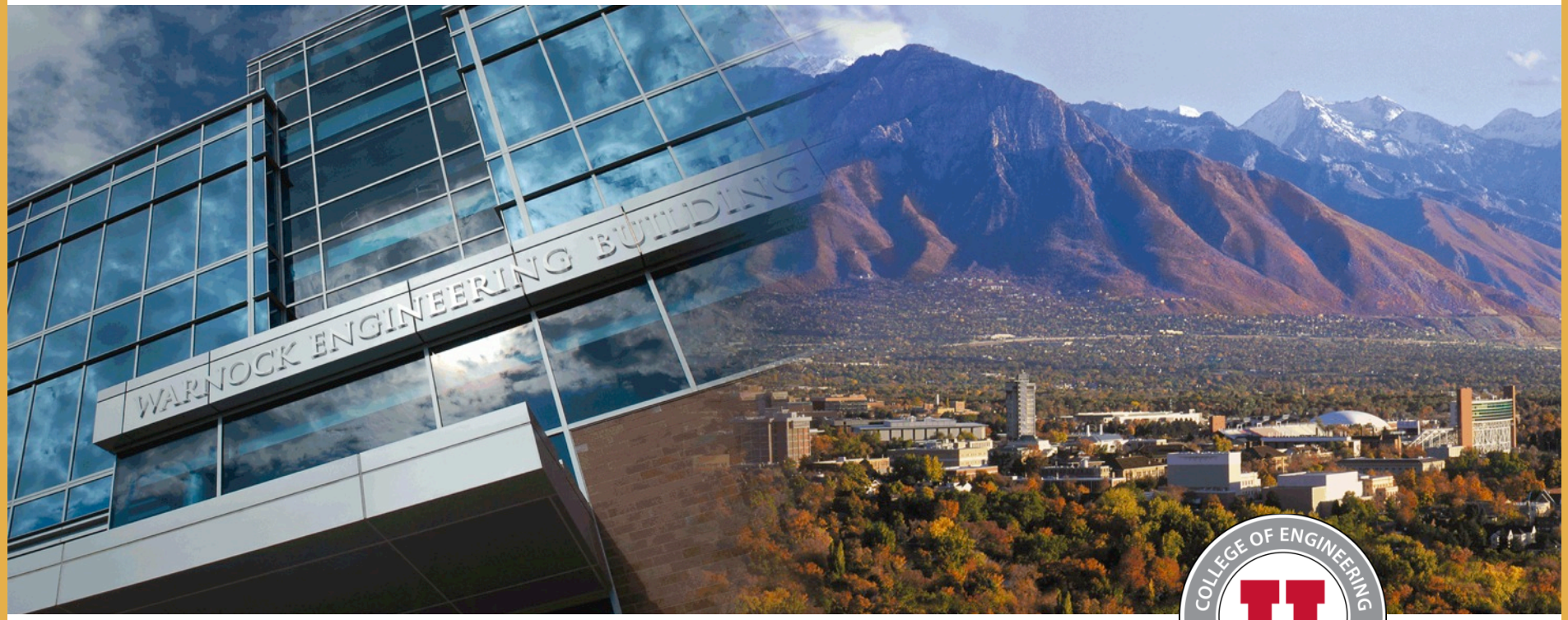
Technical Writing Skills



Dr. Aditi Risbud

October 28, 2014

Philosophy

Professionals in engineering and technology spend **40** to **70** percent of their time writing and communicating

- Read and understand information
- Share information with others
- Keep information for future reference

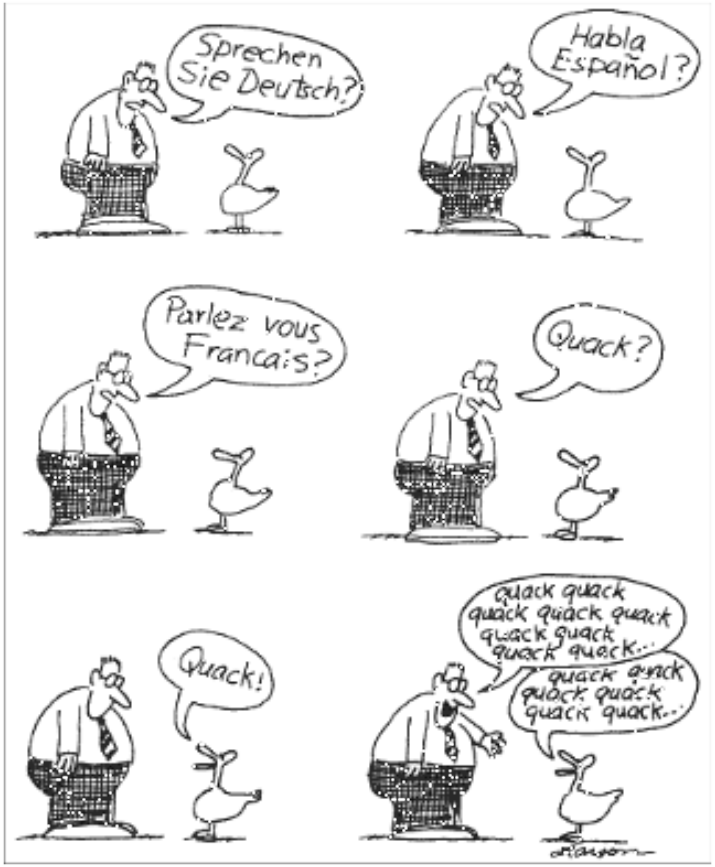
D. Cunningham and J. Stewart,
"Perceptions and Practices: A Survey of Professional Engineers."
Institute of Electrical and Electronics Engineers (2011)

Ambassadors of Information

Academia	Industry	Government
Grant writing	Work Reports	Grant writing
Publications	Memos	Reports
Reviews	Presentations	White papers
Presentations	Patents	Publications
Posters	Q&As	Policy piece
Reports	Documentation	Field reports
Lectures	Evaluations	Agency reviews
Recommendations	Investor Reports	Presentations
Outreach	Marketing	Public relations

Audience and Purpose

- **Fellow students and mentors**
- Colleagues and leaders
- The general public
- Media
- Funding agencies
- Policymakers



http://engineerblogs.org/author/cherish-the-scientist/

Effective writing

Is it **clear**?

Is it **concise**?

Does it **cater** to the right audience?

Composition and Grammar

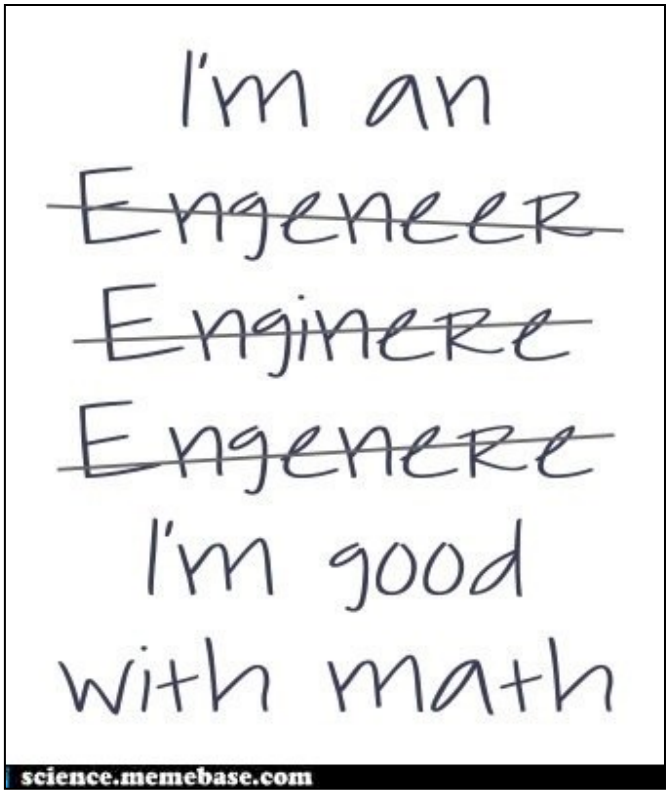
- Words
  - Choices
  - Acronyms
  - Redundancy
- Sentences
  - Subject/verb agreement
  - Clarity
  - Active voice

Spelling and Proofreading

Every word processing program* has a spell-checking function**.**

You have no excuses!

Example: *bachelor's degree, master's degree*



*Or the Google toolbar

Capitalization

Capitalization is for **proper nouns and titles**

Examples:

Professor James Bond, Department of Mixology

James Bond is a professor of mixology.

Capitalization and Acronyms

Avoid "Random Capitalization"

Example: *ALD ≠ Atomic Layer Deposition*

ALD = atomic layer deposition

Define an acronym the first time it is used.

Example: *These thin films were grown using atomic layer deposition, or ALD.*

Eliminate redundancy

absolutely essential

a large number of

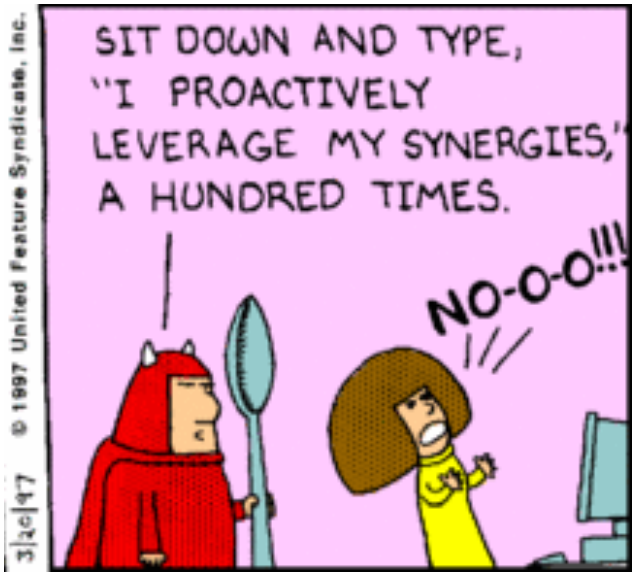
despite the fact that

in order to

square in shape

due to the fact that

the majority of



Subject/Verb Agreement

Unclear or dangling modifiers

Example: *Having tested positive for hepatitis A, we disqualified the patients for participation in the study.*

Simplicity vs. Sophistication I

Example: *There is a large body of experimental evidence that clearly shows that members of the genus* Crotalus *congregate simultaneously in cases of prolonged decreased temperature conditions in the later part of the year.*

Simplicity vs. Sophistication II

Colloquial language is not appropriate in written documents.

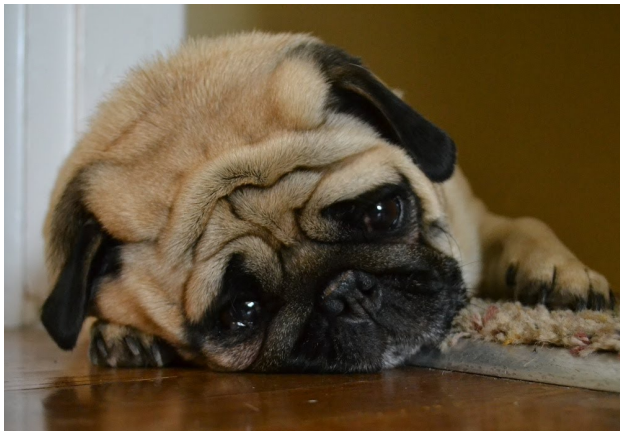
Example:

She got her bachelor's degree in physics.

Active Voice

Examples:

Dogs are hated by cats.



No change in activity was observed.

Active examples:

In-class activity

Consider:

- Basic issues: spelling, capitalization
- Words: choices, redundancy
- Sentences: location, subject/verb agreement, active voice
- Overall clarity and organization

10 min. to read and correct paragraph

Turn in your paper

Class discussion

In-class diagnostic

1The emission properties of a nanoscale optical emitter can be significantly modified by the proximity of a nanowire in order to support surface plasmons. **2**In principal, three distinct, independent decay channels exist. **3**First, direct optical emission into free-space modes are possible, with a rate modified from that of an isolated quantum dot owing to the proximity of the metallic surface. **4**The optical emitter can also be damped nonradiatively owing to Ohmic Losses in the conductor. **5**Most important, the tight confinement and reduced velocity of surface plasmons lets the nanowire capture the majority of spontaneous radiation into the guided surface plasmon modes, like a lens with really high numerical aperture.

In-class diagnostic

Corrected version:

The emission properties of a nanoscale optical emitter can be significantly modified by the proximity of a nanowire **that supports surface plasmons**. In **principle**, three **distinct** decay channels exist. First, direct optical emission into free-space modes **is** possible with a rate modified from an isolated quantum dot, **due to the** proximity of the metallic surface. **Second,** the optical emitter can also be damped nonradiatively owing to Ohmic **losses** in the conductor. **Third, and most important, most spontaneous radiation is captured by the guided surface plasmons, due to their tight field confinement and reduced velocity, much like a lens with high numerical aperture.**

IEEE style

- For conference papers (proceedings), transactions, journals and letters published by the Institute of Electrical and Electronics Engineers (IEEE)

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J. Q. Author
IEEE Conference Publishing
445 Hoes Lane
Piscataway, NJ 08854 USA

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9		Abstract	
10	Authors' affiliations, main text, equations, first letters in section titles[a]		Subheading
11	Authors' names		
24	Paper title		

[a]Uppercase

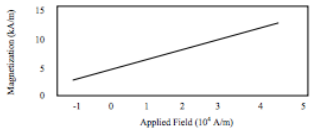

Fig. 1. Magnetization as a function of applied field. Note how the caption is centered in the column.

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IEEE style: formatting

- Organize text, data and images
- Creates consistency
- More efficient and precise: an engineer's dream

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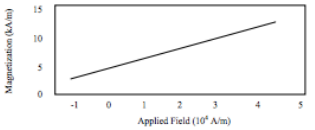

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IEEE style: formatting

- Two columns
- Single spaced
- Justified margins
- Numbered primary headings, centered
- Lettered secondary headings, left justified
- Numbered figures and tables

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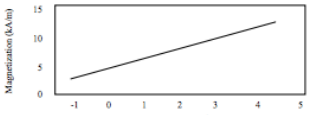

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Times New Roman font

IEEE style: structure

- Title
- Author (name and affiliation)
- Affiliation: Department of Electrical and Computer Engineering, University of Utah

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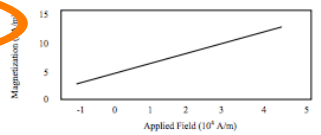

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Times New Roman font

IEEE style: structure

- Introduction
- Body (text, equations)
- Figures (≥ 2)
- Conclusion
- References (≥ 5)

Times New Roman font

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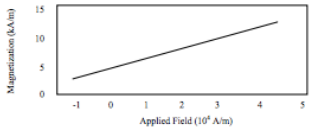

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IEEE style: title

All significant words in the title should be capitalized

(a, an, the, and, but, for, or, in, out, on => lowercase)

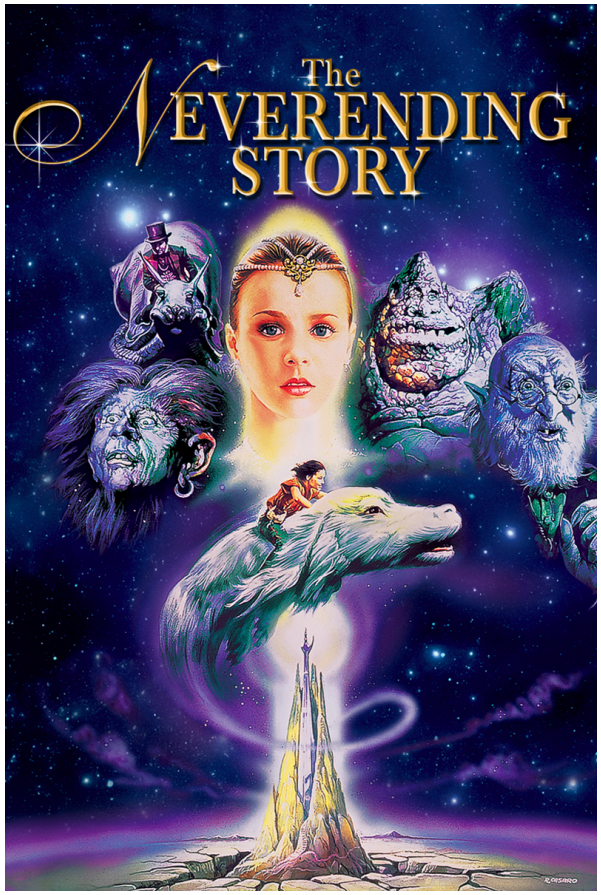
Example: Empirical Mode Decomposition Algorithm for Epileptic Seizure Detection

Be concise: shorter is better

Avoid “Nature of…”, “Studies on…”

Storytelling: introduction

1. Relevance: “So what?”
2. Limit jargon
3. **Define central question or problem**
4. Use examples and analogies



Introduction

Known: background information

- General/big picture
- Specific, previously reported data

Unknown: central question

Research purpose or study question

Experimental or theoretical approach

Main body of paper

- Summarize and evaluate research
- Chronological or grouped into topics
- In each section:
  - Purpose of experiment
  - Approach
  - Results
  - Interpretation

Figures and tables

Figures illustrate trends and relationships

Tables report precise numbers and compare data sets

- Place in the main body
- Place at top or bottom of columns, after mention in text
- Each figure or table requires a caption
- Match name of variables, units and values with text

Figure: example

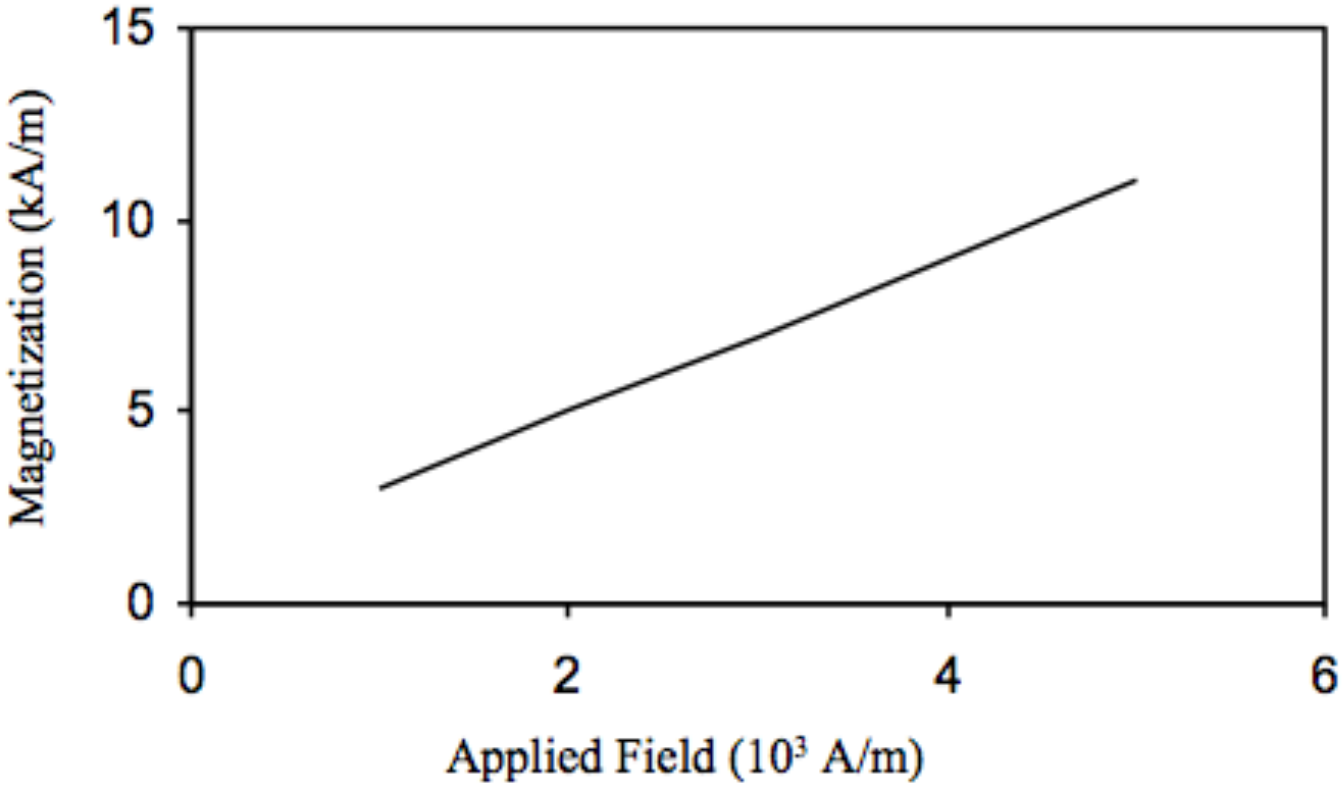


Fig. 1 Magnetization as a function of applied field.

Conclusions

- Analyze and explain findings

- Revisit central question
  - Summarize briefly
  - Answer how the issue was addressed through research findings
  - Limitations, unexpected findings, discrepancies?
  - Significance/larger impact

References: in text

- Number consecutively in square brackets [1]
- Punctuate after the bracket
  - *Example*: as shown by Stevens [2],[3].
- Three or more authors in a reference: use et al.
  - Example: as shown by Davis et al. [4].

References: section

- List consecutively as used in text
- Left justified
- **Read the style manual!**

Example: journal article

[1] A.B. Brown, C.D. Green, and E.F. White, “Optical scattering, or why the sky is blue,” *J. Sky Soc.*, v. 101, pp. 11-15, Dec. 2000.

IEEE style: abstract

Abstract is in boldface and *italics*

Keep it short (≤150 words)

Explain purpose of study, present key findings and significance of research

No equations or references

Not a "whodunit"– spill the beans!

Abstract: examples

Spend five minutes reading these two abstracts (handout)

In pairs, consider (10 min):

- What works? What doesn't?
- Do you want to read the rest of these papers?

Abstract: example 1

Carbon nanotube computer

Max M. Shulaker[1], Gage Hills[2], Nishant Patil[3], Hai Wei[4], Hong-Yu Chen[5], H.-S. Philip Wong[6] & Subhasish Mitra[7]

The miniaturization of electronic devices has been the principal driving force behind the semiconductor industry, and has brought about major improvements in computational power and energy efficiency. Although advances with silicon-based electronics continue to be made, alternative technologies are being explored. Digital circuits based on transistors fabricated from carbon nanotubes (CNTs) have the potential to outperform silicon by improving the energy–delay product, a metric of energy efficiency, by more than an order of magnitude. Hence, CNTs are an exciting complement to existing semiconductor technologies[1,2]. Owing to substantial fundamental imperfections inherent in CNTs, however, only very basic circuit blocks have been demonstrated. Here we show how these imperfections can be overcome, and demonstrate the first computer built entirely using CNT-based transistors. The CNT computer runs an operating system that is capable of multitasking: as a demonstration, we perform counting and integer-sorting simultaneously. In addition, we implement 20 different instructions from the commercial MIPS instruction set to demonstrate the generality of our CNT computer. This experimental demonstration is the most complex carbon-based electronic system yet realized. It is a considerable advance because CNTs are prominent among a variety of emerging technologies that are being considered for the next generation of highly energy-efficient electronic systems[3,4].

to incorrect logic functionality, whereas metallic CN
no bandgap, resulting in high leakage currents and
functionality[20]. The imperfection-immune design met
combines circuit design techniques with CNT proce
overcomes these problems[20,21]. It enables us to dem
first time, a complete CNT computer, realized entirely
Similar to the first silicon-based computers, our CNT co
a synchronous digital system built entirely from CNFI
programs and is programmable. Our CNT computer ru
ting system that performs multitasking, meaning tha
multiple programs concurrently (in an interleaved fashi
strate our CNT computer by concurrently executing a c
and an integer-sorting program (coordinated by a ba
operating system), and also by executing 20 different in
the commercial MIPS instruction set[22].

The CNT computer is a one-instruction-set compu
ing the SUBNEG (subtract and branch if negative) inst
by early work in ref. 23. We implement the SUBNEG ins
it is Turing complete and thus can be used to re-enco
any arbitrary instruction from any instruction-set arc
at the expense of execution time and memory space[24,2
instruction is composed of three operands: two data
third partial next instruction address (the CNT comp

Nature **501**:526 (2013)

Abstract: example 2

Candela-class high-brightness InGaN/AlGaN double-heterostructure blue-light-emitting diodes

Shuji Nakamura, Takashi Mukai, and Masayuki Senoh
Department of Research and Development, Nichia Chemical Industries, Ltd., 491 Oka, Kaminaka, Anan, Tokushima 774, Japan

(Received 2 December 1993; accepted for publication 5 January 1994)

Candela-class high-brightness InGaN/AlGaN double-heterostructure (DH) blue-light-emitting diodes (LEDs) with the luminous intensity over 1 cd were fabricated. As an active layer, a Zn-doped InGaN layer was used for the DH LEDs. The typical output power was 1500 μW and the external quantum efficiency was as high as 2.7% at a forward current of 20 mA at room temperature. The peak wavelength and the full width at half-maximum of the electroluminescence were 450 and 70 nm, respectively. This value of luminous intensity was the highest ever reported for blue LEDs.

Appl. Phys. Lett **64**:13 (1994)

Paraphrasing

- Summarize the ideas of others
- Use different words and sentences
- Quote marks not necessary
- Always include the source (reference)

Simply changing a word or two, or changing the sentence structure is plagiarism

Plagiarism

"…the intentional unacknowledged use or incorporation of any other person's work in, or as a basis for, one's own work offered for academic consideration or credit or for public presentation. Plagiarism includes, but is not limited to, **representing as one's own, without attribution, any other individual's words, phrasing, ideas, sequence of ideas, information or any other mode or content of expression**."

Consequences

Plagiarism has **SEVERE** consequences

- expulsion, termination
- full disclosure of misconduct
- loss of credibility

It's not worth it. Be honest.

Resources

Composition and grammar

OWL at Purdue University: http://owl.english.purdue.edu

Style and organization

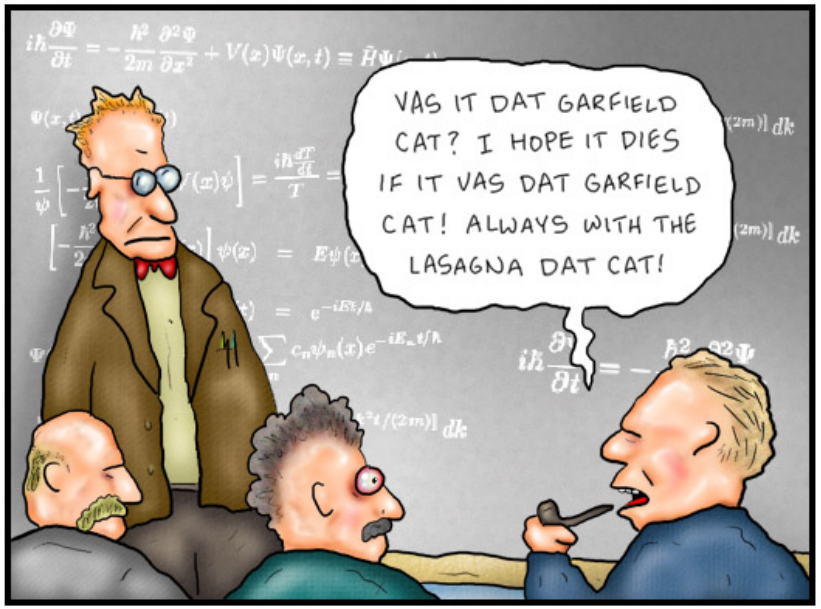
Strunk and White, The Elements of Style

A. Hofmann, Scientific Writing and Communication

A Final Thought

"If you cannot - in the long run - tell everyone what you have been doing, your doing has been worthless."

--Erwin Schrödinger



Once again Niels Bohr interrupted Schrödinger's lecture with his inane comments.

http://ibiblio.org/Dave/drfun.html

Thank you!