Unit.sty – small macros for scientific documents

Masao Kitano

2002/02/15

1 Introduction

This style file is a collection of small macros for writing documents including mathematical and physical formulea.

2 The Macros

2.1 Units

Symbols for units should be printed in a roman type in order to avoid possible confusion with physical quantities which are to be printed in an italic type. For example,

$$M = 3.5\,\mathrm{Mg}, \quad V = lhw = 24\,\mathrm{ml}, \quad f = 1/T = 4.5\,\mathrm{THz}$$

In the TeX math mode, however, all characters are printed in an italic type unless indicated otherwise. For example, simple typing `$m=10 kg$` gives a wrong result: $m = 10kg$. You should type as `$m=10\,\mathrm{kg}$` and get $m = 10\,\mathrm{kg}$ correctly. The macro `\U` is basically an abbreviation for `\mathrm`.

`\U` `\U{`*unit*`}`
By simply typing `$10\,\U{kg}$` in the math mode, you will have $10\,\mathrm{kg}$. In *unit*, you can use `O` and `u` instead of `\Omega` and `\mu`, respectively. Thus, `1.5\,\U{kO}` and `2.1\,\U{uA}` give $1.5\,\mathrm{k\Omega}$ and $2.1\,\mu\mathrm{A}$, respectively. (Use `\O` and `\u` for "O" and "u"; `10\,\U{\O e}` gives $10\,\mathrm{Oe}$.)

```
\def\U#1{{%
\def\O{\mbox{O}}
\def\u{\mbox{u}}
\mathcode`\u=\mu
\mathcode`\O=\Omega
\mathrm{#1}}}
```

`\degree` A small circle for the units of temperature and angles. `t=34\,\U{\degree C}` gives $t = 34\,^\circ\mathrm{C}$.

```
\def\degree{\mbox{$^\circ$}}
```

2.2 Literals

Literals and operators are recommended to be printed in a roman type. Otherwise a few letters (d, e, i, j) will be reserved for the special purposes and cannot be used for variables.

`\ii` The literal for the imaginary unit $\sqrt{-1}$. `\ii` gives i.

```
\def\ii{{\mathrm{i}}}
```

`\jj` It can also be printed as "j" by typing `\jj`. (Electrical engineers are still sticking to this notation for fear of the confusion with i, which typically represents a current. But "i" and "i" can well be distinguished.)

```
\def\jj{\,\mathrm{j}}                    % thin space before j
```

`\ee` The base of natural logarithm is just a literal. `\ee^{-x}` gives e^{-x}.

```
\def\ee{{\mathrm{e}}}
```

2.3 Operators

`\dd` The differential operator d can be typed as `\dd`. `\dd f/\dd t` yields $\mathrm{d}f/\mathrm{d}t$. (There may be someone who prefers d to d, but how can you express $\mathrm{d}d/\mathrm{d}t$ (the time derivative of a variable d)?)

```
\def\dd{{\mathrm{d}}}
```

`\Re` The real part of a complex number. `\Re z = (z + \cc)/2` gives $\mathop{\mathrm{Re}} z = (z + \mbox{c.c.})/2$.

```
\def\Re{\mathop{\mathrm{Re}}}
```

`\Im` The imaginary part of a complex number. `\Im z = (z - \cc)/2\ii` gives $\mathop{\mathrm{Im}} z = (z - \mbox{c.c.})/2\mathrm{i}$.

```
\def\Im{\mathop{\mathrm{Im}}}
```

`\cc` The complex conjugate for the previous term is often refered as c.c.. `\cos x = (\ee^{\jj x}+\cc)/2` gives $\cos x = (\mathrm{e}^{\mathrm{j}x} + \mbox{c.c.})/2$.

```
\def\cc{\mbox{c.c.}}
```

2.4 Quantum Mechanics

`\Hc` The hermitian conjugate for the previous term is often written as H.c..

```
\def\Hc{\mbox{H.c.}}
```

`\bra` `\bra{`*state*`}`
Dirac's bra vectors; `$\bra{\phi}$` yields $\langle \phi|$.

```
\def\bra#1{\langle #1|}
```

`\ket` `\ket{`*state*`}`
Dirac's ket vectors; `$\ket{\phi}$` yields $|\phi\rangle$.

```
\def\ket#1{|\mbox{$#1$}\rangle}
```

`\bracket` `\bracket{`*operator*`}`
Expectation value for an operator. `$\bracket{A}$` yields $\langle A\rangle$.

```
\def\bracket#1{\langle\mbox{$#1$}\rangle}
```

\bracketi

`\bracketi{`*state*`}{`*state*`}`
The inner product of two states. `$\bracketi{\phi}{\psi}$` yields $\langle\phi|\psi\rangle$.

```
\def\bracketi#1#2{\langle\mbox{$#1$}|\mbox{$#2$}\rangle}
```

\bracketii

`\bracketii{`*state*`}{`*operator*`}{`*state*`}`
The matrix element for an operator. `$\bracketi{\phi}{A}{\psi}$` yields $\langle\phi|A|\psi\rangle$.

```
\def\bracketii#1#2#3{\langle\mbox{$#1$}|\mbox{$#2$}|\mbox{$#3$}\rangle}
```

2.5 Vector Analysis

\diver

Divergence. `$\diver \vct{D}$` yields $\mathop{\mathrm{div}}\boldsymbol{D}$.

```
\def\diver{\mathop{\mathrm{div}}}
```

\curl

Curl. `$\curl\vct{H}$` yields $\mathop{\mathrm{curl}}\boldsymbol{H}$.

```
\def\curl{\mathop{\mathrm{curl}}}
```

\rot

Rotation. `$\rot\vct{E}$` yields $\mathop{\mathrm{rot}}\boldsymbol{E}$.

```
\def\rot{\mathop{\mathrm{rot}}}
```

\grad

Gradient. `$\grad\phi$` yields $\mathop{\mathrm{grad}}\phi$.

```
\def\grad{\mathop{\mathrm{grad}}}
```

2.6 Others

\sub

`\sub{`*subscript*`}` Descriptive subscripts should be printed in a roman type. `k\sub{B}` for k_{B}. ("B" for Boltzmann.)

```
\def\sub#1{_{\mbox{\scriptsize#1}}}
```

\sur

`\sur{`*surscript*`}` Descriptive surscripts should be printed in a roman type. `F\sur{(R)}` for $F^{\mathrm{(R)}}$.

```
\def\sur#1{^{\mbox{\scriptsize#1}}}
```

\vct

`\vct{`*letter*`}` Vectors should be printed in a bold italic type; `\vct{A}` for $\boldsymbol{A}$.

```
\def\vct#1{{\mathchoice{\mbox{\boldmath$#1$}}{\mbox{\boldmath$#1$}}%
  {\mbox{\scriptsize\boldmath$#1$}}{\mbox{\scriptsize\boldmath$#1$}}}}
```

\defeq

Define. `$p \defeq mv$` yields $p \stackrel{\mathrm{def}}{=} mv$.

```
\def\defeq{\stackrel{\rm def}{=}}
```

\ph

`\ph{`*variable*`}` Phasor (private version) `$\ph{E}$` yields $\tilde{E}$.

```
\def\ph#1{\tilde{#1}}                    % phasor
```

\fracpd

`\fracpd{`*numerator*`}{`*denominator*`}` Partial derivative. `$\displaystyle\fracpd{f}{x}$` yields $\displaystyle\frac{\partial f}{\partial x}$.

```
\def\fracpd#1#2{\frac{\partial#1}{\partial#2}}
```

3 Summary

macro	input	output
`\U{`*unit*`}`	`F=27\,\U{N/m^2}`	$F = 27\,\mathrm{N/m^2}$
	`I=1.3\,\U{uA}`	$I = 1.3\,\mu\mathrm{A}$
	`R=3.3\,\U{MO}`	$R = 3.3\,\mathrm{M\Omega}$
	`H=1.0\,\U{\O e}`	$H = 1.0\,\mathrm{Oe}$
`\degree`	`\theta=180\degree`	$\theta = 180^\circ$
`\ii`	`\exp \ii\omega t`	$\exp \mathrm{i}\omega t$
`\jj`	`\ee^{\jj\omega t}`	$\mathrm{e}^{\mathrm{j}\omega t}$
`\ee`	`\ee^{\ii\pi}=-1`	$\mathrm{e}^{\mathrm{i}\pi} = -1$
`\dd`	`\int f(x)\dd x`	$\int f(x)\mathrm{d}x$
`\Re`, `\Im`	`z = \Re z + \ii \Im z`	$z = \mathrm{Re}\, z + \mathrm{i}\,\mathrm{Im}\, z$
`\cc`	`\cos x = (\ee^{\ii x}+\cc)/2`	$\cos x = (\mathrm{e}^{\mathrm{i}x} + \mathrm{c.c.})/2$
`\bra{`*st*`}`, `\ket{`*st*`}`	`\bra{\phi}`, `\ket{\psi}`	$\langle\phi\vert$, $\vert\psi\rangle$
`\bracket{`*op*`}`	`\bracket{A}`	$\langle A\rangle$
`\bracketi{`*st*`}{`*st*`}`	`\bracketi{\phi}{\psi}`	$\langle\phi\vert\psi\rangle$
`\bracketii{`*st*`}{`*op*`}{`*st*`}`	`\bracketii{\phi}{A}{\psi}`	$\langle\phi\vert A\vert\psi\rangle$
`\diver`	`\diver\vct{B}=0`	$\mathrm{div}\,\boldsymbol{B} = 0$
`\curl`, `\rot`	`\curl\vct{E}=\rot\vct{E}=0`	$\mathrm{curl}\,\boldsymbol{E} = \mathrm{rot}\,\boldsymbol{E} = 0$
`\grad`	`\vct{E}=-\grad\phi`	$\boldsymbol{E} = -\,\mathrm{grad}\,\phi$
`\sub{`*subscript*`}`	`f\sub{max}`, `\theta\sub{B}`	f_{max}, θ_{B}
`\sur{`*surscript*`}`	`f\sur{max}`, `\theta\sur{(R)}`	f^{max}, $\theta^{(\mathrm{R})}$
`\vct{`*letter*`}`	`\vct{K}`, `\vct{\Omega}`	$\boldsymbol{K}$, $\boldsymbol{\Omega}$
	`\ee^{\ii\vct{k}\cdot\vct{x}}`	$\mathrm{e}^{\mathrm{i}\boldsymbol{k}\cdot\boldsymbol{x}}$
`\defeq`	`k_0\defeq \omega_0/c`	$k_0 \stackrel{\mathrm{def}}{=} \omega_0/c$
`\fracpd{`*numerator*`}{`*denominator*`}`	`\displaystyle\fracpd{f}{t}`	$\dfrac{\partial f}{\partial t}$
`\ph{`*variable*`}`	`\ph{V}\ee^{\ii\nu t}+\cc`	$V\mathrm{e}^{\mathrm{i}\nu t} + \mathrm{c.c.}$