Numbering individual lines of equation array's

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This package defines the `subeqnarray` and `subeqnarray*` environments, which behave like the equivalent `eqnarray` and `eqnarray*` environments, except that the individual lines are numbered like 1a, 1b, 1c, etc.

To refer to these numbers an extra label command `\slabel` has been defined.

Many of this code was taken from `latex.tex` and modified for this purpose.

1 Initial Code

`\c@subequation` We need to allocate a new counter for the `subequation` environment. It is reset by the `equation` counter.

```
1 ⟨*package⟩
2 \newcounter{subequation}[equation]
```

`\thesubequation` The representation o the counter `subequation` includes the `equation` counter

```
3 \def\thesubequation{\theequation\alph{subequation}}
```

2 Option Handling

The standard LaTeX options leqno and fleqn are recognised by this package.

```
4 %
5 %    When \Lopt{leqno} is used the equation numbers should appear on
6 %    the left side of the equation. The numbers are generated by
7 %    |\@subeqnnum| which needs a different definition to acheive this
8 %    effect.
9 %    \begin{macrocode}
10 \DeclareOption{leqno}{%
11   \def\@subeqnnum{\hbox to .01\p@{}\rlap{\reset@font\rmfamily
12         \hskip -\displaywidth(\thesubequation)}}}
```

The default definition of `\@subeqnnum`.

```
13 \DeclareOption{reqno}{%
14   \def\@subeqnnum{{\reset@font\rmfamily (\thesubequation)}}}
```

When the option fleqn is used, the equations have to be printed flush left, with an indent of `\mathindent`; the equations are seperated from the surrounding text by `\topsep` (plus `\partopsep` if necessary) and the width of the display is `\linewidth`.

```
\DeclareOption{fleqn}{%
  \def\subeqn@start{%
    \tabskip\mathindent
    \abovedisplayskip\topsep
    \ifvmode\advance\abovedisplayskip\partopsep\fi
    \belowdisplayskip\abovedisplayskip
    \belowdisplayshortskip\abovedisplayskip
    \abovedisplayshortskip\abovedisplayskip
    $$\everycr{}\halign to \linewidth}}% $$
```

The default will be to have displayed equations to the width of `\displaywidth`.

```
\DeclareOption{deqn}{%
  \def\subeqn@start{%
    \tabskip\@centering
    $$\everycr{}\halign to \displaywidth}}% $$
```

We don't support any other options

```
\DeclareOption*{\OptionNotUsed}
```

3 Executing Options

Make sure the `\@eqnnum` is defined by specifying reqno as a default option. Specifying deqn as a default option defines `\subeqn@start`.

```
\ExecuteOptions{reqno,deqn}
```

Now see if the use specified any options.

```
\ProcessOptions
```

4 The main code

`\slabel` A new label command to refer to subequations. It works like the `\label` command and was taken from `latex.tex`.

`\slabel{FOO}` writes the following on file `\@auxout`
`\newlabel{FOO}{{eval(\@currentlabel)}{eval(\thepage)}}`

```
\newcommand\slabel[1]{%
  \@bsphack
  \if@filesw
    {\let\thepage\relax
     \def\protect{\noexpand\noexpand\noexpand}%
     \edef\@tempa{\write\@auxout{\string
        \newlabel{#1}{{\thesubequation}{\thepage}}}}%
     \expandafter}\@tempa
     \if@nobreak \ifvmode\nobreak\fi\fi
  \fi\@esphack}
```

`subeqnarray` The `subeqnarray` environment steps the equation counter, sets the subequation counter equal to 1 and behaves much like the `eqnarray` environment. Note the `\@currentlabel` is defined to use the equation counter. This is done so that an

entire array an be referred to using the value of the equation counter. Hence the need for the `\slabel` command.

```
\newenvironment{subeqnarray}%
   {\stepcounter{equation}%
    \def\@currentlabel{\p@equation\theequation}%
    \global\c@subequation\@ne
    \global\@eqnswtrue\m@th
    \global\@eqcnt\z@\let\\\@subeqncr
    \subeqn@start
     \bgroup\hskip\@centering
      $\displaystyle\tabskip\z@skip{##}$\@eqnsel
      &\global\@eqcnt\@ne \hskip \tw@\arraycolsep \hfil${##}$\hfil
      &\global\@eqcnt\tw@ \hskip \tw@\arraycolsep
         $\displaystyle{##}$\hfil \tabskip\@centering
      &\global\@eqcnt\thr@@
         \hbox to\z@\bgroup\hss##\egroup\tabskip\z@skip\cr}
   {\@@subeqncr\egroup $$\global\@ignoretrue}
```

`\@subeqncr` These macros handle the user command `\\`; they are adapted from the ones used or the `eqnarray` environment.

First the presence of a `*` detected and the right penalty selected.

```
\def\@subeqncr{{\ifnum0=`}\fi\@ifstar{\global\@eqpen\@M
    \@ysubeqncr}{\global\@eqpen\interdisplaylinepenalty \@ysubeqncr}}
```

`@ysubeqncr` This macro is called by `\@subeqncr` and checks if the user requested any extra vertical space. It calls `\@xsubeqncr` with the wanted amount of space as its argument.

```
\def\@ysubeqncr{\@ifnextchar [{\@xsubeqncr}{\@xsubeqncr[\z@skip]}}
```

`\@xsubeqncr` This macro calls `\@@subeqncr` to put in extra `&`'s if needed, generating an error if the number of columns is too large. Then the penalty selected earlier and the white space requested are inserted.

```
\def\@xsubeqncr[#1]{\ifnum0=`{\fi}\@@subeqncr
   \noalign{\penalty\@eqpen\vskip\jot\vskip #1\relax}}
```

`\@@subeqncr` Ceck the number of columns, and insert extra `&` if needed. If there appear to be more than 3 columns an error is signalled.

```
\def\@@subeqncr{\let\@tempa\relax
    \ifcase\@eqcnt \def\@tempa{& & &}\or \def\@tempa{& &}
      \or \def\@tempa{&}\else
       \let\@tempa\@empty
       \@latexerr{Too many columns in subeqnarray environment}\@ehc\fi
     \@tempa \if@eqnsw\@subeqnnum\refstepcounter{subequation}\fi
     \global\@eqnswtrue\global\@eqcnt\z@\cr}
```

`subeqnarray*` This environment is basically the same as the `eqnarray` environment, but it is provided just or completeness.

```
\newenvironment{subeqnarray*}%
  {\def\@subeqncr{\nonumber\@ssubeqncr}\subeqnarray}
  {\global\advance\c@equation\m@ne\nonumber\endsubeqnarray}
```

`\@ssubeqncr` This is used in the `esubqnarray*` environment.

```
\let\@ssubeqncr\@subeqncr
⟨/package⟩
⟨*sample⟩
```

5 An example of the use of this package

When you run the following document through LaTeX you will see the differene between the `subeqnarray` and `eqnarray` environments.

```
⟨*sample⟩
\documentclass[fleqn]{article}
\usepackage{subeqnarray}
\begin{document}
This document shows an example of the use of the \emph{subeqnarray}
environment. Here is one:
\begin{subeqnarray}
\label{eqw}
\slabel{eq0}
 x & = & a \times b \\
\slabel{eq1}
 & = & z + t\\
\slabel{eq2}
 & = & z + t
\end{subeqnarray}
The first equation is number~\ref{eq0}, the last is~\ref{eq2}. The
equation as a whole can be referred to as equation~\ref{eqw}.

To show that equation numbers behave normally, here's an
\emph{eqnarray} environment.
\begin{eqnarray}
\label{eq10}
 x & = & a \times b \\
\label{eq11}
 & = & z + t\\
\label{eq12}
 & = & z + t
\end{eqnarray}

These are equations~\ref{eq10},~\ref{eq11} and~\ref{eq12}.
\end{document}
⟨/sample⟩
```

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Change History

1.1
General: Fixed bug in subeqnarray* environment 1
2.0
General: Added support for the fleqn option 1
Added support for the leqno option 1
2.1
General: Upgrade for LaTeX2e 1

v2.1b
General: Changed licensing remarks to use LPPL 1