

Seminar: Writing Technical Papers

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Outline

- Introduction
 - The W4 paradigm: why, who, when, and what
- Types of Papers & Where to Publish
 - Theoretical Vs. Experimental
 - Peer-Vs. non-peer reviewed publications
- Paper Structure
- Writing Guidelines
- Resources
- Q&A

Introduction (1/3)

- Why Publishing?
 - Disseminating knowledge
 - Knowledge repository & teaching others
 - To receive credit for your work
 - “Publish or perish”
- Who Should Publish?
 - Anyone involved in research or education
 - Researchers and professors
 - Industry practitioners
 - Graduate and undergraduate students
 - Paper writing is a skill to be mastered by graduate students

Introduction (2/3)

- When to Publish?
 - The earliest the better
 - Research maturity
 - Important considerations
 - Consensus among collaborators
 - Approval from whoever approves
 - Advisors
 - Boss
 - Security

Introduction (3/3)

- What is Publishable Material?
 - Novel approaches
 - New theoretical concepts and ideas
 - Experimental results
 - Modeling and simulation
 - Laboratory results
 - Surveys and tutorials

Types of Technical Papers

- **Theoretical Research Papers**
 - Highest level of scientific research publication
- **Vision/Position Papers**
 - Expresses individual's views or positions
- **Implementation Papers**
 - Validates existing ideas through implementation
- **Survey Papers**
 - Present a factual review of work made by others

Theoretical Research Paper

- Main modality of presenting formal results in the scientific community
- Solid background and clear problem identification
- Formal discussion of theoretical foundations and analytical derivations
- Formal, reproducible, experimental basis (if any) and analysis of results
- The kind of paper we all wish for

Vision/Position Papers

- Your Grand Scheme (or not so grand) to Change the World
 - Must reflect confidence to convince the reader
 - Interesting, different, and better
 - Statements backed either by citations, quantitative data, or preliminary experiments
 - Avoid statements that cannot be backed
 - Does not provide detailed measurements
 - Just enough to back-up vision statements
 - Usually a short paper or letter
 - Opens a discussion in a panel or workshop

Implementation Papers

- Detailed measurements of a system or process
 - Might have been described before (vision)
 - Contains your original contributions or your not-so-big scheme
 - Results usually validate (or reject) a research hypothesis
 - Results come from an experiment
 - Actual system measurements
 - Modeling and simulation
 - By far the most common type of engineering paper

Survey Papers

- Present a topic and examine all its sides in an objective manner
 - Typically focuses on a controversial problem
 - Open problem with conflicting approaches
 - May include author's own approach
 - Should present, identify, and summarize major arguments without taking a stance
 - Based on an extensive literature review

Publication Targets

- Peer-reviewed publications
 - Review panel of “experts” decide if your work is publishable or not
 - Based on technical merit of your work
 - Reviewers “guard” the publication reputation
- Non-peer reviewed publications
 - Work published as received
 - Typically used to report on the work of large groups
 - Authors are responsible for technical content

Peer-reviewed Publications (1/2)

- Anonymous and in many cases, blind review
- Base criteria
 - What is your contribution?
 - Is your contribution substantial enough?
 - Is your contribution feasible and useful?
- Other issues
 - Readability & Correctness
 - Prove or disprove any hypothesis? Validation?
 - Relevance to a broader scientific community?

Peer-reviewed Publications (2/2)

- Journal Papers
 - The most prestigious type of publication
 - Strict and long review process
 - Typically require clear and sound contribution to the state-of-the-art
 - Well written and strict adherence to formal guidelines
 - Might charge a fee per page (if approved)
- Conferences & Symposia Papers
 - Many are peer reviewed
 - Less strict and faster review process than a journal
 - Might accept work in progress
 - Most require registration and oral presentation
 - Some presentations in the form of poster

Non-peer Reviewed Publications

- Workshops, colloquiums, and meetings
 - Might not have a proceedings publication
 - Good exercise for first time paper authors
- Invited Papers
 - Typically do not go through a normal review
 - Reserved for well recognized individuals
 - Could appear in conference or journal
- Magazines
 - Editorial board review
 - Not considered a peer-review process
 - Exceptions are some magazines (journal equivalent)

Structure of a Technical Paper

Title

Authors

Abstract

[Keywords] → Optional

1. Introduction

1.1 One or more sections

2. <Implementation Description>

2.1 One or more sections

3. <Results & Analysis>

3.1 One or more sections

4. Conclusions

Acknowledgements

References

[Appendix] → Optional

Structural Components (1/6)

- **Title**
 - Concise and to the point
- **Authors**
 - Credit for individuals making significant intellectual contribution, intellectual reviewing, final approval
- **Abstract**
 - Basic article message
 - Problem
 - Relevance of your solution
 - Hint on solution approach
 - Most salient results
 - Limited to about 150 words
 - No references or figures

Structural Components (2/6)

- **[Keywords]**

- Selected to facilitate computer search

1. Introduction

- Problem background and importance
 - Need and opportunity
- Discuss ALL related work (could be a separate section)
 - Highlight the relevance to YOUR work
- Brief description of proposed solution
 - How is it different and superior to other solutions
- Main results, no detail
- Summary of paper organization
- Limit to more or less 25% of document length

Structural Components (3/6)

2. <Implementation Description>

- **STOP!** Do not use this title!
- Can have one or several sections and subsections
- Describe proposed model or approach
 - Assumptions, conditions
 - Exploit the power of graphics
- Provide theoretical foundations and analytical derivations
- About 30% of the document length

Structural Components (4/6)

3. <Results and Analysis>

- Describe your experimental design and setup
 - Provide reproducible details
- Describe parameters and metrics
 - Clearly establish the WHAT and HOW
- Validation
- Present the results
- Perform analysis and discussion of results
 - Focus achievements and limitations
- About 30% of the document

Structural Components (5/6)

4. Conclusions (and Future Work)

- Summarized problem statement
- Summarized solution approach
- Highlight main results and contributions
 - Why is it worthwhile
- What is to be done next
 - Solution improvement
 - Applications to other scenarios
 - Expansions of methodology
- About 10% of the document

Structural Components (6/6)

- **Acknowledgements**

- Acknowledge the funding sources
- Follow specific wording requirements
- Include grant numbers (federal agencies)
- Acknowledge those who helped you

- **Bibliography**

- Standard form reference of ALL cited sources
 - Fine line between plagiarism and referencing
- Provide complete list of authors
 - Do not *et al.*

- **[Appendix]**

- Essential materials for completeness: detailed proofs
- Special graphs or plots

Writing Guidelines

- Brainstorm your story
- Writing Order
 1. Implementation Description
 2. Results and Analysis
 3. Conclusions
 4. Introduction
 5. Abstract
 6. Title
 7. The rest of the document
- Outlined descriptions
 - One topical sentence per paragraph

Avoid Passive Voice

- Too many passive verbs make your writing boring
- Use VERBS more than NOUNS
- Passive:

An improvement in quality has been made leading to the decision being taken to raise the standard test so a higher mark means the same success rate being accepted. (29 words)

- Active:

As quality improved, the standard test rose, leading to a higher standard mark to gain the same acceptable success rate. (20 words)

Avoid Wordiness

- Wordy Style

“The experiments were conducted in order to determine the lowest possible voltage at which conduction would occur. It was found that 0.7 Volts was the lowest gate voltage necessary for the transistor to begin showing an appreciable flow of drain current”. (41 words)

- Clear Style

“Experiments show that biasing the transistor gate at 0.7 Volts or more consistently caused it to begin conducting”.
(18 words)

Avoid Jargon and Gobbledygook

- **Technical Garbage**

The ubiquitous applications of Operational amplifiers to form sigma-delta modulators have been very used to make the marvelous and omnipresent analog-to-digital and digital-to-analog converters used in many super fast contemporary communication applications. Their intricacies and extremely dense interconnect networks place outmost demand on simulation environments, requiring hyper fast execution velocities to complete a feasible functional analysis.

- **Technically Sound**

Sigma Delta Modulators (SDMs) are core components in many of today's mixed-signal designs, particularly in over sampled data converters. For these components, transistor-level simulation is the most accurate approach known. This method, however, becomes impractical for complex systems due to its long computational time requirements.

Avoid Long Sentences

- Golden Rule: **One idea = one sentence**
- How long?
 - Good writers keep the average sentence length between 15 and 20 words

- Long Style:

At first, the system exhibited very low resistivity when applied a bias voltage below $650\mu\text{V}$ because the oxide-semiconductor interface had been contaminated with hot carriers that were trapped by dangling bonds. (32-word sentence)

- Short Style:

For bias levels below $650\mu\text{V}$ the system exhibited low resistivity. This was caused by hot carriers trapped by dangling bonds in the oxide-semiconductor interface. (12.5 words per sentence)

Keep Acronyms Under Control

- Use acronyms without explanation only if they are widely known to the target reader
 - IBM, PR, 5VDC, VLSI, CAD
 - Otherwise always define them before use
- Use shortened word forms to avoid excessive abbreviations
 - *Sigma-delta modulator* becomes *the modulator* on the second use — avoiding *SDM*
- Avoid confusing abbreviations or acronyms
 - If talking about 'Puerto Rico' do not abbreviate 'Phase Reversal' as PR. Use common sense.

Preserve the Flow of Ideas (1/2)

- Provide one main point in each paragraph
 - Usually, a topical sentence is stated at the beginning of the paragraph
- Make sure ideas are in the right order
 - Write most of your sentences in a '*cause-action-effect*' or '*who-does-what*' order
- Reduce the “Fog Index”
 - $F = 0.4(L + P) < 15$
 - L = Average number of words per sentence
 - P = Average number of polysyllables per 100 words
 - Polysyllable = word with three or more syllables

Preserve the Flow of Ideas (2/3)

- Link ideas and paragraphs
 - Simple connections (sentences)
 - also, although, and, as, because, but, despite, first, however, if, next, now, second, then, therefore, third, until
 - Complex connections (paragraphs)
 - accordingly, as you are aware, consequently, for this reason, furthermore, hence, in addition, inasmuch as, likewise, more specifically, moreover, nevertheless, nonetheless

Avoid Abstract Words

- Be specific whenever and wherever possible
- Vague statement

“We determined the conditions for the high noise floor in our design. This led us to devise a...”

- Specific statement

“We identified the equivalent series resistance of the switching network elements, as the major contributors to the thermal noise floor in our design. This led us to devise a...”

Use Consistent Verb Tenses

- Common mix-ups:
 - Present and past
 - Present and future
- When reporting, stick to **past tense**
- Sometimes, it is easiest to write all in present tense
- When writing in future tense, first person, future formed with **shall** rather than will

Check Grammar & Spelling

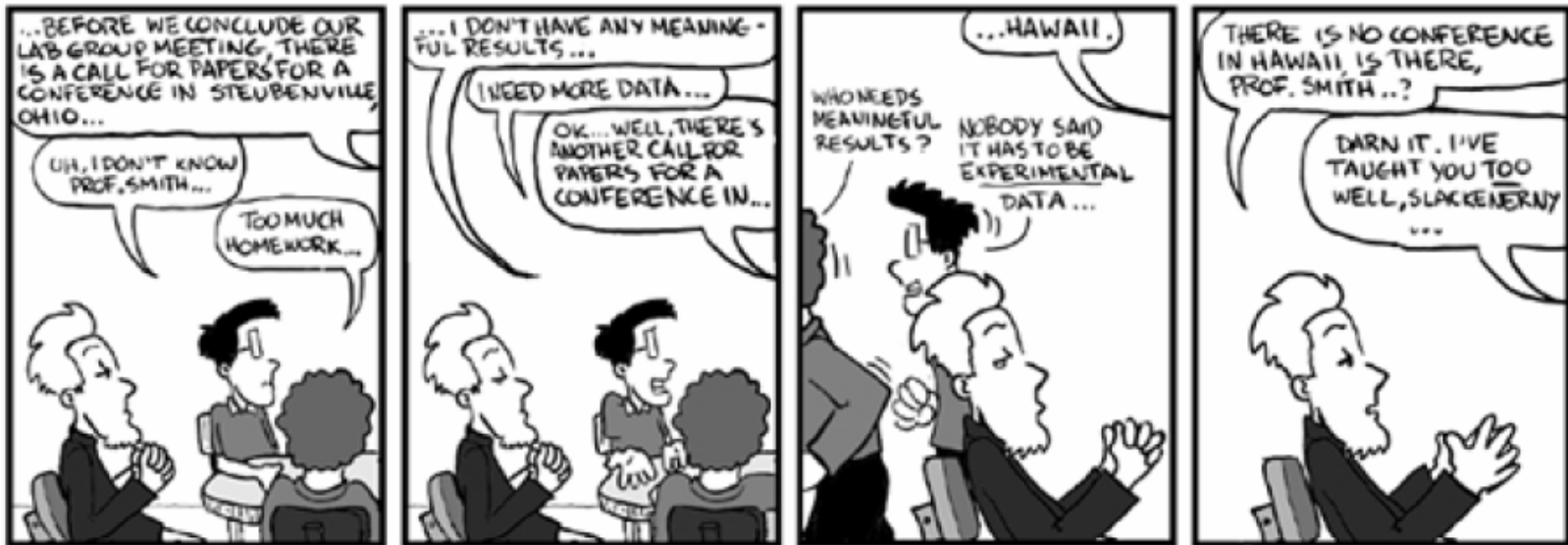
- A spell check is essential but not enough
 - One spelling error might be enough for a reviewer rejecting your paper
- Grammar checkers are sometimes OK, but not enough
 - Frequently suggest nonsense corrections
- Read, read, and then read again
 - Nothing better than the human touch
- Have someone else read your paper and criticize it
 - The hardest the better
- Read “The Elements of Style” by W. Strunk

Resources

- [1]. Strunk, W., Elements of Style. Ithaca, N.Y.: Priv. print. [Geneva, N.Y.: Press of W.P. Humphrey], 1918; Bartleby.com, 1999. www.bartleby.com/141/. [Jan. 31,2006]
- [2]. Schurzrinne, H., “Writing Technical Articles”, Available on the World Wide Web at <http://www.cs.columbia.edu/~hgs/etc/writing-style.html>, Last download Jan. 30, 2006
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Q&A

- The typical research group meeting ending...



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