Babel support for the German language (post-1996 orthography)

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Abstract

This manual documents babel language support for German (post-1996 orthography), including support for the Austrian and Swiss varieties of German. The manual is part of the babel-german bundle.

1 Aim and usage

The babel 'language definition file' ngermanb.ldf documented in this manual provides the babel package with all language specific strings, settings and commands needed for writing German texts, including texts in the Austrian and Swiss varieties of German.¹ Furthermore, it is assured that the correct hyphenation patterns for the respective language or variety are used (see sec. 3 for details). The file, and hence this manual, addresses the contemporary ('reformed', i. e., post-1996) orthography. For traditional (pre-1996) German orthography support, please refer to the complementary manual for the germanb.ldf language definition file.

In order to use the language definitions provided here, you need to use the babel package and pass the respective language/variety name² as an option, either of

- \usepackage[ngerman]{babel}
- \usepackage[naustrian]{babel}
- \usepackage[nswissgerman]{babel}
- \usepackage[nswissgerman.toss]{babel}³

New feature in v. 2.10!

Using multiple varieties in parallel is possible; consult the babel manual [2] for details.

 $^{{\}rm *Current\ maintainer.\ Please\ report\ issues\ via\ https://github.com/jspitz/babel-german.}$

¹The file ngermanb.ldf started as a re-implementation of the package ngerman.sty by Bernd Raichle (cf. [7]), which itself builds on german.sty, originally developed by Hubert Partl (cf. [5]) and later maintained by Bernd Raichle as well. The initial re-implementation was done by Johannes Braams.

 $^{^2}$ Obviously, the prefix $\langle n \rangle$ in the language/variety names stands for 'new' (orthography) here, since the names austrian, german and swissgerman were already used for pre-1996 orthography.

³See sec. 4 on the toss modifier.

2 Shorthands

For all three varieties of German, the character " is made active in order to provide some shorthand macros for frequently used special characters as well as for better control of hyphenation, line breaks and ligatures. Table 1 provides an overview of the shorthands that are provided by babel-german for ngerman, naustrian and nswissgerman.

Table 1: The extra definitions made by ngermanb.ldf

- "a Umlaut (\(\bar{a}\) (shorthand for \"a). Similar shorthands are available for all other lower-and uppercase vowels (umlauts: "a, "o, "u, "A, "0, "U; tremata: "e, "i, "E, "I).
- "s German $\langle \beta \rangle$ (shorthand for \ss{}); but cf. sec. 4.
- "z German $\langle \beta \rangle$ (shorthand for \ss{}). Differs to "s in uppercase version; but cf. sec. 4.
- "S \uppercase{"s}, typeset as $\langle SS \rangle (\langle f_S \rangle)$ must be written as $\langle SS \rangle$ in uppercase writing).
- "Z \uppercase{"z}, typeset as $\langle SZ \rangle$. In traditional spelling, $\langle \mathfrak{G} \rangle$ could also be written as $\langle SZ \rangle$ instead of $\langle SS \rangle$ in uppercase writing. Note that, with reformed orthography, the $\langle SZ \rangle$ variant has been deprecated in favour of $\langle SS \rangle$ only.
- "| Disable ligature at this position (e.g., at morpheme boundaries, as in Auf"|lage).
- "- An additional breakpoint that does still allow for hyphenation at the breakpoints preset in the hyphenation patterns (as opposed to \-).
- "= An explicit hyphen with a breakpoint, allowing for hyphenation at the other points preset in the hyphenation patterns (as opposed to plain -); useful for long compounds such as IT"=Dienstleisterinnen.
- "~ An explicit hyphen without a breakpoint. Useful for cases where the hyphen should stick at the following syllable, e. g., bergauf und "~ab.
- "" A breakpoint that does not output a hyphen if the line break is performed (consider parenthetical extensions as in (pseudo"~)""wissenschaftlich).
- A slash that allows for a linebreak. As opposed to \slash{}, hyphenation at the breakpoints preset in the hyphenation patterns is still allowed.
- "' German left double quotes \langle , \rangle .
- "' German right double quotes (").
- "< French/Swiss left double quotes $\langle \alpha \rangle$.
- "> French/Swiss right double quotes (»).

Table 2 lists some babel macros for quotation marks that might be used as an alternative to the quotation mark shorthands listed above.

Table 2: Alternative commands for quotation marks (provided by babel)

\glqq	German left double quotes $\langle ,, \rangle$.
\grqq	German right double quotes (").
\glq	German left single quotes \langle , \rangle .
\grq	German right single quotes $\langle ' \rangle$.
\flqq	French/Swiss left double quotes $\langle « \rangle$.
\frqq	French/Swiss right double quotes (»).
\flq	French/Swiss left single quotes (<).
\frq	French/Swiss right single quotes $\langle \rangle$.
\dq	The straight quotation mark character (").

3 Hyphenation patterns

The question which hyphenation patterns are used by Babel in case of the varieties of German needs some elaboration. There is a set of established hyphenation patterns for pre- and post-1996 German orthography that has been available with TeX distributions for a long time (currently, these are shipped in form of the dehypht and dehyphn files). These patterns, though, have many flaws (they produce wrong hyphenations, and not much is known about their construction). Therefore, a group of people developed completely new patterns that do much better, the so-called 'experimental' new hyphenation patterns of German, distributed in the dehyph-exptl package [3]. As opposed to the old patterns, the new ones undergo constant improvement. The price for this, however, is that hyphenation and thus the typeset document is subject to change with, and only due to, pattern updates.

Modern engines (i. e., xetex and luatex) have already embraced those new patterns, i. e., they are activated on these engines by default. The classic TeX engines (tex/pdftex), however, haven't: they continue to use the old patterns. The reason for this is one of TeX's quality standards: refrain, if ever possible, from changing the output of user's documents in the wake of software updates.

This means that you need to explicitly activate the new patterns for a given document with the classic engines, should you want to use them instead of the old ones. With Babel, this can be done quite easily by means of the hyphsubst [4] package:

```
\usepackage[ngerman=ngerman-x-latest]{hyphsubst}
\usepackage[ngerman]{babel}
```

Since naustrian and nswissgerman use the same patterns as ngerman, the given hyphsubst option activates the new patterns for all varieties; but note that hyphsubst must be loaded before babel (please refer to [3] and [4] for details).

If you only want to use experimental patterns for one variety, you can do like so:

```
\usepackage{hyphsubst}
\usepackage[ngerman,naustrian]{babel}
\HyphSubstLet{naustrian}{ngerman-x-latest}
```

4 Variety-specific options

New feature in v. 2.10!

In Swiss (and Liechtensteinian) German writing, the use of $\langle \mathfrak{B} \rangle$ is rather uncommon. Swiss writers would normally use $\langle ss \rangle$ where German or Austrian writers use the $\langle \mathfrak{B} \rangle$ character (e. g., *Buße* vs. *Busse*). When texts (or names) from other German speaking areas are quoted, however, the spelling and hence the $\langle \mathfrak{B} \rangle$ is often maintained (particularly in scholarly writing where the spelling of quoted text is not supposed to be touched).

We assume that (1) Swiss writers normally input $\langle ss \rangle$ directly when they mean $\langle ss \rangle$, and that (2) the $\langle \beta \rangle$ -related shorthands "s and "z are useful also for Swiss writers when they actually need $\langle \beta \rangle$, the more so since the $\langle \beta \rangle$ is not as directly accessible on Swiss keyboards as it is on German and Austrian ones. On the other hand, there might be occasions where writers want to transfer a text from German or Austrian into Swiss Standard German and adapt the spelling on the fly, i. e., transform all $\langle \beta \rangle$ into $\langle ss \rangle$.

For this special case, we provide an option to make the $\langle \beta \rangle$ -related shorthands "s and "z expand to the respective digraphs⁴, $\langle ss \rangle$ and $\langle sz \rangle$, rather than to $\langle \beta \rangle$. This is not the default behavior with nswissgerman since, as mentioned, there are situations when the $\langle \beta \rangle$ is (and has to be) used in Swiss writing, and normally, no shorthand is needed to input (or output) two simple $\langle s \rangle$ characters. You can opt-in (and out) digraphical expansion of "s and "z on a global and local level:

- To globally switch on the digraphical expansion, use the Babel modifier toss (read: 'to $\langle ss \rangle$ ') with nswissgerman. I. e., pass nswissgerman.toss (rather than nswissgerman) as babel option.
- To switch on the digraphical expansion only locally, you can use the boolean switch \ntosstrue. Likewise, \ntossfalse switches off (both locally and globally set) digraphical expansion.

Both these changes result in the following deviant behavior of two shorthands:

- "s Expands to digraph (ss)
- "z Expands to digraph $\langle sz \rangle$

5 Implementation

5.1 General settings

First, we define some helper macros that help us to identify later on which variety of German we are currently dealing with.

```
1\def\bbl@opt@ngerman{ngerman}
2\def\bbl@opt@ngermanb{ngermanb}
3\def\bbl@opt@naustrian{naustrian}
4\def\bbl@opt@nswissgerman{nswissgerman}
```

If ngermanb.ldf is read via the deprecated babel option ngermanb, we make it behave as if ngerman was specified.

```
5 \ifx\CurrentOption\bbl@opt@ngermanb
6 \def\CurrentOption{ngerman}
7 \fi
```

The macro \LdfInit takes care of preventing that this file is loaded more than once with the same option, checking the category code of the @ sign, etc.

```
8 \LdfInit\CurrentOption{captions\CurrentOption}
```

If ngermanb.ldf is read as an option, i.e., by the \usepackage command, ngerman could be an 'unknown' language, so we have to make it known. We check for the existence of \l@ngerman and issue a warning if it is unknown.

```
9\ifx\l@ngerman\@undefined
10 \@nopatterns{German (new orthography)}
11 \adddialect\l@ngerman0
12\fi
```

⁴In graphematics, the term *digraph* denotes two characters that make a functional pair (which means, depending on the theoretical assumptions: they represent a single sound or they are semantically distinctive).

We set naustrian and nswissgerman as dialects of ngerman, since they use the same hyphenation patterns than ngerman. If no ngerman patterns are found, we issue a warning.

```
13 \ifx\CurrentOption\bbl@opt@naustrian
_{14} \ifx\l@ngerman\@undefined
      \@nopatterns{German (new orthography), needed by Austrian (new orthography)}
15
      \adddialect\l@naustrian0
16
17
      \adddialect\l@naustrian\l@ngerman
18
19 \fi
20\fi
21 \ifx\CurrentOption\bbl@opt@nswissgerman
   \ifx\l@ngerman\@undefined
      \@nopatterns{German (new orthography), needed by Swiss German (new orthography)}
23
      \adddialect\l@nswissgerman0
24
    \else
25
      \adddialect\l@nswissgerman\l@ngerman
26
   \fi
27
28\fi
```

5.2 Language-specific strings (captions)

The next step consists of defining macros that provide language specific strings and settings.

\@captionsngerman

The macro \@captionsngerman defines all strings used in the four standard document classes provided with Lagranger for German. This is an internal macro that is inherited and modified by the following macros for the respective language varieties.

```
29 \@namedef{@captionsngerman}{%
   \def\prefacename{Vorwort}%
    \def\refname{Literatur}%
31
    \def\abstractname{Zusammenfassung}%
32
    \def\bibname{Literaturverzeichnis}%
    \def\chaptername{Kapitel}%
34
    \def\appendixname{Anhang}%
35
    \def\contentsname{Inhaltsverzeichnis}%
36
    \def\listfigurename{Abbildungsverzeichnis}%
37
   \def\listtablename{Tabellenverzeichnis}%
38
   \def\indexname{Index}%
40 \def\figurename{Abbildung}%
41 \def\tablename{Tabelle}%
42 \def\partname{Teil}%
43 \ \ensuremath{\mbox{def\enclname}\{Anlage(n)\}\%}
    \def\ccname{Verteiler}%
   \def\headtoname{An}%
45
   \def\pagename{Seite}%
46
    \def\seename{siehe}%
47
    \def\alsoname{siehe auch}%
48
    \def\proofname{Beweis}%
```

```
_{50} \def\glossaryname{Glossar}% _{51} }
```

\captionsngerman

The macro \captionsngerman is identical to \@captionsngerman, but only defined if ngerman is requested.

```
52 \ifx\CurrentOption\bbl@opt@ngerman
53 \@namedef{captionsngerman}{%
54 \@nameuse{@captionsngerman}%
55 }
56 \fi
```

\captionsnaustrian

The macro \captionsnaustrian builds on \@captionsngerman, but redefines some strings following Austrian conventions (for the respective variants, cf. [1]). It is only defined if naustrian is requested.

```
57\ifx\CurrentOption\bbl@opt@naustrian
58 \@namedef{captionsnaustrian}{%
59 \@nameuse{@captionsngerman}%
60 \def\enclname{Beilage(n)}%
61 }
62\fi
```

\captionsnswissgerman

The macro \captionsnswissgerman builds on \@captionsngerman, but redefines some strings following Swiss conventions (for the respective variants, cf. [1]). It is only defined if nswissgerman is requested.

```
63\ifx\CurrentOption\bbl@opt@nswissgerman
64 \@namedef{captionsnswissgerman}{%
65 \@nameuse{@captionsngerman}%
66 \def\enclname{Beilage(n)}%
67 }
68\fi
```

5.3 Date localizations

\month@ngerman

The macro \month@ngerman defines German month names for all varieties.

```
69\def\month@ngerman{\ifcase\month\or
70 Januar\or Februar\or M\"arz\or April\or Mai\or Juni\or
71 Juli\or August\or September\or Oktober\or November\or Dezember\fi}
```

\datengerman

The macro \datengerman redefines the command \today to produce German dates. It is only defined if ngerman is requested.

\datenswissgerman

The macro \datenswissgerman does the same for Swiss German dates. The result is identical to German. This macro is only defined if nswissgerman is requested.

```
76 \ifx\CurrentOption\bbl@opt@nswissgerman
```

\datenaustrian

The macro \datenaustrian redefines the command \today to produce Austrian versions of the German dates. Here, the naming of January ("Jänner") differs from the other German varieties. The macro is only defined if naustrian is requested.

5.4 Extras

\extrasnaustrian
\extrasnswissgerman
\extrasngerman
\noextrasnaustrian
\noextrasnswissgerman
\noextrasngerman

The macros \extrasngerman, \extrasnaustrian and \extrasnswissgerman, respectively, will perform all the extra definitions needed for the German language or the respective variety. The macro \noextrasngerman is used to cancel the actions of \extrasngerman. \noextrasnaustrian and \noextrasnswissgerman behave analoguously.

First, the character " is declared active for all German varieties. This is done once, later on its definition may vary.

```
84 \initiate@active@char{"}
```

go \newif\ifntoss\ntossfalse

Depending on the option with which the language definition file has been loaded, the macro \extrasngerman, \extrasnaustrian or \extrasnswissgerman is defined. Each of those is identical: they load the shorthands defined below and activate the "character.

```
85 \@namedef{extras\CurrentOption}{%
86  \languageshorthands{ngerman}%
87 }
88 \expandafter\addto\csname extras\CurrentOption\endcsname{%
89  \bbl@activate{"}}
```

\ntosstrue

For Swiss German, we allow optionally to expand the $\langle \mathfrak{G} \rangle$ -related shorthands the Swiss way, i. e. as $\langle ss \rangle$ (globally, if the modifier toss is used or locally if \ntosstrue.).

```
91\newif\ifbbl@ntoss\bbl@ntossfalse
92\ifx\bbl@mod@nswissgerman\@undefined\else
93 \@expandtwoargs\in@{,toss,}{,\bbl@mod@nswissgerman,}
94 \ifin@
95 \ntosstrue
96 \fi
97 \addto\extrasnswissgerman{%
98 \ifntoss\bbl@ntosstrue\else\bbl@ntossfalse\fi}
99\fi
```

Next, again depending on the option with which the language definition file has been loaded, the macro \noextrasngerman, \noextrasnaustrian or \noextrasnswissgerman is defined. These deactivate the " character and thus turn the shorthands off again outside of the respective variety.

```
100 \expandafter\addto\csname noextras\CurrentOption\endcsname{%
101 \bbl@deactivate{"}}
102 \ifx\CurrentOption\bbl@opt@nswissgerman
103 \addto\noextrasnswissgerman{\bbl@ntossfalse}
104 \fi
```

In order for TEX to be able to hyphenate German words which contain 'ß' (in the OT1 position ^^Y) we have to give the character a nonzero \lccode (see Appendix H, the TEXbook).

```
105\expandafter\addto\csname extras\CurrentOption\endcsname{%
106 \babel@savevariable{\lccode25}%
107 \lccode25=25}
```

The umlaut accent macro $\$ " is changed to lower the umlaut dots. The redefinition is done with the help of $\$ umlautlow.

```
108\expandafter\addto\csname extras\CurrentOption\endcsname{%
109 \babel@save\"\umlautlow}
110\expandafter\addto\csname noextras\CurrentOption\endcsname{%
111 \umlauthigh}
```

The current version of the 'new' German hyphenation patterns (dehyphn.tex) is to be used with \lefthyphenmin and \righthyphenmin set to 2.

```
112 \providehyphenmins{\CurrentOption}{\tw@\tw@}
```

For German texts we need to assure that \frenchspacing is turned on.

```
113 \expandafter\addto\csname extras\CurrentOption\endcsname{%
114 \bbl@frenchspacing}
115 \expandafter\addto\csname noextras\CurrentOption\endcsname{%
116 \bbl@nonfrenchspacing}
```

5.5 Active characters, macros & shorthands

The following code is necessary because we need an extra active character. This character is then used as indicated in table 1.

In order to be able to define the function of ", we first define a couple of 'support' macros.

\dq We save the original double quotation mark character in \dq to keep it available, the math accent \" can now be typed as ".

Furthermore, we define some helper macros for contextual $\langle \mathfrak{G} \rangle$ handling.

Now we can define the doublequote shorthands: the umlauts,

```
127 \declare@shorthand{ngerman}{"a}{\textormath{\"{a}\bbl@allowhyphens}{\ddot a}}
         128 \declare@shorthand{ngerman}{"o}{\textormath{\"{o}\bbl@allowhyphens}{\ddot o}}
          \label{localize} $$129 \leq are@shorthand{ngerman}{"u}_{\text{v}}bbl@allowhyphens}_{\dot u} $$
         130 \declare@shorthand{ngerman}{"A}{\textormath{\"{A}\bbl@allowhyphens}{\ddot A}}
         131 \declare@shorthand{ngerman}{"0}{\textormath{\"{0}\bbl@allowhyphens}{\ddot 0}}
         _{132} \declare@shorthand\{ngerman\}{"U}{\textormath{\"{U}\bbl@allowhyphens}{\ddot U}}
         tremata,
         133 \declare@shorthand{ngerman}{"e}{\textormath{\"{e}}}{\ddot e}}
         134 \declare@shorthand{ngerman}{"E}{\textormath{\"{E}}}{\ddot E}}
         {\tt 135 \backslash declare@shorthand \{ngerman\} \{"i\} \{\backslash textormath \{\backslash "\{\backslash i\}\} \% \}}
                                             {\ddot\imath}}
         \label{lem:index} $$137 \declare@shorthand{ngerman}{"I}_{\text{\textormath}}^{I}}_{\text{\dot }I}}$
         German ß.
         138 \declare@shorthand{ngerman}{"s}{\bbl@ss}
         _{139} \declare@shorthand{ngerman}{"S}{\bbl@SS}
         140 \declare@shorthand{ngerman}{"z}{\bbl@sz}
         141 \declare@shorthand{ngerman}{"Z}{\bbl@SZ}
         German and French/Swiss quotation marks,
         142 \declare@shorthand{ngerman}{"'}{\glqq}
         _{143} \ensuremath{\mbox{declare@shorthand{ngerman}{"'}}{\mbox{ngerman}}}
         144 \declare@shorthand{ngerman}{"<}{\flqq}
         145 \declare@shorthand{ngerman}{">}{\frqq}
         and some additional commands (hyphenation, line breaking and ligature control):
         146 \declare@shorthand{ngerman}{"-}{\nobreak\-\bbl@allowhyphens}
         _{147} \ensuremath{\mbox{declare@shorthand{ngerman}{"|}}{\%}
         148
              \textormath{\penalty\@M\discretionary{-}{}{\kern.03em}%
         149
                           \bbl@allowhyphens}{}}
         150 \declare@shorthand{ngerman}{""}{\hskip\z@skip}
         152 \ensuremath{\mbox{"=}}{\penalty\ensuremath{\mbox{0M-\hskip}z@skip}}
         153 \declare@shorthand{ngerman}{"/}{\textormath}
             {\bbl@allowhyphens\discretionary{/}{}{/}\bbl@allowhyphens}{}}
\mdgon All that's left to do now is to define a couple of commands for reasons of compatibility
\mdgoff with german.sty.
         155 \def\mdqon{\shorthandon{"}}
         156 \def\mdqoff{\shorthandoff{"}}
```

The macro $\del{ldf@finish}$ takes care of looking for a configuration file, setting the main language to be switched on at $\del{ldf@finish}$ and resetting the category code of @ to its original value.

```
157 \ldf@finish\CurrentOption
```

5.6 naustrian.ldf, ngerman.ldf and nswissgerman.ldf

Babel expects a $\langle lang \rangle$.ldf file for each $\langle lang \rangle$. So we create portmanteau ldf files for naustrian, ngerman and nswissgerman.⁵ These files themselves only load ngermanb.ldf, which does the real work:

158 \input ngermanb.ldf\relax

Change History

Version 2.6f	Do not use \@namedef when
General: Renamed from germanb.ldf;	\noextras is already defined and
language names changed from	should not be overwritten 8
german and austrian to ngerman	\noextrasnswissgerman: Added
and naustrian 1	\noextrasnswissgerman7
Version 2.6j	General: Added support for variety
\noextrasngerman: Deactivate	nswissgerman
shorthands outside of German 7	Generate portmanteau files
Version 2.6k	naustrian.ldf,ngerman.ldf and
\@captionsngerman: Added	nswissgerman.ldf10
\glossaryname5	Revised naustrian support 1
\noextrasngerman: Now use	Revised documentation: Turn the
\providehyphenmins to provide a	babel manual chapter into a
default value 8	self-enclosed manual 1
Version 2.6m	Version 2.8
\noextrasngerman: Turn frenchspacing	\@captionsngerman: Define
on, as in german.sty 8	trans-variational base captions
Version 2.6n	which are loaded and modified by
\@captionsngerman: Corrected typo	the varieties 5
\captionnsgerman 5	\captionsnaustrian: Only define
Version 2.7	\captionsnaustrian if naustrian
\@captionsngerman: Changed	is requested 6
\enclname in naustrian to	\captionsngerman: Only define
Beilage(n) 5	\captionsngerman if ngerman is
Split \captionsngerman from	requested 6
\captionsnaustrian and	\captionsnswissgerman: Only define
\captionsnswissgerman 5	\captionsnswissgerman if
\datenswissgerman: Added	nswissgerman is requested 6
\datenswissgerman 6	\datenaustrian: Only define
\extrasnswissgerman: Added	\datenaustrian if naustrian is
\extrasnswissgerman 7	requested
\noextrasngerman: Deactivate	\datengerman: Only define
shorthands also outside of	\datengerman if ngerman is
naustrian and nswissgerman 7	requested 6

⁵For naustrian and ngerman, this is not strictly necessary, since babel provides aliases for these languages (pointing to ngermanb). However, since babel does not officially support these aliases anymore after the language definition files have been separated from the core, we provide the whole range of ldf files for the sake of completeness.

\datenswissgerman: Only define	in Swiss German context
\datenswissgerman if nswissgerman is requested 6 General: Only add dialects if the respective variety is loaded 5 Version 2.9 General: Add "/ shortcut for breakable slash (taken from dutch.ldf) 9	Implement modifier toss to customize \langle \langle \langle \rangle \rangle -related shorthands in Swiss German context
Do not attempt to load	Version 2.11
\l@naustrian or \l@nswissgerman, which do not exist	General: Fix old hyphenation regression introduced with babel 3.7 (2002) in a number of shorthands (change of meaning of
\noextrasngerman: Implement boolean switch \ntosstrue/\ntossfalse to customize $\langle B \rangle$ -related shorthands	\allowhyphens vs. \bbl@allowhyphens)

References

- [1] Ammon, Ulrich et al.: Variantenwörterbuch des Deutschen. Die Standardsprache in Österreich, der Schweiz und Deutschland sowie in Liechtenstein, Luxemburg, Ostbelgien und Südtirol. Berlin, New York: De Gruyter.
- [2] Braams, Johannes and Bezos, Javier: Babel. http://www.ctan.org/pkg/babel.
- [3] Deutschsprachige Trennmustermannschaft: dehyph-exptl Experimental hyphenation patterns for the German language. https://ctan.org/pkg/dehyph-exptl.
- [4] Heiko Oberdiek: hyphsubst Substitute hyphenation patterns. https://ctan.org/pkg/hyphsubst.
- [5] Partl, Hubert: German TeX, TUGboat 9/1 (1988), p. 70-72.
- [6] Manuel Pégourié-Gonnard et al.: hyph-utf8 Hyphenation patterns expressed in UTF-8. https://ctan.org/pkg/hyph-utf8.
- [7] Raichle, Bernd: German. http://www.ctan.org/pkg/german.