Mathematics
Professional style

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Overview

Packages for professional styling

Some packages very useful for mathematics and specifically for matrix computations are listed here below:

- *mathtools* which is mainly an upgrade of the very well-known *amsmath* package (the backbone for mathematics with LaTeX),
- *physics* which provides macros to handle efficiently mathematics professional styling.

Various macros

Absolute value: `absolutevalue` command or the shorter form `abs`.
Automatic sizing, starred version to cancel it.
Examples:

$$|a|, \quad \left|a^2\right|, \quad \left|\frac{a}{b}\right|, \quad |\frac{a}{b}| \text{ (starred)}$$

Norm: `norm` command. Automatic sizing, starred version to cancel it.
Examples:

$$\|a\|, \quad \left|a^2\right|, \quad \left\|\frac{a}{b}\right\|, \quad \|\frac{a}{b}\| \text{ (starred)}$$

Order: `order` command. Automatic sizing, starred version to cancel it.
Examples:

$$\mathcal{O}(x), \quad \mathcal{O}(x^2), \quad \mathcal{O}\left(\frac{1}{x}\right), \quad \mathcal{O}(\frac{1}{x}) \text{ (starred)}$$

Named functions

Named functions, such as trigonometric (sinus, cosinus, etc.) or logarithmic, must be written in upright font because they are not variables. To do so, *mathtools* defines intuitive commands and *physics* extends them. For instance, `sin` for a sinus and `log` for logarithm, which are actually the true notations. An optional argument allows to pass a power to the function. Compare the wrong and correction notations:

- $sin(x)$ VS $\sin(x)$,
- $log(x)$ VS $\log^2(x)$,
- $Re(z)$ VS $\operatorname{Re}(z)$ ($\Re(z)$ still accepted).

Vectors
Notations

Basic style: to indicate that a variable is a vector and not a scalar, people usually put an arrow above the variable, especially for handwritten documents. Tool: `vec` command.
Example:

$$\vec{a}, \quad \|\vec{a}\|$$

Professional style: professional vector notation consists in putting the variable in bold font. Tool: `vectorbold` command, or the shorter form `vb`, from the *physics* package.
In addition, unit vectors should be written in bold font with a hat. Tool: `vectorunit`, or the shorter form `vu`.
Example:

$$\mathbf{a}, \quad \|\mathbf{a}\|, \quad \mathbf{a} = a_x\widehat{\mathbf{i}} + a_y\widehat{\mathbf{j}} + a_z\widehat{\mathbf{k}}$$

Vectors
Operators

Products:

- inner/scalar/dot product → `dotproduct`, `vdot`,
- cross product → `crossproduct`, `cross`, `cp`.

Examples:

$$\mathbf{a} \cdot \mathbf{b}, \quad \mathbf{a} \times \mathbf{b}$$

Gradient-based operators:

- gradient/nabla → `gradient`, `grad`,
- divergence → `divergence`, `div`,
- curl/rotational → `curl`
- Laplace operator/Laplacian → `laplacian`.

Examples:

$$\boldsymbol{\nabla}\Psi, \quad \boldsymbol{\nabla}\cdot, \quad \boldsymbol{\nabla}\times, \quad \nabla^2\Psi$$

Differentials and derivatives

Differential: the 'd' symbol must be in upright font because it is not a variable. Tool: `differential`, or the shorter form `dd`. Optional argument to pass the power.

Examples:

$$\mathrm{d}, \quad \mathrm{d}x, \quad \mathrm{d}^2x, \quad \mathrm{d}(\cos\theta)$$

Derivative: same remark as for differential. Very long to write with "regular" LaTeX. Tools: `derivative` or `dv` for "normal" derivative and `partialderivative` or `pdv` for partial derivative. Starred version to make it *inline*.

Examples:

$$\frac{\mathrm{d}}{\mathrm{d}t}, \quad \frac{\mathrm{d}f}{\mathrm{d}x}, \quad \frac{\mathrm{d}}{\mathrm{d}\theta}\big(\cos^2(\theta)\big), \quad \frac{\partial^n f}{\partial x^n}, \quad \frac{\partial^2 f}{\partial x \partial y}$$