

simples-matrices user guide*

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Abstract

A package to write matrices which are defined with a list of comma separated coefficients read by row.

A macro enables the definition of a named matrix, another enables the writing of a named matrix. This package provides also some shortcuts for identity matrices and null matrices.

The name of this package and of its macros are French based for there are already too many macros using the word “matrix” itself. The French “simples matrices” means “simple matrices”. *Just a letter apart!*

Résumé

Une extension pour écrire des matrices en donnant les coefficients par ligne sous la forme d’une liste de valeurs séparées par des virgules.

Une macro permet de définir des matrices nommées et une autre permet d’écrire les matrices nommées. L’extension fournit également quelques raccourcis pour les matrices identité et les matrices nulles.

La documentation française pour l’utilisateur de l’extension `simples-matrices` est disponible sous le nom de `simples-matrices-fra`.

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In memory of my maternal grandmother Adrienne BINAUT (1908-03-23 – 1997-06-08).

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The package `simples-matrices` requires `xparse` and `l3keys2e` used to define macros and manage key-options. It loads `amsmath` as well for ensuring a correct presentation of matrices.

Beware: you have to provide the suitable mathematical environment to use the macros which print a matrix. Only the unstarred version of `\declarermatrice` may be used outside math-mode.

1 The Macros

`simples-matrices` offers six main document macros.

1.1 Main Macros

This package has five main document macros viz.

<code>\matrice</code>	<code>\matrice(<prefix>) < <clist of key-value pairs> > [<type>]{<clist of coefficients>}</code>
-----------------------	--

where `<prefix>` has the same meaning as the key `prefix`; `<clist of key-value pairs>`, optional and void by default, can be used to redefine the matrix-like environment; `<type>` is a string of character the usage of which is explained later —see 3.1.2— and `<clist of coefficients>` is a clist of the coefficients of the matrix given by row order.

The French *matrice* means “matrix”.

With `\(\matrice{1, 2, 3, 4}\)` we obtain $\begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$.

With `\(\matrice(b)[3]{1, 2, 3, 4, 5, 6}\)` we obtain $\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix}$.

<code>\declarermatrice</code>	<code>\declarermatrice*(<prefix>) < <clist of key-value pairs> > {<matrix name>}[<type>]{<clist of coefficients>}</code>
-------------------------------	--

where `<matrix name>` is the name of the matrix to be used afterwards. The other arguments, optional or mandatory, have the same meaning than above. The starred version defines and prints the matrix. The unstarred version only defines it.

The definition is global but one can redefine an existing named matrix with the same function. **No check is done** to ensure that one is not redefining a previously defined matrix.

The French *déclarer une matrice* means “declare a matrix”.

\lamatrice `\lamatrice(<prefix>) <clist of key-value pairs> > {\matrix name}`

prints the previously defined matrix the name of which is given by $\langle matrix name \rangle$. The two optional arguments have the meaning as before.

The French *la matrice* means “the matrix”.

\MatriceInterieur `\MatriceInterieur`

gives the inner part of the last printed —via `\matrice`— or defined —via `\declarermatrice`— matrix. It can be used inside an `array`-like environment.

The French should be *intérieur de la matrice* which means “inside of the matrix”. What is implicit is the adjective “anonymous”. For named matrix see below.

\LaMatriceInterieur `\LaMatriceInterieur{\matrix name}`

gives the inner part of the matrix with name $\langle matrix name \rangle$. It can be used inside an `array`-like environment.

Again false French but the parallel with `\lamatrice` should suggest that, now, the matrix has a name and we have to use it.

See examples on page 4.

1.2 Setting the Keys

One can change the values of the keys of `simples-matrices` with

\simplesmatricessetup `\simplesmatricessetup{\clist of key-value pairs}`

where $\langle clist of key-value pairs \rangle$ is the usual clist of key-value pairs setting one or many of the three keys of the package as presented on page 4.

To stick to established convention the name of this macro is created from the name of the package (reduced to T_EX letters) followed by *setup*. I apologize for that strange linguistic mixture.

1.3 Shortcuts

There are also two *shortcut* macros:

\matid `\matid(<prefix>) <clist of key-value pairs> > [{coefficient}]{number of columns}`

which write the identity matrix — by default — with $\langle number of columns \rangle$ columns. If $\langle coefficient \rangle$ is given, we obtain a diagonal matrix with all its coefficients equal to $\langle coefficient \rangle$.

The two first optional arguments have the same functionality as in the preceding macros.

matid stands for “matrice identité” which means “identity matrix”.

\matnulle `\matnulle(<prefix>) <clist of key-value pairs> > [{coefficient}]{number of columns}`

writes the null matrix with $\langle number of columns \rangle$ columns —by default— or a matrix containing with $\langle number of columns \rangle$ columns and all coefficients equal to $\langle coefficient \rangle$.

The two first optional arguments have the same functionality as in the preceding macros.

matnulle stands for “matrice nulle” which means “null matrix”.

```
\(\matid{3}\)\qquad \(\matid[9]{3}\)
\par \medskip
\(\matnulle{3}\)\qquad \(\matnulle[2]{3}\)
```

$$\begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix} \quad \begin{pmatrix} 9 & 0 & 0 \\ 0 & 9 & 0 \\ 0 & 0 & 9 \end{pmatrix}$$

$$\begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix} \quad \begin{pmatrix} 2 & 2 & 2 \\ 2 & 2 & 2 \\ 2 & 2 & 2 \end{pmatrix}$$

2 The Package Options

The package uses key-value options. There are four keys: `envir`, `prefix`, `typeord` and `argopt`.

envir (*string*) the main and last part of the name of the environment used to print the matrix. Its initial value is `matrix`.

prefix (*string*) a string which is prefixed to `envir` to obtain the complete name of the environment. Its initial value is `p`. Therefore, by default, the environment used to print the matrix is `bmatrix` as defined by `amsmath`.

typeord (*string*) a string which is the ordinary —i. e. default— value of the $\langle type \rangle$ optional argument. The initial value of the key is `C`.

argopt (*token list*) for French *argument optionnel* (optional argument). That key is initially void. See page 7 for usage.

Moreover, an other key is available which is not an option of the package: `out-of-box` which is a metakey.

With `\simplesmatrixessetup{out-of-box}` we obtain the same effect as with `\simplesmatrixessetup{prefix=p, envir=matrix, argopt=, typeord=C}`.

3 Examples

3.1 Without any special package

That is with only `amsmath` loaded as done by this package.

3.1.1 Declaration and Usage

```
\declarermatrice{A}{1, 2, 300, 400}
\(\declarermatrice*{B}{a, b, c, d}\)
\qquad \(\lamatrice{A}\) \par \bigskip
\(\lamatrice(V){A}\)
\qquad \(\lamatrice(b){B}\)
```

$$\begin{pmatrix} a & b \\ c & d \end{pmatrix} \quad \begin{pmatrix} 1 & 2 \\ 300 & 400 \end{pmatrix}$$

$$\left\| \begin{array}{cc} 1 & 2 \\ 300 & 400 \end{array} \right\| \quad \begin{bmatrix} a & b \\ c & d \end{bmatrix}$$

3.1.2 The “type” argument

The last but one — optional — argument of macros `\matrice` and `\declarermatrice` defaults to `0`. In that case the value of the key `typeord` is used to determine the *type* of the matrix input, see 6.

Its value can be a number, in which case it is the number of columns, or a string —presently a one letter string— among: `C`, `D`, `I`, `J`, `S`, `T` and `x`.

`C` means square matrix for French “Carré” means “square”.

$\begin{array}{l} \backslash[\\ \backslashmatrice\{1, 2, 3, 4, 5, 6, 7, 8, 9\} \\ \backslashquad \\ \backslashmatrice[C]\{1, 2, 3, 4, 5, 6, 7, 8, 9\} \\ \backslash] \end{array}$	$\begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{pmatrix} \quad \begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{pmatrix}$
--	---

`D` means **diagonal** matrix.

$\begin{array}{l} \backslash[\\ \backslashmatrice\{1, 2, 3, 4\}\backslashquad \\ \backslashmatrice[D]\{1, 2, 3, 4\} \\ \backslash] \end{array}$	$\begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix} \quad \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 2 & 0 & 0 \\ 0 & 0 & 3 & 0 \\ 0 & 0 & 0 & 4 \end{pmatrix}$
--	---

`I` means lower triangular matrix. French “Inférieur” means “lower”; `J` means lower triangular matrix with zeros on the diagonal.

$\begin{array}{l} \backslash[\\ \backslashmatrice[I]\{1, 2, 3\}\backslashquad \\ \backslashmatrice[J]\{1, 2, 3\} \\ \backslash] \end{array}$	$\begin{pmatrix} 1 & 0 \\ 2 & 3 \end{pmatrix} \quad \begin{pmatrix} 0 & 0 & 0 \\ 1 & 0 & 0 \\ 2 & 3 & 0 \end{pmatrix}$
---	--

`S` means upper triangular matrix. French “Supérieur” means “upper”; `T` means upper triangular matrix with zeros on the diagonal.

$\begin{array}{l} \backslash[\\ \backslashmatrice[S]\{1, 2, 3\}\backslashquad \\ \backslashmatrice[T]\{1, 2, 3\} \\ \backslash] \end{array}$	$\begin{pmatrix} 1 & 2 \\ 0 & 3 \end{pmatrix} \quad \begin{pmatrix} 0 & 1 & 2 \\ 0 & 0 & 3 \\ 0 & 0 & 0 \end{pmatrix}$
---	--

`x` means `xcas`. With that value, one can copy-paste from `xcas` into the L^AT_EX document.

$\begin{array}{l} \backslash[\\ \backslashmatrice[x]\{[[7,1,3],[1,0,3],[5,1,2]]\} \\ \backslash] \end{array}$	$\begin{pmatrix} 7 & 1 & 3 \\ 1 & 0 & 3 \\ 5 & 1 & 2 \end{pmatrix}$
--	---

A number sets up the number of columns of the matrix.

$\begin{array}{l} \backslash[\\ \backslashmatrice[2]\{1, 2, 3, 4, 5, 6\} \\ \backslashquad \\ \backslashmatrice[3]\{1, 2, 3, 4, 5, 6\} \\ \backslash] \end{array}$	$\begin{pmatrix} 1 & 2 \\ 3 & 4 \\ 5 & 6 \end{pmatrix} \quad \begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{pmatrix}$
---	--

3.1.3 Using the “typeord” Key

In this document, the key `typeord` has the initial value of `C`.

```
\simplsmatrixsetup{typeord=3}
\(\matrice{1, 2, 3, 4, 5, 6}\)
\simplsmatrixsetup{typeord=2}
\(\matrice{1, 2, 3, 4, 5, 6}\)
\simplsmatrixsetup{typeord=C}
\(\matrice{1, 2, 3, 4}\)
```

$$\begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{pmatrix} \begin{pmatrix} 1 & 2 \\ 3 & 4 \\ 5 & 6 \end{pmatrix} \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$$

The preceding code is but a mere illustration. In order to declare a type for one matrix it's more convenient to use the optional argument. However if one wants to write a lesson about upper triangular matrices...

3.1.4 Using the `\(La)MatriceInterieur` Macros

```
\declarermatrice{B}[4]{
\hline ein, zwei, drei, vier,
\hline unos, dos, tres, cuatro,
\hline unu, du, tri, kvar}
\declarermatrice{A}[3]{one, two, three,
un, deux, trois, uno, due, tre}
\begin{tabular}{*{3}{l}}
\MatriceInterieur
\end{tabular}
\par \medskip
\begin{tabular}{|*{4}{l}|}
\LaMatriceInterieur{B}\hline
\end{tabular}
```

one two three
un deux trois
uno due tre

ein	zwei	drei	vier
unos	dos	tres	cuatro
unu	du	tri	kvar

3.2 Changing the Look

We can load other packages which deal with matrices such as `mathtools`, `delarray` or `nicematrix`. In that case we can change the look of our matrices thanks to the option-key `envir`, `prefix` and `argopt`.

This document loads the three packages `mathtools`, `delarray` and `nicematrix` in order to give the following examples.

3.2.1 With `mathtools`

As already stated above there are two ways to use the option-keys: through `\simplsmatrixsetup` or through the optional argument `< (list of pairs of key-value) >`. I show both.

```
\simplesmatrixessetup{
  envir=matrix*, prefix=p, argopt=[r]}
\(\matrice{1, 2, 30, 40}\) \quad
\simplesmatrixessetup{out-of-box}
\(\matrice{1, 2, 30, 40}\)
\par \medskip
\(\matrice(b)<envir=matrix*, argopt=[l]>
  {1, 2, 30, 40}\)
```

$$\begin{pmatrix} 1 & 2 \\ 30 & 40 \end{pmatrix} \quad \begin{pmatrix} 1 & 2 \\ 30 & 40 \end{pmatrix}$$

$$\begin{bmatrix} 1 & 2 \\ 30 & 40 \end{bmatrix}$$

3.2.2 With delarray

```
\simplesmatrixessetup{
  envir=array, prefix=,
  argopt=[c][l c r]\}
\(\matrice{1, 2, 30, 40}\) \quad
\(\matid(<envir=array,
  argopt={[c][l c r]\})>{3}\)
```

$$\left[\begin{array}{cc} 1 & 2 \\ 30 & 40 \end{array} \right] \quad \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

3.2.3 With nicematrix

```
\(\matrice<prefix=b, envir=NiceArray,
  argopt={[*]{2}{c}|cc}>{1, 2, 3, 4, 5, 6,
  7, 8, 9, 10, 11, 12, 13, 14, 15, 16}\)
```

$$\left[\begin{array}{cc|cc} 1 & 2 & 3 & 4 \\ 5 & 6 & 7 & 8 \\ 9 & 10 & 11 & 12 \\ 13 & 14 & 15 & 16 \end{array} \right]$$

In that case we need to double the curly braces around the column descriptors of the `array` environment because the first level is stripped off by \LaTeX when valuating the key.

In the following example, for the second matrix, it is not necessary to surround the value of `argopt` with an extra pair of curly braces —even if it is not dangerous— for the presence of `[margin]` prevents \LaTeX to strip off the curly braces.

```
\(\matrice<prefix=b, envir=NiceArray,
  argopt={\l c r}>{1, 2, 3, 40, 50, 60,
  700, 800, 900}\)
\par \medskip
\(\matrice<prefix=b, envir=NiceArray,
  argopt={\l c r}[margin]>{1, 2, 3,
  40, 50, 60, 700, 800, 900}\)
\par \medskip
\(\matrice<prefix=b, envir=NiceArray,
  argopt={\l c r}[margin]}>{1, 2, 3,
  40, 50, 60, 700, 800, 900}\)
```

$$\left[\begin{array}{ccc} 1 & 2 & 3 \\ 40 & 50 & 60 \\ 700 & 800 & 900 \end{array} \right]$$

$$\left[\begin{array}{ccc} 1 & 2 & 3 \\ 40 & 50 & 60 \\ 700 & 800 & 900 \end{array} \right]$$

$$\left[\begin{array}{ccc} 1 & 2 & 3 \\ 40 & 50 & 60 \\ 700 & 800 & 900 \end{array} \right]$$

Le TeXnicien de Surface scripsit.
