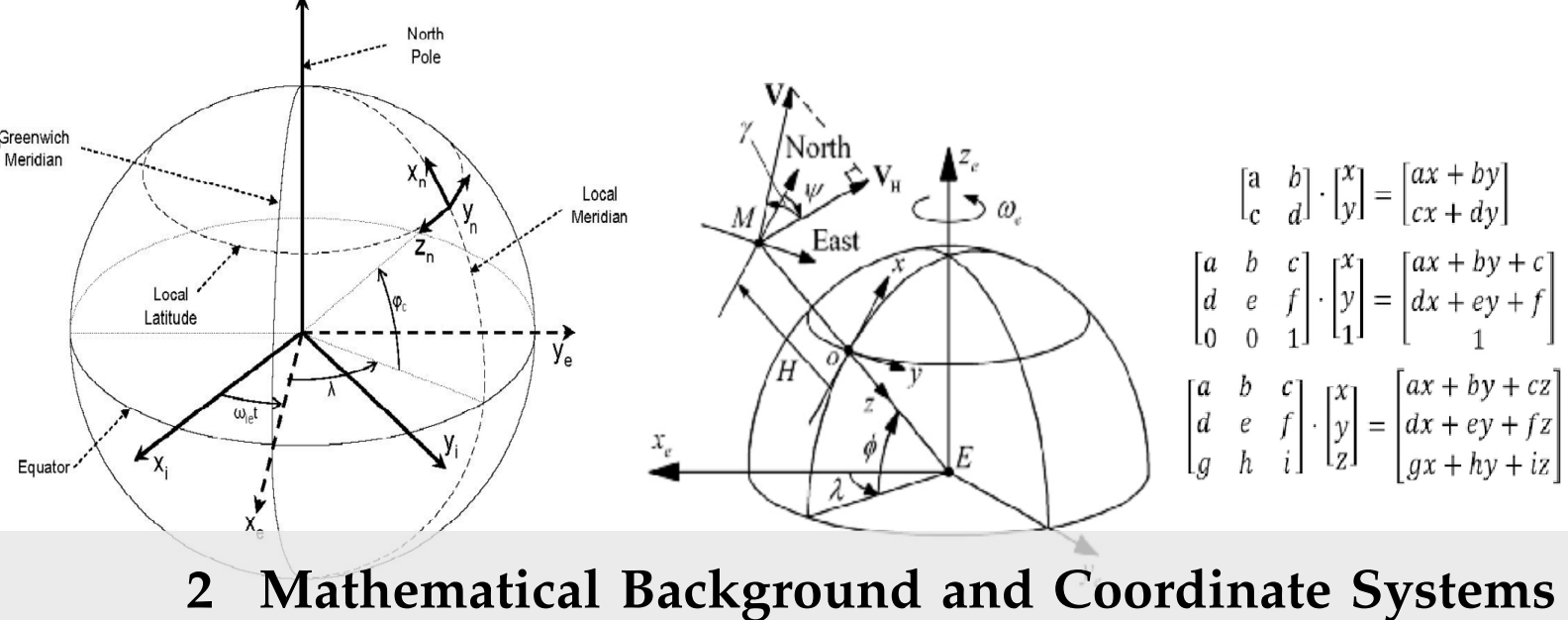
**Bibliography** We want the reader to be able to know what has been cited without having to go to the end of the document every time, so citations go in the margins as well as at the end, as in Tufte-Latex. Unlike that class, however, you are free to customise the citations as you wish.

The order of the title pages, table of contents and preface can be easily changed, as in any  $\text{\LaTeX}$  document. In addition, the class is based on KOMA-Script's `scrbook`, therefore it inherits all the goodies of that.



**COORDINATE FRAMES, EQUATIONS OF  
MOTIONS AND ENVIRONMENTAL  
MODELLING**





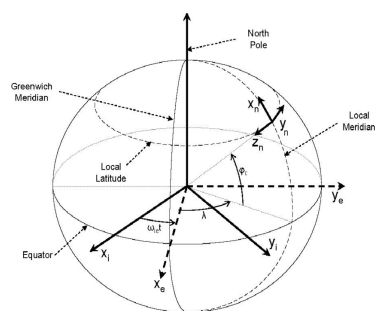
In this chapter I will describe the most common options used, both the ones inherited from scrbook and the kao-specific ones. Options passed to the class modifies its default behaviour; beware though that some options may lead to unexpected results...

### 2.1 Linear Algebra

[Introduction Linear Algebra] [Matrices] [Determinant] [Matrix multiplication]

### 2.2 Coordinate frames

#### Earth Centered Inertial - ECI



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Figure 2.1: Earth Centered Inertial.

#### Earth Centered Earth Fixed - ECEF

##### Reference Body

Note that Earth Centered Inertial as well as Earth Centered Earth Fixed have the strong implication that the reference body is indeed

Earth. The basic principle of these coordinate frames however can be applied to any arbitrary planetary body. Since the abbreviation is quite prominent it is common to use ECI and ECEF even if the reference body is not Earth. In the context of this book ECI does not always necessarily refer to Earth.

**North East Down - NED**

**Aerodynamic Frame - A**

**Bodyfixed Frame - B**

## 3 Margin Stuff

Sidenotes are a distinctive feature of all 1.5-column-layout books. Indeed, having wide margins means that some material can be displayed there. We use margins for all kind of stuff: sidenotes, marginnotes, small tables of contents, citations, and, why not?, special boxes and environments.

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### 3.1 Sidenotes

Sidenotes are like footnotes, except that they go in the margin, where they are more readable. To insert a sidenote, just use the command `\sidenote{Text of the note}`. You can specify a mark<sup>O</sup> with `\sidenote[mark]{Text}`, but you can also specify an offset, which moves the sidenote upwards or downwards, so that the full syntax is:

```
\sidenote[offset][mark]{Text}
```

If you use an offset, you always have to add the brackets for the mark, but they can be empty.<sup>5</sup> The format of the actual sidenote can be changed with the command `\setsidenotes`, which allows you to modify, for instance, the format of the markers and the separator between the marker and the text of the sidenote.

There was an alternative package, `sidenotes`, which we could have used. In the end we went for `snotez` because it was the one used in Ken Ohori's thesis, which inspired this class. The features are very similar, but one additional thing offered by `snotez` is that the offset can be specified as a multiple of `\baselineskip`. For example, if you want to enter a sidenote with the normal mark and move it upwards one line, type:

```
\sidenote[*-1][]{Text of the sidenote.}
```

Sidenotes are handled through the `snotez` package, which in turn relies on the `marginnote` package.

O: This sidenote has a special mark, a big O!

5: If you want to know more about the usage of the `\sidenote` command, read the documentation of the `snotez` package.

While the command for margin notes comes from the `marginnote` package, it has been redefined in order to change the position of the optional offset argument, which now precedes the text of the note, whereas in the original version it was at the end. We have also added the possibility to use a multiple of `\baselineskip` as offset. These things were made only to make everything more consistent, so that you have to remember less things!

## 3.2 Marginnotes

This command is very similar to the previous one. You can create a marginnote with `\marginnote[offset]{Text}`, where the offset argument can be left out, or it can be a multiple of `\baselineskip`, *e.g.*

```
\marginnote[-12pt]{Text} or \marginnote[*-3]{Text}
```

### To Do

A small thing that needs to be done is to renew the `\sidenote` command so that it takes only one optional argument, the offset. The special mark argument can go somewhere else. In other words, we want the syntax of `\sidenote` to resemble that of `\marginnote`.

We load the packages `marginnote`, `marginfix` and `placeins`. Since `snotex` uses `marginnote`, what we said for marginnotes is also valid for sidenotes. Side- and margin- notes are shifted slightly upwards (`\renewcommand{\marginnotevadjust}{3pt}`) in order to allineate them to the bottom of the line of text where the note is issued.

## 3.3 Footnotes

Even though they are not displayed in the margin, we will discuss about footnotes here, since sidenotes are mainly intended to be a replacement of them. Footnotes force the reader to constantly move from one area of the page to the other. Arguably, marginnotes solve this issue, so you should not use footnotes. Nevertheless, for completeness, we have left the standard command `\footnote`, just in case you want to put a footnote once in a while.\*

## 3.4 Margintoc

Since we are talking about margins, we introduce here the `\margintoc` command, which allows one to put small table of contents in the margin. Like other commands we have discussed, `\margintoc` accepts a parameter for the vertical offset, like so: `\margintoc[offset]`.

The command can be used in any point of the document, but we think it makes sense to use it just at the beginning of chapters or parts. In this document I make use of a KOMA-Script feature and put it in the chapter preamble, with the following code:

```
\setchapterpreamble[u]{\margintoc}
\chapter{Chapter title}
```

Not only textual stuff can be displayed in the margin, but also figures. Those will be the focus of the next chapter.

The font used in the `margintoc` is the same as the one for the chapter entries in the main table of contents at the beginning of the document.

---

\* And this is how they look like. Notice that in the PDF file there is a back reference to the text; pretty cool, uh?



## 4 Figures and Tables

### 4.1 Normal Figures and Tables

Figures and tables can be inserted just like in any standard  $\text{\LaTeX}$  document. The `graphicx` package is already loaded and configured in such a way that the figure width is equal to the `textwidth` and the height is adjusted in order to maintain the original aspect ratio. As you may have imagined, the captions will be positioned... well, in the margins. This is achieved with the help of the `floatrow` package.

Here is a picture of Mona Lisa (Figure 4.1), as an example. The captions are formatted as the margin- and the side-notes; If you want to change something about captions you can use the command `\captsetup` from the `caption` package. Remember that if you want to reference a figure, the label must come *after* the caption!



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4.3 Wide Figures and Tables	11

**Figure 4.1:** It's Mona Lisa again. Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like "Huardest gefburn"? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.

While the format of the caption is managed by `caption`, its position is handled by the `floatrow` package. Achieving this result has been quite hard, but now I am pretty satisfied. In two-side mode, the captions are printed in the correct margin.

Tables can be inserted just as easily as figures, as exemplified by the following code:

```

1 \begin{table}
2 \begin{tabular}{c c c c }
3   \toprule
4   col1 & col2 & col3 & col 4 \\\
5   \midrule
6   \multirow{3}{4em}{Multiple row} & cell2 & cell3 & cell4\\ & cell5 & cell6 & cell7 \\\ & cell8 & cell9 & cell10 \\\
9   \multirow{3}{4em}{Multiple row} & cell2 & cell3 & cell4 \\\ & cell5 & cell6 & cell7 \\\ & cell8 & cell9 & cell10 \\\
12  \bottomrule
13 \end{tabular}
14 \end{table}

```

which results in the useless Table 4.1.

**Table 4.1:** A useless table.

col1	col2	col3	col 4
Multiple row	cell2	cell3	cell4
	cell5	cell6	cell7
	cell8	cell9	cell10
Multiple row	cell2	cell3	cell4
	cell5	cell6	cell7
	cell8	cell9	cell10

I don't have much else to say, so I will just insert some blind text. Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like "Huardest gefburn"? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.

## 4.2 Margin Figures and Tables

Marginfigures can be inserted with the environment `marginfigure`. In this case, the whole picture is confined to the margin and the caption is below it. Figure 1.1 is obtained with something like this:

```

1 \begin{marginfigure}
2   \includegraphics{monalisa}
3   \caption[The Mona Lisa]{The Mona Lisa.}
4   \labfig{marginmonalisa}

```



5 | \end{marginfigure}

There is also the `marginfigure` environment, of which Table 4.2 is an example. Notice how you can place the caption above the table by just placing the `\caption` command before beginning the `tabular` environment. Usually, figure captions are below, while table captions are above. This rule is also respected for normal figures and tables: the captions are always on the side, but for figure they are aligned to the bottom, while for tables to the top.

Marginfigures and tables can be positioned with an optional offset command, like so:

```
1 | \begin{marginfigure}[offset]
2 |   \includegraphics{images/seaside}
3 | \end{marginfigure}
```

Offset can be either a measure or a multiple of `\baselineskip`, much like with `\sidenote`, `\marginnote` and `\margintoc`. If you are wondering how I inserted this orange bubble, have a look at the `todo` package.

Table 4.2: Another useless table.

col1	col2	col3
Multiple row	cell2	cell3
	cell5	cell6
	cell8	cell9

Improve this part.

### 4.3 Wide Figures and Tables



Figure 4.2: A wide seaside, and a wide caption. Credits: By Bushra Feroz — Own work, CC BY-SA 4.0, <https://commons.wikimedia.org/w/index.php?curid=6872467>

With the environments `figure*` and `table*` you can insert figures which span the whole page width. The caption will be positioned below or above, according to taste.

You may have noticed the full width image at the very beginning of this chapter: that, however, is set up in an entirely different way, which you'll read about in Chapter 6 on page 19. Now it is time to tackle hyperreferences.



## 5.1 Citations

To cite someone [Visscher2008, James2013] is very simple: just use the `\sidecite` command. It does not have an offset argument yet, but it probably will in the future. This command supports multiple entries, as you can see, and by default it prints the reference on the margin as well as adding it to the bibliography at the end of the document. For this setup I used biblatex but I think that workarounds are possible.[James2013] Note that the citations have nothing to do with the text, they are completely random as they only serve the purpose to illustrate the feature.

To compile a document containing citations, you need to use an external tool, which for this class is biber. You need to run the following (assuming that your tex file is called main.text):

```
$ pdflatex main
$ biber main
$ pdflatex main
```

[Visscher2008]: Visscher2008  
(Visscher2008), Visscher2008  
[James2013]: James2013 (James2013),  
James2013

[James2013]: James2013 (James2013),  
James2013

## 5.2 Glossaries and Indices

Unless you use [Overleaf](#) or some other fancy IDE for L<sup>A</sup>T<sub>E</sub>X, you need to run an external command from your terminal in order to compile a document with a glossary. In particular, the commands required are:<sup>8</sup>

```
$ pdflatex main
$ makeglossaries main
$ pdflatex main
```

Note that you need not run `makeglossaries` every time you compile your document, but only when you change the glossary entries.

To create an index, you need to insert the command `\index{subject}` whenever you are talking about ‘subject’ in the text. For instance, at the start of this paragraph I would write `index{index}`, and an entry would be added to the Index in the backmatter. Check it out!

A nomenclature is just a special kind of index; you can find one at the end of this book. To insert a nomenclature, we use the package `nomencl` and add the terms with the command `\nomenclature`. We put then a `\printnomenclature` where we want it to appear.

Also with this package we need to run an external command to compile the document, otherwise the nomenclature will not appear:

<sup>8</sup>: These are the commands you would run in a UNIX system; I have no idea on how it works in Windows.

In theory, you would need to run an external command for the index as well, but luckily the package we suggested, `imakeidx`, can compile the index automatically.

```
$ pdflatex main
$ makeindex main.nlo -s nomencl.ist -o main.nls
$ pdflatex main
```

These packages are all loaded in `packages.sty`, one of the files that come with this class. However, the configuration of the elements is best done in the `main.tex` file, since each book will have different entries and styles.

This brief section was by no means a complete reference on the subject, therefore you should consult the documentation of the above package to gain a full understanding of how they work.

Note that the `nomencl` package caused problems when the document was compiled, so, to make a long story short, I had to prevent `scrhack` to load the hack-file for `nomencl`. When compiling the document on Overleaf, however, this problem seem to vanish.

## 5.3 Hyperreferences

In this class we provide a handy sub-package to help you referencing the same elements always in the same way, for consistency across the book. First, you can label each element with a specific command. For instance, should you want to label a chapter, you would put `\labch{chapter-title}` right after the `\chapter` directive. This is just a convenience, because `\labch` is actually just an alias to `\label{ch:chapter-title}`, so it spares you the writing of ‘ch’. We defined similar commands for many typically labeled elements, including:

- |                                    |                                       |
|------------------------------------|---------------------------------------|
| ► Page: <code>\labpage</code>      | ► Theorem: <code>\labthm</code>       |
| ► Part: <code>\labpart</code>      | ► Proposition: <code>\labprop</code>  |
| ► Chapter: <code>\labch</code>     | ► Lemma: <code>\lablemma</code>       |
| ► Section: <code>\labsec</code>    | ► Remark: <code>\labremark</code>     |
| ► Figure: <code>\labfig</code>     | ► Example: <code>\labexample</code>   |
| ► Table: <code>\labtab</code>      | ► Exercise: <code>\labexercise</code> |
| ► Definition: <code>\labdef</code> |                                       |

Of course, we have similar commands for referencing those elements. However, since the style of the reference should depend on the context, we provide different commands to reference the same thing. For instance, in some occasions you may want to reference the chapter by name, but other times you want to reference it only by number. In general, there are four reference style, which we call plain, vario, name, and full.

The plain style references only by number. It is accessed, for chapters, with `\refch{chapter-title}` (for other elements, the syntax is analogous). Such a reference results in: Chapter 5.

The vario and name styles rest upon the `varioref` package. Their syntax is `\vrefch{chapter-title}` and `\nrefch{chapter-title}`, and they result in: Chapter 5 on the previous page, for the vario style, and: Chapter 5 (References), for the name style. As you can see, the page is referenced in `varioref` style.

The full style references everything. You can use it with `\frefch{chapter-title}` and it looks like this: Chapter 5 (References) on page 13.

Of course, all the other elements have similar commands (*e.g.* for parts you would use `\vrefpart{part-title}` or something like that). However, not all elements implement all the four styles. The commands provided should be enough, but if you want to see what is available or to add the missing ones, have a look at the [attached package](#).



# **DESIGN AND ADDITIONAL FEATURES**







## 6 Page Design

### 6.1 Headings

So far, in this document I used two different styles for the chapter headings: one has the chapter name, a rule and, in the margin, the chapter number; the other has an image at the top of the page, and the chapter title is printed in a box (like for this chapter). There is one additional style, which I used only in the appendix (on page 29); there, the chapter title is enclosed in two horizontal rules, and the chapter number (or letter, in the case of the appendix) is above it.<sup>10</sup>

Every book is unique, so it makes sense to have different styles from which to choose. Actually, it would be awesome if whenever a user designs a new heading style, he or she added it to the three styles already present, so that it will be available for new users and new books.

The choice of the style is made simple by the `\setchapterstyle` command. It accepts one option, the name of the style, which can be: ‘plain’, ‘kao’, or ‘lines’.<sup>11</sup> If instead you want the image style, you have to use the command `\setchapterimage`, which accepts the path to the image as argument; you can also provide an optional parameter in square brackets to specify the height of the image.

Let us make some examples. In this book, I begin a normal chapter with the lines:

```
1 \setchapterstyle{kao}
2 \setchapterpreamble[u]{\margintoc}
3 \chapter{Title of the Chapter}
4 \labch{title}
```

In Line 1 I choose the style for the title to be ‘kao’. Then, I specify that I want the margin toc. The rest is ordinary administration in  $\text{\LaTeX}$ , except that I use my own `\labch` to label the chapter. Actually, the `\setchapterpreamble` is a standard KOMA-Script one, so I invite you to read about it in the KOMA documentation. Once the chapter style

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10: To be honest, I do not think that mixing heading styles like this is a wise choice, but in this document I did only to show you how they look.

11: Plain is the default  $\text{\LaTeX}$  title style; the other ones are self explanatory.

12: The `\margintoc` has to be specified at every chapter. Perhaps in the future this may change; it all depends on how this feature will be welcomed by the users, so keep in touch with me if you have preferences!

is set, it holds until you change it.<sup>12</sup> Whenever I want to start a chapter with an image, I simply write:

```
1 \setchapterimage[7cm]{path/to/image.png} % Optionally specify the
   height
2 \setchapterpreamble[u]{\margintoc}
3 \chapter{Catchy Title} % No need to set a chapter style
4 \labch{catchy}
```

## 6.2 Headers & Footers

Headers and footers in KOMA-Script are handled by the `scrlayer-scrpage` package. There are two basic style: ‘`scrheadings`’ and ‘`plain.scrheadings`’. The former is used for normal pages, whereas the latter is used in title pages (those where a new chapter starts, for instance) and, at least in this book, in the front matter. At any rate, the style can be changed with the `\pagestyle` command, *e.g.* `\pagestyle{plain.scrheadings}`.

In both stles, the footer is completely empty. In `plain.scrheadings`, also the header is absent (otherwise it wouldn’t be so plain...), but in the normal style the design is reminiscent of the ‘kao’ style for chapter titles.

### To Do

The `twoside` class option is still unstable and. As always, any help will be greatly appreciated.

## 6.3 Table of Contents

Another important part of a book is the table of contents. By default, in `kaobook` there is an entry for everything: list of figures, list of tables, bibliographies, and even the table of contents itself. Not everybody might like this, so we will provide a description of the changes you need to do in order to enable or disable each of these entries. In the following Table 6.1, each item corresponds to a possible entry in the TOC, and its description is the command you need to provide to have such entry. These commands are specified in the attached [style package](#),<sup>13</sup> so if you don’t want the entries, just comment the corresponding lines.

Of course, some packages, like those for glossaries and indices, will try to add their own entries. In such cases, you have to follow the instructions specific to that package. Here, since we have talked about glossaries and notations in Chapter 5, we will briefly see how to configure them.

For the `glossaries` package, use the ‘`toc`’ option when you load it: `\usepackage[toc]{glossaries}`. For `nomencl`, pass the ‘`intoc`’ option at the moment of loading the package. Both `glossaries` and `nomencl` are loaded in the attached [‘packages’ package](#).

13: In the same file, you can also choose the titles of these entries.

In a later section, we will see how you can define your own floating environment, and endow it with an entry in the TOC.

Entry	Command to Activate
Table of Contents	<code>\setuptoc{toc}{totoc}</code>
List of Figs and Tabs	<code>\PassOptionsToClass{toc=listof}{\@baseclass}</code>
Bibliography	<code>\PassOptionsToClass{toc=bibliography}{\@baseclass}</code>

**Table 6.1:** Commands to add a particular entry to the table of contents.

Additional configuration of the table of contents can be performed through the packages `etoc`, which is loaded because it is needed for the `margintocs`, or the more traditional `tocbase`. Read the respective documentations if you want to be able to change the default TOC style.<sup>14</sup>

14: (And please, send me a copy of what you have done, I'm so curious!)

## 6.4 Page Layout

Besides the page style, you can also change the width of the content of a page. This is particularly useful for pages dedicated to part titles, where having the 1.5-column layout might be a little awkward, or for pages where you only put figures, where it is important to exploit all the available space.

In practice, there are two layouts: 'wide' and 'margin'. The former suppresses the margins and allocates the full page for contents, while the latter is the layout used in most of the pages of this book, including this one. The wide layout is also used automatically in the front and back matters.

To change page layout, use the `\pagelayout` command. For example, when I start a new part, I write:

```
1 \pagelayout{wide}
2 \addpart{Title of the New Part}
3 \pagelayout{margin}
```

## 6.5 Numbers & Counters

In this short section we shall see how dispositions, sidenotes and figures are numbered in the `kaobook` class.

By default, dispositions are numbered up to the section. This is achieved by setting: `\setcounter{secnumdepth}{1}`.

The sidenotes counter is the same across all the document, but if you want it to reset at each chapter, just uncomment the line

```
\counterwithin*{sidenote}{chapter}
```

in the `styles/style.sty` package provided by this class.

Figure and Table numbering is also per-chapter; to change that, use something like:

```
\renewcommand{\thefigure}{\arabic{section}.\arabic{figure}}
```

## 6.6 White Space

One of the things that I find most hard in  $\text{\LaTeX}$  is to finely tune the white space around objects. There are not fixed rules, each object needs its own adjustment. Here we shall see how some spaces are defined at the moment in this class.

Attention! This section may be incomplete.

### Space around figures and tables

```
\renewcommand\FBaskip{.4\topskip}
\renewcommand\FBbskip{\FBaskip}
```

### Space around captions

```
\captionsetup{
  aboveskip=6pt,
  belowskip=6pt
}
```

### Space around displays (*e.g.* equations)

```
\setlength\abovedisplayskip{6pt plus 2pt minus 4pt}
\setlength\belowdisplayskip{6pt plus 2pt minus 4pt}
\abovedisplayskip 10\p@ \@plus2\p@ \@minus5\p@
\abovedisplayshortskip \z@ \@plus3\p@
\belowdisplayskip \abovedisplayskip
\belowdisplayshortskip 6\p@ \@plus3\p@ \@minus3\p@
```

7.1 Theorems

7.1 Theorems . . . . . 23  
7.2 Boxes & Environments . . . 24  
7.3 Experiments . . . . . 25

Despite most people complain at the sight of a book full of equations, mathematics is an important part of many books. Here, we shall illustrate some of the possibilities. We believe that theorems, definitions, remarks and examples should be emphasised with a shaded background; however, the colour should not be too heavy on the eyes, so we have chosen a sort of light yellow.<sup>16</sup>

**Definition 7.1.1** *Let  $(X, d)$  be a metric space. A subset  $U \subset X$  is an open set if, for any  $x \in U$  there exists  $r > 0$  such that  $B(x, r) \subset U$ . We call the topology associated to  $d$  the set  $\tau_d$  of all the open subsets of  $(X, d)$ .*

Definition 7.1.1 is very important. I am not joking, but I have inserted this phrase only to show how to reference definitions. The following statement is repeated over and over in different environments.

**Theorem 7.1.1** *A finite intersection of open sets of  $(X, d)$  is an open set of  $(X, d)$ , i.e  $\tau_d$  is closed under finite intersections. Any union of open sets of  $(X, d)$  is an open set of  $(X, d)$ .*

**Proposition 7.1.2** *A finite intersection of open sets of  $(X, d)$  is an open set of  $(X, d)$ , i.e  $\tau_d$  is closed under finite intersections. Any union of open sets of  $(X, d)$  is an open set of  $(X, d)$ .*

**Lemma 7.1.3** *A finite intersection<sup>a</sup> of open sets of  $(X, d)$  is an open set of  $(X, d)$ , i.e  $\tau_d$  is closed under finite intersections. Any union of open sets of  $(X, d)$  is an open set of  $(X, d)$ .*

<sup>a</sup> I'm a footnote

You can safely ignore the content of the theorems... I assume that if you are interested in having theorems in your book, you already know something about the classical way to add them. These examples should just showcase all the things you can do within this class.

**Corollary 7.1.4** (Finite Intersection, Countable Union) *A finite intersection of open sets of  $(X, d)$  is an open set of  $(X, d)$ , i.e  $\tau_d$  is closed under finite intersections. Any union of open sets of  $(X, d)$  is an open set of  $(X, d)$ .*

*Proof.* The proof is left to the reader as a trivial exercise. Hint: Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference

16: The boxes are all of the same colour here, because we did not want our document to look like [Harlequin](#).

You can even insert footnotes inside the theorem environments; they will be displayed at the bottom of the box.

between this text and some nonsense like “Huardest gefburn”? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.  $\square$

Here is a random equation, just because we can:

$$x = a_0 + \frac{1}{a_1 + \frac{1}{a_2 + \frac{1}{a_3 + \frac{1}{a_4}}}}$$

**Definition 7.1.2** Let  $(X, d)$  be a metric space. A subset  $U \subset X$  is an open set if, for any  $x \in U$  there exists  $r > 0$  such that  $B(x, r) \subset U$ . We call the topology associated to  $d$  the set  $\tau_d$  of all the open subsets of  $(X, d)$ .

**Example 7.1.1** Let  $(X, d)$  be a metric space. A subset  $U \subset X$  is an open set if, for any  $x \in U$  there exists  $r > 0$  such that  $B(x, r) \subset U$ . We call the topology associated to  $d$  the set  $\tau_d$  of all the open subsets of  $(X, d)$ .

**Remark 7.1.1** Let  $(X, d)$  be a metric space. A subset  $U \subset X$  is an open set if, for any  $x \in U$  there exists  $r > 0$  such that  $B(x, r) \subset U$ . We call the topology associated to  $d$  the set  $\tau_d$  of all the open subsets of  $(X, d)$ .

As you may have noticed, definitions, example and remarks have independent counters; theorems, propositions, lemmas and corollaries share the same counter.

**Remark 7.1.2** Here is how an integral looks like inline:  $\int_a^b x^2 dx$ , and here is the same integral displayed in its own paragraph:

$$\int_a^b x^2 dx$$

We provide two files for the theorem styles: [plaintheorems.sty](#), which you should include if you do not want coloured boxes around theorems; and [mdftheorems.sty](#), which is the one used for this document.<sup>17</sup> Of course, you will have to edit these files according to your taste and the general style of the book.

17: The plain one is not showed, but actually it is exactly the same as this one, only without the yellow boxes.

## 7.2 Boxes & Custom Environments <sup>18</sup>

18: Notice that in the table of contents and in the header, the name of this section is ‘Boxes & Environments’; we achieved this with the optional argument of the section command.

Say you want to insert a special section, an optional content or just something you want to emphasise. We think that nothing works better than a box in these cases. We used `mdframed` to construct the ones shown below. You can create and modify such environments by editing the provided file [environments.sty](#).

### Title of the box

Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information?

Is there a difference between this text and some nonsense like “Huardest gefburn”? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.

If you set up a counter, you can even create your own numbered environment.

#### Comment 7.2.1

Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like “Huardest gefburn”? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.

## 7.3 Experiments

It is possible to wrap marginnotes inside boxes, too. Audacious readers are encouraged to try their own experiments and let me know the outcomes.

I believe that many other special things are possible with the kaobook class. During its development, I struggled to keep it as flexible as possible, so that new features could be added without too great an effort. Therefore, I hope that you can find the optimal way to express yourselves in writing a book, report or thesis with this class, and I am eager to see the outcomes of any experiment that you may try.

#### title of margin note

Margin note inside a kaobox.  
(Actually, kaobox inside a margin-note!)





# APPENDIX





---

## Heading on Level 0 (chapter)

---

Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like “Huardest gef-burn”? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.

### A.1 Heading on Level 1 (section)

Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like “Huardest gef-burn”? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.

#### Heading on Level 2 (subsection)

Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like “Huardest gef-burn”? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.

#### Heading on Level 3 (subsubsection)

Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text,

you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like “Huardest gefburn”? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.

**Heading on Level 4 (paragraph)** Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like “Huardest gefburn”? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.

## A.2 Lists

### Example for list (itemize)

- ▶ First item in a list
- ▶ Second item in a list
- ▶ Third item in a list
- ▶ Fourth item in a list
- ▶ Fifth item in a list

### Example for list (4\*itemize)

- ▶ First item in a list
  - First item in a list
    - \* First item in a list
      - First item in a list
      - Second item in a list
    - \* Second item in a list
  - Second item in a list
- ▶ Second item in a list

### Example for list (enumerate)

1. First item in a list
2. Second item in a list
3. Third item in a list
4. Fourth item in a list
5. Fifth item in a list

**Example for list (4\*enumerate)**

1. First item in a list
  - a) First item in a list
    - i. First item in a list
      - A. First item in a list
      - B. Second item in a list
    - ii. Second item in a list
  - b) Second item in a list
2. Second item in a list

**Example for list (description)**

**First** item in a list  
**Second** item in a list  
**Third** item in a list  
**Fourth** item in a list  
**Fifth** item in a list

**Example for list (4\*description)**

**First** item in a list  
     **First** item in a list  
         **First** item in a list  
             **First** item in a list  
             **Second** item in a list  
         **Second** item in a list  
     **Second** item in a list  
**Second** item in a list



# Greek Letters with Pronunciation

Character	Name	Character	Name
$\alpha$	alpha <i>AL-fuh</i>	$\nu$	nu <i>NEW</i>
$\beta$	beta <i>BAY-tuh</i>	$\xi, \Xi$	xi <i>KSIGH</i>
$\gamma, \Gamma$	gamma <i>GAM-muh</i>	$\omicron$	omicron <i>OM-uh-CRON</i>
$\delta, \Delta$	delta <i>DEL-tuh</i>	$\pi, \Pi$	pi <i>PIE</i>
$\epsilon$	epsilon <i>EP-suh-lon</i>	$\rho$	rho <i>ROW</i>
$\zeta$	zeta <i>ZAY-tuh</i>	$\sigma, \Sigma$	sigma <i>SIG-muh</i>
$\eta$	eta <i>AY-tuh</i>	$\tau$	tau <i>TOW (as in cow)</i>
$\theta, \Theta$	theta <i>THAY-tuh</i>	$\upsilon, \Upsilon$	upsilon <i>OOP-suh-LON</i>
$\iota$	iota <i>eye-OH-tuh</i>	$\phi, \Phi$	phi <i>FEE, or FI (as in hi)</i>
$\kappa$	kappa <i>KAP-uh</i>	$\chi$	chi <i>KI (as in hi)</i>
$\lambda, \Lambda$	lambda <i>LAM-duh</i>	$\psi, \Psi$	psi <i>SIGH, or PSIGH</i>
$\mu$	mu <i>MEW</i>	$\omega, \Omega$	omega <i>oh-MAY-guh</i>

Capitals shown are the ones that differ from Roman capitals.





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