Ethics in Engineering and Research

Lecture #15

Research Paper Writing

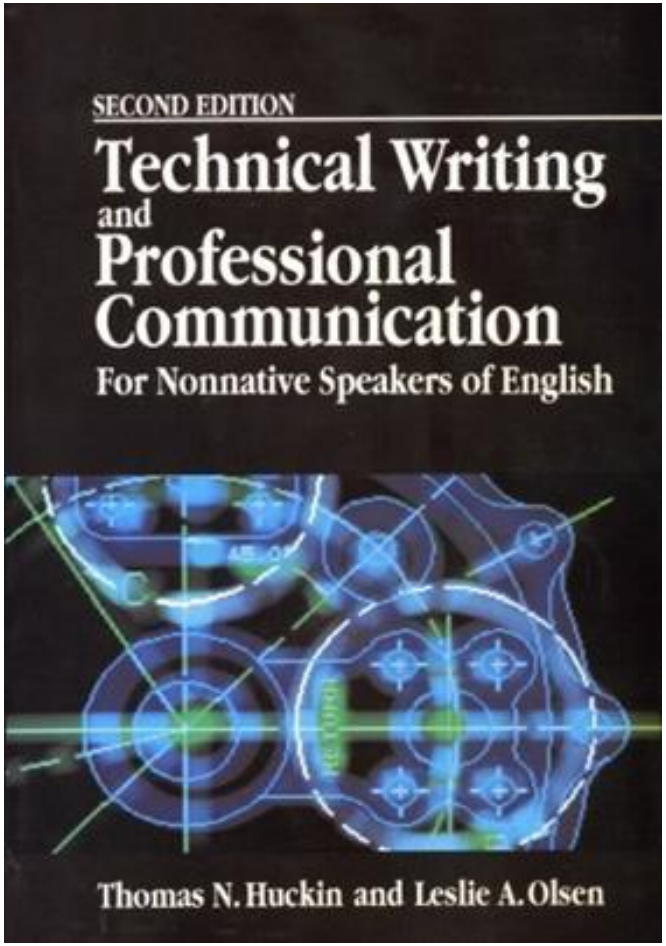
Bonus Track

Contents

- Introduction to Papers and Related Issues
- The Structure of a Scientific Paper
- How to get your Paper Accepted – the Reviewers Point of View
- The Process of Submitting a Paper

A Useful Book

- If you need a book to refer to, you can try
  - Thomas N. Huckin and Leslie A. Olsen, "Technical Writing and Professional Communication for Nonnative Speakers of English", 2nd Edition, McGraw-Hill, 1991.



Types of Scientific Papers

- Journal papers
  - Letter, 3 to 4 pages
  - Full paper, 3 to several tens of pages
- Full papers
  - Normal papers, which generate knowledge or new understandings of known issues
  - Review papers
- Conference papers
- Technical reports – not reviewed
- Magazines
  - For example, IEEE Spectrum, may or may not reviewed
- Books – least common way of publishing results

SPIE.

IEDM 69th International Electron Devices Meeting

Conference papers

- Conference and workshop papers
  - Very common in Electrical Eng. and Comp. Science areas.
  - You are expected to present your paper, don't submit if you do not intend to go!
  - Printed in proceedings.
  - Accessible over internet.

Author's goals

- To get published – to graduate
- To describe interesting new knowledge in an understandable way
- Must be unpublished work (except review papers)
  - It may be an extension of your previous work

- You can cite other people's work, but never, ever, claim someone else's work as yours!!!

Some questions to ask yourself before writing

- Who is going to read this?
- Why did I do the work in the first place?
- What is the problem I have solved?
  - What is new?
- Is my work new and relevant?
- What are my contributions?
- Are there remaining unsolved questions?

The editor and reader's perspective

- Suppose you are an editor
  - Is the paper in my journal domain?
  - Is there new finding?
  - Will it have a wider audience? – boost my journal impact factor
  - Is it understandable? - English
- Suppose you are a reader
  - Is it new and relevant to me?
  - Helpful to my research?
  - Easy to read?

The reader should be …

- Intrigued within the first 5 minutes of reading.
- Excited within 15 minutes.
- Satisfied after 45 minutes.

Where to submit

- For School of EEE students,
  - IEEE series, for example, IEEE Signal Proc, Trans. On Robotics
  - Applied Physics, for example, APL, JAP.
- Decide where to submit before you write
  - Different journals have different formats.
  - You may also need to cater for a particular audience.
- Journal paper usually needs longer time
  - May take one or two years.
  - Follow “Instructions to Authors”.
- Conference paper – Remember important dates
  - Submission
  - Notification: reject or accept.
  - Camera-ready copy.
  - Actual conference with presentation.

Dealing with page limits

- Letters usually have very limited pages
- Journal can accept long papers with extra charge (overlength page charge)
- Conferences usually have a page or word limit
- Don’t cheat with small fonts, narrow margins etc.
- Try to eliminate redundant materials
- Trim the technical section, if necessary

Rejections

- Articles can be rejected for various reasons.
- For example, your topic does not have a wide audience (for Nature, Science journal etc.)
- Some conferences accept only 15%.
- However … you get valuable reviews.
- Think twice before complaining (appeal).
- Reviewers are anonymous, don't try to guess who they are.
- Use the criticism constructively – if they misunderstood you, others will do as well.
- Consider sending it elsewhere.

The Structure of a Paper

A skeleton paper

- Title, author(s) and affiliation(s)
- Abstract
- Index term/keywords
- Introduction
  - Background information
  - Problem definition
  - Summary of contributions
  - Related works
- New Ideas/Experiments
- Results and discussions
- Conclusions
- Acknowledgements
- References
- Appendix if any

The Title

- Must be informative, clear and meaningful.
- Should gain attention of the reader immediately.
- Don’t use symbols in titles.
- Imagine someone searching for your paper.

Abstract = Package of a product

The abstract

- Summarizes problem, reasons for the work and the results.
- Short and concise, 100 – 250 words.
- Avoid references and acronyms.
- Try to sell the paper to the reader – why should he/she read it!!!

Indexing and Keywords

- Use them to classify the paper

- Some Examples
  - Robot Navigation
  - Sensing, vision, perception
  - Artificial intelligence
  - SLAM (abbreviations should be well known!)
  - Index Terms or Keywords (IEEE)

Introduction

- Explains the background/significance of the paper.
- The opening paragraph should be your best paragraph.
- Ended by what you have done in this paper:
  - In this paper, we shall present ……

Background information

- A short introduction to the area.
- What is the current interest?
- What is the current development/status?
- Cite relevant references and maybe briefly explain what has been reported there

Problem definition

- A concise statement of what you are doing/solving.
- **Why it is useful to do/solve?**
- Identifying a loophole/over looked issue.
- Eg: Current liquid crystal displays have a slow response - results in blurred video images. Fast response liquid crystal displays would therefore be useful.

Related work

- Identifying all relevant work (with references), even if it is old or does not solve exactly the same problem.
- Generally, references should be locatable, avoid use of “personal communications”.
- Do not “bad-mouth” others’ work.

- Report similar methods from different groups together, instead of reporting one method from one group.

high temperature waste heat [16]. Recently, Jiang et al. om-temperature thermoelectric performance in copper $(AgCu)_{0.995}Te_{0.9}Se_{0.1}$ by stabilizing the face-centered room temperature. Although this material showed *ZT* 350 K (near room-temperature) [14], there may have o its high cost, scarcity and difficult processing for practical application. Since organic thermoelectric materials including polymers, CNTs and graphene have advantages of being inexpensive and recyclable, they may compensate the use of traditional inorganic thermoelectric materials for low-temperature operation. Furthermore, it has been reported that near room-temperature TE properties of organic materials could be enhanced via nanocomposite formation [17]. In 2016, Cho et al. made printable thermoelectric materials using layer by layer assembly technique, in which an 80 quadlayer thin film made of a polyaniline (PANi)/graphene-poly (3, 4-ethylene dioxythiophene): poly styrene sulfonate (PEDOT:PSS)/PANi/double-walled carbon nanotube (DWCNT)-PEDOT:PSS exhibits thermoelectric power factor of 2710 μW $m^{-1}K^{-2}$ at room temperature [18]. In 2019, Liu et al. reported the simultaneous enhancement of electrical conductivity and Seebeck coefficient in single-walled carbon nanotube (SWCNT)/PEDOT:PSS nanocomposite by tailoring charge transfer concentration, which exhibits TE power factor of 526 μW $m^{-1}K^{-2}$ [16]. In 2020, Zheng et al. fabricated organic spacer fabric shaped three-dimensional thermoelectric textiles by sweing carbon nanotube yarn based segmented thermoelectric yarn, which showed high specific power of 171.7 μW/(g.K) at $\Delta T = 47.5$ K [19]. In 2020, Hwang et al. created machine-washable conductive silk yarns with a composite coating of Ag nanowires and PEDOT:PSS for e-textile devices, which has the electrical conductivity of 320 Scm^{-1} and Seebeck coefficient of 0.8 μVK^{-1} [20].

Recent reports on STOSCs applied light utilization efficiency (LUE, determined as PCE × AVT) to reflect the trade-off between average visible transmittance (AVT) and PCE, and to make a fair comparison of overall system efficiency. There are different advances in active materials to improve the performances of STOSCs including applying multicomponent active layer,[5–7] adjusting donor/acceptor ratio and structure of active layer,[8–12] and designing near infrared (NIR) absorption active materials.[13–16] These strategies assist STOSCs to achieve remarkable NIR photon utilization efficiency and high transparency in the visible range.

- Compare and benchmark with different technologies, especially for Nature and Science journal

Organic–inorganic lead halide perovskites are promising semiconducting materials for a range of optoelectronic and electronic applications[1,2]. Their excellent performance in photovoltaic devices is often attributed to their high absorption coefficients[3], long charge carrier diffusion lengths and lifetimes[4,5], band-like charge carrier transport[6], and high fractions of radiative recombination[7–9]. The latter is particularly important for light-emitting applications as well as photovoltaics, where ideal devices operate in the radiative limit[10]. As this limit is approached, all avoidable charge carrier recombination pathways are eliminated, and only radiative recombination remains[11]. As such, any non-radiative recombination reduces the steady-state, non-equilibrium carrier concentrations in the conduction and valence bands, and thus reduces the difference between the quasi-Fermi levels of these two bands ($\Delta\mu = E_F^{CB} - E_F^{VB}$) and the resulting maximum achievable open-circuit voltage (V_{OC})[12,13]. Therefore, when assessing the fundamental limitations of a new material, one of the most important considerations is determining whether the material can demonstrate a high fraction of radiative recombination relative to other recombination pathways[14]. For example, although Si has been deployed as a successful commercial technology and has recently achieved a record power conversion efficiency of 90% of its limiting efficiency[15,16], it has demonstrated internal photoluminescence quantum efficiencies (PLQEs) (η_{int}) just exceeding 20% (ref. [17]), which at present limits its open-circuit voltage to 88% of its radiative limit open-circuit voltage[18,19]. On the other hand, GaAs, which holds the record power conversion efficiency for a single-junction solar cell at 28.8%, has demonstrated η_{int} as high as 99.7%[20].

Thermoelectric generators (TEGs) transform a heat flow into electricity. Thermoelectric materials are being investigated for electricity production from waste heat (co-generation) and natural heat sources. For temperatures below 200 °C, the best commercially available inorganic semiconductors are bismuth telluride (Bi_2Te_3)-based alloys, which possess a figure of merit ZT close to one[1]. Most of the recently discovered thermoelectric materials with ZT > 2 exhibit one common property, namely their low lattice thermal conductivities[2,3]. Nevertheless, a high ZT value is not enough to create a viable technology platform for energy harvesting. To generate electricity from large volumes of warm fluids, heat exchangers must be functionalized with TEGs. This requires thermoelectric materials that are readily synthesized, air stable, environmentally friendly and solution processable to create patterns on large areas. Here we show that conducting polymers might be capable of meeting these demands. The accurate control of the oxidation level in poly(3,4-ethylenedioxythiophene) (PEDOT) combined with its low intrinsic thermal conductivity ($\lambda = 0.37$ W m^{-1} K^{-1}) yields a ZT = 0.25 at room temperature that approaches the values required for efficient devices.

Summary of Contributions

- The main findings.
- Be concise/precise! (Eg: EVERY symbol in every equation should be precisely defined!)
- Do not say “new” or “novel” yourself, which should be mentioned by others.
  - Some journals do not allow such terms at all

Experiment/Theory

- Explain how your experiment is done.
- Show how your equations are derived – only critical steps should be listed.
- How your sample is characterized.
- You may need to have both of these two components if you have both theory and experiment

Results and discussions

- Show your experimental results or simulations with figures.
- *"Figure 1 shows ….."*
- *"It can be seen from figure 1 that ……"*
- You may want to highlight some hidden results by "*It is worth mentioning that …*"
- You should compare your results with others.
- This is one of the most important parts.

Conclusions

- A short summary of what has been reported in this paper (like your abstract).
- But, do not simply copy your abstract.
- Interpretation of your work: pros & cons.
- Limitation of your work.
- Maybe suggestions for future work.

Acknowledgements

- Under which grant the project is carried out.
- Whoever has helped you in finishing this work.
- If the contribution is significant, you should consider to list the person as a co-author.

References

- All sources should be referenced.
- Reference numbers should follow the sequence in which they are cited.
- Different journals have different formats for references – take note!
- Eg. IEEE: Author, Journal, Vol. No. pages Month, Year.

Writing your paragraph

- An easy way to start a paragraph is “Figure 1 shows ….”

- Try to avoid very long sentences, i.e. separate into many short sentences.

  – Long sentences are difficult to comprehend.

  – Purpose is to let readers know exactly what you are doing, not to confuse the them!

Figures

- They should be numbered according to the sequence they appeared in the text.
- They should have figure captions to explain what is in the figure.
- You must refer to EVERY figure in the text.
- Postscript format is generally preferred, Tiff is not good as it is too big and hard to know whether you have lost some resolution.

Tables

- The caption of the table should be on top of the table.
  - For a figure, it is below the figure.
- Different journals have different formats for tables.
- Eg. For APL, JAP, use Table I, Table II, rather than Table 1, Table 2.

How to get your paper accepted?

Reviewer's Checklist (IEEE TRO)

- What is the contribution of the paper?
- Does the author explain the significance of this paper?
- Is the paper clearly written and well organized?
- Does the introduction state the purpose of the paper?
- Are the references relevant and complete? Supply missing references.
- If the paper is not technically sound, why not?
- If the paper is too long, how can it be shortened?

Reviewer's Recommendations (IEEE TRO)

- Paper Contribution
- Technical Quality
- Originality
- Thoroughness of Results
- Clarity of Presentation
- Adequacy of Citations
- Relevance to the Field

- Confidential Comments to the Editor:
- Comments to the Author:

Submitting your paper

- Nowadays, online submission is popular or even mandatory.
- Check for example:

http://www.ieee-ras.org/tro/for_authors

How to write your draft manuscript?

The format

- Nowadays – very strict – Template often given.
- Eg: IEEE-TRO: Double column format, using IEEE style file (Latex or Word).
- Sequence: title, author, abstract, keywords, main text, references, tables and figures to be cited/placed within text.

Peer Review

- Review by independent scientists provides advice to editors of scientific journals concerning the publication of research results. It is an essential component of the scientific enterprise, and all scientists have an obligation to participate in the process.

- Privileged information or ideas obtained through peer review must be kept confidential and not used for competitive gain. Reviewers must disclose conflicts of interest resulting from direct competitive, collaborative, or other relationships with any of the authors, and avoid cases in which such conflicts preclude an objective evaluation.

- Reviewers should judge objectively the quality of the research reported and respect the intellectual independence of the authors. In no case is personal criticism appropriate. Reviewers should explain and support their judgments in such a way that editors and authors may understand the basis of their comments.

- Reviewers should point out relevant published work that has not been cited by the authors. Any statement that an observation, derivation, or argument had been previously reported should be accompanied by the relevant citation. A reviewer should also call to the editor's attention any substantial similarity between the manuscript under consideration and any published paper or manuscript submitted concurrently to another journal.

- A reviewer should treat a manuscript sent for review as a confidential document. It should neither be shown to nor discussed with others except, in special cases, to persons from whom specific advice may be sought; in that event, the identities of those consulted should be disclosed to the editor.

- Reviewers should not use or disclose unpublished information, arguments, or interpretations contained in a manuscript under consideration, except with the consent of the author.

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Editorial Responsibilities

- The editor of a journal has complete responsibility and authority to accept a submitted paper for publication or to reject it. The editor may confer with associate editors or reviewers for an evaluation to use in making this decision.

- An editor should give prompt and unbiased consideration to all manuscripts offered for publication, judging each on its merits without regard to race, gender, religious belief, ethnic origin, citizenship, or political philosophy of the authors, and respecting the intellectual independence of the authors. Situations that may lead to real or perceived conflicts of interest should be avoided.

- The editor and the editorial staff should not disclose any information about a manuscript under consideration to anyone other than reviewers and potential reviewers. Unpublished information, arguments, or interpretations disclosed in a submitted manuscript should not be used in an editor's own research except with the consent of the author.

- An editor presented with convincing evidence that the substance or conclusions of a published paper are erroneous should promote the publication of a correction or retraction.