Giving Effective Technical Presentations

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Types of Presentations

- Inspirational
- Persuasive
- Technical
- Lecture
Conference Presentations

• Explain the value and impact of your work
• Obtain feedback from the community
• Motivate audience to read the paper
• Represent yourself, your work, and your group
Presentation Overview

• Presentation Content
• Slide Formatting
• Preparation and Delivery
• Conclusion
Part I: Presentation Content
Outlining Your Presentation

• Begin by organizing

• Answer:
  − What is the key takeaway?
  − Why is it relevant and impactful?
  − What is necessary to understand?

• Remove unnecessary complexity

• Focus on the flow of information

• Understand your audience
Most of your time is spent on engineering tasks.
Most of your time is spent on the broader impacts
Structure: Your Goal

Complexity
- Quantitative Results
- Key Equations
- Technical Analysis
- Derivations
- Mathematical Equations

Comprehension
- Real-world applications
- Discussion Flow
- Functional Descriptions
- Complete Testing Results
- Complete

Technical Analysis

Mathematical Equations
Presenting Application

• *What* are you working on?
• *Why* are you working on it?
• *How* will solving the problem benefit the audience?
## Application Example

![DC-DC Converter Diagram](image1)

### Parameter Table

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_g$</td>
<td>12</td>
</tr>
<tr>
<td>$I_{out}$</td>
<td>100</td>
</tr>
<tr>
<td>$V_{out}$</td>
<td>1.2</td>
</tr>
<tr>
<td>Efficiency</td>
<td>95%</td>
</tr>
</tbody>
</table>
Application Example

Parameter | Value
--- | ---
$V_g$ | 12
$I_{out}$ | 100
$V_{out}$ | 1.2
Efficiency | 95%

- Lost in power conversion:
  - 1.14% of US electricity
  - $7.02 billion
  - Annual CO₂ emissions of 3.3 million US homes

Use of power in a typical data center
Presenting Literature Review

• *How* is your approach better than what has been done before?

• Focus on *trends* and *gaps* in prior work

• Establish the *novelty* of your work
Literature Review Example

Literature Review Example

Trends in commercial power density
Presenting Analysis

- **Why** hasn’t the issue been solved already?
- **How** have you solved it?

- Only put enough technical detail to convey the complexity of the problem
- You can’t explain the full theory; don’t try!
Analysis Example

\[ A_1 = \begin{bmatrix} 0 & 0 & -\frac{1}{C_p} \\ \frac{1}{L_t} & 0 & -\frac{1}{L_t n_t} \\ -\frac{1}{L_t n_t} & \frac{1}{C_{out} n_t} & 0 \end{bmatrix}, \quad B_1 = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}, \]

\[ A_2 = \begin{bmatrix} \frac{-1}{2R_p C_p} & 0 & 0 \\ 0 & 0 & -\frac{1}{C_{out} n_t} \\ 0 & \frac{1}{L_t n_t} & 0 \end{bmatrix}, \quad B_2 = \begin{bmatrix} \frac{2R_p C_p}{L_t} \\ 0 \\ \frac{1}{L_t} \end{bmatrix}, \]

\[ A_3 = \begin{bmatrix} \frac{-1}{2R_p C_p} & 0 & 0 \\ 0 & 0 & -\frac{1}{C_{out} n_t} \\ 0 & \frac{1}{L_t n_t} & 0 \end{bmatrix}, \quad B_3 = \begin{bmatrix} \frac{2R_p C_p}{L_t} \\ 0 \\ \frac{1}{L_t} \end{bmatrix}. \]

\[ x(t) = A_i x(t) + B_i v_g(t) + P_i i_{load}(t), \]
\[ y(t) = C_i x(t), \]
\[ \hat{x}(t) = e^{A_i t} \hat{x}_0 + A_i^{-1} \left( e^{A_i t} - I \right) \left( B_i \hat{v}_g(t) + P_i \hat{i}_{load}(t) \right), \]
\[ \hat{x}[n+1] = F \hat{x}[n] + G \hat{\phi}[n] + K \hat{v}_g[n] + L \hat{i}_{load}[n], \]
\[ \hat{y}[n+1] = C \hat{x}[n]. \]

\[ x(t) = e^{A_i t} \hat{x}_0 + \int_0^t e^{-A_i(t-\tau)} \left( B_i \hat{v}_g(\tau) + P_i \hat{i}_{load}(\tau) \right) d\tau. \]

\[ L = \sum_{i=1}^n \left( \prod_{k=i+1}^n e^{A_k t_k} \right) A_i \left( e^{A_i t_i} - I \right) P. \]
Analysis Example

- Linear equivalent used to derive discrete-time state space

\[
\hat{x}[n+1] = F\hat{x}[n] + L\hat{i}_{\text{load}}[n] ,
\]

\[
\hat{y}[n+1] = C\hat{x}[n] .
\]

- Derivation in full paper

\[
L = \sum_{i=1}^{n} \left( \prod_{k=i+1}^{n} e^{A_{k}t_k} \right) A_i (e^{A_{i}t_i} - I) P .
\]
Presenting Results

• *Prove* that you have solved the issue

• *Show* the impact of your contribution
Results Example

![Diagram of a converter power stage with labels for currents and voltages: $i_i$, $v_{ds2}$, $v_{ds4}$, $v_{ds6}$, and $i_{load}$ with corresponding components and connections.](image)

*Converter power stage*
Results Example

Prototype hardware implementation

Model validation using experimental results
Summarizing Your Talk

• In conclusion, we have discussed the general format of conference presentations
• Both positive and negative examples have been presented
• A comparison between organization in a paper and organization in a presentation was presented
Summarizing Your Talk

- In conclusion, we have discussed the general format of conference presentations.
- Both positive and negative examples have been presented.
- A comparison between organization in a paper and organization in a presentation was presented.

But you already knew that!
Concluding Your Talk

• Avoid superficial repetition
• End on a strong note
• Emphasize the *Takeaway*
Part II: Slide Preparation
Slide Preparation

• Slides are a tool to help clarify
  – *Not* the whole presentation!

• Key points clear from slides alone
Normal

- Black-on-white is the default
- Will display clearly in any venue
Off-White

- Can reduce eyestrain
- May reduce visibility if overdone
Dark

- Works well in rooms with dim light
- Requires work on color selection
Slide Structure

• Key point number one
• Key point number two
  – Subpoint one
  – Subpoint two
• Key takeaway / transition

Reduce title height; this space is valuable

Increase spacing between bulletpoints to improve readability

Align elements to common bounds. Prefer left-alignment to center in most cases

Bottom of slide is often obscured in the venue. Do not put critical elements down here.
Fonts

**Serif Fonts**
- Good readability in large text blocks
- Use in papers, books

**Sans-Serif Fonts**
- Good readability in short text blocks
- Use for presentations

- Calibri (these slides) works well
- Arial is also common
- Never use Comic Sans for technical talks
- Courier works well for code

- Use one or two fonts/colors at most
- Every change to text styling draws attention
Number Formatting

• Reduce digits as much as possible to maintain point
  – No: 234.234652345   Yes: 234
  – No: 2.2345 e-6 A    Yes: 2.2 µA
  – No: 100000000      Yes: 100,000,000

• In columns, align numbers for readability
### Variable Formatting

- Use sub/super-script
- Variables in italics
  - Numbers and punctuation not italicized, even when part of a variable
  - Operators, including functions (e.g. sin, abs, ln), not italicized
  - Descriptive subscripts not italicized
- Serif fonts or mathematical type improve readability

<table>
<thead>
<tr>
<th>No</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>va1</td>
<td>$v_{a1}$</td>
</tr>
<tr>
<td>$lx^3$</td>
<td>$I_x^3$</td>
</tr>
<tr>
<td>$r_{ds(on)}$</td>
<td>$r_{ds(on)}$</td>
</tr>
<tr>
<td>$Sin(x)$</td>
<td>$sin(x)$</td>
</tr>
<tr>
<td>$u$</td>
<td>$\mu$</td>
</tr>
</tbody>
</table>
Figures

• *Bad* figures need to be qualified or explained
  - “… you don’t need to understand *all* of this, but…”
  - “… you probably can’t read this, but…”

• *Good* figures show your point with little or no explanation
Limit Amount of Text

• Use short bullet text
• Have only a few bullets per page
• Use figures to explain your speech, not vice-versa
Competing Figures

- If you show it, they will read it
- Avoid needless comics/clipart
Choosing Element Colors

- Reduce saturation

- Use saturated colors only for extreme emphasis
Figure Formatting

- Always
  - Label Axes
  - Include legend
  - Use color and line style
- Make font large enough to be readable
Plotting in Excel – Default
Plotting in Excel – Template Chart Styles
Plotting in Excel – Formatted

Random Number Generator Output

Y-axis Data [p.u.]

X-axis Data [$]

-0.1 0.1 0.3 0.5 0.7 0.9 1.1

0 0.2 0.4 0.6 0.8 1
## Formatting Tables

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Capacitor Used</th>
<th>Analytical Value</th>
<th>Experimental Value</th>
<th>Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soft-Switched Time</td>
<td>$C_{eq,t}$</td>
<td>40.7 ns</td>
<td>39 ns</td>
<td>4.4 %</td>
</tr>
<tr>
<td>Minimum ZVS Current</td>
<td>$C_{eq,Z}$</td>
<td>819 mA</td>
<td>850 mA</td>
<td>3.6 %</td>
</tr>
<tr>
<td>Hard Switched Loss</td>
<td>$C_{eq,Q}$</td>
<td>6.9 W</td>
<td>7.05 W</td>
<td>2.1 %</td>
</tr>
</tbody>
</table>

### Experimental Results for Dual Active Bridge Converter

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Capacitor Used</th>
<th>Value</th>
<th>Error</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Analytical</td>
<td>Experimental</td>
</tr>
<tr>
<td>Soft-Switched Time</td>
<td>$C_{eq,t}$</td>
<td>41 ns</td>
<td>39 ns</td>
</tr>
<tr>
<td>Minimum ZVS Current</td>
<td>$C_{eq,Z}$</td>
<td>820 mA</td>
<td>850 mA</td>
</tr>
<tr>
<td>Hard Switched Primary Loss</td>
<td>$C_{eq,Q}$</td>
<td>6.9 W</td>
<td>7.1 W</td>
</tr>
</tbody>
</table>
Animations

• This is distracting

• Use animation only to help clarify
  – Not to make it fancy

• Useful to help explain complex behaviors
Example: ZVS Volt-Second Feedback

- Generalized ZVS transition
- Voltage $v_c(t)$ determined by initial conditions
Example: ZVS Volt-Second Feedback

- Initial current $I_0$ increased by $\Delta I$
Example: ZVS Volt-Second Feedback

- Initial current $I_0$ increased by $\Delta I$
- Voltage waveform responds with $\Delta \lambda$
Part III: Preparation and Delivery
Preparation

• *Practice*
  – Alone
  – With peers
  – With Group
  – With Advisor

• Do not memorize

• *Know* your material

• Earn confidence
  – You are the foremost expert on your research
  – Practice!
Speaking

• Be passionate and excited
• Face audience
  − Eye contact
  − Speak clearly
• Avoid distracting behaviors
  − Superfluous words (“uh…”, “like…”, etc.)
  − Blocking audience view
  − Fidgeting and excessive movement
• “Bookend” each slide
  − Never end on a low
Tools of the Trade

• Know your setup before you begin
  – Is slide remote available?
  – Podium?
  – Presenter view?

• Avoid excess use of laser pointer
Getting There Early

\[ R_s(t) = \prod_{i=1}^{n} e^{\frac{\beta_i}{\theta_i}} = e^{\sum_{i=1}^{n} \frac{\beta_i}{\theta_i}} \]

\[ \lambda(t) = \frac{e^{\sum_{i=1}^{n} \frac{\beta_i}{\theta_i}}}{e^{\sum_{i=1}^{n} \frac{\beta_i}{\theta_i}}} = \sum_{i=1}^{n} \frac{\beta_i}{\theta_i} e^{\frac{\beta_i}{\theta_i}} \]

\[ R_s(t) = \prod_{i=1}^{n} e^{\left( \frac{\beta_i}{\theta_i} \right)} = e^{\sum_{i=1}^{n} \left( \frac{\beta_i}{\theta_i} \right)} \]

\[ \dot{\lambda}(t) = \frac{e^{\sum_{i=1}^{n} \left( \frac{\beta_i}{\theta_i} \right)}}{e^{\sum_{i=1}^{n} \left( \frac{\beta_i}{\theta_i} \right)}} = \sum_{i=1}^{n} \frac{\beta_i}{\theta_i} e^{\frac{\beta_i}{\theta_i}} \]

Figure 1 – Microprocessor Power Trends
After You Present

• End on time for questions
  − Do not try to include too much

• Answering questions
  − Answer specific question; stay on topic
  − “I don’t know the answer, but...”

• Backup slides are useful

• Remain until session ends
“Man, that person looked way too nicely dressed, I bet he doesn’t know what he’s talking about”

– Nobody, ever.

“Nice of him to crawl out of bed for this”

– Overheard at APEC 2012
Part IV: Conclusion
How Your Talk is Judged

You are judged by the volume

Technical Content

Explanation Clarity

Visual Quality
Breaking the Rules

• Be sure anytime you break a rule

• Good presentations require time and effort
  – Ensure good reputation of your group
  – Foster interest in your work
  – Often lead to employment opportunities
Additional Resources

• Markus Puschel, “Small Guide to Giving Presentations”
• Joseph Haworth Jr & David Reardon, “How to Give a Really Lousy Technical Presentation”
• Chad Wilson, “Technical PowerPoint Presentation Cheat Sheet”
• Victor Li, “Hints on Writing Technical Papers and Making Presentations”

Additionally:
1. Google, “How to format powerpoint slides”
2. Click on any link from a .edu domain
3. Do the opposite of all recommendations
Good Luck

Discussion