TOP, BOTTOM specifiable 2 column floats
Version v2.9

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Date : 2018/07/28

The package nidanfloat enables bottom (b) placement option for double float in two column mode (*nidan-kumi*). This package was originally part of Japanese pLaTeX, and now is distributed as a separate package because it supports all LaTeX formats.

日本語版ドキュメントは “nidanfloat.pdf“です。

[TODO] This package needs adjustment for LaTeX 2_ε 2015/01/01 changes of the float order in two column mode!

1 Code

1.1 Package Options

In the `nidanfloat` package, the height of the left and right columns of the last page set is designed to be equalised. However, due to the effect of this function, the `\newpage` and `\clearpage` commands on last page do not work properly. We introduced an option to specify whether or not to use this function. If you specify the option “ balance” when specifying a package, automatic adjustment of last page will be done. It is not done by default.

```
⟨*core⟩
\DeclareOption{balance}{\AtEndDocument{\let\clearpage\balanceclearpage}}
\DeclareOption{nobalance}{\relax}
\ExecuteOptions{nobalance}
\ProcessOptions
```

1.2 Float parameters

Here, we explain the parameters created to place a floating float at the bottom of the page.

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`\dblbotfraction` Percentage of a page that may be occupied by a two-column float. The default is 0.5, which means that it can occupy half of the page.

```
\newcommand\dblbotfraction{0.5}
```

`\c@dblbotnumber` Number of two-column floats that can be placed at the bottom of the page. By default this is set to 2. `\c@dblbotnumber` is the internal format of the counter `dblnumber`.

```
\newcount\c@dblbotnumber
\setcounter{dblbotnumber}{2}
```

`\@dblbotroom` `\@dblbotroom`: Length variable indicating the percentage of the page a two-column float can occupy at the bottom of the page. `\@dblbotnum`: Counter that holds the number of two-column floats that can be placed at the bottom of the page.

`\@dblbotnum`

```
\newdimen\@dblbotroom
\newcount\@dblbotnum
```

`\@dblfloatplacement` Redefine this macro to set the newly added parameters.

```
\def\@dblfloatplacement{%
   \global\@dbltopnum\c@dbltopnumber
   \global\@dblbotnum\c@dblbotnumber % added
   \global\@dbltoproom\dbltopfraction\@colht
   \global\@dblbotroom\dblbotfraction\@colht % added
   \@textmin\@colht
     \advance\@textmin-\@dbltoproom
     \advance\@textmin-\@dblbotroom % added
   \@fpmin\dblfloatpagefraction\textheight
   \@fptop\@dblfptop
   \@fpsep\@dblfpsep
   \@fpbot\@dblfpbot
}
```

1.3 Define float lists

The definition of a double column float should be done in a class file, as follows.

```
\newenvironment{figure*}
               {\@dblfloat{figure}}
               {\end@dblfloat}
```

The content of `figure*` environment is registered in the two-column float holding list. In this section, we expand it so that you can put a float at the bottom of the page.

\@dblbotlist
\L@toplist
\R@toplist
\L@botlist
\R@botlist

Add the \@dblbotlist to hold the float to be placed at the bottom of the two-column page. In addition, for floats to be placed above and below the column, distinguish between the left side and the right side,

```
\gdef\@dblbotlist{}
\gdef\L@toplist{}
\gdef\R@toplist{}
\gdef\L@botlist{}
\gdef\R@botlist{}
```

\@dblfloat
\@dbflt
\end@dblfloat

\@dblfloat, \@dbflt is redefined so that the default position argument is set to "tb". Also, set \end@dblfloat to \end@float to allow floats to be placed at the bottom of the page.

```
\def\@dblfloat{%
  \if@twocolumn\let\reserved@a\@dbflt\else\let\reserved@a\@float\fi
  \reserved@a}
\def\@dbflt#1{\@ifnextchar[{\@xdblfloat{#1}}{\@xdblfloat{#1}[tb]}}
\def\@xdblfloat#1[#2]{%
  \@xfloat{#1}[#2]\hsize\textwidth\linewidth\textwidth}
\let\end@dblfloat\end@float
```

\@addtocurcol

Called from @xdblfloat, \@xfloat evaluates the position specification option, and start building the float object. Assembling a float object ends with \end@float. \end@float starts the \output routine with a penalty value of −10004. The \output routine with this value invokes \@specialoutput. \@specialoutput calls \@addtocurcol to move the contents of the float to the current page. If it can be output, then do so; otherwise we explore another possibility.

```
\def\@addtocurcol{%
```

In the case of this package, there is a possibility that a double column float may be passed, so check it. If the width of the float is larger than the column width, forcibly treat as starred, double column float.

```
  \ifdim\wd\@currbox>\columnwidth
    \@addtodblcol
  \else
```

Otherwise, it is almost the same as the original version.

```
    \@insertfalse
    \@setfloattypecounts
    \ifnum\@fpstype=8 % is only `!p'
    \else
      \ifnum\@fpstype=24 % is only `p'
      \else
        \@flsettextmin
        \advance\@textmin\@textfloatsheight
```

```
        \@reqcolroom\@pageht
        \ifdim\@textmin>\@reqcolroom \@reqcolroom\@textmin\fi
        \advance\@reqcolroom\ht\@currbox
        \ifdim\@colroom>\@reqcolroom
          \@flsetnum\@colnum
          \ifnum\@colnum>\z@
            \@bitor\@currtype\@deferlist
            \if@test
            \else
```

The only difference from LaTeX is the name of float list,

```
              \@bitor\@currtype{\L@botlist\R@botlist}%
              \if@test
                \@addtobot
              \else
                \ifodd\count\@currbox
                  \advance\@reqcolroom\intextsep
                  \ifdim\@colroom>\@reqcolroom
                    \global\advance\@colnum\m@ne
                    \global\advance\@textfloatsheight\ht\@currbox
                    \global\advance\@textfloatsheight 2\intextsep
                    \@cons\@midlist\@currbox
                    \if@nobreak
                      \nobreak
                      \@nobreakfalse
                      \everypar{}%
                    \else
                      \addpenalty \interlinepenalty
                    \fi
                    \vskip\intextsep
                    \box\@currbox
                    \penalty\interlinepenalty
                    \vskip\intextsep
                    \ifnum\outputpenalty<-\@Mii \vskip-\parskip \fi
                    \outputpenalty\z@
                    \@inserttrue
                  \fi
                \fi
                \if@insert\else\@addtotoporbot\fi
              \fi
            \fi
          \fi
        \fi
      \fi
    \fi
    \if@insert\else\@resethfps\@cons\@deferlist\@currbox\fi
  \fi
}
```

`\@addtotoporbot` Update variables holding float lists.

```
\def\@addtotoporbot{%
  \@getfpsbit \tw@
  \ifodd\@tempcnta
    \@flsetnum\@topnum
    \ifnum\@topnum>\z@
      \@tempswafalse
      \@flcheckspace\@toproom\@toplist\L@toplist\R@toplist
      \if@tempswa
        \@bitor\@currtype{\@midlist\L@botlist\R@botlist}%
        \if@test\else
          \if@firstcolumn
            \@flupdates \@topnum \@toproom \L@toplist
          \else
            \@flupdates \@topnum \@toproom \R@toplist
          \fi
          \@inserttrue
        \fi
      \fi
    \fi
  \fi
  \if@insert\else\@addtobot\fi
}
```

`\@addtobot` Update variables holding float lists.

```
\def\@addtobot{%
  \@getfpsbit 4\relax
  \ifodd\@tempcnta
    \@flsetnum\@botnum
    \ifnum\@botnum>\z@
      \@tempswafalse
      \@flcheckspace\@botroom\@botlist\L@botlist\R@botlist
      \if@tempswa
        \global\maxdepth\z@
        \if@firstcolumn
          \@flupdates \@botnum \@botroom \L@botlist
        \else
          \@flupdates \@botnum \@botroom \R@botlist
        \fi
        \@inserttrue
      \fi
    \fi
  \fi
}
```

`\org@addtonextcol` `\@addtonextcol` These macros are used inside `\@startcolumn`, to output a float that failed to be inserted or a float specified by 'p'. In this package, a width larger than the column width signals the float should be added to the double column float list.

```
\let\org@addtonextcol\@addtonextcol
\def\@addtonextcol{%
  \ifdim\wd\@currbox>\columnwidth
    \@addtodblcol
  \else
    \org@addtonextcol
  \fi
}
```

`\@addtodblcol` The `\@addtodblcol` macro determines whether the float object fits in the current page and calls `\@addtodbltoporbot` if it would fit. Otherwise, adds to `\@dbldeferlist`.

First set `@insert` flag to false, obtain the float type as `\@fpstype`. If the float type is 8 or 24, the position option is only '!p 'or 'p', so unconditionally add to `\@dbldeferlist`.

```
\def\@addtodblcol{%
  \begingroup
  \@insertfalse
  \@setfloattypecounts
  \ifnum\@fpstype=8 % is only '!p'
  \else
    \ifnum\@fpstype=24 % is only 'p'
    \else
```

Otherwise, check whether there are unplaced ones of the same float type. If there is a float of the same type that has not been output yet, do not output. However, even with the same type, consider the float column width. If you can output it, call `\@addtodblbotortop`.

```
      \@bitor\@currtype{\@dbldeferlist}
      %\@bitor\@currtype{\@deferlist\@dbldeferlist}
      \if@test
      \else
        \@tempswafalse
        \@checkdblspace
        \if@tempswa
          \@addtodbltoporbot
        \fi
      \fi
    \fi
  \fi
  \if@insert\else\@cons\@dbldeferlist\@currbox\fi
  \endgroup
}
```

`\@addtodbltoporbot` First, check whether there is a specification of 't', and whether it exceeds the number allowed at the top of the page.

```
\def\@addtodbltoporbot{%
  \@getfpsbit \tw@
  \ifodd\@tempcnta
    \@flsetnum\@dbltopnum
    \ifnum\@dbltopnum>\z@
```

Then, check whether the same type of float may be output at the top or bottom of the page. Note that two-column floats are placed on the top of a one-column floats.

```
      \@bitor\@currtype{%
         \L@toplist\R@toplist\L@botlist\R@botlist\@dblbotlist}
      \if@test
      \else
```

If possible, check if there is enough space to output the float.

```
        \@tempswafalse
        \@dblflcheckspace \@dbltoproom \@dbltoplist
```

If there is a space, subtract the height of the float from the space available for top floats. Also, reduce the number of starred floats to put in the top, and update the float list for double column top floats.

```
        \if@tempswa
          \@tempdima-\ht\@currbox
          \advance\@tempdima
           -\ifx\@dbltoplist\@empty \dbltextfloatsep\else\dblfloatsep\fi
          \global\advance\@dbltoproom\@tempdima
          \global\advance\@dbltopnum\m@ne
          \@cons\@dbltoplist\@currbox
```

For the left column, subtract the float from the column height `\@colroom`.

```
          \if@firstcolumn
            \advance\@colroom\@tempdima
            \global\advance\@colroom\maxdepth
```

In the case of the right column, insert not only the new float, also the height of the text moved from the left column is decreased.

```
          \else
            \@tempdima\textheight
            \@chkdblfloatht\advance\@tempdima-\@floatht
            \L@chkfloatht\advance\@tempdima-\@floatht
            \vbadness=\@M \splittopskip=\topskip \splitmaxdepth=\maxdepth
            \setbox\z@=\vbox{\unvcopy\@leftcolumn}%
            \setbox\@ne=\vsplit\z@ to\@tempdima
            \advance\@colroom-\ht\z@
            \global\advance\@colroom-\dp\z@
          \fi
```

Finally, set the `@insert` flag to true.

```
          \@inserttrue
```

```
        \fi
      \fi
    \fi
  \fi
  \if@insert\else\@addtodblbot\fi
}
```

`\@addtodblbot` Placing a two-column float at the bottom of the page is similar to the preceding section. However, because a two-column float is placed at the very bottom, we don't have to examine other output lists.

```
\def\@addtodblbot{%
  \@getfpsbit 4\relax
  \ifodd\@tempcnta
    \@flsetnum\@botnum
    \ifnum\@botnum>\z@
      \@tempswafalse
      \@dblflcheckspace \@dbltoproom \@dbltoplist
      \if@tempswa
        \@tempdima-\ht\@currbox \advance\@tempdima
           -\ifx\@dblbotlist\@empty \dbltextfloatsep\else\dblfloatsep\fi
        \global\advance\@dblbotroom\@tempdima
        \global\advance\@dblbotnum\m@ne
        \@cons\@dblbotlist\@currbox
        \if@firstcolumn
          \advance\@colroom\@tempdima
          \global\advance\@colroom\maxdepth
        \else
          \@tempdima\textheight
          \@chkdblfloatht\advance\@tempdima-\@floatht
          \L@chkfloatht\advance\@tempdima-\@floatht
          \vbadness=\@M \splittopskip=\topskip \splitmaxdepth=\maxdepth
          \setbox\z@=\vbox{\unvcopy\@leftcolumn}%
          \setbox\@ne=\vsplit\z@ to\@tempdima
          \advance\@colroom-\ht\z@
          \global\advance\@colroom-\dp\z@
        \fi
        \@inserttrue
      \fi
    \fi
  \fi
}
```

1.4 Macro to calculate float height

`\@floatht` `\@floatht` is used to store the float height stored in the output list.

```
\global\newdimen\@floatht \@floatht\z@
```

`\@flcheckspace`

```
\def \@flcheckspace #1#2#3#4{%
   \advance \@reqcolroom
  \if@twocolumn
    \if@firstcolumn
      \ifx #3\@empty \textfloatsep \else \floatsep \fi
    \else
      \ifx #4\@empty \textfloatsep \else \floatsep \fi
    \fi
  \else
     \ifx #2\@empty \textfloatsep \else \floatsep \fi
  \fi
   \ifdim \@colroom>\@reqcolroom
     \ifdim #1>\ht\@currbox
       \@tempswatrue
     \else
       \ifnum \@fpstype<\sixt@@n
         \@tempswatrue
       \fi
     \fi
   \fi
}
```

`\@dblflcheckspace` Check if the percentage that can be occupied by floats on the top or bottom of the page has been exceeded. If not, `\@tempswa` will be made true.

```
\def\@dblflcheckspace#1#2{%
  \@tempdima=#1\relax
  \advance\@tempdima
     -\ifx #2\@empty \dbltextfloatsep\else\dblfloatsep\fi
  \ifdim\@tempdima>\ht\@currbox
    \@tempswatrue
  \else
    \ifnum\@fpstype<\sixt@@n
      \advance\@tempdima\@textmin
      \if \@tempdima>\ht\@currbox
        \@tempswatrue
      \fi
    \fi
  \fi
}
```

`\@checkdblspace` Check whether the float would fit in the space allocated to text page floats.

First, compare the height of text currently assembled with the amount of text that must be minimized, and store the larger one in `\@tempdima`. If you are in the right column, also add the height of the text in the left column.

```
\def\@checkdblspace{%
   \@tempdima\@pageht\advance\@tempdima\@pagedp
   \@tempdimb\textfraction\@colht
   \ifdim\@tempdima<\@tempdimb \@tempdima\@tempdimb\fi
```

```
    \if@firstcolumn\else
      \advance\@tempdima\ht\@leftcolumn
      \advance\@tempdima\dp\@leftcolumn
    \fi
```

Then add the height of the column width float and two-column float that are to be output. At this time, double the height of the two-column float.

```
    \L@chkfloatht\advance\@tempdima\@floatht
    \R@chkfloatht\advance\@tempdima\@floatht
    \@chkdblfloatht\advance\@tempdima\tw@\@floatht
```

Then add the current float height and required space. Again, double their heights.

```
    \@tempdimb\ht\@currbox\advance\@tempdimb\dp\@currbox
    \advance\@tempdimb
       \ifdim\@floatht>\z@ \dbltextfloatsep\else\dblfloatsep\fi
    \multiply\@tempdimb\tw@ \advance\@tempdima\@tempdimb
```

If the height of all these elements is less than twice the `\textheight`, we can place the current float.

```
    \ifdim\@tempdima>\tw@\textheight
      \@tempswafalse
    \else
      \@tempswatrue
    \fi
}
```

`\tmp@comflelt` `\tmp@comdblflelt` Used to measure the height of the float stored in the output list. Almost the same as `\@comfelt`, `\@comdblflelt` respectively, but use `\copy` so that the original box is not lost.

```
\def\tmp@comflelt#1{%
  \setbox\@tempboxa
  \vbox{\unvbox\@tempboxa\copy #1\vskip\floatsep}%
}
\def\tmp@comdblflelt#1{%
  \setbox\@tempboxa
  \vbox{\unvbox\@tempboxa\copy #1\vskip\dblfloatsep}%
}
```

`\L@chkfloatht` `\R@chkfloatht` Used to calculate the height of the float to be output to the left and right column, respectively. The calculation result is stored in `\@floatht`.

```
\def\L@chkfloatht{\@floatht\z@
  \ifx\L@toplist\@empty\else
    \let\@elt\tmp@comflelt\setbox\@tempboxa\vbox{}\L@toplist
    \setbox\@ne\vbox{\boxmaxdepth\maxdepth
        \unvbox\@tempboxa\vskip-\floatsep\topfigrule\vskip\textfloatsep
        }%
    \let\@elt\relax \advance\@floatht\ht\@ne \advance\@floatht\dp\@ne
  \fi
```

```
  \ifx\L@botlist\@empty\else
    \let\@elt\tmp@comflelt\setbox\@tempboxa\vbox{}\L@botlist
    \setbox\@ne\vbox{\boxmaxdepth\maxdepth
        \vskip\textfloatsep\botfigrule\unvbox\@tempboxa\vskip-\floatsep
        }%
    \let\@elt\relax \advance\@floatht\ht\@ne \advance\@floatht\dp\@ne
  \fi
  \global\@floatht\@floatht
}
\def\R@chkfloatht{\@floatht\z@
  \ifx\R@toplist\@empty\else
    \let\@elt\tmp@comflelt\setbox\@tempboxa\vbox{}\R@toplist
    \setbox\@ne\vbox{\boxmaxdepth\maxdepth
        \unvbox\@tempboxa\vskip-\floatsep\topfigrule\vskip\textfloatsep
        }%
    \let\@elt\relax \advance\@floatht\ht\@ne \advance\@floatht\dp\@ne
  \fi
  \ifx\R@botlist\@empty\else
    \let\@elt\tmp@comflelt\setbox\@tempboxa\vbox{}\R@botlist
    \setbox\@ne\vbox{\boxmaxdepth\maxdepth
        \vskip\textfloatsep\botfigrule\unvbox\@tempboxa\vskip-\floatsep
        }%
    \let\@elt\relax \advance\@floatht\ht\@ne \advance\@floatht\dp\@ne
  \fi
  \global\@floatht\@floatht
}
```

`\@chkdblfloatht` Calculate the height of the double float output on the top and bottom of the page, store the result in `\@floatht`.

```
\def\@chkdblfloatht{\@floatht\z@
  \ifx\@dbltoplist\@empty\else
    \let\@elt\tmp@comdblflelt\setbox\@tempboxa\vbox{}\@dbltoplist
    \setbox\@ne\vbox{\boxmaxdepth\maxdepth
        \unvbox\@tempboxa
        \vskip-\dblfloatsep
        \dblfigrule
        \vskip\dbltextfloatsep
        }%
    \let\@elt\relax \advance\@floatht\ht\@ne \advance\@floatht\dp\@ne
  \fi
  \ifx\@dblbotlist\@empty\else
    \let\@elt\tmp@comdblflelt\setbox\@tempboxa\vbox{}\@dblbotlist
    \setbox\@ne\vbox{\boxmaxdepth\maxdepth
        \vskip\dbltextfloatsep
        \dblfigrule
        \unvbox\@tempboxa
        \vskip-\dblfloatsep
        }%
    \let\@elt\relax \advance\@floatht\ht\@ne \advance\@floatht\dp\@ne
```

```
  \fi
  \global\@floatht\@floatht
}
```

1.5 Merging float and text

`\@fixht` `\@fixht` is used to store the height of the left column.

```
%
\global\newdimen\@fixht
```

`\@rightfixht` *Added by the Japanese TEX development community*: `\@rightfixht` is used to store the height of the right column.

```
\global\newdimen\@rightfixht
```

`\@combinefloats` This macro is executed in the right column.

```
\def\@combinefloats{%
  %%\boxmaxdepth\maxdepth
  \if@twocolumn
    \if@firstcolumn
    \else
```

Store the total height of left column text, upper and lower column width float, upper and lower double column float height in `\@fixht`.

```
      \@fixht\ht\@leftcolumn \advance\@fixht\dp\@leftcolumn
      \@chkdblfloatht \@tempdima\@floatht
      \L@chkfloatht \advance\@tempdima\@floatht
      \advance\@fixht\@tempdima
```

If `\@fixht` is greater than `\textheight`, split the text and transfer the remaining to the right column.

```
      \ifdim\@fixht>\textheight
```

Stores the height of the part left in the left column in `\@fixht`.

```
        \@fixht\textheight
        \advance\@fixht-\@tempdima
        \advance\@fixht\maxdepth
```

Store the text of height `\@fixht` in box 0.

```
        \vbadness=\@M \splittopskip=\topskip \splitmaxdepth=\maxdepth
        \setbox\z@=\vsplit\@leftcolumn to\@fixht
```

Since the part to be moved remains in `\@leftcolumn`, place it in the right column (`\@outputput`). Also, return the contents of box 0 to the left column.

```
        \advance\@fixht-\maxdepth
        \@tempdima\baselineskip \advance\@tempdima-\topskip
        \setbox\@outputbox=\vbox{%
            \ifvoid\@leftcolumn
```

```
            \else
              \unvbox\@leftcolumn\vskip\@tempdima
            \fi\relax
            \unvbox\@outputbox}% \vss moved from here
```

0 *Modified by the Japanese TEX development community*: the `\vss` that was immediately after `\unvbox\@outputbox` of the code immediately above this location was moved here.

```
        \setbox\@leftcolumn=\vbox to\@fixht{\unvbox\z@\vss}% to here (2017/05/01)
      \fi
```

Stores the height of the left column in `\@fixht`, by adding the height of the float that enters the left column to the text height of the left column.

```
      \@fixht\ht\@leftcolumn
        \advance\@fixht\dp\@leftcolumn \advance\@fixht\@floatht
```

Added by the Japanese TEX development community: Process the right column as well. Fixed a longstanding bug where the right column overlapped with the float.

```
      \@rightfixht\ht\@outputbox \advance\@rightfixht\dp\@outputbox
      \@chkdblfloatht \@tempdima\@floatht
      \R@chkfloatht \advance\@tempdima\@floatht
      \advance\@rightfixht\@tempdima
      \ifdim\@rightfixht>\textheight
        \@rightfixht\textheight
        \advance\@rightfixht-\@tempdima
        \advance\@rightfixht\maxdepth
        \vbadness=\@M \splittopskip=\topskip \splitmaxdepth=\maxdepth
        \setbox\z@=\vsplit\@outputbox to\@rightfixht
        \advance\@rightfixht-\maxdepth
        \unvbox\@outputbox
        \setbox\@outputbox=\vbox to\@rightfixht{\unvbox\z@\vss}%
      \fi
      \@rightfixht\ht\@outputbox
        \advance\@rightfixht\dp\@outputbox \advance\@rightfixht\@floatht
```

Assemble text and column width floats, for left and right respectively.

```
      \ifx\L@toplist\@empty\else\L@cflt\fi
      \ifx\L@botlist\@empty\else\L@cflb\fi
      \ifx\R@toplist\@empty\else\R@cflt\fi
      \ifx\R@botlist\@empty\else\R@cflb\fi
    \fi
```

When it is not a two-column float, it operates as usual.

```
  \else
      \ifx\@toplist\@empty\else\@cflt\fi
      \ifx\@botlist\@empty\else\@cflb\fi
  \fi
}
```

\L@cflt Used to assemble left and right columns.

\L@cflb *Added by the Japanese TEX development community*: Update the height of

\R@cflt \@fixht in the left column, \@rightfixht in the right column. Also update

\R@cflb \@colht to these heights.

```
\def\L@cflt{%
  \let\@elt\@comflelt\setbox\@tempboxa\vbox{}\L@toplist
  \setbox\@leftcolumn\vbox to\@fixht{\boxmaxdepth\maxdepth
      \unvbox\@tempboxa
      \vskip-\floatsep\topfigrule\vskip\textfloatsep\unvbox\@leftcolumn
      \vss}%
  \let\@elt\relax
  \xdef\@freelist{\@freelist\L@toplist}\global\let\L@toplist\@empty
  \@colht\@fixht
}
\def\L@cflb{%
  \let\@elt\@comflelt\setbox\@tempboxa\vbox{}\L@botlist
  \setbox\@leftcolumn\vbox to\@fixht{\boxmaxdepth\maxdepth
      \unvbox\@leftcolumn
      \vskip\textfloatsep\botfigrule\unvbox\@tempboxa\vskip-\floatsep
      \vss}%
  \let\@elt\relax
  \xdef\@freelist{\@freelist\L@botlist}\global\let\L@botlist\@empty
  \@colht\@fixht
}
\def\R@cflt{%
  \let\@elt\@comflelt\setbox\@tempboxa\vbox{}\R@toplist
  \setbox\@outputbox\vbox to\@rightfixht{\boxmaxdepth\maxdepth
      \unvbox\@tempboxa
      \vskip-\floatsep\topfigrule\vskip\textfloatsep\unvbox\@outputbox
      \vss}%
  \let\@elt\relax
  \xdef\@freelist{\@freelist\R@toplist}\global\let\R@toplist\@empty
  \@colht\@rightfixht
}
\def\R@cflb{%
  \let\@elt\@comflelt\setbox\@tempboxa\vbox{}\R@botlist
  \setbox\@outputbox\vbox to\@rightfixht{\boxmaxdepth\maxdepth
      \unvbox\@outputbox
      \vskip\textfloatsep\botfigrule\unvbox\@tempboxa\vskip-\floatsep
      \vss}%
  \let\@elt\relax
  \xdef\@freelist{\@freelist\R@botlist}\global\let\R@botlist\@empty
  \@colht\@rightfixht
}
```

\@combinedblfloats Merge text and float. In this package, double column float at the bottom of the page are also merged.

```
%\def\@comdblflelt#1{\setbox\@tempboxa
```

```
%       \vbox{\unvbox\@tempboxa\box#1\vskip\dblfloatsep}}
%
\def\@combinedblfloats{%
  \ifx\@dbltoplist\@empty
  \else
    \let\@elt\@comdblflelt\setbox\@tempboxa\vbox{}\@dbltoplist
    \setbox\@outputbox\vbox{\boxmaxdepth\maxdepth
       \unvbox\@tempboxa
       \vskip-\dblfloatsep
       \dblfigrule
       \vskip\dbltextfloatsep
       \box\@outputbox}%
    \let\@elt\relax\xdef\@freelist{\@freelist\@dbltoplist}%
    \global\let\@dbltoplist\@empty
  \fi
  \ifx\@dblbotlist\@empty
  \else
    \let\@elt\@comdblflelt\setbox\@tempboxa\vbox{}\@dblbotlist
    \setbox\@outputbox\vbox{\boxmaxdepth\maxdepth
       \box\@outputbox
       \vskip\dbltextfloatsep
       \dblfigrule
       \unvbox\@tempboxa
       \vskip-\dblfloatsep
       }%
    \let\@elt\relax\xdef\@freelist{\@freelist\@dblbotlist}%
    \global\let\@dblbotlist\@empty
  \fi
  \global\setbox\@outputbox\vbox to\textheight{\unvbox\@outputbox}%
}
```

1.6 Output of two columns

`\if@balance` Flag indicating whether the left and right columns are to be balanced.

```
\newif\if@balance \@balancefalse
```

`\@outputdblcol` Concatenate left and right columns and output them by `\@outputdblcol`. In this package, a routine for equally dividing the left and right columns has been added.

```
\newbox\@combinebox
```

Just store the assembled left column in `\@leftcolumn`, do not output it yet.

```
\def\@outputdblcol{%
  \if@firstcolumn
    \global\@firstcolumnfalse
    \global\setbox\@leftcolumn\box\@outputbox
    \@colht\textheight
    \@chkdblfloatht\global\advance\@colht-\@floatht
  \else
    \global\@firstcolumntrue
```

Here starts the code that balances the left and right columns.

```
    \if@balance
      \@tempdima\baselineskip
      \advance\@tempdima-\topskip
      \setbox\@combinebox=\vbox{%
          \unvbox\@leftcolumn\vskip\@tempdima\unvbox\@outputbox}%
      \@tempdima\ht\@combinebox
      \advance\@tempdima\dp\@combinebox
      \divide\@tempdima\tw@
      \vbadness=\@M \splittopskip=\topskip \splitmaxdepth=\maxdepth
      \setbox\@leftcolumn=\vsplit\@combinebox to\@tempdima
      \setbox\@outputbox=\vtop{\unvbox\@combinebox}
      \setbox\@leftcolumn=\vtop{\unvbox\@leftcolumn}
    \fi
```

Format it.

```
    \@tempdima\ht\@leftcolumn
    \setbox\@outputbox\vbox to\@tempdima{%
      \hb@xt@\textwidth{%
        \hb@xt@\columnwidth{%
           \vbox to\@tempdima{\box\@leftcolumn\vss}\hss}%
        \hfil
        \vrule width\columnseprule
        \hfil
        \hb@xt@\columnwidth{%
           \vbox to\@tempdima{\box\@outputbox\vss}\hss}%
      }%
      \vss
    }%
    \@combinedblfloats
    \@outputpage
    \begingroup
      \@dblfloatplacement
      \@startdblcolumn
      \@whilesw\if@fcolmade \fi{\@outputpage\@startdblcolumn}%
    \endgroup
  \fi
  \global\@balancefalse
}
```

`\@startdblcolumn` When starting a two-column page, output a float that has not yet been output. They are output by `\@addtonextcol` via `\@sdblcolelt`. In this package, update the height of the column by subtracting the height of the float from `\textheight`.

```
\def\@startdblcolumn{%
  \global\@colht\textheight
  \@tryfcolumn\@dbldeferlist
  \if@fcolmade
  \else
    \begingroup
```

```
      \let\reserved@b\@dbldeferlist
      \global\let\@dbldeferlist\@empty
      \let\@elt\@sdblcolelt
      \reserved@b
    \endgroup
  \fi
  \@chkdblfloatht
  \global\advance\@colht-\@floatht
}
```

\@doclearpage Redefine \@doclearpage to initialize output float list.

```
\def\@doclearpage{%
  \ifvoid\footins
    \setbox\@tempboxa\vsplit\@cclv to\z@ \unvbox\@tempboxa
    \setbox\@tempboxa\box\@cclv
    \xdef\@deferlist{%
       \L@toplist\R@toplist\L@botlist\R@botlist\@deferlist}%
    \global\let\L@toplist\@empty % changed from \@toplist
    \global\let\R@toplist\@empty % added
    \global\let\L@botlist\@empty % changed from \@botlist
    \global\let\R@botlist\@empty % added
    \global\@colroom\@colht
    \ifx\@currlist\@empty
    \else
      \@latexerr{Float(s) lost}\@ehb
        \global\let\@currlist\@empty
    \fi
    \@makefcolumn\@deferlist
    \@whilesw\if@fcolmade \fi{\@opcol\@makefcolumn\@deferlist}%
    \if@twocolumn
      \if@firstcolumn
        % added \@dblbotlist
        \xdef\@dbldeferlist{\@dbltoplist\@dblbotlist\@dbldeferlist}%
        \global\let\@dbltoplist\@empty
        \global\let\@dblbotlist\@empty % added
        \global\@colht\textheight
        \begingroup
          \@dblfloatplacement
          \@makefcolumn\@dbldeferlist
          \@whilesw\if@fcolmade \fi{\@outputpage
                                    \@makefcolumn\@dbldeferlist}%
        \endgroup
      \else
        \vbox{}\clearpage
      \fi
    \fi
  \else
    \setbox\@cclv\vbox{\box\@cclv\vfil}%
    \@makecol\@opcol
    \clearpage
```

```
  \fi
}
```

`\@topnewpage` Redefine `\@topnewpage` to initialize `\@dblbotroom` and `dblbotnumber`.

```
\long\def\@topnewpage[#1]{%
  %\@nodocument
  \@next\@currbox\@freelist{}{}%
  \global\setbox\@currbox
    \color@vbox
      \normalcolor
      \vbox{\hsize\textwidth
            \@parboxrestore
            \col@number\@ne
            #1%
            \vskip-\dbltextfloatsep}%
    \color@endbox
  \ifdim\ht\@currbox>\textheight
    \ht\@currbox\textheight
  \fi
  \global\count\@currbox\tw@
  \@tempdima-\ht\@currbox
  \advance\@tempdima-\dbltextfloatsep
  \global\advance\@colht\@tempdima
  \ifx\@dbltoplist\@empty
  \else
    \@latexerr{Float(s) lost}\@ehb
    \let\@dbltoplist\@empty
  \fi
  \@cons\@dbltoplist\@currbox
  \global\@dbltopnum\m@ne
  \global\@dblbotnum\m@ne % added
  \ifdim\@colht<2.5\baselineskip
    \@latex@warning@no@line {Optional argument of \noexpand\twocolumn
          too tall on page \thepage}%
    \@emptycol
    \if@firstcolumn
    \else
      \@emptycol
    \fi
  \else
    \global\vsize\@colht
    \global\@colroom\@colht
    \@floatplacement
  \fi
  %\global\@dbltoproom\maxdimen
  %\global\@dblbotroom\maxdimen
  %\@addtodblcol
}
```

`\balancenewpage` `\balanceclearpage` Macro for evenly dividing text and outputting it. However, when using this macro,

\newpage or \clearpage are not allowed on the current page.

```
\def\balancenewpage{\par\vfil\global\@balancetrue\penalty-\@M}
\def\balanceclearpage{\balancenewpage
    \write\m@ne{}\vbox{}\global\@balancetrue\penalty-\@Mi}
\endinput
```

⟨/core⟩