Seminar:
Writing Technical Papers

Dr. Manuel A. Jiménez
ECE Department, UPRM

Fall 2012

ICDL ETC

Outline

- **PART I: Background**
  - The W^4 Paradigm
  - Types of Papers
  - Where to Publish
- **PART II: Organization**
  - Paper Structure
  - Filling Content
- **PART III: Tips and Tricks**
  - Writing Order
  - Guidelines
- **PART IV: Ethics in Writing**
  - Plagiarism
  - Publisher Reputation

PART I: Background

The W^4 Paradigm: **W**hy, **W**ho, **W**hen, & **W**hat

- **Why** Publishing?
  - Disseminating knowledge
    - Increasing human knowledge repository
  - 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
  - Essential skill for graduate students

Introduction (2/3)

- **When** to Publish?
  - The earliest the better
    - After a through literature review
    - When research begins to mature
  - Important considerations
    - Consensus among collaborators
    - Approval from whoever may approve
      - Advisor
      - Clearance
      - Co-authors

Introduction (3/3)

- **What** is Publishable Material?
  - Novel approaches
  - New theoretical concepts and ideas
  - Experimental results
    - Modeling and simulation
    - Algorithms
    - 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 experimentation and 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 and independently reproducible, experimental basis
  - Concise analysis of results

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 system or process
  - Might have been described before (vision)
  - Contains original contributions or proposed scheme
  - Results usually validate (or reject) a research hypothesis
  - Results come from an experiment
    - Actual system measurements
    - Modeling and simulation
  - A 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
  - Panel of experts decide if your work is publishable
  - 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
    - Technical Reports
    - Project Reviews
  - 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
  - Rigorous and long review process
  - 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 accepted)
- Conferences & Symposia Papers
  - Most are peer reviewed
  - Less rigorous and faster review process than a journal
  - Might accept work in progress
  - Require registration and oral presentation
    - Some presentations in the form of posters

Non-peer Reviewed Publications

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

PART II: Paper Organization

Structure of a Technical Paper

Title
Authors
Abstract
Keywords

1. Introduction
   1.1 One or more sections
2. <Methods and Procedures>
   2.1 One or more sections
3. <Results & Analysis>
   3.1 One or more sections
4. Conclusions

Acknowledgements → Optional
References
[Appendix] → Optional

Structural Components (1/6)

- **Title**
  - Concise and to the point
- **Authors**
  - Credit for individuals making significant intellectual contribution, intellectual contents
- **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 automated 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. <Methods and Procedures>

- **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 (Future Work)
     - 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

PART III: Tips and Tricks

Writing Guidelines

- Suggested Writing Order
  1. Methods and Procedures
  2. Results and Analysis
  3. Conclusions
  4. Introduction
  5. Abstract
  6. Title
  7. The rest of the document

One Writing Strategy

- Begin by brainstorm your main story
- Break story into sections to make an outline
- Describe sections in sentences sets
  - Outline descriptions with topical sentences
  - One topical sentence per paragraph
- Verify adherence to main story
- Expand sentences
  - Add idea details
  - Include figures, tables, formulas, and references
- Now you have your first paper draft!

Advise from the Experts

- The idea that prolific writers are born is more myth than truth [8]
  - Research has demonstrated that writing is a habit that can be cultivated and grown

- T. Gray

- Three key steps [8]
  - Write daily for short periods of time
  - Establish a write accountability method
  - Review what you write

- B. Boise

Avoid Passive Voice

- Too many passive verbs make your writing boring
- Use VERBS more than NOUNS
- Sentence organization: Subject then predicate
- 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 transconductance 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 in the super information highway. Their intricacies and extremely dense interconnect networks place outmost demand on simulation environments, requiring ultra fast execution speeds to complete a feasible functional analysis on time.

- 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 resistance when applied a bias voltage below 650μV 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 650μV the system exhibited low resistance. 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

Preserve the Flow of Ideas (2/2)

- 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 found some conditions that contributed to the high noise floor in the design. This led us to devise a…"

- Specific statement

  "We found that the equivalent series resistance of the switching network was a major contributor to the thermal noise floor in the 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 [1]

Part IV: Ethics in Writing

Ethics in Research & Writing (1/3)

Dr. Hwang Woo Suk

A South Korean scientist who published a paper in 2004 in the journal Science that claimed his team had successfully obtained stem cells from cloned human embryos.

Allegations mounted that he had falsified data. The scandal forced his resign from Seoul National University.

A panel investigated his research results and concluded that he had fabricated data. His paper was retired, his name dishonored, and a criminal investigation was open.

In October 2009 Dr. Woo was convicted of fraud for receiving nearly $1M in research funds based in his fabrications.

Four of Dr. Hwang's former colleagues were also found guilty of participating in the fraud.

- Source: BBC News Asia Pacific: October 26, 2009

Ethics in Writing (2/3)

Dr. Karl-Theodor Zu Guttenberg

German Minister of Defense. On February 23, 2011 the University of Bayreuth revoked his doctoral degree, citing "extensive violations" of doctorate regulations by the omission of source citations.

On March 1st, 2011 he resigned from office after it became known that he plagiarized the works of numerous authors in his thesis.

- Source: BBC News, Europe, March 1, 2011

Dr. Esther Silvana Koch-Mehrin

Her 2001 doctoral thesis was analyzed using a crowd-source effort, and she was accused of plagiarism. As a consequence, on May 2011 she resigned as vice-president of the European Parliament.

Later that year the University of Heidelberg officially rescinded her doctorate due to massive plagiarism.

- Source: BBC News, Europe, May 11, 2011

Ethics in writing (3/3)

Dr. Pal Schmitt

Elected in 2010 Hungarian President, resigned in April 2012 amid a scandal created when Budapest's Semmelweis University revoked his 1992 doctorate after finding that much of his thesis had been copied.

- Source: BBC News, Europe, April 2, 2012

Prof. Ivan Rios Hernández

Forced to resign from his position as Assistant Professor in the UPR Carolina after being accused of copying without crediting the writings of several Latin American authors in a newspaper column.

- Source: ENDI.com, September 26, 2012

Plagiarism: Don't Do It!

- Examples of Plagiarism
  - Using someone's else work without giving credit to the source (referencing)
  - "Copy & Paste" of work without proper citing and quoting
  - Violating Copyright Law in graphics and artwork
- Automated software tools can easily detect plagiarism in electronic documents
  - Check in google for "plagiarism checker"

If you publish fake data or copy someone's else work without due credit, you'll pay the consequences… in the worst way

Publisher Reputation

- Bogus Conferences
  - A paper “generated” with SCIgen got accepted at WMSCI 2005. Check by yourself at: http://pdos.csail.mit.edu/scigen/
- Bogus Journals and Books
  - Make money publishing low quality material “as is” for a hefty fee
- Unfamiliar about a publisher? **Google it!**

Resources

[1] W. Strunk, “Elements of Style”, N.Y. Priv. Print [Geneva, N.Y.: Press of W.P. Humphrey], 1918; Bartleby.com 1999, www.bartleby.com/141/. [Jan. 31,2006]

[2] H. Schurzrinne, “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

[3] Fox, A., “Helpful Hints for Writing Technical Papers”, Available on the World Wide Web at http://swig.stanford.edu/~fox/paper_writing.html, Last download Jan. 30, 2006

[4] Li V. O. K., “Hints on Writing Technical Papers and Making Presentations”, IEEE Transactions on Education, Education, Vol. 42 No. 2, pp. 134-137, May 1999

[5] Compton, R. T., “Fourteen Steps to a Clearly Written Technical Paper”, IEEE Circuits and Devices Magazine, Sep. 1992

[6] Corrington, M. S., “Why Engineers Should Write Technical Papers”, In IRE Transactions – Audio Vol. 4 No. 1, pp. 1, Jan 1956

[7] W. Trape, “Guidelines for Writing Technical Papers (For Classes and Research)”, Available on the World Wide Web at http://www.winlab.rutgers.edu/~trappe/Courses/CommNets1, Last downloaded Jan. 30, 2006

[8] Tomorrow’s Professor Mailing List “661 Publish & Flourish: Become a Prolific Scholar” Available on the World Wide Web at http://cgi.stanford.edu/~dept-ctl/tomprof/posting.php?ID=661, Last downloaded Apr. 30, 2011

Q&A