The LuaTEX-ja package

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Contents

This documentation is far from complete. It may have many grammatical (and contextual) errors.

Part I
User's manual

1 Introduction

The LuaTEX-ja package is a macro package for typesetting high-quality Japanese documents when using LuaTEX.

1.1 Backgrounds

Traditionally, ASCII pTEX, an extension of TEX, and its derivatives are used to typeset Japanese documents in TEX. pTEX is an engine extension of TEX: so it can produce high-quality Japanese documents without using very complicated macros. But this point is a mixed blessing: pTEX is left behind from other extensions of TEX, especially ε-TEX and pdfTEX, and from changes about Japanese processing in computers (*e.g.*, the UTF-8 encoding).

Recently extensions of pTEX, namely pTEX (Unicode-implementation of pTEX) and ε-pTEX (merging of pTEX and ε-TEX extension), have developed to fill those gaps to some extent, but gaps still exist.

However, the appearance of LuaTEX changed the whole situation. With using Lua 'callbacks', users can customize the internal processing of LuaTEX. So there is no need to modify sources of engines to support Japanese typesetting: to do this, we only have to write Lua scripts for appropriate callbacks.

1.2 Major Changes from pTEX

The LuaTEX-ja package is under much influence of pTEX engine. The initial target of development was to implement features of pTEX. However, *LuaTEX-ja is not a just porting of pTEX; unnatural specifications/behaviors of pTEX were not adopted.*

The followings are major changes from pTEX:

- A Japanese font is a tuple of a 'real' font, a Japanese font metric (**JFM**, for short), and an optional string called 'variation'.
- In pTEX, a linebreak after Japanese character is ignored (and doesn't yield a space), since linebreaks (in source files) are permitted almost everywhere in Japanese texts. However, LuaTEX-ja doesn't have this function completely, because of a specification of LuaTEX.
- The insertion process of glues/kerns between two Japanese characters and between a Japanese character and other characters (we refer these glues/kerns as **JAglue**) is rewritten from scratch.
  - As LuaTEX's internal character handling is 'node-based' (*e.g.*, `of{}fice` doesn't prevent ligatures), the insertion process of **JAglue** is now 'node-based'.
  - Furthermore, nodes between two characters which have no effects in linebreak (*e.g.*, `\special` node) are ignored in the insertion process.
  - In the process, two Japanese fonts which differ in their 'real' fonts only are identified.
- At the present, vertical typesetting (*tategaki*), is not supported in LuaTEX-ja.

For detailed information, see Part III.

1.3 Notations

In this document, the following terms and notations are used:

- Characters are divided into two types:
  - **JAchar**: standing for Japanese characters such as Hiragana, Katakana, Kanji and other punctuation marks for Japanese.
  - **ALchar**: standing for all other characters like alphabets.

We say ‘alphabetic fonts’ for fonts used in **ALchar**, and ‘Japanese fonts’ for fonts used in **JAchar**.

- A word in a sans-serif font (like prebreakpenalty) represents an internal parameter for Japanese typesetting, and it is used as a key in `\ltjsetparameter` command.
- The word ‘primitive’ is used not only for primitives in LuaTEX, but also for control sequences that defined in the core module of LuaTEX-ja.
- In this document, natural numbers start from 0.

1.4 About the project

Project Wiki Project Wiki is under construction.

- `http://sourceforge.jp/projects/luatex-ja/wiki/FrontPage%28en%29` (English)
- `http://sourceforge.jp/projects/luatex-ja/wiki/FrontPage` (Japanese)

This project is hosted by SourceForge.JP.

Members

2 Getting Started

2.1 Installation

To install the LuaTEX-ja package, you will need:

- LuaTEX (version 0.65.0-beta or later) and its supporting packages.
  If you are using TEX Live 2011 or current W32TEX, you don't have to worry.
- The source archive of LuaTEX-ja, of course:)

The installation methods are as follows:

1. Download the source archive.

   At the present, LuaTEX-ja has no official release, so you have to retrieve the archive from the repository. You can retrieve the Git repository via

   ```
   $ git clone git://git.sourceforge.jp/gitroot/luatex-ja/luatexja.git
   ```

   or download the archive of HEAD in `master` branch from

   `http://git.sourceforge.jp/view?p=luatex-ja/luatexja.git;a=snapshot;h=HEAD;sf=tgz`.
2. Extract the archive. You will see `src/` and several other sub-directories.
3. Copy all the contents of `src/` into one of your `TEXMF` tree.
4. If `mktexlsr` is needed to update the filename database, make it so.

2.2 Cautions

- The encoding of your source file must be UTF-8.
- Not well-tested. In particular, the default setting of the range of **JAchar** in the present version does not coexist with other packages which use Unicode fonts.

2.3 Using in plain TEX

To use LuaTEX-ja in plain TEX, simply put the following at the beginning of the document:

```
\input luatexja.sty
```

This does minimal settings (like `ptex.tex`) for typesetting Japanese documents:

- The following 6 Japanese fonts are preloaded:

classification	font name	13.5 Q	9.5 Q	7 Q
mincho	Ryumin-Light	`\tenmin`	`\sevenmin`	`\fivemin`
gothic	GothicBBB-Medium	`\tengt`	`\sevengt`	`\fivegt`

  - The 'Q' is a unit used in Japanese phototypesetting, and 1 Q = 0.25 mm. This length is stored in a dimension `\jQ`.
  - It is widely accepted that the font 'Ryumin-Light' and 'GothicBBB-Medium' aren't embedded into PDF files, and PDF reader substitute them by some external Japanese fonts (*e.g.*, Kozuka Mincho is used for Ryumin-Light in Adobe Reader). We adopt this custom to the default setting.
  - You may notice that size of above fonts is slightly smaller than their alphabetic counterparts: for example, the size `\texmin` is 13.5 Q ≃ 9.60444 pt. This is intensional: ...
- A character in Unicode is treated as **JAchar** if and only if its code-point has more than or equal to U+0100.
- The amount of glue that are inserted between a **JAchar** and an **ALchar** (the parameter xkanjiskip) is set to

$$0.25\,\texttt{\textbackslash zw}^{+1\,\mathrm{pt}}_{-1\,\mathrm{pt}} = \frac{27}{32}\,\mathrm{mm}^{+1\,\mathrm{pt}}_{-1\,\mathrm{pt}}.$$

  Here `\zw` is the counterpart of `em` for Japanese fonts, that is, the length of 'full-width' in current Japanese font.

2.4 Using in LaTeX

LaTeX 2ε Using in LaTeX 2ε is basically same. To set up the minimal environment for Japanese, you only have to load `luatexja.sty`:

```
\usepackage{luatexja}
```

It also does minimal settings (counterparts in pLaTeX are `plfonts.dtx` and `pldefs.ltx`):

- `JY3` is the font encoding for Japanese fonts (in horizontal direction).
  When vertical typesetting is supported by LuaTeX-ja in the future, `JT3` will be used for vertical fonts.
- Two font families `mc` and `gt` are defined:

classification	family	\mdseries	\bfseries	scale
mincho	`mc`	Ryumin-Light	GothicBBB-Medium	0.960444
gothic	`gt`	GothicBBB-Medium	GothicBBB-Medium	0.960444

Note on fonts in bold series

- Japanese characters in math mode are typeset by the font family `mc`.

However, above settings are not sufficient for Japanese-based documents. To typeset Japanese-based documents, You are better to use class files other than `article.cls`, `book.cls`, ... At the present, BXjscls (`bxjsarticle.cls` and `bxjsbook.cls`, by Takayuki Yato) are better alternative. It is not determined whether LuaTeX-ja will develop and contain counterparts of major classes used in pTeX (including jsclasses by Haruhiko Okumura).

2.5 Changing Fonts

Remark: Japanese Characters in Math Mode Since pTeX supports Japanese characters in math mode, there are sources like the following:

```
1 $f_{高温}$~($f_{\text{high temperature}}$).
2 \[ y=(x-1)^2+2\quad{}よって\quad y>0 \]
3 $5\in{}素:=\{\,p\in\mathbb N:\text{$p$ is a
      prime}\,\}$.
```

$f_{高温}$ ($f_{\text{high temperature}}$).

$$y = (x-1)^2 + 2 \quad よって \quad y > 0$$

$5 \in 素 := \{\, p \in \mathbb{N} : p \text{ is a prime} \,\}$.

We (the project members of LuaTeX-ja) think that using Japanese characters in math mode are allowed if and only if these are used as identifiers. In this point of view,

- The lines 1 and 2 above are not correct, since '高温' in above is used as a textual label, and 'よって' is used as a conjunction.
- However, the line 3 is correct, since '素' is used as an identifier.

Hence, in our opinion, the above input should be corrected as:

```
1 $f_{\text{高温}}$~%
2 ($f_{\text{high temperature}}$).
3 \[ y=(x-1)^2+2\quad
4   \mathrel{\text{よって}}\quad y>0 \]
5 $5\in{}素:=\{\,p\in\mathbb N:\text{$p$ is a
      prime}\,\}$.
```

$f_{高温}$ ($f_{\text{high temperature}}$).

$$y = (x-1)^2 + 2 \quad よって \quad y > 0$$

$5 \in 素 := \{\, p \in \mathbb{N} : p \text{ is a prime} \,\}$.

We also believe that using Japanese characters as identifiers is rare, hence we don't describe how to change Japanese fonts in math mode in this chapter. For the method, please see Part II.

plain TeX To change Japanese fonts in plain TeX, you must use the primitive `\jfont`. So please see Part II.

NFSS2 For LaTeX 2ε, LuaTeX-ja simply adopted the font selection system from that of pLaTeX 2ε (in `plfonts.dtx`).

- Two control sequences `\mcdefault` and `\gtdefault` are used to specify the default font families for *mincho* and *gothic*, respectively. Default values: `mc` for `\mcdefault` and `gt` for `\gtdefault`.
- Commands `\fontfamily`, `\fontseries`, `\fontshape` and `\selectfont` can be used to change attributes of Japanese fonts.

	encoding	**family**	**series**	**shape**
alphabetic fonts	`\romanencoding`	`\romanfamily`	`\romanseries`	`\romanshape`
Japanese fonts	`\kanjiencoding`	`\kanjifamily`	`\kanjiseries`	`\kanjishape`
both	—	–	`\fontseries`	`\fontshape`
auto select	`\fontencoding`	`\fontfamily`	—	—

- For defining a Japanese font family, use `\DeclareKanjiFamily` instead of `\DeclareFontFamily`.

fontspec To coexist with `fontspec` package, it is needed to load `luatexja-fontspec` package in the preamble. This additional package automatically loads `luatexja` and `fontspec` package, if needed.

In `luatexja-fontspec` package, the following 7 commands are defined as counterparts of original commands in `fontspec`:

Japanese fonts	`\jfontspec`	`\setmainjfont`	`\setsansjfont`	`\newjfontfamily`
alphabetic fonts	`\fontspec`	`\setmainfont`	`\setsansfont`	`\newfontfamily`
Japanese fonts	`\newjfontface`	`\defaultjfontfeatures`	`\addjfontfeatures`	
alphabetic fonts	`\newfontface`	`\defaultfontfeatures`	`\addfontfeatures`	

使用例

Note that there is no command named `\setmonojfont`, since it is popular for Japanese fonts that nearly all Japanese glyphs have same widths.

3 Changing Parameters

There are many parameters in LuaTeX-ja. And due to the behavior of LuaTeX, most of them are not stored as internal register of TeX, but as an original storage system in LuaTeX-ja. Hence, to assign or acquire those parameters, you have to use commands `\ltjsetparameter` and `\ltjgetparameter`.

3.1 Editing the range of JAchars

As noted before, the default setting is:

A character in Unicode is treated as **JAchar**,
if and only if its code-point has more than or equal to U+0100.

↑ TODO: CHANGE THIS!

To edit the range of **JAchar**s, You have to assign a non-zero natural number which is less than 217 to the character range first. This can be done by using `\ltjdefcharrange` primitive. For example, the next line assigns whole characters in Supplementary Multilingual Plane and the character '漢' to the range number 4.

```
\ltjdefcharrange{4}{"10000-"1FFFF,'漢}
```

This assignment of numbers to ranges are always global, so you should not do this in the middle of a document.

上書き

After assigning numbers to ranges, ...

3.2 kanjiskip and xkanjiskip

JAglue is divided into the following three categories:

- Glues/kerns specified in JFM. If `\inhibitglue` is issued around a Japanese character, this glue will be not inserted at the place.
- The default glue which inserted between two **JAchar**s (kanjiskip).
- The default glue which inserted between a **JAchar** and an **ALchar** (xkanjiskip).

The value (a skip) of kanjiskip or xkanjiskip can be changed as the following.

```
\ltjsetparameter{kanjiskip={0pt plus 0.4pt minus 0.4pt},
                 xkanjiskip={0.25\zw plus 1pt minus 1pt}}
```

It may occur that JFM contains the data of 'ideal width of kanjiskip' and/or 'ideal width of xkanjiskip'. To use these data from JFM, set the value of kanjiskip or xkanjiskip to `\maxdimen`.

3.3 Insertion Setting of xkanjiskip

It is not desirable that xkanjiskip is inserted between every boundary between **JAchar**s and **ALchar**s. For example, xkanjiskip should not be inserted after opening parenthesis (*e.g.*, compare '(あ' and '(あ').

LuaTEX-ja can control whether xkanjiskip can be inserted before/after a character, by changing jaxspmode for **JAchar**s and alxspmode parameters **ALchar**s respectively.

```
\ltjsetparameter{jaxspmode={`あ,preonly},
    alxspmode={`\!,postonly}}
p あ q ！う
```

p あq！う

The second argument `preonly` means 'the insertion of xkanjiskip is allowed before this character, but not after'. the other possible values are `postonly`, `allow` and `inhibit`. For the compatibility with pTEX, natural numbers between 0 and 3 are also allowed as the second argument[1].

If you want to enable/disable all insertions of kanjiskip and xkanjiskip, set autospacing and autoxspacing parameters to `false`, respectively.

3.4 Shifting Baseline

To make a match between a Japanese font and an alphabetic font, sometimes shifting of the baseline of one of the pair is needed. In pTEX, this is achieved by setting `\ybaselineshift` to a non-zero length (the baseline of alphabetic fonts is shifted below). However, for documents whose main language is not Japanese, it is good to shift the baseline of Japanese fonts, but not that of alphabetic fonts. Because of this, LuaTEX-ja can independently set the shifting amount of the baseline of alphabetic fonts (yalbaselineshift parameter) and that of Japanese fonts (yjabaselineshift parameter).

```
\vrule width 150pt height 0.4pt depth 0pt\hskip
    -120pt
\ltjsetparameter{yjabaselineshift=0pt,
    yalbaselineshift=0pt}abc あいう
\ltjsetparameter{yjabaselineshift=5pt,
    yalbaselineshift=2pt}abc あいう
```

abc あいう abc あいう

Here the horizontal line in above is the baseline of a line.

There is an interesting side-effect: characters in different size can be vertically aligned center in a line, by setting two parameters appropriately. The following is an example (beware the value is not well tuned):

```
xyz 漢字
{\scriptsize
  \ltjsetparameter{yjabaselineshift=-1pt,
    yalbaselineshift=-1pt}
  XYZ ひらがな
}abc かな
```

xyz 漢字 XYZ ひらがな abc かな

[1] But we don't recommend this: since numbers 1 and 2 have opposite meanings in jaxspmode and alxspmode.

3.5 Cropmark

Cropmark is a mark for indicating 4 corners and horizontal/vertical center of the paper. In Japanese, we call cropmark as tombo(w). pLaTeX and this LuaTeX-ja support 'tombow' by their kernel. The following steps are needed to typeset cropmark:

1. First, define the banner which will be printed at the upper left of the paper. This is done by assigning a token list to `\@bannertoken`.

   For example, the following sets banner as '`filename (2012-01-01 17:01)`':

   ```
   \makeatletter

   \hour\time \divide\hour by 60 \@tempcnta\hour \multiply\@tempcnta 60\relax
   \minute\time \advance\minute-\@tempcnta
   \@bannertoken{%
      \jobname\space(\number\year-\two@digits\month-\two@digits\day
      \space\two@digits\hour:\two@digits\minute)}%
   ```

2. ...

Part II
Reference

4 Font Metric and Japanese Font

4.1 `\jfont` primitive

To load a font as a Japanese font, you must use the `\jfont` primitive instead of `\font`, while `\jfont` admits the same syntax used in `\font`. LuaTeX-ja automatically loads `luaotfload` package, so TrueType/OpenType fonts with features can be used for Japanese fonts:

```
\jfont\tradgt={file:ipaexg.ttf:script=latn;%
  +trad;jfm=ujis} at 14pt
\tradgt{}当／体／医／区
```

當／體／醫／區

Note that the defined control sequence (`\tradgt` in the example above) using `\jfont` is not a *font_def* token, hence the input like `\fontname\tradgt` causes a error. We denote control sequences which are defined in `\jfont` by ⟨*jfont_cs*⟩.

Prefix Besides `file:` and `name:` prefixes, `psft:` can be used a prefix in `\jfont` (and `\font`) primitive. Using this prefix, you can specify a font that has its name only and is not related to any real font.

Mainly, use of this `psft:` prefix is for using non-embedding 'standard' Japanese fonts (Ryumin-Light and GothicBBB-Medium). 歷史

Features jfm, jfmvar

4.2 Structure of JFM file

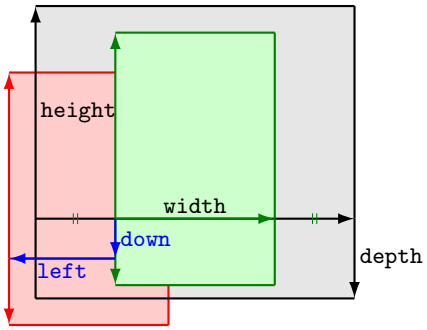
A JFM file is a Lua script which has only one function call:

```
luatexja.jfont.define_jfm { ... }
```

Real data are stored in the table which indicated above by `{ ... }`. So, the rest of this subsection are devoted to describe the structure of this table. Note that all lengths in a JFM file are floating-point numbers in design-size unit.

`dir=`⟨*direction*⟩ (required)

The direction of JFM. At the present, only `'yoko'` is supported.



Consider a node containing Japanese character whose value of the `align` field is `'middle'`.

- The black rectangle is a frame of the node. Its width, height and depth are specified by JFM.
- Since the `align` field is `'middle'`, the 'real' glyph is centered horizontally (the green rectangle).
- Furthermore, the glyph is shifted according to values of fields `left` and `down`. The ultimate position of the real glyph is indicated by the red rectangle.

Figure 1. The position of the 'real' glyph.

`zw=`⟨*length*⟩ (required)

The amount of the length of the 'full-width'.

`zh=`⟨*length*⟩ (required)

`kanjiskip={`⟨*natural*⟩`,` ⟨*stretch*⟩`,` ⟨*shrink*⟩`}` (optional)

This field specifies the 'ideal' amount of kanjiskip. As noted in Subsection 3.2, if the parameter kanjiskip is `\maxdimen`, the value specified in this field is actually used (if this field is not specified in JFM, it is regarded as 0 pt). Note that ⟨*stretch*⟩ and ⟨*shrink*⟩ fields are in design-size unit too.

`xkanjiskip={`⟨*natural*⟩`,` ⟨*stretch*⟩`,` ⟨*shrink*⟩`}` (optional)

Like the `kanjiskip` field, this field specifies the 'ideal' amount of xkanjiskip.

Besides from above fields, a JFM file have several sub-tables those indices are natural numbers. The table indexed by $i \in \omega$ stores informations of 'character class' i. At least, the character class 0 is always present, so each JFM file must have a sub-table whose index is `[0]`. Each sub-table (its numerical index is denoted by i) has the following fields:

`chars={`⟨*character*⟩`, ...}` (required except character class 0)

This field is a list of characters which are in this character type i. This field is not required if $i = 0$, since all **JAchar** which are not in any character class other than 0 (hence, the character class 0 contains most of **JAchar**s). In the list, a character can be specified by its code number, or by the character itself (as a string of length 1).

In addition to those 'real' characters, the following 'imaginary characters' can be specified in the list:

`width=`⟨*length*⟩`, height=`⟨*length*⟩`, depth=`⟨*length*⟩`, italic=`⟨*length*⟩ (required)

Specify width of characters in character class i, height, depth and the amount of italic correction. All characters in character class i are regarded that its width, height and depth are as values of these fields. But there is one exception: if `'prop'` is specified in `width` field, width of a character becomes that of its 'real' glyph

`left=`⟨*length*⟩`, down=`⟨*length*⟩`, align=`⟨*align*⟩

These fields are for adjusting the position of the 'real' glyph. Legal values of `align` field are `'left'`, `'middle'` and `'right'`. If one of these 3 fields are omitted, `left` and `down` are treated as 0, and `align` field is treated as `'left'`. The effects of these 3 fields are indicated in Figure 1.

In most cases, `left` and `down` fields are 0, while it is not uncommon that the `align` field is `'middle'` or `'right'`. For example, setting the `align` field to `'right'` is practically needed when the current character class is the class for opening delimiters'.

`kern={[`j`]=`⟨*kern*⟩`, ...}`

`glue={[`j`]={`⟨*width*⟩`,` ⟨*stretch*⟩`,` ⟨*shrink*⟩`}, ...}`

Table 1. Primitives for Japanese math fonts.

	Japanese fonts	alphabetic fonts
font family	`\jfam` $\in [0, 256)$	`\fam`
text size	jatextfont={⟨*jfam*⟩,⟨*jfont_cs*⟩}	`\textfont`⟨*fam*⟩=⟨*font_cs*⟩
script size	jascriptfont={⟨*jfam*⟩,⟨*jfont_cs*⟩}	`\scriptfont`⟨*fam*⟩=⟨*font_cs*⟩
scriptscript size	jascriptscriptfont={⟨*jfam*⟩,⟨*jfont_cs*⟩}	`\scriptscriptfont`⟨*fam*⟩=⟨*font_cs*⟩

4.3 Math Font Family

TEX handles fonts in math formulas by 16 font families[2], and each family has three fonts: `\textfont`, `\scriptfont` and `\scriptscriptfont`.

LuaTEX-ja's handling of Japanese fonts in math formulas is similar; Table 4.3 shows counterparts to TEX's primitives for math font families.

5 Parameters

5.1 `\ltjsetparameter` primitive

As noted before, `\ltjsetparameter` and `\ltjgetparameter` are primitives for accessing most parameters of LuaTEX-ja. One of the main reason that LuaTEX-ja didn't adopted the syntax similar to that of pTEX (*e.g.*, `\prebreakpenalty‘) =10000`) is the position of `hpack_filter` callback in the source of LuaTEX, see Section 8.

`\ltjsetparameter` and `\ltjglobalsetparameter` are primitives for assigning parameters. These take one argument which is a ⟨*key*⟩=⟨*value*⟩ list. Allowed keys are described in the next subsection. The difference between `\ltjsetparameter` and `\ltjglobalsetparameter` is only the scope of assignment; `\ltjsetparameter` does a local assignment and `\ltjglobalsetparameter` does a global one. They also obey the value of `\globaldefs`, like other assignment.

`\ltjgetparameter` is the primitive for acquiring parameters. It always takes a parameter name as first argument, and also takes the additional argument—a character code, for example—in some cases.

```
1 \ltjgetparameter{differentjfm},
2 \ltjgetparameter{autospacing},                    average, 1, 10000.
3 \ltjgetparameter{prebreakpenalty}{‘) }.
```

The return value of `\ltjgetparameter` *is always a string.* This is outputted by `tex.write()`, so any character other than space '␣' (U+0020) has the category code 12 (other), while the space has 10 (space).

5.2 List of Parameters

In the following list of parameters, [`\cs`] indicates the counterpart in pTEX, and each symbol has the following meaning:

- No mark: values at the end of the paragraph or the hbox are adopted in the whole paragraph/hbox.
- '∗' : local parameters, which can change everywhere inside a paragraph/hbox.
- '†': assignments are always global.

jcharwidowpenalty=⟨*penalty*⟩ [`\jcharwidowpenalty`]

Penalty value for supressing orphans. This penalty is inserted just after the last **JAchar** which is not regarded as a (Japanese) punctuation mark.

kcatcode={⟨*chr_code*⟩,⟨*natural number*⟩}

An additional attributes having each character whose character code is ⟨*chr_code*⟩. At the present version, the lowermost bit of ⟨*natural number*⟩ indicates whether the character is considered as a punctuation mark (see the description of jcharwidowpenalty above).

[2]Omega, Aleph, LuaTEX and ε-(u)pTEXcan handles 256 families, but an external package is needed to support this in plain TEX and LATEX.

prebreakpenalty ={⟨*chr_code*⟩,⟨*penalty*⟩} [\prebreakpenalty]

postbreakpenalty ={⟨*chr_code*⟩,⟨*penalty*⟩} [\postbreakpenalty]

jatextfont ={⟨*jfam*⟩,⟨*jfont_cs*⟩} [\textfont in TEX]

jascriptfont ={⟨*jfam*⟩,⟨*jfont_cs*⟩} [\scriptfont in TEX]

jascriptscriptfont ={⟨*jfam*⟩,⟨*jfont_cs*⟩} [\scriptscriptfont in TEX]

yjabaselineshift =⟨*dimen*⟩*

yalbaselineshift =⟨*dimen*⟩* [\ybaselineshift]

jaxspmode ={⟨*chr_code*⟩,⟨*mode*⟩} [\inhibitxspcode]

Setting whether inserting xkanjiskip is allowed before/after a **JAchar** whose character code is ⟨*chr_code*⟩. The followings are allowed for ⟨*mode*⟩:

0, inhibit Insertion of xkanjiskip is inhibited before the charater, nor after the charater.

2, preonly Insertion of xkanjiskip is allowed before the charater, but not after.

1, postonly Insertion of xkanjiskip is allowed after the charater, but not before.

3, allow Insertion of xkanjiskip is allowed before the charater and after the charater. This is the default value.

alxspmode ={⟨*chr_code*⟩,⟨*mode*⟩} [\xspcode]

Setting whether inserting xkanjiskip is allowed before/after a **ALchar** whose character code is ⟨*chr_code*⟩. The followings are allowed for ⟨*mode*⟩:

0, inhibit Insertion of xkanjiskip is inhibited before the charater, nor after the charater.

1 preonly Insertion of xkanjiskip is allowed before the charater, but not after.

2 postonly Insertion of xkanjiskip is allowed after the charater, but not before.

3, allow Insertion of xkanjiskip is allowed before the charater and after the charater. This is the default value.

Note that parameters jaxspmode and alxspmode use a common table.

autospacing =⟨*bool*⟩* [\autospacing]

autoxspacing =⟨*bool*⟩* [\autoxspacing]

kanjiskip =⟨*skip*⟩ [\kanjiskip]

xkanjiskip =⟨*skip*⟩ [\xkanjiskip]

differentjfm =⟨*mode*⟩† Specify how glues/kerns between two **JAchar**s whose JFM (or size) are different. The allowed arguments are the followings:

average

both

large

small

jacharrange =⟨*ranges*⟩*

kansujichar ={⟨*digit*⟩, ⟨*chr_code*⟩} [\kansujichar]

6 Other Primitives

6.1 Compatibility with pTEX

`\kuten`

`\jis`

`\euc`

`\sjis`

`\ucs`

`\kansuji`

7 Control Sequences for LATEX 2ε

7.1 Patch for NFSS2

As described in Subsection 2.4, LuaTEX-ja simply adopted `plfonts.dtx` in pLATEX 2ε for the Japanese patch for NFSS2.

7.2 Cropmark/'tombow'

Part III
Implementations

8 Storing Parameters

8.1 Used Dimensions and Attributes

Here the following is the list of dimension and attributes which are used in LuaTEX-ja.

`\jQ` (dimension) As explained in Subsection 2.3, `\jQ` is equal to 1 Q = 0.25 mm, where 'Q' (also called '級') is a unit used in Japanese phototypesetting. So one should not change the value of this dimension.

`\jH` (dimension) There is also a unit called '歯' which equals to 0.25 mm and used in Japanese phototypesetting. The dimension `\jH` stores this length, similar to `\jQ`.

`\ltj@zw` (dimension) A temporal register for the 'full-width' of current Japanese font.

`\ltj@zh` (dimension) A temporal register for the 'full-height' (usually the sum of height of imaginary body and its depth) of current Japanese font.

`\jfam` (attribute) Current number of Japanese font family for math formulas.

`\ltj@curjfnt` (attribute) The font index of current Japanese font.

`\ltj@charclass` (attribute) The character class of Japanese *glyph_node*.

`\ltj@yablshift` (attribute) The amount of shifting the baseline of alphabetic fonts in scaled point (2^{-16} pt).

`\ltj@ykblshift` (attribute) The amount of shifting the baseline of Japanese fonts in scaled point (2^{-16} pt).

`\ltj@autospc` (attribute) Whether the auto insertion of kanjiskip is allowed at the node.

`\ltj@autoxspc` (attribute) Whether the auto insertion of xkanjiskip is allowed at the node.

`\ltj@icflag` (attribute) For distinguishing 'kinds' of the node. To this attribute, one of the following value is assigned:

ITALIC (1) Glues from an itaric correction (\/). This distinction of origins of glues (from explicit \kern, or from \/) is needed in the insertion process of xkanjiskip.

PACKED (2)

KINSOKU (3) Penalties inserted for the word-wrapping process of Japanese characters (*kinsoku*).

FROM_JFM (4) Glues/kerns from JFM.

LINE_END (5) Kerns for ...

KANJI_SKIP (6) Glues for kanjiskip.

XKANJI_SKIP (7) Glues for xkanjiskip.

PROCESSED (8) Nodes which is already processed by ...

IC_PROCESSED (9) Glues from an itaric correction, but also already processed.

BOXBDD (15) Glues/kerns that inserted just the beginning or the ending of an hbox or a paragraph.

\ltj@kcat*i* (attribute) Where i is a natural number which is less than 7. These 7 attributes store bit vectors indicating which character block is regarded as a block of **JAchar**s.

8.2 Stack System of LuaTEX-ja

Background LuaTEX-ja has its own stack system, and most parameters of LuaTEX-ja are stored in it. To clarify the reason, imagine the parameter kanjiskip is stored by a skip, and consider the following source:

```
1 \ltjsetparameter{kanjiskip=0pt}ふがふが.%
2 \setbox0=\hbox{\ltjsetparameter{kanjiskip=5pt}
    ほげほげ}
3 \box0.ぴよぴよ\par
```

ふがふが. ほ げ ほ げ. ぴよぴよ

As described in Part II, the only effective value of kanjiskip in an hbox is the latest value, so the value of kanjiskip which applied in the entire hbox should be 5 pt. However, by the implementation method of LuaTEX, this '5 pt' cannot be known from any callbacks. In the tex/packaging.w (which is a file in the source of LuaTEX), there are the following codes:

```
void package(int c)
{
    scaled h;                    /* height of box */
    halfword p;                  /* first node in a box */
    scaled d;                    /* max depth */
    int grp;
    grp = cur_group;
    d = box_max_depth;
    unsave();
    save_ptr -= 4;
    if (cur_list.mode_field == -hmode) {
        cur_box = filtered_hpack(cur_list.head_field,
                                 cur_list.tail_field, saved_value(1),
                                 saved_level(1), grp, saved_level(2));
        subtype(cur_box) = HLIST_SUBTYPE_HBOX;
```

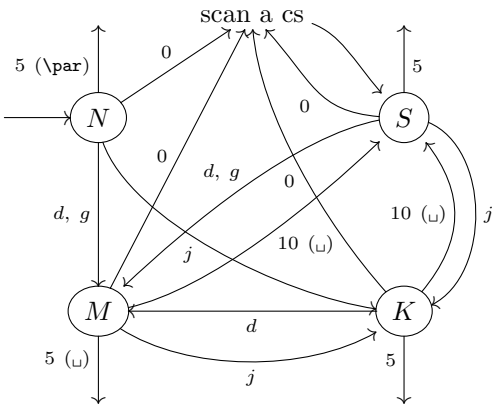
Notice that unsave is executed *before* filtered_hpack (this is where hpack_filter callback is executed): so '5 pt' in the above source is orphaned at +unsave+, and hence it can't be accessed from hpack_filter callback.

The method The code of stack system is based on that in a post of Dev-luatex mailing list[3].

These are two TEX count registers for maintaining informations: \ltj@@stack for the stack level, and \ltj@@group@level for the TEX's group level when the last assignment was done. Parameters are stored in one big table named charprop_stack_table, where charprop_stack_table[i] stores data of stack level i. If a new stack level is created by \ltjsetparameter, all data of the previous level is copied.

To resolve the problem mentioned in 'Background' above, LuaTEX-ja uses another thing: When a new stack level is about to be created, a whatsit node whose type, subtype and value are 44 (*user_defined*), 30112, and current group level respectively is appended to the current list (we refer this node by *stack_flag*). This enables us to know whether assignment is done just inside a hbox. Suppose that the stack level is s and the TEX's group level is t just after the hbox group, then:

[3] [Dev-luatex] tex.currentgrouplevel, a post at 2008/8/19 by Jonathan Sauer.



$d := \{3, 4, 6, 7, 8, 11, 12, 13\}$, $g := \{1, 2\}$, $j :=$ (Japanese characters)

- Numbers represent category codes.
- Category codes 9 (ignored), 14 (comment) and 15 (invalid) are omitted in above diagram.

Figure 2. State transitions of pTEX's input processor.

- If there is no *stack_flag* node in the list of hbox, then no assignment was occurred inside the hbox. Hence values of parameters at the end of the hbox are stored in the stack level s.
- If there is a *stack_flag* node whose value is $t + 1$, then an assignment was occurred just inside the hbox group. Hence values of parameters at the end of the hbox are stored in the stack level $s + 1$.
- If there are *stack_flag* nodes but all of their values are more than $t + 1$, then an assignment was occurred in the box, but it is done is 'more internal' group. Hence values of parameters at the end of the hbox are stored in the stack level s.

Note that to work this trick correctly, assignments to `\ltj@@stack` and `\ltj@@group@level` have to be local always, regardless the value of `\globaldefs`. This problem is resolved by using `\directlua{tex.globaldefs=0}` (this assignment is local).

9 Linebreak after Japanese Character

9.1 Reference: Behavior in pTEX

(NOT COMPLETED)

In pTEX, a linebreak after a Japanese character doesn't emit a space, since words are not separated by spaces in Japanese writings. However, this feature isn't fully implemented in LuaTEX-ja due to the specification of callbacks in LuaTEX. To clarify the difference between pTEX and LuaTEX, We briefly describe the handling of a linebreak in pTEX, in this subsection.

pTEX's input processor can be described in terms of a finite state automaton, as that of TEX in Section 2.5 of [**?**]. The internal states are as follows:

- State N: new line
- State S: skipping spaces
- State M: middle of line
- State K: after a Japanese character

The first three states—N, S and M—are as same as TEX's input processor. State K is similar to state M, and is entered after Japanese characters. The diagram of state transitions are indicated in Figure 9.1. Note that pTEX doesn't leave state K after 'beginning/ending of a group' characters.

9.2 Behavior in LuaTEX-ja

States in the input processoe of LuaTEX is the same as that of TEX, and they can't be customized by any callbacks. Hence, we can only use `process_input_buffer` and `token_filter` callbacks for to suppress a space by a linebreak which is after Japanese characters.

However, `token_filter` callback cannot be used either, since a character in category code 5 (end-of-line) is converted into an space token *in the input processor*. So we can use only the `process_input_buffer` callback. This means that suppressing a space must be done *just before* an input line is read.

Considering these situations, handling of a end-of-line in LuaTEX-ja are as follows:

> A character U+FFFFF (its category code is set to 14 (comment) by LuaTEX-ja) is appended to an input line, before LuaTEX actually process it, if and only if the following two conditions are satisfied:
>
> 1. The category code of the character ⟨return⟩ (whose character code is 13) is 5 (end-of-line).
> 2. The input line matches the following 'regular expression':
>
> $$(\text{any char})^*(\textbf{JAchar})\big(\{\text{catcode} = 1\} \cup \{\text{catcode} = 2\}\big)^*$$

10 Insertion of JFM glues, kanjiskip and xkanjiskip

This is the longest section of the document.

jfmglue.tex の内容をここに入れる