Science is built up with facts, as a house is with stones. But a collection of facts is no more a science than a heap of stones is a house.

- J. H. Poincaré
Engineers are Communicators

- “Professional engineers will spend 40-60% of their working time writing and giving presentations.”
- “Ironically, most engineering programs devote less than 5% of their curriculum to communication skills.”


● Your value as an engineer is your knowledge, and knowledge is only useful when shared.
Technical vs Prosaic Writing

- Other types of writing actively try to complicate things.
- Technical writing works to simplify things.
- Focus on **accuracy**, **clarity**, and **efficiency**
  - Concise, unambiguous sentences
  - Emphasis on organization
  - No embellishment or fluff
  - No superfluously big words
Cater to the Audience

- Every technical document has an audience. Always keep them in mind.

- Different audiences can require substantially different information:
  - Type of information
  - Depth of information
  - Even minor things like whether or not you need to define acronyms before use.
Things to Avoid

● No personal pronouns
  o “We did [something]” → “[Something] was done”

● No contractions

● No slang or conversational speech
  o “Hook up the circuit”
  o “Deal with the problem”

● No fluff
  o “The findings are extremely important…”
  o “In today’s society, robots are ubiquitous.”
Writing Style

- Technical documents tend to be “dry,” and that’s fine
  - Writing to inform, not to entertain
- Passive voice is acceptable
  - “An ASM chart is shown in Figure 3.”
- Everything is quantified
  - *How fast, how accurate, how reliable.*
  - Avoid vague language: ‘somewhat’, ‘very’, ‘several’, etc.
Avoid Monotony

- “Dry” does not mean monotonous
- Avoid repeating the same sentence structure over and over; vary your sentences
- Example sentence openers:

<table>
<thead>
<tr>
<th>Type</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>subject-verb</td>
<td>Pulse-width modulation is a technique …</td>
</tr>
<tr>
<td>prepositional phrase</td>
<td>By varying the duty cycle, PWM can …</td>
</tr>
<tr>
<td>dependent clause</td>
<td>Although PWM generates a digital output, a simple passive filter can …</td>
</tr>
<tr>
<td>adverb</td>
<td>Often, the load itself provides adequate …</td>
</tr>
<tr>
<td>infinitive phrase</td>
<td>To avoid damaging voltage spikes, a diode …</td>
</tr>
</tbody>
</table>
Efficient Wording

- Unless a more complicated word or phrase adds meaning, use the simpler form.

<table>
<thead>
<tr>
<th>Verbiage</th>
<th>Efficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>commence</td>
<td>start</td>
</tr>
<tr>
<td>endeavor</td>
<td>try</td>
</tr>
<tr>
<td>in the majority of instances</td>
<td>usually</td>
</tr>
<tr>
<td>connected together</td>
<td>connected</td>
</tr>
</tbody>
</table>
Eschew Obfuscation

● The goal of every technical document is information transfer

● Overly prosaic text distracts and confuses, and has no place in technical writing:
  ○ Innuendo, euphemism, hyperbole, sarcasm, word-play, dramatic imagery, suspense

● Give all the information up front, as clearly and concisely as possible
Wording Examples

• Same information, simpler wording:
  o In the majority of failed cases, poor lighting conditions were found to be the cause.
  o Most of the failed cases were caused by poor lighting.

• Less information but more accessible:
  o Operations at the plant stopped momentarily because the thermal storage charging system desuperheater attemperator valve was replaced.
  o Operations at the plant stopped for 1.5 hours so that a valve in the thermal storage system could be replaced.
Avoid Ambiguity

- If a sentence can be interpreted in more than one way, it must be rephrased

"Reductions of up to 80% in heat and mass transfer coefficients were measured due to outgassing."

- Were the reductions caused by outgassing?
- Is the heat and mass transfer from outgassing?
- Was it measured because of outgassing?
Spelling and Grammar

- Spelling and grammar are even more important in technical writing than in prose.
- Mistakes can change the meaning of a sentence, causing costly errors.
- Even if the meaning can be deciphered, your credibility will be damaged.
- Proofread for proper grammar, punctuation, word-usage, and sentence- and paragraph-level coherence.
Grammar Rules to Watch For

- Numbers:
  - Zero-nine, spell the number out; 10+, use numerals.
  - Exceptions:
    - Numbers with units or decimals: 3V, 9%, factor of 6.5
    - Enumeration: Figure 5, Samples 1-4
    - Start of sentence: “Sixty-one gates were used.” (re-word sentence to avoid, if possible)

- Acronyms:
  - ‘A’ vs ‘An’ depends on sound, not letter.
    - an FPGA, a UART

- Symbols:
  - $u \neq \mu$; $m \neq M$

More number rules: http://www.mhhe.com/mayfieldpub/tsw/numbers.htm
Large-scale Organization

- Technical documents usually have a clear introduction, body, and conclusion
  - **Introduction**: provides motivation and context; “big picture” information
  - **Body**: contains technical details
  - **Conclusion**: reemphasize main points and discuss “big picture”
Small-scale Organization

- Most technical writing makes heavy use of headings and subheadings
  - Should be descriptive enough to guide reader to appropriate section

- Paragraphs tend to be shorter than in other types of writing

- Goal is to make information as accessible and easy-to-find as possible
Using Visual Information

- Large paragraphs of text are the least-accessible form of information.
- When possible, make use of lists, tables, charts, figures, and other graphics.
  - Visual information is nearly always better.
  - But don’t shy away from using text to explain or give context to figures.
  - And there are things that work better as text. Use common sense.
• Remember: accuracy, clarity, and efficiency
  o Tailored to the audience
  o Concise, unambiguous sentences
  o Emphasis on organization
  o No fluff