How to write a technical paper

Mohamed A. El-Sharkawi
Smart Energy Lab (SEL)
Department of Electrical Engineering
University of Washington
Seattle, WA 98195-2500
e-mail: elsharkawi@ee.washington.edu
web: http://SmartEnergyLab.com

Some of the material are from Steven W. Van Sciver,
Mechanical Engineering Department, Florida State University

Why Publish in Journals?

• Research is complete only when the results are shared with the scientific community
• Scientific journals are the repository of the accumulated knowledge in a field.
  – If you don’t get it out, no one will notice.
• A literature built of meticulously prepared, carefully reviewed contributions fosters the growth of a field

How about Theses and Reports?

• Internal reports and theses are not peer reviewed
• Are less suitable for widely distributed publications

Where Should I Publish?

• Conference proceedings
  – Somewhat reviewed
  – Suitable for progress reports
  – Not all in the citation index.
• Journals
  – Peer and strongly reviewed
  – Suitable for archival results
• How to choose the right journal for your work?
  – Journal ranking (impact factor)
  – Journal exposure to the interested community
General Considerations: Article Size

- Length of an article is often determined by the Journal.
- Never exceed the limit because
  - it could be directly rejected without any review
  - it could cost you money for the extra page charges

General Considerations: Tone and Style

**Technical Writing is not classic literature**

1. Use direct declarative sentence structure.
   - **Bad:** “Having acquired the components and assembled them in the laboratory, the system was built.”
   - **Good:** “The system was built and assembled using components from industry.”

2. Use professional, non-combative language:
   - **Bad:** “El-Sharkawi, et al totally overlooked…”
   - **Better:** “El-Sharkawi, et al did not consider…”

General Considerations: Tone and Style

**Technical Writing is not classic literature**

   - Most readers are interested in the *What, Why and How* of your work. Don’t make it hard to find.

4. Don’t weigh your paper down with minutia.

5. Don’t repeat yourself; don’t repeat yourself; don’t...

General Considerations: Formatting

- Most journals have on-line format instructions and manuscript templates.
  - Poor job of laying out your paper is a sure way to annoy a reviewer
  - Many conference proceedings and Journals reject poorly formatted papers before they are sent to the technical editor

- Pay particular attention to reference, figures, table and caption formats
- All figures and figure texts must be legible
Main Components of Technical Papers

1. Header
2. Authorships
3. Abstract
4. Introduction
5. Analysis/Experiment
6. Results and Discussions
7. Summary and Conclusions
8. Acknowledgement
9. References
10. Biography

1. Header

• Headings should summarize the main idea of the paper simply and with style
• Catchy titles grab attention
• Misleading title can be a reason for rejection
• Long titles are not always recommended. Should be <12 words.
  — Good: “Heat Transfer Analysis of Flat Plate”
  — Poor: “3-D Numerical Analysis for Heat Transfer from a Flat Plate in a Duct with Contractions Filled with Pressurized He II”

2. Authorship

• Authors: Who perform the main work in the paper
• Co-Authors: limited to those who
  – have materially contributed to the research and preparation of the manuscript.

3. The Abstract

• A brief summary of the contents of the article.
• The most important paragraph in the article.
• An abstract should be
  — Accurate: should reflect the content of the paper.
  — Self-contained:
    • avoid abbreviations and acronyms
    • define unique terms.
    • Don’t include references.
    • Don’t include equations.
    • Summarize conclusions.
  — Concise and specific: Be as brief as possible, yet convey the information. 5% of article or 500 words at most.
• Abstracts can be published separately in on-line indices, so make it clear
4. Introduction

• Contains background information
• Places your work in context
• Avoid repeating the contents of the Abstract
• Most citations occur here, so
  — avoid critical statements
  — keep in mind that most potential referees are authors of similar work.
• Should not exceed 25% of total paper length.
• Often the Introduction is the most difficult section to write. Probably not the best section to start writing this section first.

5. Experiment or Analysis Discussion

• Describe the apparatus and method used to obtain the data.
  — Avoid too much detail (part numbers, model numbers, unnecessary dimensions)
  — Experimental schematic is more valuable than a photo of the outside of the apparatus
• Reference to other similar experiments:
  — “this apparatus, which was originally developed for liquid oxygen viscosity measurements, was modified…”
  — “our design is similar to that of Dillon, et al…”
• Describe the data collection and analysis.
• If appropriate include error discussion, but keep it **brief!**
• Present only what is necessary to understand the experiment, but be complete.
• It is OK to repeat some info published elsewhere if it helps the reader avoid looking up another reference.
  — Use quotation if you are using the same words
• This is often the easiest section to write and thus might be a good place to start

• Describe the algorithm you used
• Do not use an extensive flow chart
• Present the main equations that describe your technique
• Do not use well known equations
• Do not get bugged down with detailed steps
• Use concise and necessary material to understand the model and simulation
• Do not assume that off-the-shelf software is equivalent to lab test
6. Results and Discussion

- This section typically contains
  - tables and graphs of all data
  - analysis comparison
- Should be compact. Don’t attempt to show everything.
  - Good: A sample of the data compared to a general correlation
  - Bad: multiple plots of data for different operational conditions with or without explanations

7. Summary/Conclusion

- Keep this section short!
- State the most important findings
- State how your work has advanced the field
  - Be objective
  - Don’t be melodramatic
- Possibly comment on what additional work would be beneficial or is planned

8. Acknowledgement

- It is optional section
- Thanks those who have helped with the work, but are not co-authors.
- List and thank the funding agencies
- Good examples
  - Thanks to David Miller for his technical assistance to the research team
  - We would like to acknowledge the helpful suggestions from Dr. S. Andrew
  - The work in this paper is supported by the US Department of Energy under grant DE-FG-02-96ER-40952
  - This research has been supported by NASA through the Research Initiative for the University of Washington under grant NAG3-2751.
9. References

- Should be listed in the *order cited in the paper*.
- List must be complete.
- Don’t make the list from essentially your work.
- Worst thing is to overlook an important reference from potential referees.
- References formats depend on journals’ policies.

Writing your Manuscript

- Choose your time for writing so that there are few interruptions.
- Set aside a block of time (min ~ 2 to 3 hours) preferably every day so that you maintain *continuity*.
- Make an outline: with annotations and references. Build the text within the outline.
- Set a goal for each time period. e.g. finish a section.
- Keep your effort up until you produce a draft.
  - The key is perseverance.

Strategy to Getting Started

- Make that annotated outline.
  - **Approach 1:**
    - collect data and decide on graphics, equations.
    - Build the outline around the data to be displayed.
  - **Approach 2:**
    - prepare the talk first and use the Power Point as the outline of your paper.
    - Give the talk and modify your logic, discussion that you can later write.
- Proof read *often*.
- Have a colleague proof read what you have written, particularly if English is not your native language.

Time

- Don’t wait to the last minute, so get started now.
- Don’t stop until you have a first draft.
- No one said this would be easy, but it IS important.
References

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2. AIP Style Manual
3. How to Write & Publish a Scientific Paper, Robert A. Day
4. Advice to New Faculty Members, Robert Boice
5. The Visual Display of Quantitative Information, E. Tufte
6. How to write a scientific paper: http://www.scidev.net/ms/howdoi/index.cfm?pageid=60
7. How to submit a paper to a scientific journal http://www.scidev.net/ms/howdoi/index.cfm?pageid=61