The hagenberg-thesis Package

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2023/11/06

Abstract

The hagenberg-thesis package is a collection of modern LaTeX templates for university theses (bachelor, master, or diploma programs) and related documents. This manual describes the main features of this package. Pre-configured document templates for English and German manuscripts and a complete tutorial are available on the package's home repository.

1 Introduction

The complete source of this package and auxiliary materials are available on CTAN[1] and its development repository.[2] The package is made available under the terms of the Creative Commons Attribution 4.0 International Public License.[3]

2 Document classes

The `hgb` package provides the following document classes, which are based on the standard LaTeX classes `book`, `report`, and `article`, respectively:

- **`hgbthesis`** (`book`): for bachelor's, master's, and diploma theses;
- **`hgbreport`** (`report`): for project and term reports;
- **`hgbarticle`** (`article`): for drafting journal articles.

2.1 Class options

2.1.1 General options

All document classes accept the following general options:

- `english` or `german` (select the primary document language),
- `smartquotes` (use smart quotes replacement),
- `apa` (use `apa` bibliography style instead of `numeric-comp`),
- `noUpdateCheck` (suppress check of package release date).

[1] https://ctan.org/pkg/hagenberg-thesis
[2] https://github.com/Digital-Media/HagenbergThesis
[3] https://creativecommons.org/licenses/by/4.0/legalcode

2.1.2 Class-specific options

In addition, the following class-specific options are accepted:

- **hgbthesis**:
  `type={bachelor, master, diploma, phd, internship, custom}`,
  `language={english, german}` (language in main document),
  `titlelanguage={english, german}` (language on title pages, defaults to main language),
  `proposal` (flag to indicate proposal documents);
- **hgbreport**:
  `notitlepage`;
- **hgbarticle**
  `twocolumn`.

For example, to start a master's thesis in German, simply place

```
\documentclass[type=master,language=german,smartquotes]{hgbthesis}
```

at the beginning of the document.

The `proposal` option is intended for a *thesis proposal* ("Exposé" or "Proposal") and is only effective in *conjunction* with the main thesis types, e.g.,

```
\documentclass[type=bachelor,language=english,titlelanguage=german,proposal]{
    hgbthesis}
```

The result is a short exposé that contains only one chapter. Thus, chapter numbers are not displayed. Remove the `proposal` option to migrate a proposal document straight to the final thesis (and restore the usual numbering scheme).

2.2 Thesis parameters (class `hgbthesis`)

`hgbthesis` supports several types of thesis documents. The following parameters must be specified at the beginning of the main document:

- `\title{...}`,
- `\subtitle{...}` (optional),
- `\author{...}`,
- `\programtype{...}` (optional),
- `\programname{...}`,
- `\institution{...}`,
- `\placeofstudy{...}`,
- `\dateofsubmission{yyyy}{mm}{dd}`,
- `\advisor[]{...}` (optional, multiple `\advisor` statements allowed),

Note that `hgbthesis` only supports a *single author* inside the `\author{...}` macro argument (commands `\and` and `\thanks{...}` are deactivated)!

The command `\advisor[role]{name}` accepts an optional argument to associate a *role* with the advisor's *name*, e.g., `\advisor[Supervisor]{Prof.~Marie␣Curie,␣PhD}`. Multiple advisors can be specified, for example

```
\advisor[1.~Betreuerin]{Professor Frida K.~Putnik, PhD}
\advisor[2.~Betreuer]{Franz Grillparzer, TU Wien}
\advisor[Gutachter]{Dr.~B.\,Rutal, MIT}
```

Other (optional) settings for `hgbthesis` include:

- `\license{cc|strict}`
  Use the Creative Commons License (`cc` = default) or strict terms ("all rights reserved");
- `\logofile{xxx.pdf}`
  Specifies a custom logo image for the title page, to be placed in `images/xxx.pdf` (default is `logo.pdf`).

3 Style files and user commands

The package comes with a set of style (`*.sty`) files that can be used independently of the document classes listed above:

- `hgb.sty` (language, date setup, custom commands;
- `hgbabbrev.sty`: various abbreviation commands;
- `hgbalgo.sty`: additions to `algpseudocodex` package;
- `hgbbib.sty`: bibliography setup;
- `hgbdict.sty`: language dictionary functions;
- `hgbheadings.sty`: definition of page headers;
- `hgblistings.sty`: setup for code listings;
- `hgbmath.sty`: setup and commands for math typesetting;
- `hgbpdfa.sty`: setup for PDF/A generation.

3.1 General user commands and environments (`hgb.sty`)

- **`\hgbDate`**
  Outputs the package version date, e.g., "`2023/11/06`".
- **`\getcurrentlabel`**
  Yields the most recently assigned label number.
- **`\calibrationbox{width}{height}`**
  Inserts a test box for checking the final print size (in millimeters).
- `\begin{block}...\end{block}`
  Dummy environment, provides a limited scope for variable/command redefinitions.
- `\begin{english}...\end{english}`
  Temporarily switches to English language settings.
- `\begin{german}...\end{german}`
  Temporarily switches to German language settings.

3.2 Text commands (`hgbabbrev.sty`)

Special characters:

- **`\bs`**: Inserts a backslash character (short for `\textbackslash`).
- **`\obnh`**: Inserts an optional break with no hyphen (e.g., `PlugIn{\obnh}Filter`).

German abbreviations:

- **`\bzgl`**: bzgl.
- **`\bzw`**: bzw.
- **`\ca`**: ca.
- **`\dah`**: d. h.
- **`\Dah`**: D. h.
- **`\ds`**: d. sind
- **`\etc`**: etc.
- **`\evtl`**: evtl.
- **`\ia`**: i. Allg.
- **`\sa`**: s. auch
- **`\so`**: s. oben
- **`\su`**: s. unten
- **`\ua`**: u. a.
- **`\Ua`**: U. a.
- **`\uae`**: u. Ä.
- **`\usw`**: usw.
- **`\uva`**: u. v. a.
- **`\uvm`**: u. v. m.
- **`\va`**: vor allem
- **`\vgl`**: vgl.
- **`\zB`**: z. B.
- **`\ZB`**: Zum Beispiel

English abbreviations:

- **`\ie`**: i.e.
- **`\eg`**: e.g.
- **`\etc`**: etc.
- **`\Eg`**: E.g.
- **`\wrt`**: w.r.t.

Note that none of the above abbreviation macros "eats" subsequent white space, i.e., they can be used without additional controls, as in "`\wrt␣what␣I␣said`", for example.

3.3 Bibliography commands (hgbbib.sty)

- **\AddBibFile**
  A wrapper to biblatex's \addbibresource macro (for backward compatibility only).
- **\MakeBibliography**[*options*]
  Inserts the reference section or chapter. By default, references are automatically split into category subsections.[4] Use the option **nosplit** to produce a traditional (i.e., contiguous) list of references.
- **\mcite**[*text1*]{*key1*}[*text2*]{*key2*}...[*textN*]{*keyN*}
  Analogous to biblatex's \cites command[5] but inserts semicolons between reference entries for better readability.

3.4 Code environments (hgblistings.sty)

The following types of code environments are defined:

- **CCode**: for C (ANSI),
- **CppCode**: for C++ (ISO),
- **CsCode**: for C#,
- **CssCode**: for CSS,
- **GenericCode**: for generic code,
- **HtmlCode**: for HTML,
- **JavaCode**: for Java,
- **JsCode**: for JavaScript,
- **LaTeXCode**: for LaTeX,
- **ObjCCode**: for ObjectiveC,
- **PhpCode**: for PHP,
- **PythonCode**: for Python,
- **Swift**: for Swift,
- **XmlCode**: for XML.

hgblistings is based on the listingsutf8[6] package, thus any valid listings[7] option may be used; for example, the option numbers=none to suppress line numbers:

```
\begin{JavaCode}[numbers=none]
... // Java code comes here
\end{JavaCode}
```

3.5 Mathematical commands (hgbmath.sty)

hgbmath requires (and automatically loads) the amsmath[8] package, thus, all commands and symbols of amsmath are available by default. The following *additional* commands

[4] Predefined reference categories are literature, avmedia, online and software.
[5] http://mirrors.ctan.org/macros/latex/contrib/biblatex/doc/biblatex.pdf (see Sec. 3.8.3)
[6] https://ctan.org/pkg/listingsutf8
[7] https://ctan.org/pkg/listings
[8] https://ctan.org/pkg/amsmath

can only be used in math mode:

- **\Cpx**: $\mathbb{C}$ (complex numbers),
- **\N**: $\mathbb{N}$ (natural numbers),
- **\R**: $\mathbb{R}$ (real numbers),
- **\Q**: $\mathbb{Q}$ (rational numbers),
- **\Z**: $\mathbb{Z}$ (integer numbers).

3.6 Algorithms (hgbalgo.sty)

hgbalgo is a stand-alone package that is based on – and extends – the algorithmicx and algpseudocodex packages.[9] It fixes some (mostly indentation-related) problems, adds color, and provides some additional commands. It also loads the algorithm[10] package, which defines a compatible float container for algorithms: \begin{algorithm} ... \end{algorithm}.

Additional algorithm commands:

- **\StateNN[<nesting>]{<text>}**: Creates a *non-numbered* statement like algorithmicx's \Statex command but provides controlled indentation inside nested constructs. The optional integer argument <nesting> can be used to specify the *nesting depth* to compensate for a bug in algorithmicx (the nesting level inside a block is not set properly before the first \State command). Omitting the optional argument should give correct indentation in most situations.
- **\Input{<text>}**: For describing the input parameters in a procedure's preamble.
- **\Output{<text>}**: For describing the output values in a procedure's preamble.
- **\Returns{<text>}**: For describing the return values in a procedure's preamble.

Vertical spacing commands: The following commands are provided for fine-tuning the vertical spacing between individual statements of an algorithm (the standard spacing commands like \smallskip etc. have no effect between statements):[11]

- **\algsmallskip**: inserts 3pt extra space,
- **\algmedskip**: inserts 6pt extra space,
- **\algbigskip**: inserts 12pt extra space.

They are supposed to be used inside (i.e., at the end of) statements, for example:

```
    \State $x \gets x + 1$ \algsmallskip
```

Defined algorithm colors:

- **AlgKeywordColor** (for algorithm keywords),
- **AlgProcedureColor** (for procedure and function names).

[9] https://ctan.org/pkg/algorithmicx, https://ctan.org/pkg/algpseudocodex

[10] https://ctan.org/pkg/algorithms

[11] Note that the standard spacing commands work *between* procedure and function blocks in the usual way.

These colors can be redefined at any time (see the `xcolor`[12] package), e.g., by

```
\definecolor{AlgKeywordColor}{named}{black}
\definecolor{AlgProcedureColor}{rgb}{0.0, 0.5, 0.0}      % dark green
```

4 PDF/A generation (`hgbpdfa.sty`)

Package `hgbpdfa` contains definitions for generating PDF/A-compliant (PDF/A-2b) output files. It is based on the `pdfmanagement-testphase` package (requires version 0.95s or higher) and must be loaded before the `\documentclass` statement in the main document, for example, by

```
\RequirePackage{hgbpdfa}
```

If omitted, a plain PDF (non-PDF/A-compliant) file is generated.

5 Customizing thesis title pages

The content and structure of the title pages generated for the various thesis types (`bachelor`, `master` etc.) may be customized to meet the specific requirements of different institutions or departments. Thus customization is usually done at the institutional level and not by the individual author (student).

5.1 Standard title page setups (*themes*)

The various front page arrangements are called *themes* in the following. Each theme is identified by a unique `themeID` and associated with a particular style (LaTeX package) file named `hgbtheme-<themeID>.sty`. For example, the `default` theme is defined by file

`hgbtheme-default.sty`,

Additional resources required by a theme (such as graphics files) must be named with the complete *theme name* (`hgbtheme-<themeID>`) as a prefix, for example,[13]

`hgbtheme-default-logo.pdf`

which contains the logo graphics used by that theme.

To *use* a specific theme, option `theme=<themeID>` is added to the `\documentclass` command, for example,

```
\documentclass[theme=default,...]{hgbthesis}
```

All these "inherit" from a parent theme file

`hgbtheme-thesis.sty`,

which contains the bulk of the definitions, while derived themes typically contain only a small number of specific settings.

[12] https://ctan.org/pkg/xcolor

[13] This is to avoid file name conflicts since themes are part of the CTAN distribution and thus all theme-related files will eventually end up in a single, flat directory.

5.2 Customizing themes

To customize the title page setup to their needs, authors (or administrators) should *not* modify any of the standard theme files, since these may not be local but loaded from a package distribution. There are two recommended ways instead:

5.2.1 Option 1: Adapt `hgbtheme-custom.sty`

Copy the theme file`hgbtheme-custom.sty` (which is part of this distribution) to the *main document directory* (if not there already) and open it in your LaTeX editor. It defines `hgbtheme-default.sty` as the parent theme by the initial command

```
\hgb@UseTheme{default}
```

All commands defined in the parent theme are visible and may be redefined, typically by `\renewcommand` (see Sec. 5.3 for available commands). To activate the associated theme simply use `custom` as the theme ID, i.e.,

```
\documentclass[theme=custom,...]{hgbthesis}
```

This is the simplest approach if only a *single* custom theme is needed.

5.2.2 Option 2: Create multiple custom themes

Thesis administrator may find it useful to define *multiple* custom themes for their institution or department(s). For this purpose, simply copy file `hgbtheme-default.sty` or `hgbtheme-custom.sty` to a new file, e.g., `hgbtheme-physics.sty`,[14] and modify it accordingly. The associated theme can then be activated by

```
\documentclass[theme=physics,...]{hgbthesis}
```

An error will be raised if the associated `.sty` file cannot be found.

5.3 Commands and variables available to custom theme styles

Any theme style must at least *redefine* the

`\hgb@MakeFrontPages{..}`

command, which is pre-defined (as throwing an error) in `hgbthesis.cls` and invoked by `\maketitle`. If `default` is used as the parent theme, `\hgb@MakeFrontPages` is already set up properly and redefinition is optional, i.e.,

```
\hgb@UseTheme{default}      % parent theme
\renewcommand{\hgb@MakeFrontPages}{..}  % optional
```

Moreover, the following macros and variables are assured to be available for defining custom themes (see `hgbtheme-default.sty` for their typical usage). These are defined in `hgbthesis.cls` and should *not* be redefined:

`\hgb@Author`
`\hgb@Title`
`\hgb@SubTitle`
`\hgb@Institution`

[14] To be placed in the main document directory. Note the naming conventions!

`\hgb@ProgramType`
`\hgb@ProgramName`
`\hgb@PlaceOfStudy`

`\hgb@ThesisName`
`\hgb@ProposalName`

`\hgb@AdvisorCount`
`\hgb@getAdvisorRole{<number>}`
`\hgb@getAdvisorName{<number>}`

`\hgb@MainLanguage`
`\hgb@TitleLanguage`
`\hgb@TitlePageFont`

`\hgb@SubmissionYear`
`\hgb@SubmissionMonth`
`\hgb@SubmissionDay`
`\hgb@GetMonthName{<language>}{<monthnumber>}`

`\hgb@License`

`hgb@IsProposal` (*boolean*, without \)

Class `hgbthesis.cls` also defines a special *hook*

`hgb@InitThemeHook`

for adding custom initialization code for the current theme in the form

```
\AddToHook{hgb@InitThemeHook}{<initialization code>},
```

typically placed at the beginning of the theme file. The collected code for this hook is executed immediately before `\maketitle`.

In addition, theme `hgbtheme-default.sty` defines the following commands for generating individual title pages:

`\hgb@MakeTitlePage`
`\hgb@MakeAdvisorPage`
`\hgb@MakeCopyrightPage`
`\hgb@MakeDeclarationPage`

Each of these may be redefined by inheriting themes.

6 Package dependencies

The `hagenberg-thesis` package builds on the following LaTeX packages:
`abstract`, `algorithm`, `algorithmicx`, `algpseudocodex`, `amsbsy`, `amsfonts`, `amsmath`, `amssymb`, `babel`, `biblatex`, `breakurl`, `caption`, `cmap`, `csquotes`, `datetime2`, `enumitem`, `epstopdf`, `exscale`, `fancyhdr`, `float`, `fontenc`, `forloop`, `geometry`, `graphicx`, `hypcap`, `hyperref`, `ifpdf`, `inputenc`, `lengthconvert`, `listingsutf8`, `lmodern`, `marvosym`, `moreverb`, `overpic`, `pdfmanagement-testphase`, `pdfpages`, `pict2e`, `subdepth`,

titlesec, titling, tocbasic, url, upquote, verbatim, xcolor, xifthen, xstring, xspace.