DOTSEQN: Flush-left equations with dotted leaders to the equation number

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1 Introduction

The dotseqn package provides a different format for typesetting equations, one reportedly used in 'old style Britsh books' – equations aligned on the left, with dots on the right leading to the equation number. Like this

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \quad \text{. . . . . } \quad (1)$$

Equations without numbers have no leaders.

This package behaves a lot like fleqn (so that option is superfluous). In particular, the equations are not centered, but indented a constant distance from the left margin, controlled by `\mathindent`. The default indentation is the same as for lists.

2 Affected environments

Math environments with equation numbers, equation and eqnarray, are changed to produce left-justified equations, and to draw dotted leaders between the equation and the equation number. If there is no number, as specified by `\nonumber`, then no leaders are drawn.

Other math environments – displaymath, eqnarray*, and `\[ ... \]` – do not produce equation numbers and therefore behave the same as they do under the fleqn document option.

3 Options

This package is very similar to the fleqn document class option, so specifying fleqn is superfluous. The leqno class option is forbidden because it is incompatible with the dotted style of equation labeling. (Where would the leaders go?) As is the case for the ordinary fleqn option, the equation indentation is controlled by the

length \mathindent, with a default indentation equal to the indentation of lists. It can be changed in the document preamble (with \setlength). Reasonable alternatives are zero (0pt) or the paragraph indentation (\parindent).

The dotseqn package has two options of its own which can be specified with the \usepackage command. The leftjust option causes the first column in eqnarray and eqnarray* to be flush left. Ordinarily, these pieces are flush right against the middle column.

Another option is nocolsep, which gets rid of that (ridiculous) extra space in the second column of eqnarray equal to twice \arraycolsep. I would prefer to make nocolsep the default, but it seems best that the normal behavior agrees with the usual documented behavior of LaTeX.

This typeset documentation was generated by running LaTeX on dotseqn.dtx, and dotseqn.sty is generated the same way. This is my experiment with single-file dtx distribution.

4 The implementation

\EqnDots The definitions here are based closely on the class option fleqn. The principal difference is that dotted leaders are used to replace some horizontal filling commands. The leaders are given by the fairly typical \leaders command:

```
\newcommand\EqnDots{\leaders\hbox{\kern4\p@ .\kern4\p@}\hfill}
```

which can be changed by the intrepid document designer.

\mathindent Imitating the definitions for fleqn, we define a math indentation, but only if it is not defined already, and set the default indentation equal to the outer-level list indentation.

```
\@ifundefined{mathindent}{\newdimen\mathindent \mathindent\leftmargini}{}
```

The implementation in fleqn.clo is complicated by the need to delay assigning the default value to \mathindent, but that is not necessary here because packages like this are processed after the document class is fully declared.

displaymath \[The environment displaymath, alias \[... \], is identical with its definition in fleqn.clo. First the beginning

```
\renewcommand{\[}{\relax \ifmmode\@badmath \else
 \begin{trivlist}%
  \@beginparpenalty\predisplaypenalty \@endparpenalty\postdisplaypenalty
  \item[]\leavevmode \hbox to\linewidth\bgroup $\m@th\displaystyle %$
  \hskip\mathindent\bgroup
 \fi}
```

\] ... and then the \end{displaymath} or \]

```
\renewcommand{\]}{\relax\ifmmode \egroup $\hfil% $
    \egroup \end{trivlist}%
  \else \@badmath \fi}
```

`equation` The equation environment begins exactly the same was as in `fleqn`, but it ends using `\EqnDots` in place of `\hfil`.

```
\renewenvironment{equation}%
 {\@beginparpenalty\predisplaypenalty \@endparpenalty\postdisplaypenalty
     \refstepcounter{equation}\trivlist \item[]\leavevmode
       \hbox to\linewidth\bgroup $\m@th% $
         \displaystyle \hskip\mathindent}%
 {$\EqnDots % $   Replace `\hfil' with dotted leaders `\EqnDots'.
     \displaywidth\linewidth\hbox{\@eqnnum}\egroup \endtrivlist}
```

The equation∗ environment need not be redefined because it is defined in terms of equation, and it has no equation number so it needs no `\EqnDots`.

`eqnarray` The eqnarray environment has the most changes. In order to make the leaders fill the width, the space between the equation and the equation number must be part of a column entry; it cannot be filled by tabskip glue. Thus, this redefinition has one fewer column – there is no separate column for the equation number! This also necessitates a changed definition for `\\`, so see `\@@eqncr` below. As yet, eqnarray is not described in detail in `classes.dtx`, but there are some useful comments in `ltmath.dtx`. They are reproduced here:

> To get a proper `\@currentlabel` we have to redefine it for the whole display. Note that we can't use `\refstepcounter` as this results in `\@currentlabel` getting [frozen at the beginning] and thus always writing the first label to the `.aux` file. Default is for left-hand side of equations to be flushright. To make them flushleft, `\let\@eqnsel = \hfil` [this is just what the leftjust option does].

In further explanation, I should add that the counter `\@eqcnt` is globally set in each of the columns so that `\\` will know how many column separators (`&`) to insert before the equation number. This redefined version has only 3 alignment columns, so this insertion is modified (in `\@@eqncr`). In the third and final column, after the math material, there is a confusing `\hskip\@centering`. In fact, this has no effect when an equation number is present, because the `\EqnDots` are infinitely more stretchable, but the `\hskip` is left in place for the case of `\nonumber` which needs some filling.

So, in the absence of tabskip glue, how is the equation forced out to the full line width? Using `\halign to\linewidth`' will not work because it only stretches `\tabskip` glue. The original `\halign to\linewidth` is retained only to give overfull box warnings when an alignment is too wide for the page. To stretch the third coulumn out to the full line width, a blank row is added at the end of the alignment by `\end{eqnarray}`, with a single entry spanning the full line width. This makes use of an often annoying behavior of TEX: when multiple columns need to be enlarged to match a spanning entry, all the extra space is added to the final column. The extra 'phantom' row uses a negative `\vskip` and a strut with a depth given by `\prevdepth` to simulate the depth of the expected last line in the

equation array. A temporary macro is used to preserve the value of `\prevdepth` and use it after an end-of-group.

A special command '`\DEQ@acs`' surrounds the entry for the second column. Ordinarily this gives `\hskip 2\arraycolsep`, but with the nocolsep option it gives `\null` (like `\mbox{}`), which produces the natural math-mode spacing around the entry.

```
\renewenvironment{eqnarray}{%
  \stepcounter{equation}%
  \def\@currentlabel{\p@equation\theequation}%
  \global\@eqnswtrue \m@th \global\@eqcnt\z@  \tabskip\mathindent
  \let\\\@eqncr \setlength\abovedisplayskip\topsep
  \ifvmode \addtolength\abovedisplayskip\partopsep \fi
  \addtolength\abovedisplayskip\parskip
  \setlength\belowdisplayskip\abovedisplayskip
  \setlength\belowdisplayshortskip\abovedisplayskip
  \setlength\abovedisplayshortskip\abovedisplayskip
  $$\everycr{}\halign to\linewidth% $$
  \bgroup
    \hskip\@centering
    $\displaystyle\tabskip\z@skip{##}$\@eqnsel&%
    \global\@eqcnt\@ne \hfil${\DEQ@acs##\DEQ@acs}$\hfil&%
    \global\@eqcnt\tw@ $\displaystyle{##}$\hskip\@centering\cr%
}% end of "\begin" part
{\@@eqncr
  \noalign{% vertical skip up to overlay phantom line
     \penalty\@M \vskip-\prevdepth
     \edef\@tempa{\omit\span\omit\span\omit   % span three columns
       \vrule\@depth\the\prevdepth \@width\z@ % strut of proper depth
       \kern-\mathindent \kern\linewidth}%    % full line width
     \nointerlineskip \expandafter % use saved |\@tempa| outside group
  }\@tempa\cr
  \egroup
  \global\advance\c@equation\m@ne$$% $$
  \global\@ignoretrue
}
```

`\@@eqncr` Now the `\@@eqncr` macro (alias `\\`) needs redefining. The number of inserted `&` separators is reduced, the warning is removed because it is quite proper to already be in the last column, and the placement of the equation number is changed: instead of letting the `\halign` template do the spacing, `\@@eqncr` leaves math mode, inserts the leaders, typesets the equation number (using `\@eqnnum`), then begins math mode again so things will balance when the template tries to end math. Note: `\reserved@a` is set to something innocuous before `\ifcase` just in case it was let equal to something like `\fi`.

```
\def\@@eqncr{\let\reserved@a\@empty
  \ifcase\@eqcnt \def\reserved@a{& &}\or \def\reserved@a{&}\fi
  \reserved@a
  \if@eqnsw \egroup $\EqnDots \@eqnnum $\bgroup \stepcounter{equation}%
  \fi \global\@eqnswtrue\global\@eqcnt\z@\cr}
```

Finally, we handle the package options leftjust and nocolsep. Declare the default behavior; declare the optional behavior, as described above; and process any options specified.

```
\def\DEQ@acs{\hskip\tw@\arraycolsep}
\DeclareOption{leftjust}{\let\@eqnsel\hfil}
\DeclareOption{nocolsep}{\let\DEQ@acs\null}
\ProcessOptions
```