Writing a good paper in OSM

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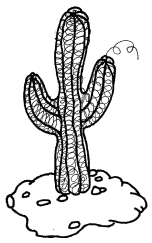

Figure 1: Booklet **in OSM**, vol I.

The **in OSM** series :

- Vol I. Writing a good paper in OSM

To appear in the **in OSM** series :

- Vol II. Preparing for a conference in OSM
- Vol III. Preparing your own conference in OSM
- Vol IV. Good email usage in OSM
- Vol V. Succesfully securing and completing your European contract in OSM
- Vol VI. Building your career in OSM
- Vol VII. My very own oueb page in OSM
- Vol VIII. Writing software in OSM

The aim of the **in OSM** series, coordinated by PL. George, your humble servant, is to help real progress to be made by drawing attention to some of our own worst excesses. All contributions are welcome.

The very meaning of the word (acronym) OSM remains a closely guarded secret.

The format is a 16-page booklet in LaTex style which is available upon request.

The diffusion of this series is actually almost null and, anyway, is not guaranteed.

The cover image is due to Peha.

Caveat lector

This document, translated[1] from [1], while reflecting a viewpoint that some may consider controversial, is far from being totally negative. As such, it sets the tone for the APM (OSM) series. The points made are, for the most part, based on facts. The topic dealt with here is mesh construction (with a view to finite element style computations), but it could easily be applied to other scientific disciplines, as the clever reader will not fail to realize. It should be mentioned that the author is fully aware that he himself applies some of the processes set out in this document.

1 Introduction

In this paper we propose a general method to write a good scientific paper. Many new results are presented and used to this end. Extensions are proposed which lead us to claim that the method can be applied to a variety of problems in a range of different disciplines. Before reading the following, see (or revisit) the satirical article by Georges Pérec, entitled Experimental demonstration of the tomatotopic organization in the Soprano, which can be easily found on the Internet by entering the key-word tomatotopic. Having done that, let us now look at a method that will result in a good scientific article. Several parameters must be considered, each of which plays an important role in the quality of the final article. Here, we must include the importance of choosing the title, the key-words and the referenced bibliography. It is also important to mention the applicability of the material presented in the paper, giving some details about its implementation, setting out the corresponding theoretical foundations, its validation and diffusion. The topic itself, while being of lesser importance, should nevertheless be clearly defined. Then, to conclude, we will give some easy-to-follow tips on how to improve the actual writing of the paper.

2 The title

Choosing a good title for the paper is crucial. Let us consider a simple example (easily adapted to other fields) and then let us attempt to quantify

[1] with the valuable help of R. James

its quality by giving it a score. The aim is obviously to get as high a score as possible. Let us look at the following title:

- "A mesh generation method in three dimensions"

Although informative and understandable, this title is poor in many respects: there are no key-words. Accordingly, its score is null, $score = 0$. However, with very little effort, it is possible to do better:

- "A *new* mesh generation method in three dimensions"

The title is now much more pleasing, $score = 1$. The word 'new' makes the method (like so many things) sound more attractive.

- "A *new optimal* mesh generation method in three dimensions"

The word 'optimal' always adds value, $score = 2$.

- "A *new optimal* method for *optimal* mesh generation in three dimensions"

The notion of optimality is indicated twice, $score = 3$.

- "A *new optimal* method for *Delaunay optimal* mesh generation in three dimensions"

The reference to Delaunay wins us another point (although some might think that the word 'optimal' is now redundant), $score = 4$.

- "A *new optimal Delaunay* method for *Delaunay optimal* mesh generation in three dimensions"

The double reference to Delaunay adds another point, $score = 5$ (although it would have been preferable to mention two well-known scientists once, and not the same one twice). The names of some acclaimed scientists in the title (and in the text, for that matter) increase the score. Depending on the targeted audience, their nationality (French, Russian, Anglo-Saxon, etc.) will also have an impact. A top score ($score = 6$) would be achieved using the title:

- "A *new optimal Delaunay* method for *Delaunay optimal* mesh generation in *arbitrary* dimensions"

This is thanks to the word 'arbitrary'.

If the method proposed has been developed in only two dimensions, it is advisable not to use the title:

- "A mesh generation method in two dimensions"

but:

- "A *new* mesh generation method "

And now we can apply the previous process, successively obtaining:

- "A *new optimal* mesh generation method "
- "A *new optimal* method constructing *optimal* meshes"
- "A *new optimal* method constructing *optimal Delaunay* meshes"
- "A *new Delaunay optimal* method constructing *optimal Delaunay* meshes"
- "A *new Delaunay optimal* method constructing *optimal Delaunay* meshes in *arbitrary* dimensions"

A simple and judicious comment in the text (the method can be extended without difficulty) justifies the appealing addition of "arbitrary" dimensions.

3 Key-words

Articles always include a number of key-words for classification purposes. Choosing the best key-words is undoubtedly essential. If the paper deals with Triangulation, include this key-word, together with the word Meshing. If the paper deals with Meshing, add Triangulation (it's better to be safe than sorry). If you don't do any Visualization (in general, meshes are displayed using some graphical device), make sure you add the word Visualization. Conversely, if you do some visualization and no meshing, don't forget to include the word Meshing. Some key-words are always easy to include: Finite Element, PDE, CFD, Biomedical, Reverse Engineering, and why not throw in Virtual Reality, etc. together with a few members of the CAX family, X needing to be defined (as regards using acronyms, see below).

4 References

For the sake of credibility, your paper must include a number of entries in the bibliography list. Some common-sense remarks might be helpful on how to choose such or such a citation. 'God helps those who help themselves', as the saying goes; therefore make sure that at least 75% of the references refer to your own work. This will allow the reader, even if the names of the authors are masked, to identify you. A more elegant solution, perhaps, is to ask a friend to reference your work and, in return, you reference his work. Another, more extreme, solution is to leave out the names of any other authors except yourself. This is not as difficult as it may sound. First, you only need to write an initial paper or, even better, a survey (a synthesis or state-of-the-art) or, better still, a book, in which you mention the other contributors. Having done that, you only have to mention this first paper (survey/book) and all the other authors simply disappear. However, and seeming perhaps contradictory to the above, be careful to include the work of 'referees' in your bibliography - these referees being peers who will certainly be selected to read your paper prior to its acceptance for publication. In fact, only one name is necessary, as this will allow the other referee to gleefully remind you in his comments and remarks that you inadvertently forgot to include his name. The revised version will then satisfy his vanity and win his approval. Should yet another referee be selected, the process will require a few iterations but will, in fact, converge. If, by some quirk of fate, your mother-tongue is aboriginal (i.e. anything other than English), feel free to add a few entries in this exotic language (it will add a little local colour and, in any case, nobody will check). If, on the other hand, the article is written in an aboriginal tongue, cite only articles in English, for internal use. To end, throw in a sprinkling of references that cannot be traced, like [7]. A glance at the bibliography at the end of this booklet should be enough to convince anyone that the author of the present paper is 'Author', and that the above rules have been applied.

5 Applications and extensions

If your method is not automatic, call it *interactive*. If it is two-dimensional, state confidently that it could be extended (without any difficulty) to the

three-dimensional case. If it works in three dimensions, remember to say that it could be extended (again without any difficulty) to an arbitrary dimension. Don't forget that a two-dimensional method applies for a surface (are the surface meshes composed of triangles as in a planar case?). Point out that your method applies to PDE, mechanics, graphics, geophysics, astronomy, the biomedical field, the environment and any other domains you can think of - particularly if you know nothing whatsoever about these areas.

6 Programing language, systems, computers

If, by chance, you wrote a computer program corresponding to your method, don't forget to mention the name of the language used. C++ is, as its name suggests, a plus (plus), Java also has a pleasant ring to it. Give the name of the system (Unix or, better still, Linux), particulary if it doesn't make any difference at all. Also specify the computer, and don't hold back on this: a cluster made up of 256 processors sounds much more impressive than a single work-station or a simple PC - especially if the cost in time is larger than for a simple machine.

7 Theorems and definitions

One or two theorems will give more value to your work. Here, the method is well-known: first, we look at what we can prove, and then we adopt the definitions that are suitable. Here is an example. If we know how to prove that the surface of the elements (or the length of a piece of string) is bounded between 17.32 and 88.79, it is mandatory to give the corresponding definition. This could be "a mesh is optimal if the surface of its elements is between 17.32 and 88.79." This is very important because the word optimal is introduced as proof. If the bounds are different, just tweak the definition so that it fits. Another simple method is to use theorems that have been proved in disciplines other than yours. That way, you can show off your multi-disciplinary credentials, safe in the knowledge that nobody will check in any detail whether or not these theoretical assertions are really relevant to the problem under consideration. Nevertheless, avoid stating specifically that the method works well only if certain restrictive conditions hold, which

will be criticized as not being realistic anyway.

8 Validation

One good theorem is enough (particularly if no computer implementation is available). Otherwise, a theorem and a carefully chosen example will do the job. It is generally easy to demonstrate the value of a method using a given example. To do so, a few well-tuned parameters and coefficients should provide the solution you are looking for (even if, for a second example, the useful values will have to be different). The alternative is that you provide a series of examples that are significant both in terms of their number and their complexity, which is time-consuming and tedious and, more importantly, delays the completion (and therefore the publication) of your paper. The perverse effect of such a validation is that you only publish a few papers, while your smarter colleagues turn one out every fortnight.

9 Figures, stastitics and curves

The method we propose is better than all the other existing methods (put together). While this is obvious (and clearly mentioned in the text), it is easy to provide irrevocable proof of this fact by using some carefully selected graphics and statistics.

Speed. The speed of the method reflects its complexity. Given in terms of the number of elements constructed (assuming it is a construction method, of course), per unit of time, we can choose between:

- 6 000 000 elements/hour,
- 100 000 elements/minute,
- 1 666 elements/second,

It's up to you, knowing perfectly well that they are all the same. If the speed is judged to be too slow, it is best to present it as:

- 0.036 sec/element,

-	1	2	3	4	5	6	7	8	9	10
Mine	5	10	15	20	25	30	35	40	45	50
Other	.2	.8	1.8	3.2	5	7.2	9.8	12.8	16.2	20

Table 1: Comparing method Mine and a previous method (time versus number (of millions) of elements).

- 36 ms/element,

Which is nothing other than 100 000 elements/hour and therefore 60 times slower than the example above - but it looks better: it is more elegant. It is also possible to count using processor cycles and, in that case, no comparison is then possible.

Complexity. The table above compares two methods, mine (`Mine`, in the first row) and another (`Other`, which is worse).

The `Mine` method is linear and therefore necessarily faster than the other, which is quadratic, as can be seen in Table 1, where the slower method is nevertheless much faster in the range of the application.

How do you measure your method? Easy! Omit the time required to

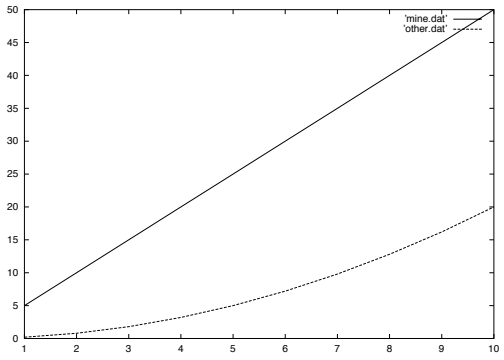

Figure 2: Comparing method Mine (top) and a previous method (bottom) (time versus number (of millions) of elements).

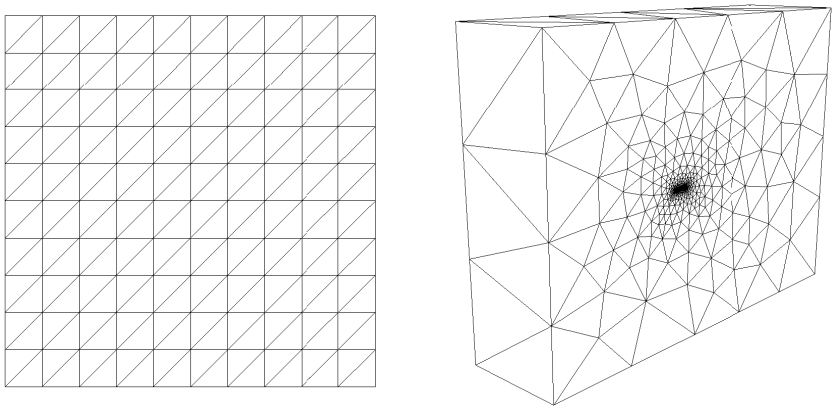

Figure 3: *Don't include the leftside, put only the right example (doc. T.J. Xiss)*

read the data, to prepare the data and to write the output (nobody will know). Or, and more subtly, instead of running larger and larger examples, do a single test while reporting the time (versus the number of elements) every n elements. Just look at the result, it's fascinating. Using a log scale can also give a flattering - if not totally accurate - appearance which is even more valuable (while momentarily forgetting how it was achieved).

One or two good figures. To demonstrate your method, which only runs well on a square, do not use Figure 3, left, but use Figure 3, right, which was provided by your friend (it may have been produced using another method, but there's no point mentioning that minor detail).

Since your method is supposed to be validated for CFD, but you only tested it on the example in Figure 4, don't include this figure, but use Figure 3, (right) again, which shows the mesh around an aircraft

10 Publication and diffusion of the paper

The diffusion of the paper must be optimized, and numerous appearances of the same paper (or close versions of it) is one way to ensure that your work reaches as wide an audience as it deserves. A personal page provides a first

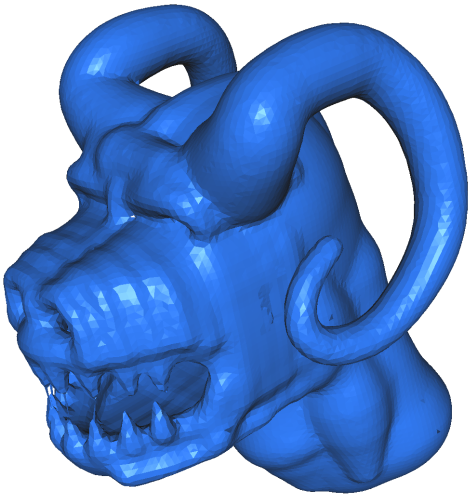

Figure 4: *Lovely legend for this example, clearly concerned with CFD.*

appearance, an internal report (written in English of, course, so that the entire planet will be able to understand it) will provide a second appearance. A few short versions presented at various conferences will help it on its way. The latest version of the paper would then mention these earlier publications to show how important it is. If your paper is rejected, a number of solutions are possible. First, do not mention these rejections. Submit it to another journal, after having taken into account the comments that were apparently the cause of the rejection: change the order in which the authors are listed, modify the title, the key-words and the bibliography (this should make it possible to have different reviewers). The ultimate solution is to organize your own conference, and then produce a "special issue" for a well-known journal. If all else fails, publish your own journal which, by some stroke of good fortune, will accept your paper for publication.

11 Diffusing the software

If, by mistake, some software has in fact been developed for the paper, the best solution, frankly, is not to diffuse it at all. If you nonetheless decide to go ahead, you should bear in mind that there are various degrees of diffusion:

- no diffusion, the software works only in the author's office and only the author runs it,
- the software is available in the office next door,
- the software is available in the author's team,
- the software is available in the community in which the authors are, in his own country or elsewhere,
- the software is marketed by a professional distributor (freely or not),
- the software is available in the `Internet`.

Each level has its own advantages and drawbacks. The less available the code is, the less feedback you'll get - and the less feedback you get, the fewer problems you'll have to sort out. On the other hand, making your code available on the Internet does have certain advantages: thousands of users will download it. As to whether they will actually use it is of no concern whatever, just remember to mention the number of downloads (the so-called Google-O-Meter effect).

12 The topic

If you have paid close attention to everything that has been said so far, you will no doubt realize that the actual topic itself is only of relatively minor importance. Nevertheless, a few points are worth making:

- deal with a problem that you know how to deal with, and not with the problem that was initially posed,
- deal with a local, and thus relatively simple, problem (for instance, split a triangle into 4) rather than a global and complicated problem (mesh adaptation by means of local splitting),

- consider looking at a *microscopic* level: every small result (due to chopping up a large problem into smaller parts) will, of course, provide material for a new paper which will cite all the previous ones (although you have the tricky problem of initializing the process),
- consider meta notions (which is slightly contradictory to the previous point); consider looking at dimension d, d obviously not being 2 or 3,
- give the appropriate definitions (see above),
- etc.

13 Some final advice

We end with a few miscellaneous tips which we hope may be of use. Firstly, feel free to sprinkle Acronyms and Abbreviations (AaA) liberally around the text - you can leave it up to the reader to decide whether this makes the manuscript more scholarly or more impenetrable. Secondly, do not fail to establish that it is your method. Taking a Russian doll approach to writing papers makes it rather difficult to analyse these papers and other contributors simply disappear.

The very words you use can have a great impact on the readability of your paper. Let us consider a simple example, "cut an edge into 2". This sentence is brief, it is to the point, and easy to understand - so throw in words like dichotomy, recursivity, hierarchy, tree, graph, etc. which will obviously improve the quality of your paper. Don't spend too much time worrying about how you present your work - talk rather about data structures, classes, templates, GUI (yes, another abbreviation). Even if the majority of your readers won't understand, they will look upon everything that you have written, and behold, they will see that it is very good.

Returning to our example, if "cut an edge into 2" sounds too prosaic and unworthy of serious scientific consideration, then we need to wrap it up more attractively, preferably with one or two theorems, lemmas, propositions, definitions, etc. For good measure, you could well add a couple of formulae and a few complex equations (particularly if they bear no direct relationship to the subject). Following on along these lines, we can extend to higher dimensions, go into duality (if you're sure that this adds nothing, but allows

some theorems to be included), and then map back down to the initial space again.

A popular way of showing just how clever you are consists of expressing a simple idea by something that sounds much more intelligent and scholarly. A banal point then becomes a 0-simplex, a triangle a 2-simplex or again a p-polygon in a d-dimensional space. Having said that, however, it is also sometimes useful to replace a relatively complex notion by something much simpler and easier to understand. In this way, the reader will make it his own, cherish it, and thus add value to your invention.

14 Loss of knowledge and consequences

Before turning to some consequences of such a situation, let me add some observations.

Biasing the `Web`. A carefully chosen keyword will make sure the search engine comes up with your name - as is well known by plumbers, electricians, garages, etc. Searching for Dirichlet (or Euler, Archimedes, Delaunay, etc.) and having your name returned by Google, can mean only one thing: that you are the greatest specialist on Dirichlet (or Euler, etc.) on earth. If you replace Dirichlet by "meshing" and your name comes up, there can be no doubt that you are the world's leading authority on this subject.

Self-attribution You have proved that 'cutting an edge into 2' leads to such and such results or properties. Consequently, any method that includes this type of operation to obtain such and such (other) results, is necessarily the same, and therefore you must boldly and vociferously claim your rights of paternity to this method (particularly if it was devised before your own work was published).

Patents Nobody has thought of filing a patent for the Rule of Three and, while it is tempting to do so, you would be unlikely to succeed. If, however, you did manage to get away with it, you would secure the rights to any development that used this simple (but efficient) process which can be employed in a wide variety of contexts and disciplines.

Howlers. Some howlers I have been awarded here or there, merit a visit. In this respect, we have :

- a surface, this is nothing but $2D$ with a z added (seen),
- there is no problem in surface meshing, it is enough to consider the CAD patches (heard),
- the discretisation of boundary curves is made by locating points along them (seen),
- tet meshing is an open problem (heard),
- ...

Acknowledgments. This work was partially funded by the NSF, EEC, etc. Including such Great and Glorious abbreviations (GaGa) adds extra credibility and reflected glory to your already brilliant paper.

Some consequences. The most important consequence concerns the loss of knowledge on a subject and the recent trends in the corresponding work carried out in the field. In no particular order, let me mention the following aspects:

- A general decline in the level of the associated research and studies. While it is clear that progress has undoubtedly been made in the discipline since the 1960s and '70s, it is worth saying that this curve has now become inverted. After starting out with problems in two dimensions for simple particular cases (convex domains, uniform meshes, small meshes (in terms of the number of elements)), we turned to more complex cases (arbitrary domains, non-uniform meshes, large meshes (parallel computing), etc.) and then to problems in three-dimensions or concerned with surfaces. After, we turned to mesh adaptation, anisotropic things, Navier-Stokes calculations, error estimates, etc. All of this took us to the end of the 90s and into the start of this century. Currently, we can observe a large number of studies and papers dealing (again) with two-dimensions, and many articles about minor topics that are unrelated to concrete applications. The unit square is alive and well!

- The unearthing of previously discarded methods, which are now being investigated again and which, in general, lead to the same conclusions as

before. This phenomenon seems to be quite widespread in various other scientific domains.

- The failure to tackle concrete problems, but rather to concentrate on small subjects which are broken down again and are of little intrinsic interest. Thus we find numerous papers on topics would have been addressed by no more than one or two remarks, or even a footnote, in previous papers dealing with real-life issues.

- The list is depressingly easy to continue - why don't you have a go yourself.

15 Conclusions

In this paper we have proposed a general method to write a good paper. Numerous new results have been presented and used to this end. Extensions have been proposed which lead us to claim that the method can be applied to a variety of problems in different fields.

I hope that you noticed that the conclusion is very similar to the introduction (with only minor changes to the vocabulary and verb tenses).

A false conclusion. After all that has been said above, it is up to you whether you reach a negative conclusion, or whether you actually try to do something about the situation. It isn't as hard as it might seem. Once again, I leave it up to you to see where and how solutions can be found.

A depressing final remark. While originally written in 2005, this paper unfortunately seems to be just as relevant today as it was then.

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