WRITING A PAPER: REQUIRED ELEMENTS AND SUGGESTIONS

Serge Abrate

Mechanical Engineering and Energy Processes

Southern Illinois University

Objectives in writing a research article

1. Get it published

2. Get people to read it

3. Get it cited

Anatomy of a paper

Typically, journal articles or conference papers contain the following

elements:

1. Title

2. Abstract

3. Introduction

4. Body of the paper

5. Conclusion

6. References

What editors and reviewers are looking for?

In the contents:

1. Something new (not available in the literature)

2. Not trivial

3. Useful to others

In the writing:

1. Article is prepared according to the guidelines

2. Topic is within the scope of the publication

3. A clear explanation of what the paper is about (title and abstract)

4. A clear explanation of why this study is needed, what was done, significant results, why should anyone care

5. Clear and enticing presentation

6. Correct English

Why the title is very important

1. A majority of readers will find your paper via electronic database searches

2. Search engines use key words in the title.

3. A first selection is made based on the title only. If the title does not seem to match the interest of the user, he will not look any further.

4. Use words that someone might use in a search to make sure that your article will show up in such a search.

Selecting a title

1. The title should succinctly describe the contents of the paper: general area, specific topic, main result

2. The goal is to entice people to read the article.

3. Nature: "why would anyone want to read this past the title?"

4. The title should contain terms describing a very broad area and terms defining the specific issue being investigated.

5. Example:

    -   general area: liquid molding, composite materials

    -   specific issue: modeling resin flow

6. Bad example: "Resin flow in fabric preforms"

Four types of titles

1. **Nominal construction**: head with pre- and post-modifiers. Example: Free vibration analysis of shells using a higher order theory.

2. **Full sentence construction**. Example: Functionally graded plates behave like homogeneous plates.

3. **Compound titles**. Use the interrelationship between the two parts of the title to present the object of study in two different ways: problem–solution, general–specific, topic–method, and major–minor. Example: "Dynamics of structures coupled with elastic media—A review of numerical models and methods".

4. **Titles in the form of a question**. Example: "Slamming of ships: where are we now?"

A few more tips

1. Always write the title last. Focus it on what is really important after you have had time to reflect on it.

2. Try to fit it all in one line. Definitely no more than two lines.

3. Do not waste space with phrases such as "An analysis of" or "A study of"

4. Avoid punctuation unless it is absolutely necessary for proper understanding.

5. Avoid abbreviations. Not everyone knows what they mean.

The abstract: the second most important part of the article

1. Many abstracts are published without the complete paper itself in abstract journals or in online databases.

2. Abstracts help readers decide if they should download an article or read the entire article

3. Help readers understand the article by outlining key points prior to reading the full document

What is an abstract?

1. An abstract is a stand-alone statement that briefly conveys the essential information of a paper, article, document or book.

2. It presents the objectives, methods, results, and conclusions of a research project; has a brief, non-repetitive style.

3. Abstracts are typically 100 to 250 words long.

The four sentence abstract

First sentence: a clear direct statement of the general area of investigation. For example: the study of impact on composite structures

Second sentence: a clear direct statement defining the specific issue to be addressed. For example: develop a numerical method for predicting impact-induced damage.

Third sentence: describe the approach used. For example: finite element model with a failure criterion to predict the onset of delaminations and a fracture mechanics approach to predict the propagation of delaminations.

Fourth sentence: discuss one or two major contributions made. For example: the method proposed here enabled us to predict the location, shape and size of impact-induced delaminations.

Tips for writing an abstract

1. To improve the chances that your paper will appear in a computer search, key words or phrases from the title should be repeated within the abstract.

2. The abstract should not contain any abbreviations or references.

3. Ensure that the abstract contains the most important words that relate to the topic.

4. Check that the abstract reads well, remember the primary audience is still the reader not a search engine, so write for readers not robots.

The introduction

1. What this paper is about: general problem area (first sentence), specific issue to be investigated (2nd sentence)

2. Why this is something that needs to be studied (3rd sentence): new, not a trivial issue, existing methods do not apply, this is something useful (to others).

3. Literature survey to show the current state of the art: what we know, what is lacking (**define domain**). This demonstrates the need for the further study and show where the present study will fit in the puzzle (**define niche**).

4. Outline of the approach used to solve the problem

5. Outline for the rest of the paper

6. Preview of main results (no more than three), why should anyone care?

A few things about the literature survey

1. Provide background directly related to your topic: limits on how far back it goes and how wide it is.

2. Each reference should be cited because it contributed something significant to the current state of knowledge. Make that clear.

3. Do not send the reader to the library: several beam theories have been proposed [1-25]

4. Build up to the point where you can say: here is what we know and here is what we do not know

5. Explain why what we do not know might be important

6. Describe what part of it this paper will address

7. Do not mischaracterize the contents of the references

8. Do not say anything negative or show a lack of knowledge of the literature

What has been accomplished so far?

1. The article appeared in a computer search in a good position on the list

2. Based on the title and the abstract, it has been selected for down loading

3. The introduction successfully described what the paper is about (general area, specific topic), why this study was needed, the approach used, the main results.

4. The reader is convinced that this article is worth reading

Body of the paper

The body of the paper should be divided into several sections for easy reference. For example: Experimental, Numerical model, Results.

Each section should have:

1. A brief introduction describing the objectives of this section (one sentence). For example: "experiments were conducted to measure …"

2. Emphasize what is new about it. For example: a new machine was designed in order to …

3. Provide all details needed to duplicate your results: dimensions, material properties, other test conditions, …

4. Validation of the approach

5. Major accomplishments in this section, accuracy and limitations of the approach

Experimental section

1. Introduction

2. Give a clear description of the apparatus used with all the equipment used to make measurement.

3. Show an actual sketch or a photograph and describe how it all works.

4. Give all information necessary for someone to duplicate your results: dimensions, name and model number of equipment, essential characteristics.

5. Describe the procedure followed during the experiments

6. Discuss what this apparatus allows you to measure and how accurate it is (show some analysis and estimate the error on these measurements).

7. Present some sample results.

Numerical or analytical approaches

1. Introduction
2. Describe the approach used (analytical, variational, finite element, finite difference, SPH approximations, …)
3. If you use existing software that should be made clear and there is no need to describe everything the software is based on from scratch.
4. Describe any new developments that you came up with and may not be found elsewhere.
5. Give all details: dimensions, material properties, loads, boundary conditions, type of elements, number of elements,… This is essential for the reader to understand what you have done and try to duplicate your results.
6. Justify choices made in developing your model.
7. Validate your model on a simple example.

Presentation of the results

1. Focus on the physics of the problem. What can we learn from your experiments or your analysis?

2. Discuss why the results make sense. Compare your results to experimental results or somebody else's results.

3. Color pictures are not everything. Results in graphical form help visualize some trends but numerical results are much more valuable for someone else to compare his results with yours.

4. This is where you have to make some strong points about what is unique about your paper: nobody has produced this kind of results before, here is a new phenomenon, the method developed here is more efficient, …

5. Leave the reader with a clear indication of what has been accomplished. Not a list with dozens of items but two or three strong points.

Figures

- For all figures and tables, captions should contain all information necessary to understand and interpret them.

- Pay attention to what the final version of the figure will be. What looks good on a full computer screen may not be acceptable when reduced to 2" x 2".

- Learn to use Excel properly do not just accept the default setting. Everything can be set exactly as you wish: color and thickness of each line, gridlines, legends for curves, labels for the axes, fonts and font sizes.

- Some publishers charge huge fees for figures in colors. Is it really necessary.

- Figures should be self-explanatory. Labels and the caption play a big role.

- Figures should be part of the narrative and not something added afte rwards for decoration. They should be mentioned in the text and should be introduced because they have information that cannot be conveyed otherwise.

- Figures should be numbered consecutively.

- Figures that have already been published elsewhere, can only be used with permission from the copyright owner(s) for both the print and online format.

Writing the conclusion

Objectives:

- Remind the reader of what this paper is about and the approach taken

- State what the major contributions are (no more than three)

- Explain why they are new, why they are important

Essential elements:

1. First sentence: recall what this article is all about (See first two sentences of the introduction).

2. Second sentence: Answer the research questions. For example: when a structure is impacted by a rigid body, what are the failure mechanisms leading to a permanent dent on the surface? How can the dent depth be predicted?

3. Third (and maybe fourth) sentence:

- what is new here: (a) a particular issue that has not been studied before; (b) a new experimental or numerical approach has been developed; (c) a new phenomenon has been discovered.

- Refer to studies mentioned in the introduction and discuss why you think that your main contributions are new.

3. Last sentence: explain why what your main contribution is significant.

- It cannot be trivial

- it has to be something that cannot be readily addressed using existing approaches.

- It has to be something difficult not just busy work.

- It has to be something useful to others. If it is an extreme special case that will never happen in practice, it will not interest many readers.

Who is an author?

General definition: Individuals who have made a ''Significant Intellectual Contribution''

The 2001 guidelines of the International Committee of Medical Journal Editors (ICMJE), state that authorship credit requires that three criteria be met:

(1) substantial contributions to conception and design, or acquisition of data, or analysis and interpretation of data;

(2) drafting the article or revising it critically for important intellectual content; and

(3) final approval of the version to be published.

All those who contributed to the work but do not qualify as authors should be named in the Acknowledgments, and what they did should be described.

Decide authorship before you start each article: Many authorship difficulties arise because of misplaced expectations and poor communication.

Ghost authors:
1. professional writers who are not involved in the design of studies, or the collection or interpretation of data. Their contribution should be acknowledged to avoid a potential conflict of interest.

2. people who made a significant contribution to a research project and fullfill the ICMJE criteria but are not listed as authors: **'All persons designated as authors should qualify for authorship, and all those who qualify should be listed.'**

Gift, guest, or honorary authors:
1. People who do not fulfill the ICMJE criteria: senior figures (e.g. heads of department, funding agency officials) whose names are added to curry favor.
2. A ''big name'' added on a manuscript in order to increase the likelihood of publication
3. A colleague whose name is added on the understanding that he will do the same for you simply to swell your publication lists. **Career boost authorship**

Who funded the work?

- Readers have a right to know who funded a research project or the publication of a document.

- Research funders should be listed on all research papers.

- The role of the research funder should be stated in the publication.

Dubious ethical practices

1. "Self-plagiarism", "repackaging", or "duplicate publication": entire sections duplicated in several articles or same paper published in several different journals.

2. The "least publishable unit'', "slicing the salami": Fragmentation of research papers in order to bolster the number of publications