How to Write a Technical Paper and Report

Mohamed A. El-Sharkawi
Department of Electrical Engineering
University of Washington
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- Internal reports and theses are not peer reviewed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.
    - Why is this important?
- 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
Impact Factor (IF)

\[ IF = \frac{\text{number of times that all papers published were cited}}{\text{number of papers published by that journal}} \]

IF should be greater than 1.0

For IEEE-PES Journals

- 2014 Impact Factor=2.814
- 2013 Impact Factor=3.53

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…”

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.
  - Poor: “3-D Numerical Analysis for Heat Transfer from a Flat Plate in a Duct with Contractions Filled with Pressurized He II”
  - Better: “3-D Heat Transfer Analysis of Flat Plate”

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

• The most important paragraph in the article.
• A brief summary of the contents of the article.
• Must address the following questions
  – What are you doing?
  – Why are you doing it?
  – How are you doing it?

3. The Abstract

• 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**

Exercise

• **Abstract**—As demand for clean renewable sources of energy continues to grow, utilities will increasingly rely on wind power to fit that demand. This paper presents a method to estimate the impact on the system area control error (ACE) from integrating wind generating facilities. This method is accurate in the absence of transmission constraints. The method relies on known and calculable quantities derived from the ACE equation. A method of simulating the additional automatic generation control (AGC) response to the wind schedule/forecast mismatch is also presented. In its base case, this method is a lower bound on the negative impact to the system reliability metrics from additional wind facilities. This base case is easily implementable on all systems. Simulations to verify the method are performed on the North West utility system and show that it accurately predicts the impact from integrating an actual wind facility.

Exercise

• **Abstract**—In this work, a new stochastic dispatch (SD) formulation for a power grid with high penetration of wind power is presented. The formulation takes into account the stochastic nature of the wind power output. The uncertainty associated with the wind power output given the forecast is modeled using conditional probability density functions (cpdf). Several cpdf functions are examined to model wind uncertainty, including Weibull, extreme value, and Beta distributions. In this study, the objective function is to minimize the expected value of the system operating costs. The operating costs include thermal units’ fuel costs, wind plants’ operating costs, and imbalance charges associated with the mismatch between wind schedules and wind actual outputs. A comparison between the proposed SD and deterministic dispatch (DD), at which scheduled wind is equal to forecasted wind, is carried out. In addition, the results of perfect scheduling (PS), where the forecast is assumed to be perfect, are included. Simulation results show that the proposed SD is about 2% less costly, on average, than deterministic dispatch.
4. Introduction

- Contains background information
- Places your work in context
- Avoid repeating the contents of the Abstract
- Most citations occur here, so
  - Avoid harsh statements on others work
  - 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.”
5. Experiment or Analysis Discussion

- 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

5. Experiment or Analysis Discussion

- 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 show a general correlation
  - Bad: multiple plots of data for different operational conditions with or without explanations, or without added new information.
6. Results and Discussion

- Do not duplicate data in tables that are adequately presented in graphs
  - Precision data is better in tables
  - Trends are better in graphs
- Compare your results with other similar work, if appropriate.
  - In this case, be sure to use complete references.

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 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 early.
- 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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6. How to write a scientific paper: [http://www.scidev.net/ms/howdoi/index.cfm?pageid=60](http://www.scidev.net/ms/howdoi/index.cfm?pageid=60)
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