The package EASYEQN

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19th March 2002

Abstract

The package EASYEQN introduces some equation environments that simplify the typesetting of equations. It uses a syntax similar to the array environment to define the column alignment. The label field is fully customizable. A package option permits to number only those equations that were *labeled and referenced*.i Additional macros are also included to facilitate the typing of formulae.

Contents

1 Some examples with EASYEQN

The package is loaded by means of the usual syntax:

```
\documentclass{article}
.
.
\usepackage[allnumber,warning, easyold,
            fleqn,leqno,math]{easyeqn}
.
.
```

The package[1] introduces the EQ and EQA environments. The package options are:

allnumber Means that all of the EQ and EQA environments are numbered. Without that option, only those EQ and EQA environments that are explicitly *labeled* and *referenced* are numbered.

warning Causes the flagging of the equations that are labeled but *not referenced*.

easyold Produces obsolete environment EQS, EQS*, EQ*, EQA* for backward compatibilty.

fleqn equations will be left-justify.

leqno Writes equation number on the left.

math Defi nes additional macros for mathematics.

Remark: When EASYEQN is used with HYPERREF the package EASYEQN *must* be included after HYPERREF or cross referencing do not work.

2 Use of the EQ environment

The use of EQ environment is best unserstood by the following example:

[1] the option “showkeys” is eliminated because the new release of EASYEQN is compatible with the SHOWKEYS package

```
\begin{EQ}\label{eq:1}
    \frac{x}{y} = z
\end{EQ}
\begin{EQ}\label{eq:2}
    \frac{a}{b} = c
\end{EQ}
I will refer only to \eqref{eq:1} or,
in the old style, \refeq{eq:1}.
```

$$\frac{x}{y} = z \tag{1}$$

$$\frac{a}{b} = c$$

I will refer only to (1) or, in the old style, 1.

Note that the reference is done by `\eqref` or `\refeq`. The command `\refeq` produces the same output as `\ref`, while `\eqref` uses `( )` for the output.

Remark: Due to the algorithm implementation, in order to obtain the right cross reference, you need to recompile the file 3 times. The use of `\label` is not permitted from within EQ* environments. If you use `\ref` to reference equations results are unpredictable[2].

Here is another example:

```
\begin{EQ}[rcll]
   \nabla\cdot(\rho\nabla u)&=&f \qquad
      &\mbox{on $\Omega$} \\
   u&=&u_{0}&\mbox{on $A\subset\partial\Omega$} \\
   (\rho\nabla u)\cdot n&=&u_{1}
      &\mbox{on $B\subset\partial\Omega$}
\end{EQ}
```

$$\begin{aligned} \nabla\cdot(\rho\nabla u) &= f && \text{on } \Omega \\ u &= u_{0} && \text{on } A\subset\partial\Omega \\ (\rho\nabla u)\cdot n &= u_{1} && \text{on } B\subset\partial\Omega \end{aligned}$$

[2]The previous release used the command `eqlabel` for equation labelling, for backward compatibility this command is maintained but the user should use the `label` command

Note that between **[...]** you can specify the column alignment in the same way as in the array or tabular environment[3]. The permitted alignment are **l** for left alignment, **r** for right alignment and **c** for centering. There is also the character "**.**" that if used between the definition of two columns, disables the spacing between columns as in the following example, which is taken from the documentation of EQNARRAY of Roland Winkler;

```
\begin{EQ}[rcl.l]
  \phi & = & \sum \bigg( & \frac{xxxxxxxxxx}{\phi}\\
       & & & + \frac{yyyyyyyyyy}{\phi} \bigg)\\
       & = & \eqmulticol{2}{l}
             {\frac{zzzzzzzzzz}{\phi}}
\end{EQ}
```

$$\phi = \sum \left(\frac{xxxxxxxxxx}{\phi} + \frac{yyyyyyyyyy}{\phi} \right) = \frac{zzzzzzzzzz}{\phi}$$

In the above example the command `\eqmulticol` has been introduced. Its syntax is:

```
\eqmulticol{ncol}{align}{body}
```

where:

ncol number of column to merge.

aling alignment, parameter to be chosen among the set **l**, **r**, **c**.

body expression to put across the column.

3 The `\yesnumber` command

If may you want to number an equation without reference it. The `\yesnumber` command does the work as this example shows:

[3] In a previous release of EASYEQN multicolumn alignment was implemented in a EQS environment. However to keep backward compatibility such an environment is maintained

```
\begin{EQ}[rcl]\yesnumber
   a & = & \frac{1}{23} \\
   b & = & \sqrt{\frac{1}{23}}
\end{EQ}
```

$$a = \frac{1}{23}$$
$$b = \sqrt{\frac{1}{23}} \tag{2}$$

4 Use of EQA environment

```
\begin{EQA}[rcll]
   \nabla\!\cdot\!(\rho\nabla u)&=&f \qquad
      &\mbox{on $\Omega$}
   \yesnumber \\
   u&=&u_{0}&\mbox{on $A\subset\partial\Omega$}
         \label{eq:3} \\
   (\rho\nabla u)\!\cdot\!n&=&u_{1}
       &\mbox{on $B\subset\partial\Omega$}
          \label{eq:4}
\end{EQA}
it is referenced only \eqref{eq:4}!!
```

$$\nabla\cdot(\rho\nabla u) = f \qquad \text{on } \Omega \tag{3}$$
$$u = u_0 \qquad \text{on } A \subset \partial\Omega$$
$$(\rho\nabla u)\cdot n = u_1 \qquad \text{on } B \subset \partial\Omega \tag{4}$$

it is referenced only (4)!!

Note that only the referenced lines or the lines with `\yesnumber` are numbered.

5 The `\label` command

It is possible to use custom label by `\label` command. The syntax is one of the following:

```
\label{labelname}
\label[eqnum]
\label[eqnum]{labelname}
\label(eqnum)
\label(eqnum){labelname}
```

where **[eqnum]** is an optional argument that if defined, causes the equation displays **eqnum** instead of **(equation number)**. The equation counter is not advanced and **labelname** if present will refer to **eqnum**.

For example:

```
\begin{EQA}[c]
   \nabla\cdot(\rho\nabla u) = 0
       \label(eq.1){eq:custom:a} \\
   \nabla\cdot(\rho\nabla u) = 0
       \label[eq.2]{eq:custom:b} \\
   \nabla\cdot(\rho\nabla u) = 0
       \label[***1***]
\end{EQA}
I will refer to \eqref{eq:custom:a}
and \eqref{eq:custom:b}
```

$$\nabla \cdot (\rho \nabla u) = 0 \qquad \text{(eq.1)}$$

$$\nabla \cdot (\rho \nabla u) = 0 \qquad \text{eq.2}$$

$$\nabla \cdot (\rho \nabla u) = 0 \qquad \text{***1***}$$

I will refer to (eq.1) and (eq.2)

Note that custom label are always displayed even if not referenced.

6 Label positioning

It is possible to change the default position of a single label by the commands:

- `\eqlabeltop`
- `\eqlabelbot`
- `\eqlabelcenter`

For example:

```
\eqlabeltop
\begin{EQ}\label[TOP]
   \nabla\cdot(\rho\nabla u) = 0 \\
   \nabla\cdot(\rho\nabla u) = 0
\end{EQ}
**********************************
\eqlabelbot
\begin{EQ}\label[BOT]
   \nabla\cdot(\rho\nabla u) = 0 \\
   \nabla\cdot(\rho\nabla u) = 0
\end{EQ}
```

$$\nabla \cdot (\rho \nabla u) = 0 \qquad \text{TOP}$$
$$\nabla \cdot (\rho \nabla u) = 0$$

****

$$\nabla \cdot (\rho \nabla u) = 0$$
$$\nabla \cdot (\rho \nabla u) = 0 \qquad \text{BOT}$$

7 Sub-numbering

To sub-number equation, instead of use something like

```
\begin{subequations}
\begin{EQ}...

\end{EQ}
\end{subequations}
```

I prefer to use the `\label` command with the character `~` as a shortcut for the command `\theequation`. The following example shows the use:

```
\begin{EQA}[c]\yesnumber
   \nabla\cdot(\rho\nabla u) = 0 \label(~.A) \\
   \nabla\cdot(\rho\nabla u) = 0 \label(~.B) \\
   \nabla\cdot(\rho\nabla u) = 0 \label(~.C)
\end{EQA}
```

$$\nabla \cdot (\rho \nabla u) = 0 \tag{5.A}$$

$$\nabla \cdot (\rho \nabla u) = 0 \tag{5.B}$$

$$\nabla \cdot (\rho \nabla u) = 0 \tag{5.C}$$

the `\yesnumber` command is necessary to enforce the advancing of equation counter.

8 Use of fleqn and leqno option

You can use fleqn to left justify the equations or leqno to number equations on the left. For example:

```
\documentclass{article}
.
.
\usepackage[fleqn,leqno]{easyeqn}
.
.
```

and the following example shows the effect

```
\begin{EQA}[rcll]
   \nabla\cdot(\rho\nabla u)&=&f \qquad
      &\mbox{on $\Omega$}\yesnumber \\
   u&=&u_{0}&\mbox{on $A\subset\partial\Omega$}
      \yesnumber\\
   (\rho\nabla u)\!\cdot\!n&=&u_{1}
      &\mbox{on $B\subset\partial\Omega$}
        \label{eq:5}
\end{EQA}
it is referenced only \eqref{eq:5}!!
```

$$\nabla\cdot(\rho\nabla u) = f \qquad \text{on } \Omega \tag{6}$$

$$u = u_0 \qquad \text{on } A\subset\partial\Omega \tag{7}$$

$$(\rho\nabla u)\cdot n = u_1 \qquad \text{on } B\subset\partial\Omega \tag{8}$$

it is referenced only (8)!!

The same effect can be obtained everywhere using the commands `\equationleft` and `\numberleft` before defi ning the equation. To restore the default values use the commands `\equationcenter` and `\numberright` after the equation.

9 Cosmetic changes

It is possible to slighly modify the appearance of the equations. There are three parameters that can be changed:

left indent Whenever equations are left justifi ed, the left indent can be changed by the command `\eqleftmargin`.

```
\eqleftmargin{new indent}
```

for example

```
\eqleftmargin{1cm}
```

The default value for the left margin is `\leftmarginі`.

equation spacing The spacing of a formula, (default **7pt**) can be controlled by the command

```
\eqspacing{new spacing}
```

for example

```
\eqspacing{4pt}
```

column spacing The spacing among columns (default value **4pt**) can be changed by the command

```
\eqcolumnsep{new spacing}
```

for example

```
\eqcolumnsep{10pt}
```

row spacing The spacing among rows in multiple equations (default value **7pt**) can be changed by the command

```
\eqrowsep{new spacing}
```

for example

```
\eqrowsep{10pt}
```

for example

```
\eqrowsep{20pt}
\eqcolumnsep{10pt}
\eqspacing{1cm}
bla bla bla bla bla bla bla bla bla bla bla bla
\begin{EQ}[rcll]
   \nabla\cdot(\rho\nabla u)&=&f \qquad
      &\mbox{on $\Omega$} \\
   u&=&u_{0}&\mbox{on $A\subset\partial\Omega$} \\
   (\rho\nabla u)\cdot n&=&u_{1}
      &\mbox{on $B\subset\partial\Omega$}
\end{EQ}
nonsense, nonsense, nonsense, monsense, nonsense
```

---

bla bla bla bla bla bla bla bla bla bla bla bla

$$\begin{aligned} \nabla\cdot(\rho\nabla u) &= f && \text{on } \Omega \\ u &= u_0 && \text{on } A\subset\partial\Omega \\ (\rho\nabla u)\cdot n &= u_1 && \text{on } B\subset\partial\Omega \end{aligned}$$

nonsense, nonsense, nonsense, monsense, nonsense

10 Additional macros

Using the package as follow

```
\documentclass{article}
.
.
\usepackage[...,math]{easyeqn}
.
.
```

as additional macros useful for typesetting mathematics can be invoked. The macros are defined as `\frac`, `\dfrac`, `\tfrac`, `\binom` and `\boxed` and their use is described in the following example:

```
\begin{EQ}[rclrcl]
    \frac[1pt]{\frac{1}{2}}{\frac{1}{2}}
    & = & \frac{\frac{1}{2}}{\frac{1}{2}} \qquad &
    \dfrac{\frac{1}{2}}{\frac{1}{2}}
    & = & \dfrac{\frac[0pt]{1}{2}}{\frac{1}{2}} \\
   \tfrac{1}{2} &=& \frac{1}{2}\qquad &
   \binom{n-1}{n-k} && \boxed{a+b}
\end{EQ}
```

$$\frac{\frac{1}{2}}{\frac{1}{2}} = \frac{\frac{1}{2}}{\frac{1}{2}} \qquad \frac{\frac{1}{2}}{\frac{1}{2}} = \frac{1}{\frac{2}{\frac{1}{2}}}$$

$$\tfrac{1}{2} = \frac{1}{2} \qquad \binom{n-1}{n-k} \qquad \boxed{a+b}$$

Definition of the macro `\eqbox` and its effect:

```
\[
  \eqbox{1+\dfrac{1}{2}} \qquad
  \eqbox(1pt,20pt){1+\dfrac{1}{2}} \qquad
  \eqbox(5pt,5pt){1+\dfrac{1}{2}}
\]
```

$$\boxed{1+\frac{1}{2}} \qquad \boxed{1+\frac{1}{2}} \qquad \boxed{1+\frac{1}{2}}$$

Definition of the macros `\norm` and `\abs` and their effect:

```
\[ \norm{A}, \qquad \abs{A} \]
```

$$\|A\|, \qquad |A|$$

Definition of the macro `\ParDer` and its effect:

```
\[
  \ParDer[xyyz]{f(x,y,z)}, \qquad
  \ParDer[{x^{2}}{x^{2}}{x^{2}}y\alpha]{f(x,y,z)}
\]
```

$$\frac{\partial^4 f(x,y,z)}{\partial x \partial y^2 \partial z}, \qquad \frac{\partial^5 f(x,y,z)}{\partial x^{2\,3} \partial y \partial \alpha}$$

Notice the single item of the derivatives must be a single letter (or a macro) or must be inside a group **{ ... }**. If you use `\ParDer` with package EASYVECTOR remember to put macros in brace when use "[ ]" as follows:

```
\[ \xx,\xx[i,j] =
   \ParDer[\xx\xx{\xx[i,j]}\yy]{f(x,y,z)} \]
```

$$\mathbf{x}, x_{i,j} = \frac{\partial^4 f(x,y,z)}{\partial \mathbf{x}^2 \partial x_{i,j} \partial \mathbf{y}}$$

otherwise you obtain weird results like the following

```
\[ \ParDer[\xx\xx\xx[i,j]\yy]{f(x,y,z)} \]
```

$$\frac{\partial^7 \mathbf{y}}{\partial \mathbf{x}^3 \partial [\partial i \partial, \partial j}] f(x,y,z)$$

Definition of the macros `\DIV`, `\GRAD` and `\LAPLA` and their effect:

```
\[ \DIV{A}, \qquad \GRAD{B}, \qquad \LAPLA{C} \]
```

$$\nabla \cdot A, \qquad \nabla B, \qquad \Delta C$$

Definition of the macro `\SUM` and its effect:

```
\[
  \SUM{i=1}{100}a_{i},\quad
  \SUM[10]{i=1}{100}a_{i}
\]
```

$$\sum_{i=1}^{100} a_i, \quad \sum_{i=1}^{100}{}^{(10)} a_i$$

Definition of the macro `\PROD` and its effect:

```
\[
  \PROD{i=1}{100}a_{i},\quad
  \PROD[10]{i=1}{100}a_{i}
\]
```

$$\prod_{i=1}^{100} a_i, \quad \prod_{i=1}^{100}{}^{(10)} a_i$$

The environment ARRAY is defined, is a simple subset of the environment array with a different spacing; look the following example

```
\[
  \left(\begin{array}{cc}
    1        & \frac{1}{2} \\
        \sqrt{3} & \frac{2}{\sqrt{3}}
  \end{array}\right), \qquad
  \left(\begin{ARRAY}{cc}
    1        & \frac{1}{2} \\
        \sqrt{3} & \frac{2}{\sqrt{3}}
  \end{ARRAY}\right),
\]
```

$$\left(\begin{array}{cc} 1 & \frac{1}{2} \\ \sqrt{3} & \frac{2}{\sqrt{3}} \end{array} \right), \qquad \left(\begin{ARRAY}{cc} 1 & \frac{1}{2} \\ \sqrt{3} & \frac{2}{\sqrt{3}} \end{ARRAY} \right),$$

The environment MATRIX is defined, is a simple replacement of `\matrix` command with a different spacing; look the following example

```
\[
  \matrix{
    1        & \frac{1}{2} \cr
    \sqrt{3} & \frac{2}{\sqrt{3}}
  }, \qquad
  \begin{MATRIX}
    1        & \frac{1}{2} \cr
    \sqrt{3} & \frac{2}{\sqrt{3}}
  \end{MATRIX},
\]
```

$$\begin{matrix} 1 & \frac{1}{2} \\ \sqrt{3} & \frac{2}{\sqrt{3}} \end{matrix}, \qquad \begin{MATRIX} 1 & \frac{1}{2} \\ \sqrt{3} & \frac{2}{\sqrt{3}} \end{MATRIX},$$

11 Test `latex2html` interface

A file named `easyeqn.perl` is furnished for interfacing macros with perl program `latex2html`. The effect is to generate better HTML images of equations. For example the following equation has equation number always aligned on the right of the page:

$$1 \neq \frac{1}{2} \tag{eqn}$$

While equation array equations are also splitted in a table to maintain alignement on resize:

$$1 \neq \frac{1}{2} \tag{A}$$

$$-\frac{1}{3} \neq \frac{1}{3} \tag{B}$$

$$1 \neq \frac{2}{3} \tag{C}$$

$$\frac{2}{3} \neq \frac{4}{3} \tag{D}$$