Scientific writing and research ethics

Structure and language of scientific articles

Presentation based on:
N.J. Higham
Handbook of writing for the Mathematical Sciences
SIAM, 1993, 1998

Uppsala, November 30, 2020

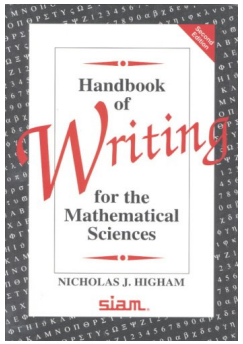
Good writing ... is clear thinking made visible. (A. Bierce, 1937)

- In order to write a good article we have to think clearly and know what do we want to say.
- Next comes the question how to say/write it.
- Writing is difficult!
  However, correcting a draft is easier than starting from scratch.

How to proceed?

Ask Google on 'Scientific writing':

2020 1 040 000 000 references
2019 341 000 000 references
2018 692 000 000 references
2017 22 400 000 references
2016 21 400 000 references



Plan:

- Ingredients of Mathematical writing
  - symbols
  - words against symbols
  - definitions, theorems, ...
- English usage
  - Abbreviations
  - 'a', 'an', 'the' ...
  - overused words
  - consistency
  - ...
- When English is a foreign language
  - Thinking in English
  - Construction, phrases
  - Spelling

Notations:

- unambiguous
- easy to remember
- no harmful second meanings
- profit from useful second meanings

Let $\widehat{H}_k = Q_k^H \widetilde{H} Q_k$
Partition $X = [X_1, X_2]$ and let $\widetilde{X} = range(X_1)$
Follow the conventions:

- where $\delta(x - x_1)$ is the Dirac delta function
- we can use a defect-correction method:
  compute a correction $\delta u^{(0)}(x_i)$ and let $u^{(1)} = u^{(0)} + \delta u^{(0)}$

'Words versus symbols' guidelines

- Use words as long as they do not take too much space, compared to symbols; explain in words what the symbols mean.
- Use symbols for a precise mathematical statement or if the idea would be too cumbersome to express only with words.

Since $\|g'(0)\| > 1$, 0 is a repelling fixed point, so $x_k \not\to 0$ as $k \to \infty$.
Since $\|g'(0)\| > 1$, zero is a repelling fixed point, so x_k does not tend to zero as $k \to \infty$.

$\forall$	for all
$\exists$	there exists
$\Rightarrow$	it follows that
$\neq 0$	nonzero

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  The general form of the estimate has the form

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If $x > 1$ $f(x) < 0$.	If $x > 1$, $f(x) < 0$.
If $x > 1$, then $f(x) < 0$.	

$$\begin{cases} \text{For } n = 2 \text{ (1) holds with } \delta = 0. \\ \text{For } n = 2, \text{ equation (1) holds with } \delta = 0. \end{cases}$$

General rule: 'A' (not unique) or - 'The' (unique)

$$\begin{cases} \text{Let the Schur decomposition of } A \text{ be } Q\Lambda Q^*. \\ \text{Let a Schur decomposition of } A \text{ be } Q\Lambda Q^*. \\ \text{Let } Q\Lambda Q^* \text{ be a Schur decomposition of } A. \\ \text{Let } A \text{ have a Schur decomposition } Q\Lambda Q^*. \end{cases}$$

Under what conditions does the method converge to the / a solution of $f(x) = 0$?

Miscellaneous

$$The \left\{ \begin{array}{l} k\text{-th} \\ k\text{'ht} \\ k^{th} \\ kth \end{array} \right\} term$$

$-8(b-a)^3/12\, f''(\eta)$ $\quad$ $-8((b-a)^3/12)\, f''(\eta)$

Definitions:

To think about:

why	is it necessary to include it?
where	minimize the distance between the definition and the first use, but before the first use
how	when there are multiple possibilities to define something, choose the one that is - short - consistent with related definitions - expressed in terms of fundamental properties - easy to understand.

'Normal matrix' - more than 70 ways to characterize it!

A graph is connected if there is a path from every vertex to every other vertex.

English usage - keep it simple!

- "A" or "AN"
  a uniformly convergent sequence
  an LAPAC routine
  a NAG routine
- Abbreviations

, i.e. (id est)	in other words which is to say	ie.
, e.g. (exempli gratia)	for example for instance	eg.
if and only if		iff
et al. (et alii)	and other people	et. al.
(et alia)	and other things	

Let's / It's / can't / don't

Gaussian Elimination (GE) is a method for solving a system of n linear equations in n unknowns. GE has a long history.

As stated in Theorem 2, ...

... as stated in the above / later theorem ...

Active versus passive

- The answer was provided to sixteen decimal places by Gaussian elimination.
- Gaussian elimination gave the answer to sixteen decimal places.
- Gaussian elimination gave the answer to sixteen decimal places.

Passive voice brings variety and is the choice when a specific information is missing:

The above subjects have been given serious research attention in the course of the last twenty years.

Active versus passive

- The following problem is next considered.
- Consider the problem ...

The Ten Commandments of Good Writing

1. Each pronoun should agree with their antecedent.
2. Just between you and I, case is important.
3. A preposition is a poor word to end a sentence with.
4. Verbs has to agree with their subject.
5. Don't use no double negatives.
6. Remember to never split an infinitive.
7. When dangling, don't use participles.
8. Join clauses good, like a conjunction should.
9. About sentence fragments.
10. Don't write a run-on sentence it is difficult when you got to punctuate it so it makes sense when the reader reads what you wrote.

Adjective and Adverb Abuse

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– The result is quite important.

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– The method for estimating the convergence rate ...

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– Euler is unstable.→ Euler's method is unstable.
– This sequence is Cauchy.→ This is a Cauchy sequence.

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– The method for convergence rate estimation ...
– The method for estimating the convergence rate ...
– Euler is unstable.→ Euler's method is unstable.
– This sequence is Cauchy.→ This is a Cauchy sequence.
– ... λ and μ are the coefficients of Lamé.
– ... λ and μ are the so-called Lamé coefficients.

It is interesting to consider how to ...

It is interesting to consider how to ...
It is ~~interesting~~ instructive to consider how to ...

nice, very, quite, rather

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nice, very, quite, rather

XX essentially derived the singular value decomposition.
XX derived the singular value decomposition for sparse, nonsingular matrices.

Ambiguous 'this' and 'it'

Always make it clear for the reader what is the entity under consideration.

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... preconditioners were first presented in [1,2] and are multilevel extensions of the methods in [3] and [4]. Here, block matrices are considered...

British versus American

British	American	British	American
behaviour	behavior	speciality	specialty
catalogue	catalog	travelling	traveling
centre	center	modelling	modeling
grey	gray	...yse	...yze
marvellous	marvelous	acknowledgement	acknowledgment
skilful	skillful	focussed	focused

Moral: (1) Be consistent! (2) Use dictionaries!

Common misspellings

Correct	Misspelled
analogous	analagous
dependent	dependant
discrete	discreet
to practise	to practice
led (past)	lead (present)
lose	loose
preceding	preceeding
referring	refering
separate	seperate
supersede	supercede
zeros	zeroes

Consistency

Use only one of: $ker(A)$, $null(A)$
Cholesky factorization, Cholesky decomposition
othogonalise, optimise
orthogonalize, optimize

OBS: Distinguish between:

- affect, effect
- alternate, alternative
- compare with, compare to
- compose (make up), comprise (to consist of), constitute

The course comprises three topics.
These three topics constitute the course.

'Which' versus 'That'

- Extra property (which)
  Consider the matrix A, which is symmetric, positive definite.
- Focus on a particular element
  Consider the matrix A, that is symmetric, positive definite.

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  Consider the matrix A, which is symmetric, positive definite.
- Focus on a particular element
  Consider the matrix A, that is symmetric, positive definite.

False 'If':
If we wish to compare the solution of $f - \lambda k(f) = 0$ and $f_n - \lambda k(f_n) = 0$, then XY shows that for a wide class of nonlinear functions $k(f)$, $\|f - f_n\| \leq c(\lambda \|k(f) - k(f_n)\|$.
When we wish to compare .... we can use XY's result that shows ...
To compare ... we can use ...

Hyphenation: 'ill'–'ill-'; 'well'–'well-'

{ This is an ill-posed problem.
  The problem is ill posed

{ The well-known theorem ...
  The theorem is well known.

{ An ill-conditioned function
  A very ill conditione function!

{ The second-order term...
  This term is of second order.

Variations:

Anglo-Saxon	French	Latin
ask	question	interrogate
rise	mount	ascend
good	marvellous	superior
show	establish	exhibit, demonstrate
need	requirement	necessity

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Simplifications:

conduct an investigation	investigate
in the course of	during
in the case that	if

Tenses

We ~~will~~ discuss this in Section ...
This ~~will be proven~~ is proved in Theorem 3.

Banach shows that ...
Banach showed that ...

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Banach shows that ...
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Refer to your earlier result:
I showed in [1] that ...
We showed in [1] ...
The author showed in [1] that ...
It was shown in [1] ...

When English is a foreign language

Thinking in English

capable to do	capable of doing
we have the possibility to obtain	we can obtain
this approach permits to exploit	this approach exploits
the solution has been known since ten years	the solution has been known for ten years

Articles: some rules

(1) Do not use "the" with plural or uncountable nouns when talking in general:
– Mathematics is interesting.
– Indefinite integrals do not always have a closed form solution..

(2) Do not use singular countable names/nouns without articles:
– a derivative is ...
– the derivative is ...
but not 'derivative is...

Theorem shows that ...

Following properties are basic.

Constructions:

Let ... be ...
Suppose (that) ... is/are ...
We define ... to be ...
It is straightforward to see that ...
If ... then ...
A lower bound for ...
By substituting .... into .... we obtain ...

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A lower bound for ...
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Let $\{v_i\}_{i=1}^n$ be the eigenvectors of A and $\{\lambda_i\}_{i=1}^n$ are the corresponding eigenvalues.

Thinking in English, cont.

A greater flexibility of non-conforming Finite Elements comparing them with the conforming ones, makes them attractive for application to the solution of the problems, which are difficult to solve by the conforming Finite elements due to various so called locking phenomena.

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We give up and rewrite:

Thinking in English, cont.

A greater flexibility of non-conforming Finite Elements comparing them with the conforming ones, makes them attractive for application to the solution of the problems, which are difficult to solve by the conforming Finite elements due to various so called locking phenomena.

Due to the so-called locking phenomena, some problems turn out to be difficult to solve using conforming Finite elements. The locking effect is circumvented by using the more flexible non-conforming finite element.

Thinking in English, cont.

Because one pair-member has to receive before send data and vice versa, each processor will be set to receive or send first by assigning each processor a value which depends on which of the members have a higher processor number.

Thinking in English, cont.

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The processors are numbered consecutively in an increasing order and act in pairs. Within each pair, a send-receive operation has to take place. In order to prevent blocking, we order the execution of the send and the receive operations for each pair, so that the processor with the smaller number first issues the receive command and then the send command, while ...

Thinking in English, cont.

- In the present paper, the mathematical formulation for two different types of advection-diffusion equation will be presented. The first type is for advection-diffusion equation with constant coefficients while the second type is for the same equation but with variable coefficients.

Thinking in English, cont.

- In the present paper, the mathematical formulation for two different types of advection-diffusion equation will be presented. The first type is for advection-diffusion equation with constant coefficients while the second type is for the same equation but with variable coefficients.
- In the present paper, we consider two cases - the advection-diffusion equation with constant coefficients and with variable coefficients.

Thinking in English, cont.

- In this part, the comparisons among three kinds of subgrid models are investigated for lid-driven cavity flows. These investigations will address the actions of subgrid models on large-scale flow structures.

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- In this part, for lid-driven cavity flows, we compare three kinds of subgrid models. In particular, we address the effect of these subgrid models on large-scale flow structures.

Thinking in English, cont.

- We know that for high Reynolds number fluid flows, when the fluid convection dominates fluid flow fields, under the finite-resolution of meshes, the flow becomes very instable. When the mesh scales cannot resolve the smallest scale in fluid flows, we must add some term into Navier-Stokes equations to smear out the effect from the unresolved scales.

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- For high Reynolds number fluid flows, where convection dominates, due to the finite resolution of the discretization mesh, the flow becomes very instable. When the mesh cannot resolve the smallest flow scales, we must add some term into the Navier-Stokes equations to smear out the effect ~~from~~ of the unresolved scales.

Thinking in English, cont.

- It is known by D. de Caen [10] that $1 + 2 + 3$....
- It is known, see, e.g., D. de Caen [10], that $1 + 2 + 3$....

Thinking in English, cont.

- Now, suppose that the equality holds in (20). Then the equality holds in (21). From the equality in (21), we get $d1 = d2 = ... = dn = d$,then D is a regular graph.

Thinking in English, cont.

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- Now, suppose that ~~the~~ equality holds in (20). Then ~~the~~ equality holds also in (21). From the latter we obtain that $d1 = d2 = ... = dn = d$. Therefore, D is a regular graph.

Thinking in English, cont.

- The author would like to thank the anonymous reviewers for a careful reading of this paper and for all their comments, which lead to a number of improvements of the paper.

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- The constructive comments of both reviewers are hereby thankfully acknowledged.

Thinking in English, cont.

- **Abstract:** In this research paper, we aim to present a hybrid algorithm in order to obtain a better solution to the single machine total weighted tardiness scheduling problem (SMTWT). Here, the proposed approach called guided genetic algorithm (GGA) is the combination of the standard genetic algorithm (GA), the Kangaroo technique (KA) and the weighted modified due date (WMDD) dispatching rule. The main idea of this hybridization is to take the advantages of the global search process assured by GA and the potent of the local search gained by KA during the evolution of the population initially improved by WMDD rule.

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Thinking in English, cont.

Theorem 3: Let us consider the macroelement M . Let A_H be the FE matrix corresponding to the space $V_H(M)$ with standard nodal basis $\{\phi_1, \phi_2, \phi_3\}$, i.e.

$$\langle A_H x,\, x\rangle = a(u,u) \text{ for } u = \sum x_i \phi_i,\ \ x \in R^3$$

and $\hat{A}_{22}$ is the matrix corresponding to the space V_2, i.e.

$$\langle \hat{A}_{22} x,\, x\rangle = a(v,v) \text{ for } v = \sum x_j \phi_j^2\ \ x \in R^3.$$

Above,

$$a(u,u) = \int_M \langle Dd(u),\, d(u)\rangle\, dx$$

with matrix of coefficients D, which is a general SPD matrix, and $d(u) = \text{grad}(u)$. Then

Thinking in English, cont.

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Thinking in English, cont.

https://www.sciencedocs.com/wrong-scientific-writing/

*"I edit your manuscript for **spelling, grammar, clarity, consistency, cohesion, and coherence**. My 'comments' are questions, suggestions, or alternatives that you might consider. Briefly, copyediting corrects spelling errors, grammar, punctuation, misplaced modifiers, changes in tense, problems in parallelisms, and the use of inappropriate language.*
In addition, copyediting includes changing passive voice to active voice where appropriate and developing a consistent style and tone. I usually find it necessary to perform substantive editing, which includes all of the features of copyediting with particular attention to the structure, organization, and concepts. This ensures an appropriate pace, uniform tone and clear focus, eliminating wordiness, triteness, and jargon, and smoothing transitions and positioning sentences to improve readability."

Some thoughts about writing

"Bad thinking never produces good writing." (L. Lamport)

"Good writing promotes good thinking." (D. Bertsekas)

The famous physicist Paul Dirac once said about a scientific article: " This isn't right. It is not even wrong."

"The worse things one can write are those that do not make sense."

Structure of a scientific article

A general rule:

1. Say what you are going to do.
2. Do it.
3. Say what have you done.

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VERY important: who is your audience?
VERY IMPORTANT: the title

Structure of a scientific article, cont.

1. Abstract
2. Introduction - put the work in perspective with respect to other related work, give motivation, sketch the structure of the rest of the text.
3. Main sections
   - 3.1 Setting, definitions, notations
   - 3.2 Method description, properties, theoretical derivations
   - 3.3 Numerical illustrations (reproducible tests !!!!!, parameters, computer used, readable figures and tables... Analysis of the results, comparisons etc.
4. Conclusions, outlook
5. Bibliography (styles)
6. Appendices

Something on plagiarism:

Question: Are our 'copy-paste' activities detected?
Answer: Yes they are. To a large extend.

An illustration via the online submission system of one of the scientific journals, published by Wiley...