Algorithm 1 Smoothing estimates of the orientation using optimization

HELLO WORLD

1 Delimiters

See how the delimiters are of reasonable size in these examples

$$(a+b)\left[1-\frac{b}{a+b}\right]=a\,,$$

$$\sqrt{|xy|}\leq\left|\frac{x+y}{2}\right|,$$

even when there is no matching delimiter

$$\int_a^b u\frac{d^2v}{dx^2}\,dx=\left.u\frac{dv}{dx}\right|_a^b-\int_a^b\frac{du}{dx}\frac{dv}{dx}\,dx.$$

2 Spacing

Differentials often need a bit of help with their spacing as in

$$\iint xy^2\,dx\,dy=\frac{1}{6}x^2y^3,$$

whereas vector problems often lead to statements such as

$$u=\frac{-y}{x^2+y^2}\,,\quad v=\frac{x}{x^2+y^2}\,,\quad\text{and}\quad w=0\,.$$

Occasionally one gets horrible line breaks when using a list in mathematics such as listing the first twelve primes $2,3,5,7,11,13,17,19,23$ In such cases, perhaps include `\mathcode`\,="213B` inside the inline maths environment so that the list breaks: $2\,,3\,,5\,,7\,,11\,,13\,,17\,,19\,,23\,,29\,,31\,,37$. Be discerning about when to do this as the spacing is different.

3 Arrays

Arrays of mathematics are typeset using one of the matrix environments as in

$$\begin{bmatrix}1&x&0\\0&1&-1\end{bmatrix}\begin{bmatrix}1\\y\\1\end{bmatrix}=\begin{bmatrix}1+xy\\y-1\end{bmatrix}.$$

Case statements use cases:

$$|x|=\begin{cases}x, & \text{if } x\geq 0\,,\\ -x, & \text{if } x<0\,.\end{cases}$$

Many arrays have lots of dots all over the place as in

$$\begin{matrix}-2&1&0&0&\cdots&0\\1&-2&1&0&\cdots&0\\0&1&-2&1&\cdots&0\\0&0&1&-2&\ddots&\vdots\\\vdots&\vdots&\vdots&\ddots&\ddots&1\\0&0&0&\cdots&1&-2\end{matrix}$$

4 Equation arrays

In the flow of a fluid film we may report

$$\begin{aligned}u_\alpha &= \epsilon^2\kappa_{xxx}\left(y-\frac{1}{2}y^2\right), &&(1)\\ v &= \epsilon^3\kappa_{xxx}y\,, &&(2)\\ p &= \epsilon\kappa_{xx}\,. &&(3)\end{aligned}$$

Alternatively, the curl of a vector field (u,v,w) may be written with only one equation number:

$$\begin{aligned} \omega_1 &= \frac{\partial w}{\partial y} - \frac{\partial v}{\partial z}, \\ \omega_2 &= \frac{\partial u}{\partial z} - \frac{\partial w}{\partial x}, \\ \omega_3 &= \frac{\partial v}{\partial x} - \frac{\partial u}{\partial y}. \end{aligned} \tag{4}$$

Whereas a derivation may look like

$$\begin{aligned} (p \wedge q) \vee (p \wedge \neg q) &= p \wedge (q \vee \neg q) \quad \text{by distributive law} \\ &= p \wedge T \quad \text{by excluded middle} \\ &= p \quad \text{by identity} \end{aligned}$$

5 Functions

Observe that trigonometric and other elementary functions are typeset properly, even to the extent of providing a thin space if followed by a single letter argument:

$$\exp(i\theta) = \cos\theta + i\sin\theta\,, \quad \sinh(\log x) = \frac{1}{2}\left(x - \frac{1}{x}\right).$$

With sub- and super-scripts placed properly on more complicated functions,

$$\lim_{q\to\infty} \|f(x)\|_q = \max_x |f(x)|,$$

and large operators, such as integrals and

$$\begin{aligned} e^x &= \sum_{n=0}^{\infty} \frac{x^n}{n!} \quad \text{where } n! = \prod_{i=1}^{n} i\,, \\ \overline{U_\alpha} &= \bigcap_\alpha U_\alpha\,. \end{aligned}$$

In inline mathematics the scripts are correctly placed to the side in order to conserve vertical space, as in $1/(1-x) = \sum_{n=0}^\infty x^n$.

6 Accents

Mathematical accents are performed by a short command with one argument, such as

$$\tilde f(\omega) = \frac{1}{2\pi}\int_{-\infty}^{\infty} f(x)e^{-i\omega x}\,dx\,,$$

or

$$\dot{\vec\omega} = \vec r \times \vec I\,.$$

7 Command definition

The Airy function, $\operatorname{Ai}(x)$, may be incorrectly defined as this integral

$$\operatorname{Ai}(x) = \int \exp(s^3 + isx)\,ds\,.$$

This vector identity serves nicely to illustrate two of the new commands:

$$\boldsymbol{\nabla} \times \boldsymbol{q} = \boldsymbol{i}\left(\frac{\partial w}{\partial y} - \frac{\partial v}{\partial z}\right) + \boldsymbol{j}\left(\frac{\partial u}{\partial z} - \frac{\partial w}{\partial x}\right) + \boldsymbol{k}\left(\frac{\partial v}{\partial x} - \frac{\partial u}{\partial y}\right).$$

Recall that typesetting multi-line mathematics is an art normally too hard for computer recipes. Nonetheless, if you need to be automatically flexible about multi-line mathematics, and you do not mind some rough typesetting, then perhaps invoke `\parbox` to help as follows:

$$u_1 = -2\gamma\epsilon^2 s_2 + \mu\epsilon^3\big(\tfrac{3}{8}s_2 + \tfrac{1}{8}s_1 i\big) + \epsilon^3\big(-\tfrac{81}{32}s_4 s_2^2 - \tfrac{27}{16}s_4 s_2 s_1 i + \tfrac{9}{32}s_4 s_1^2 + \tfrac{27}{32}s_3 s_2^2 i - \tfrac{9}{16}s_3 s_2 s_1 - \tfrac{3}{32}s_3 s_1^2 i\big) + \int_a^b 1 - 2x + 3x^2 - 4x^3\,dx$$

Also, sometimes use `\parbox` to typeset multiline entries in tables.

8 Theorems et al.

Definition 1 (right-angled triangles) *A* right-angled triangle *is a triangle whose sides of length a, b and c, in some permutation of order, satisfies $a^2 + b^2 = c^2$.*

Lemma 2 *The triangle with sides of length 3, 4 and 5 is right-angled.*

This lemma follows from the Definition 1 as $3^2 + 4^2 = 9 + 16 = 25 = 5^2$.

Theorem 3 (Pythagorean triplets) *Triangles with sides of length $a = p^2 - q^2$, $b = 2pq$ and $c = p^2 + q^2$ are right-angled triangles.*

Prove this Theorem 3 by the algebra $a^2 + b^2 = (p^2 - q^2)^2 + (2pq)^2 = p^4 - 2p^2q^2 + q^4 + 4p^2q^2 = p^4 + 2p^2q^2 + q^4 = (p^2 + q^2)^2 = c^2$.