Giving Effective Technical Presentations

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Contributions from:

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Types of Presentations

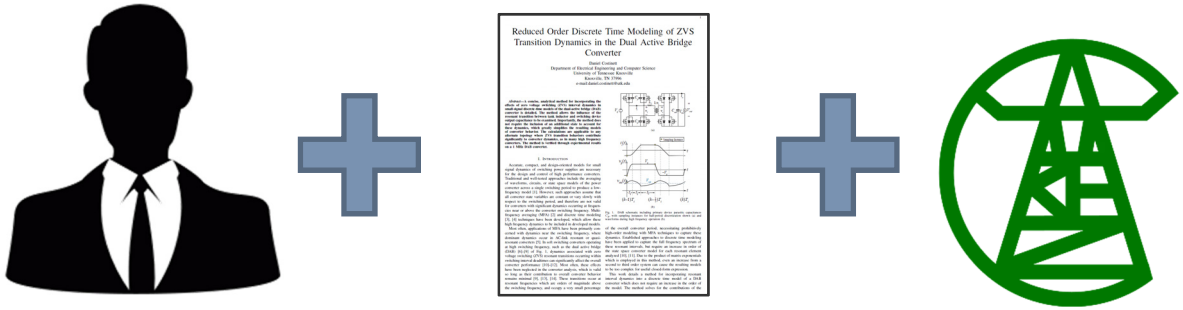
- Inspirational

- 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



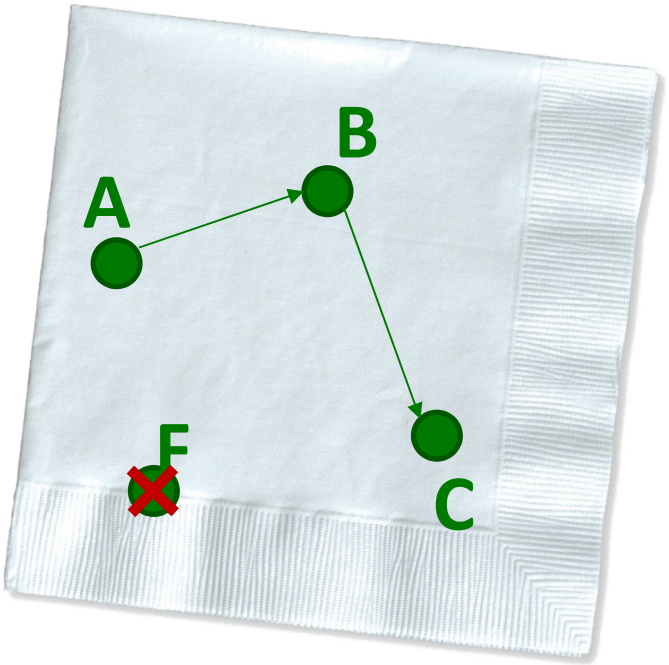
Presentation Overview

- Presentation Content
- Slide Formatting
- Preparation and Delivery
- Conclusion

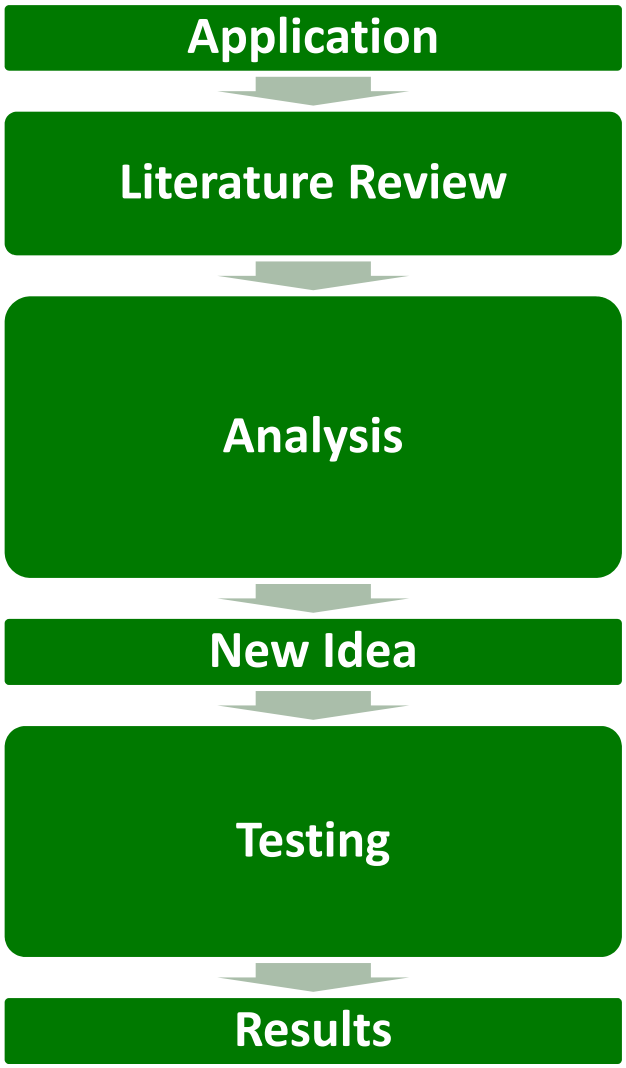
Part I: Presentation Content

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



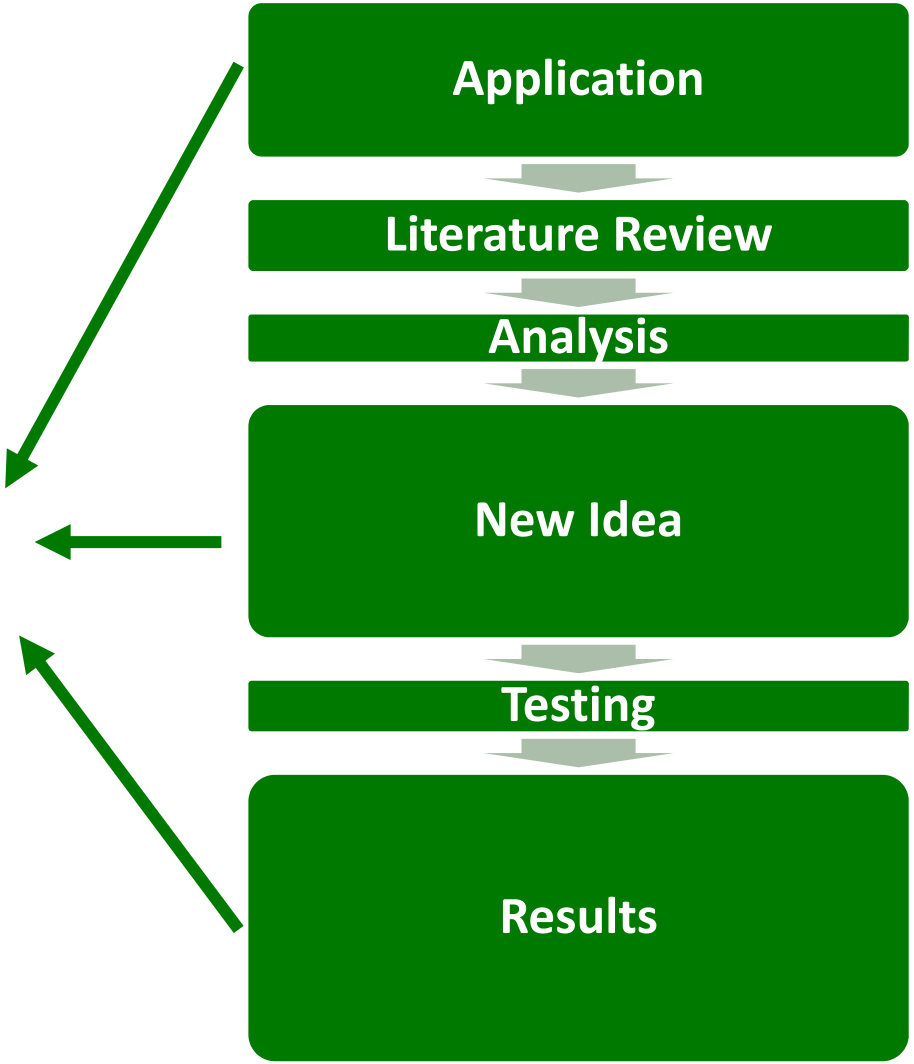
Research Structure



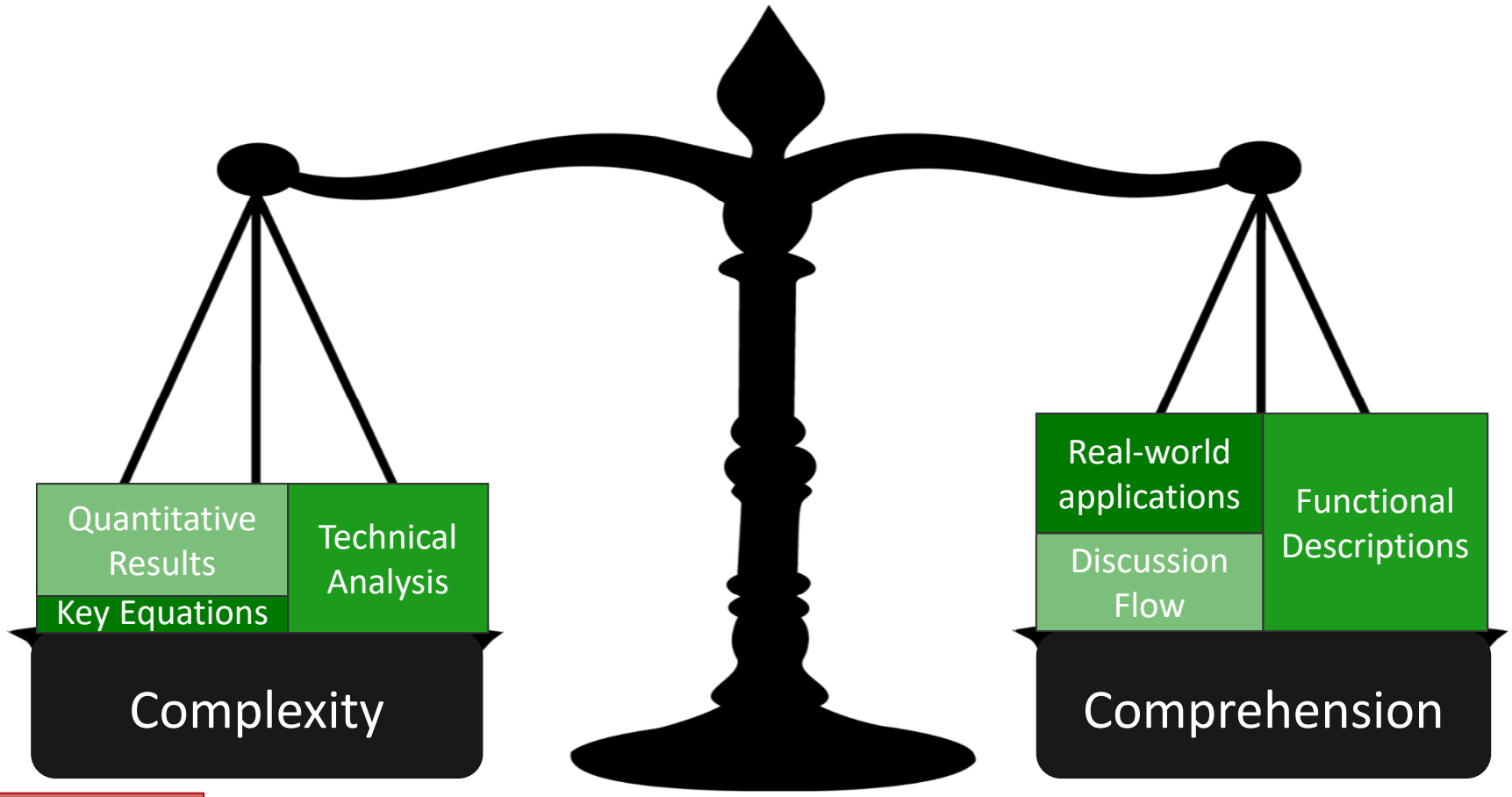
Most of your time is spent on engineering tasks

Presentation Structure

Most of your time is spent on the broader impacts



Structure: Your Goal



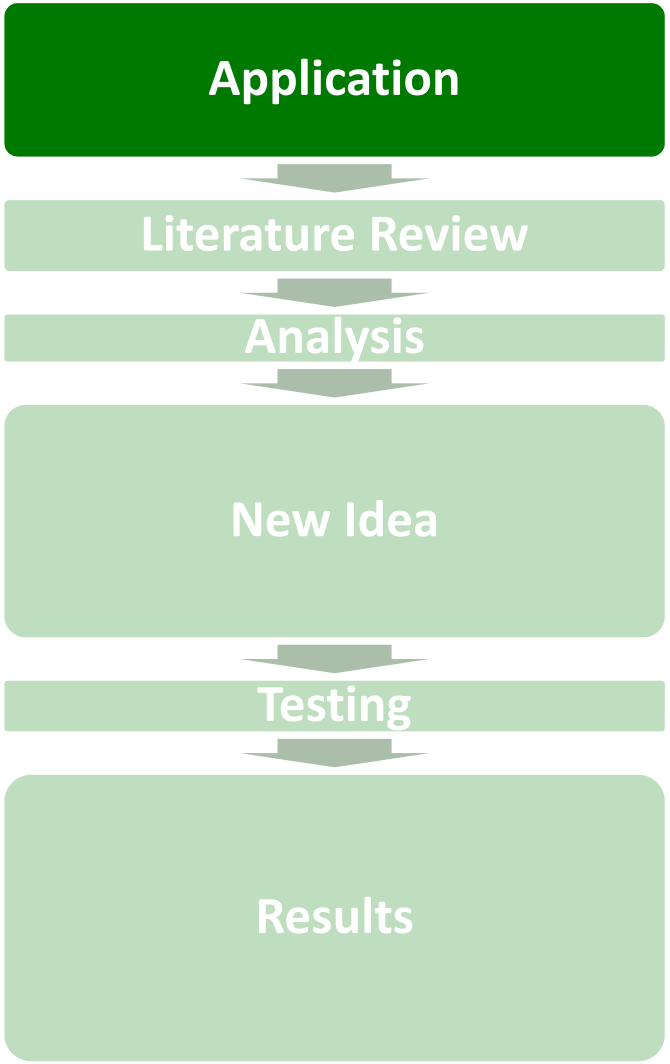
Derivations

Mathematical Equations

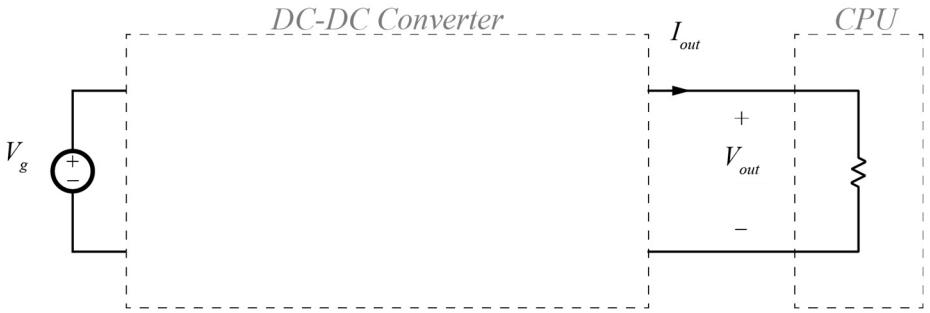
Complete Testing Results

Presenting Application

- *What* are you working on?
- Why are you working on it?
- How will solving the problem benefit the audience?

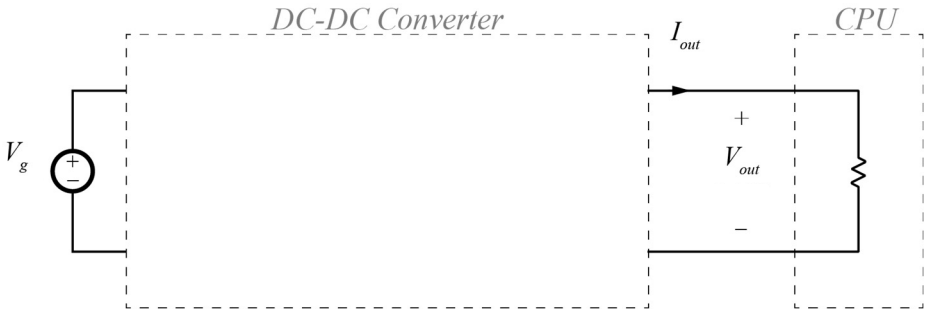


Application Example



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

Application Example



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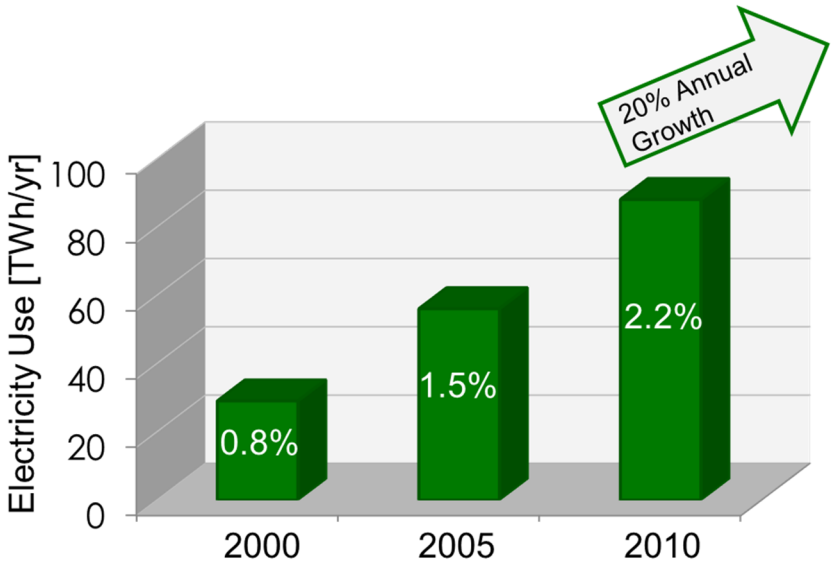
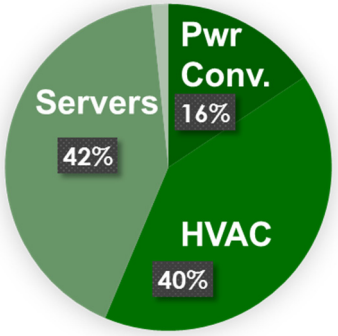


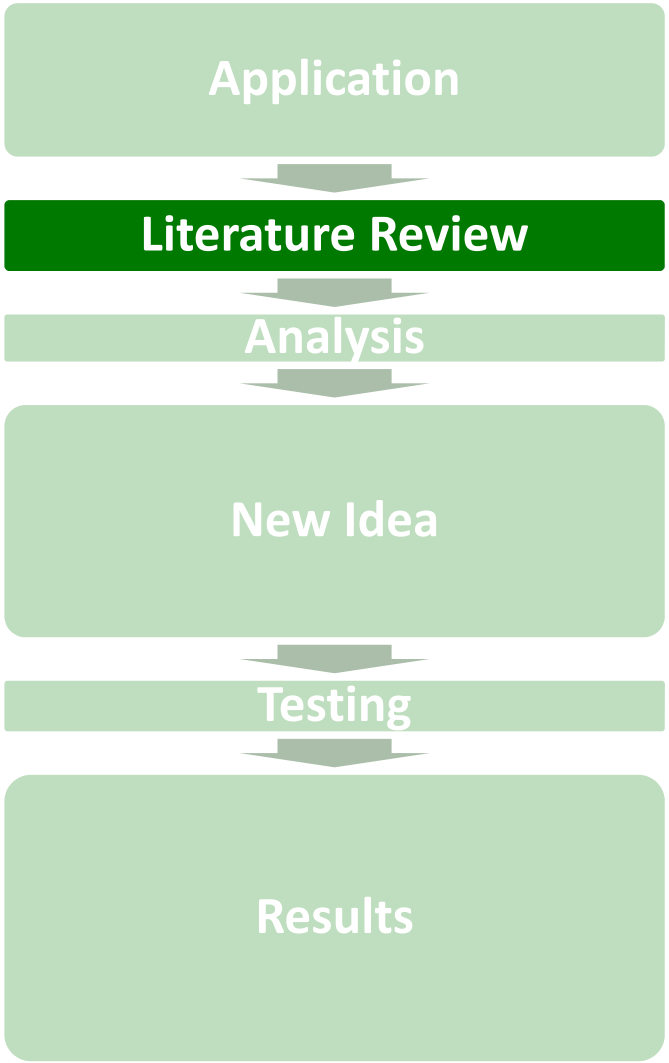
- Lost in power conversion:
  - 1.14% of US electricity
  - $7.02 billion
  - Annual CO_2 emissions of 3.3 million US homes



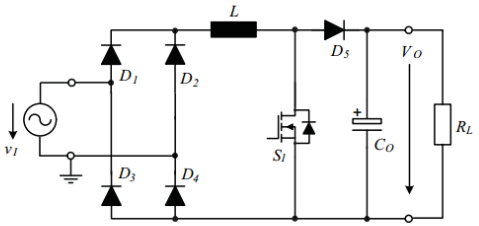
Use of power in a typical data center

Presenting Literature Review

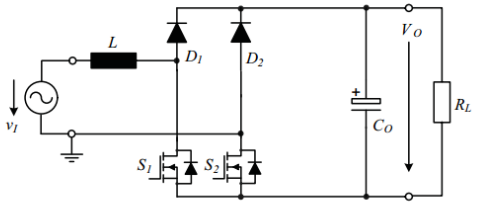
- *How* is your approach better than what has been done before?
- Focus on *trends* and *gaps* in prior work
- Establish the *novelty* of your work



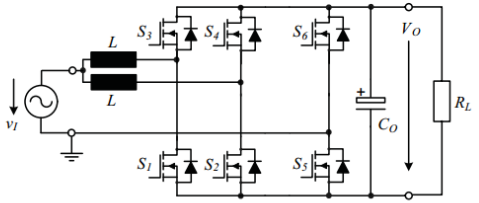
Literature Review Example



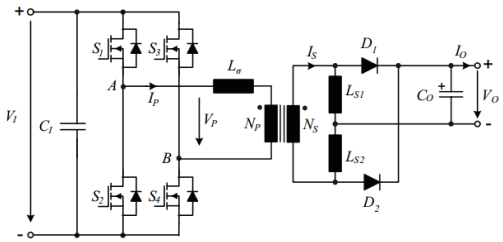
4.5 kW/dm^3 [1]



10 kW/dm^3 [2]

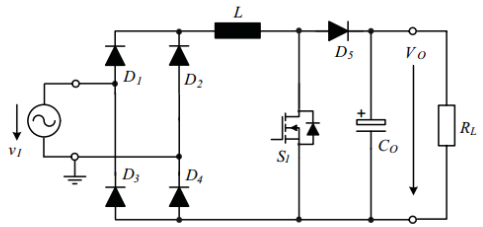


13 kW/dm^3 [3]

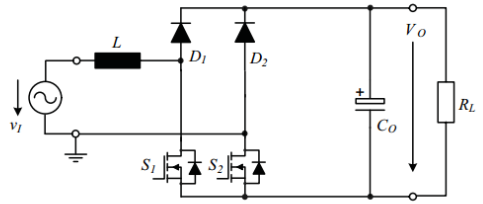


14 kW/dm^3 [4]

Literature Review Example



4.5 kW/dm^3 [1]



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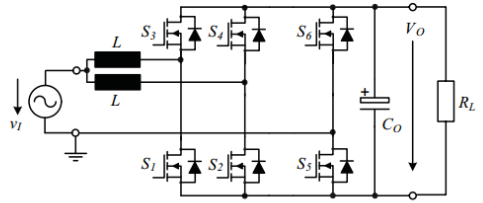

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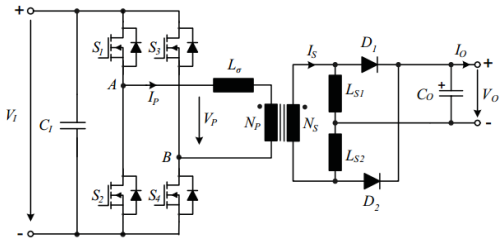

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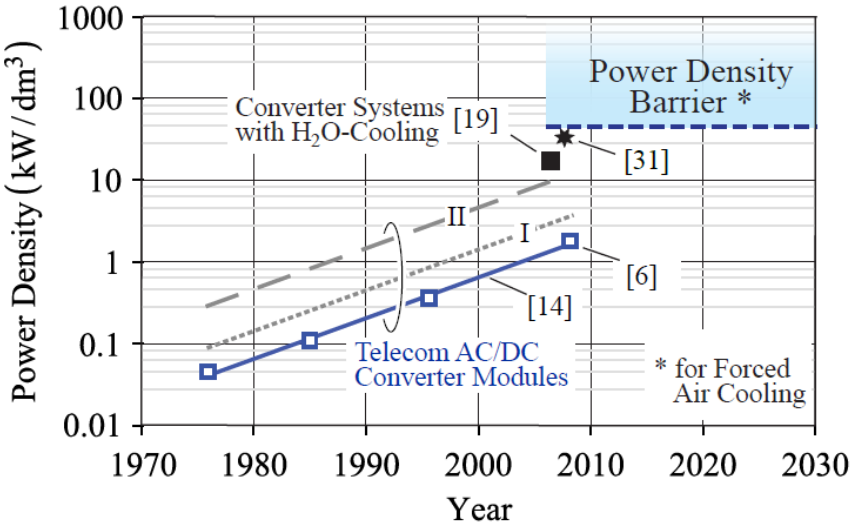
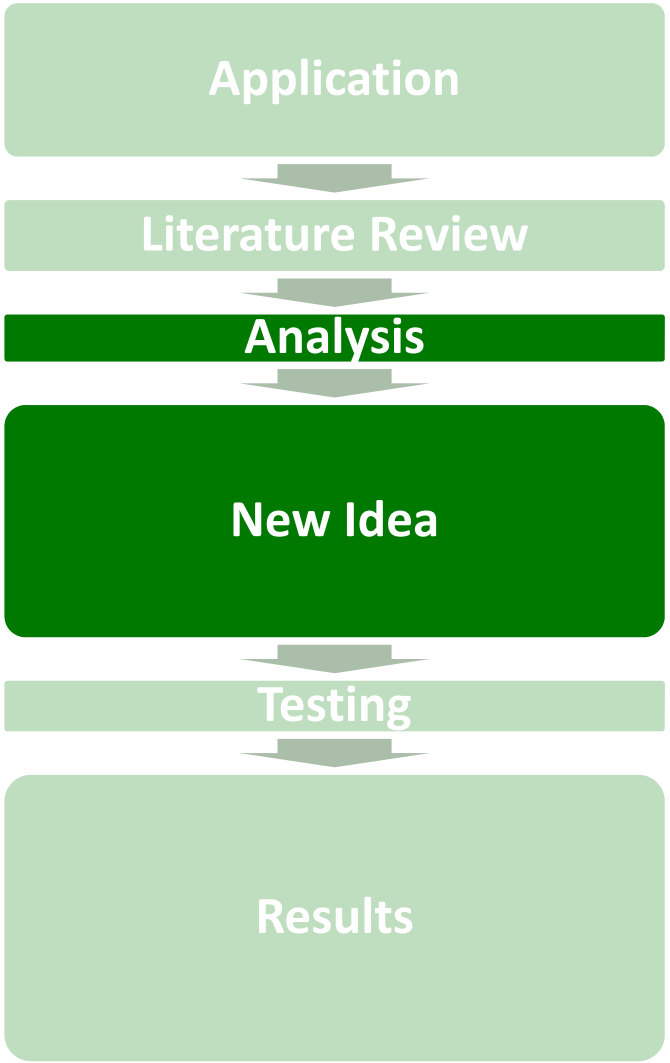


Trends in commercial power density

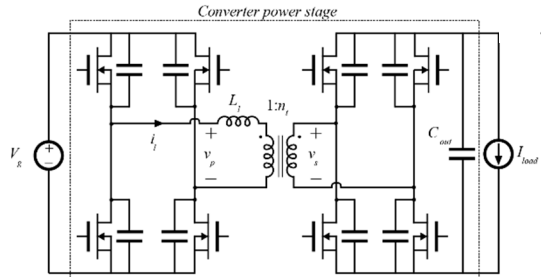
Presenting Analysis

- *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



$$A_1 = \begin{bmatrix} 0 & 0 & \frac{-1}{C_p} \\ 0 & 0 & \frac{1}{C_{out} n_t} \\ \frac{1}{L_l} & \frac{-1}{L_l n_t} & 0 \end{bmatrix} \qquad B_1 = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix},$$

$$A_2 = \begin{bmatrix} \frac{-1}{2R_p C_p} & 0 & 0 \\ 0 & 0 & \frac{1}{C_{out} n_t} \\ 0 & \frac{-1}{L_l n_t} & 0 \end{bmatrix} \qquad B_2 = \begin{bmatrix} \frac{-1}{2R_p C_p} \\ 0 \\ \frac{-1}{L_l} \end{bmatrix},$$

$$A_3 = \begin{bmatrix} \frac{-1}{2R_p C_p} & 0 & 0 \\ 0 & 0 & \frac{-1}{C_{out} n_t} \\ 0 & \frac{1}{L_l n_t} & 0 \end{bmatrix} \qquad B_3 = \begin{bmatrix} \frac{-1}{2R_p C_p} \\ 0 \\ \frac{-1}{L_l} \end{bmatrix}.$$

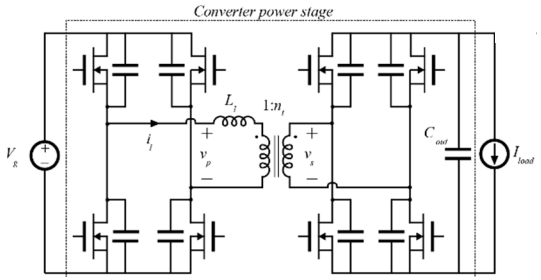
$$\dot{x}(t) = A_i x(t) + B_i v_g(t) + P_i i_{load}(t) \ ,$$
$$y(t) = C_i x(t) \ ,$$

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

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

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

Analysis Example



$$A_1 = \begin{bmatrix} 0 & 0 & \frac{-1}{C_p} \\ 0 & 0 & \frac{1}{C_{out} n_t} \\ \frac{1}{L_l} & \frac{-1}{L_l n_t} & 0 \end{bmatrix} \qquad B_1 = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix},$$

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$$\dot{x}(t) = A_i x(t) + B_i v_g(t) + P_i i_{load}(t) \ ,$$
$$y(t) = C_i x(t) \ ,$$

$$\hat{x}(t) = e^{A_i t}\hat{x}_0 + A_i{}^{-1}\left(e^{A_i t} - I\right)\left(B_i \hat{v}_g(t) + P_i \hat{i}_{load}(t)\right)$$

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

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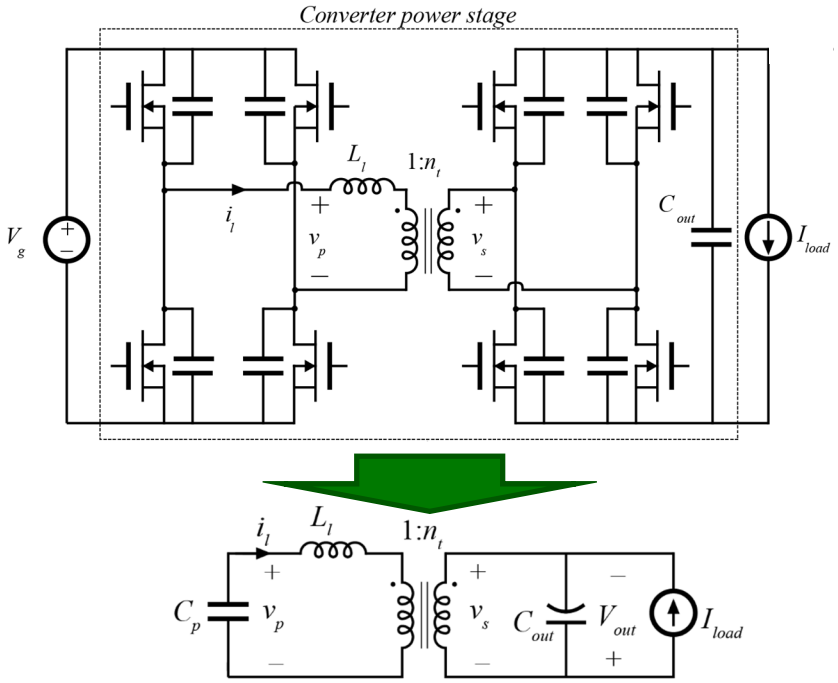
$$L = \sum_{i=1}^{n}\left(\prod_{k=i+1}^{n} e^{A_k t_k}\right) A_i \left(e^{A_i t_i} - I\right) P \ .$$



- Linear equivalent used to derive discrete-time state space

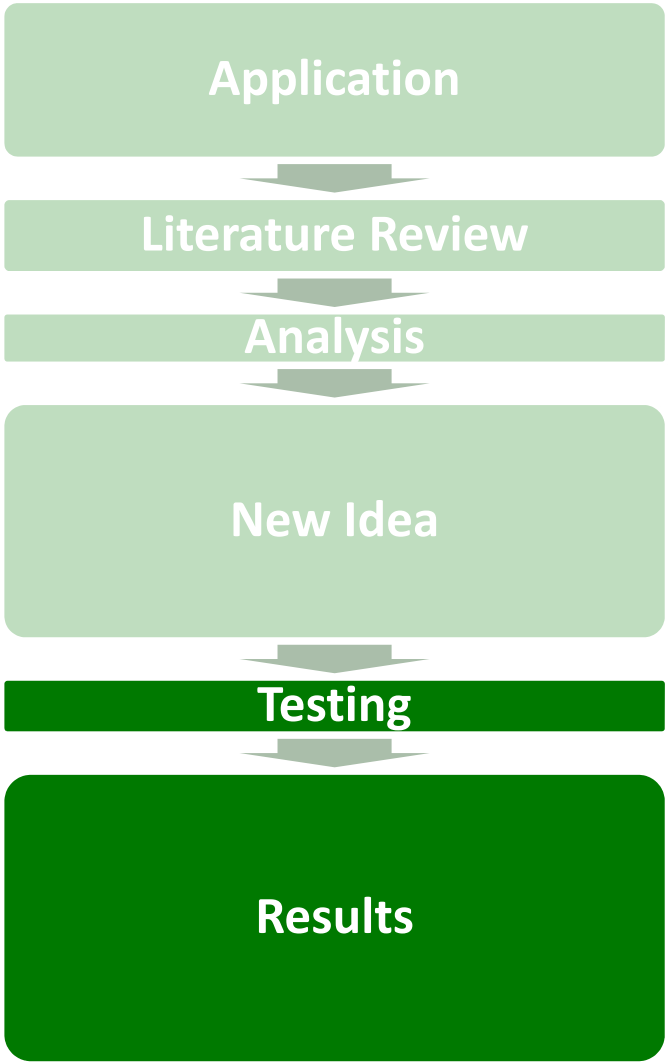
$$\hat{x}[n+1] = F\hat{x}[n] + \boldsymbol{L}\hat{i}_{load}[n] \ ,$$
$$\hat{y}[n+1] = C\hat{x}[n] \ .$$

- Derivation in full paper

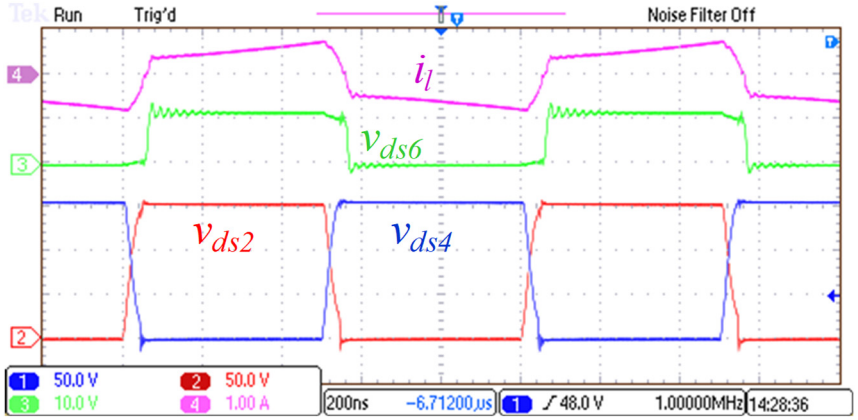
$$\boldsymbol{L} = \sum_{i=1}^{n}\left(\prod_{k=i+1}^{n} e^{A_k t_k}\right) A_i \left(e^{A_i t_i} - I\right) P \ .$$

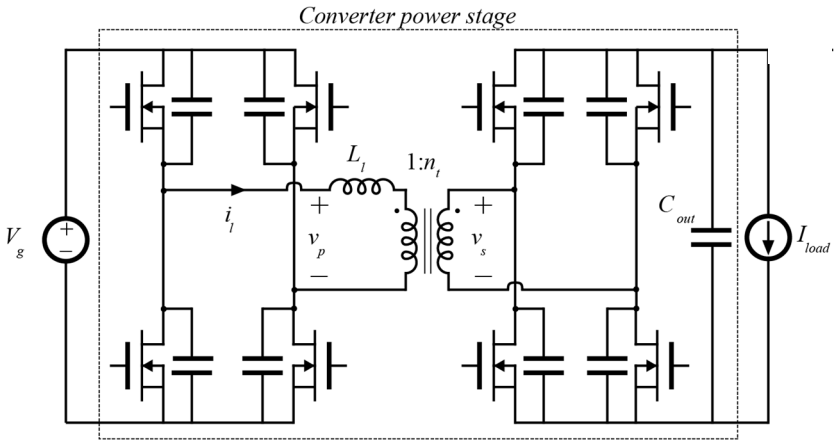
Presenting Results

- *Prove* that you have solved the issue
- *Show* the impact of your contribution

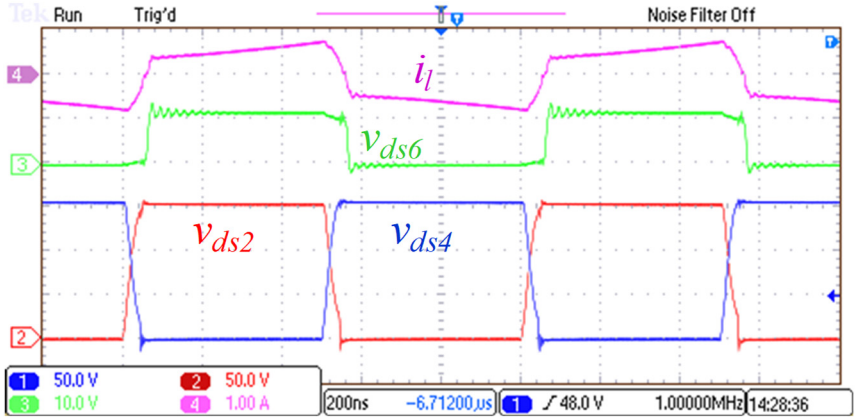


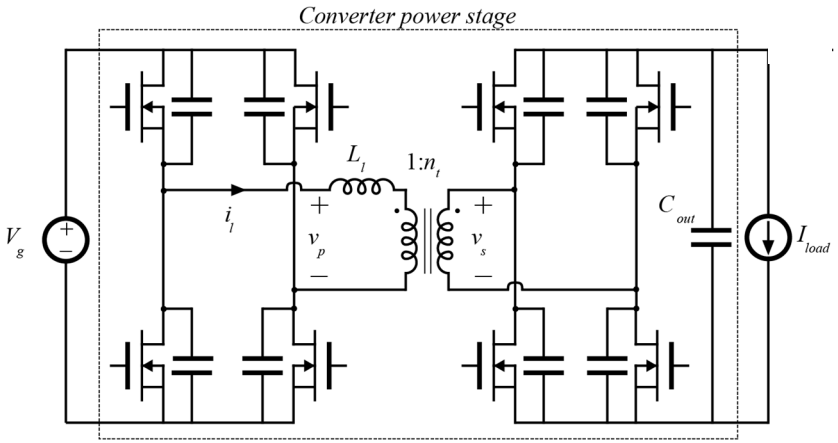
Results Example

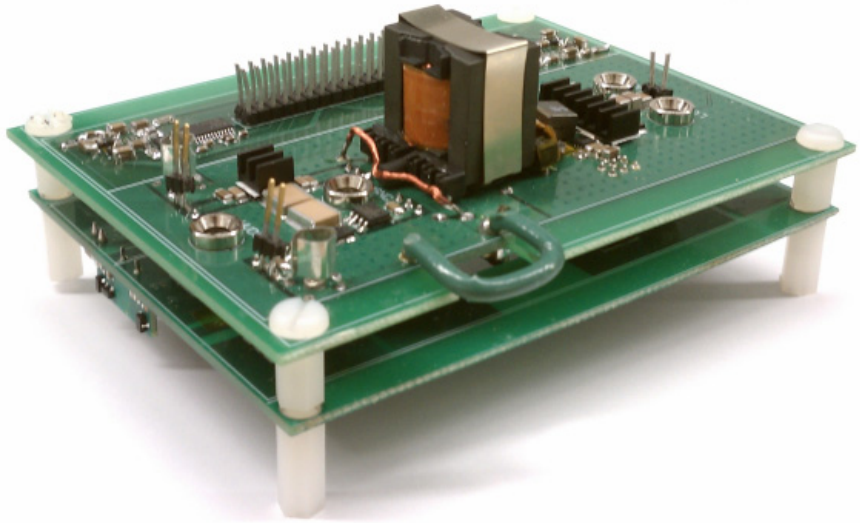




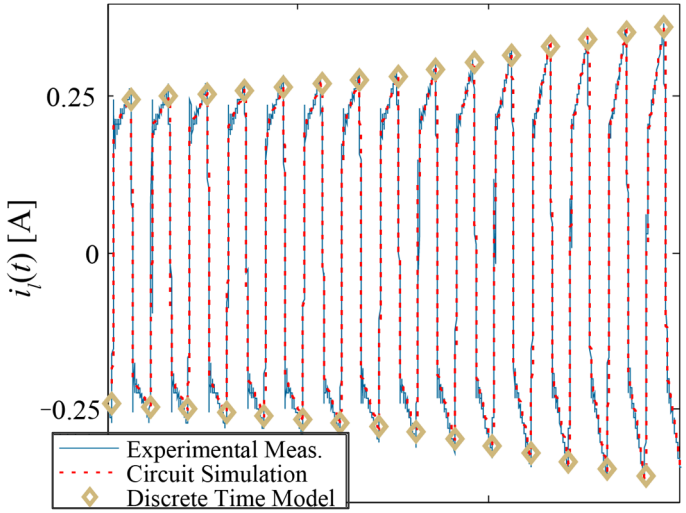
Results Example







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
- Bot[illegible]e bee[illegible]
- A c[illegible]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

Reduce title height; this space is valuable

- Key point number one
- Key point number two
  - Subpoint one
  - Subpoint two
- Key takeaway / transition

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

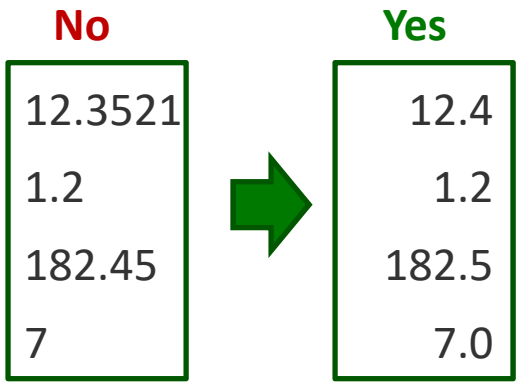
Serif Fonts	Sans-Serif Fonts
• Good readability in large text blocks • Use in papers, books	• Good readability in short text blocks • Use for presentations

- 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

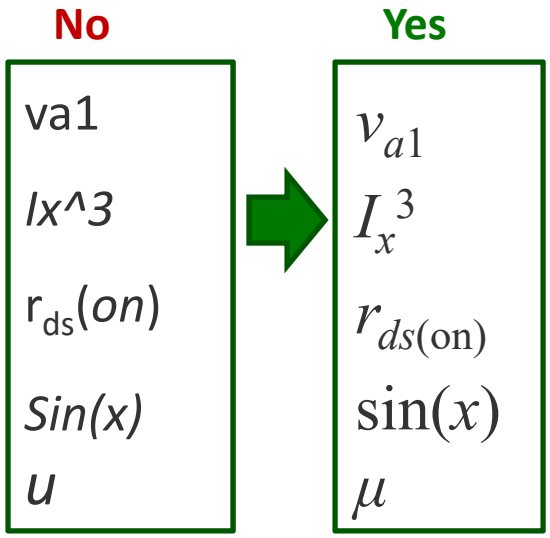
Number Formatting

- 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



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

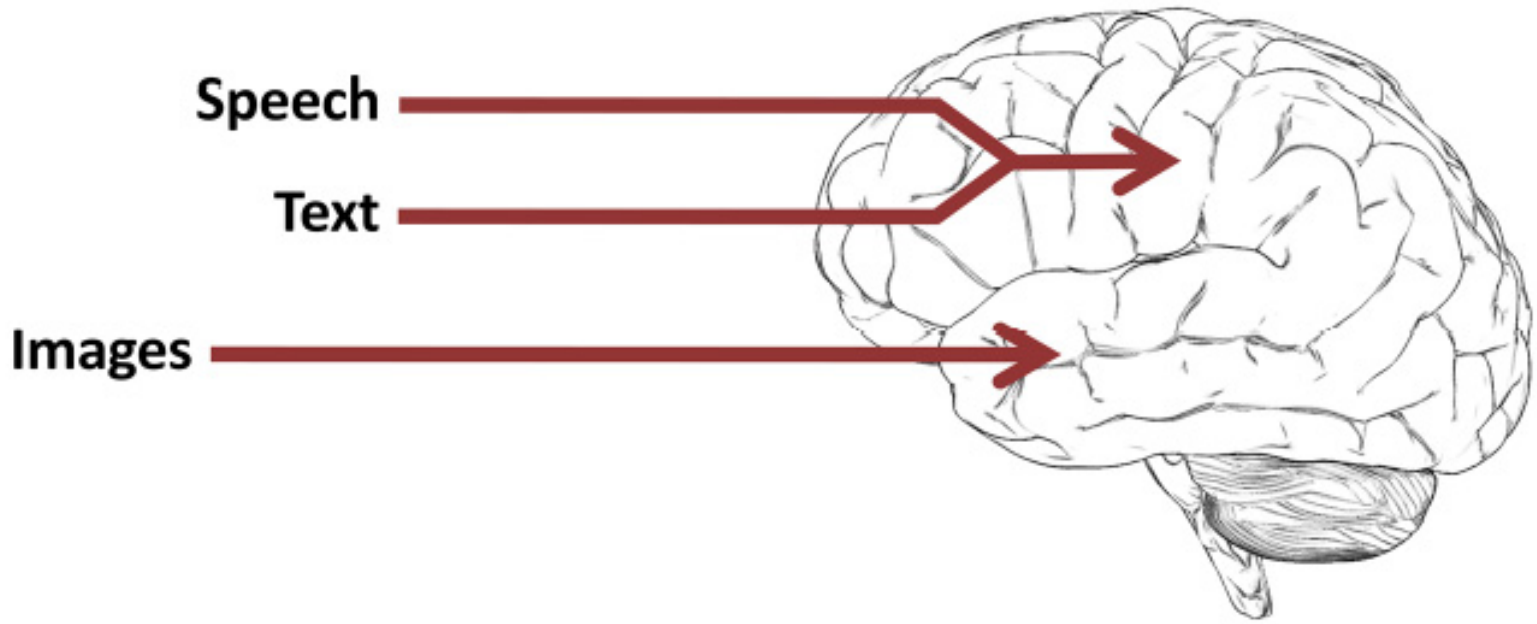
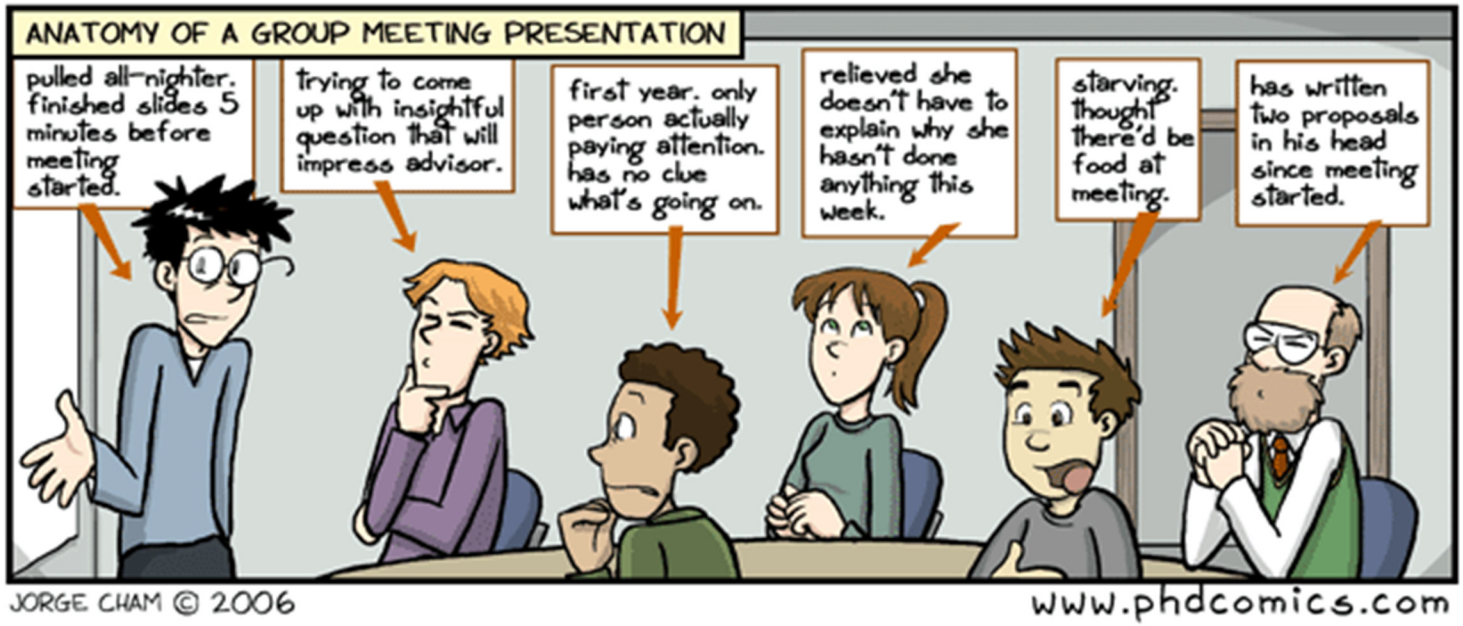


Image: http://www.illuminati-news.com/technology.htm

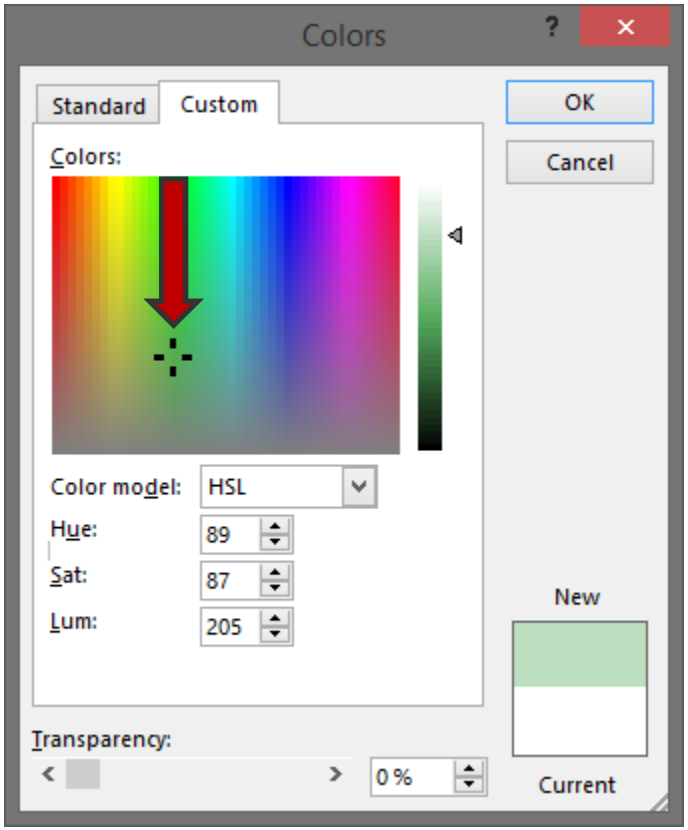
- Use short bullet text
- Have only a few bullets per page
- Use figures to explain your speech, not vice-versa

Competing Figures

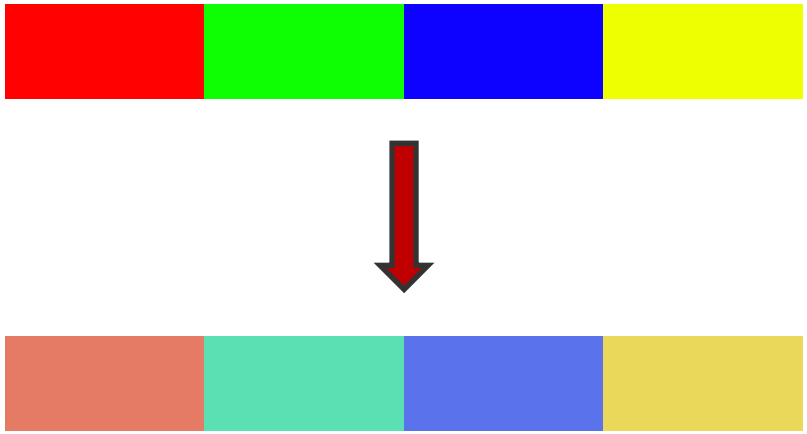


- If you show it, they will read it
- Avoid needless comics/clipart

Choosing Element Colors

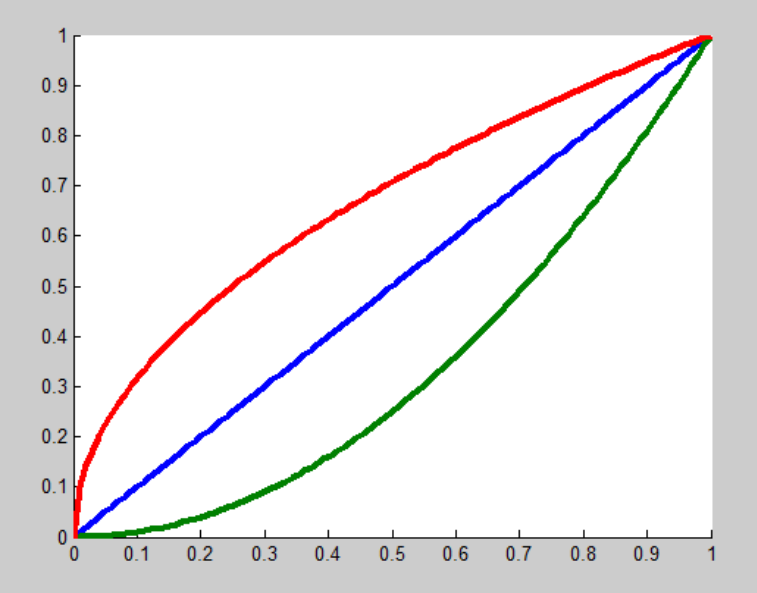


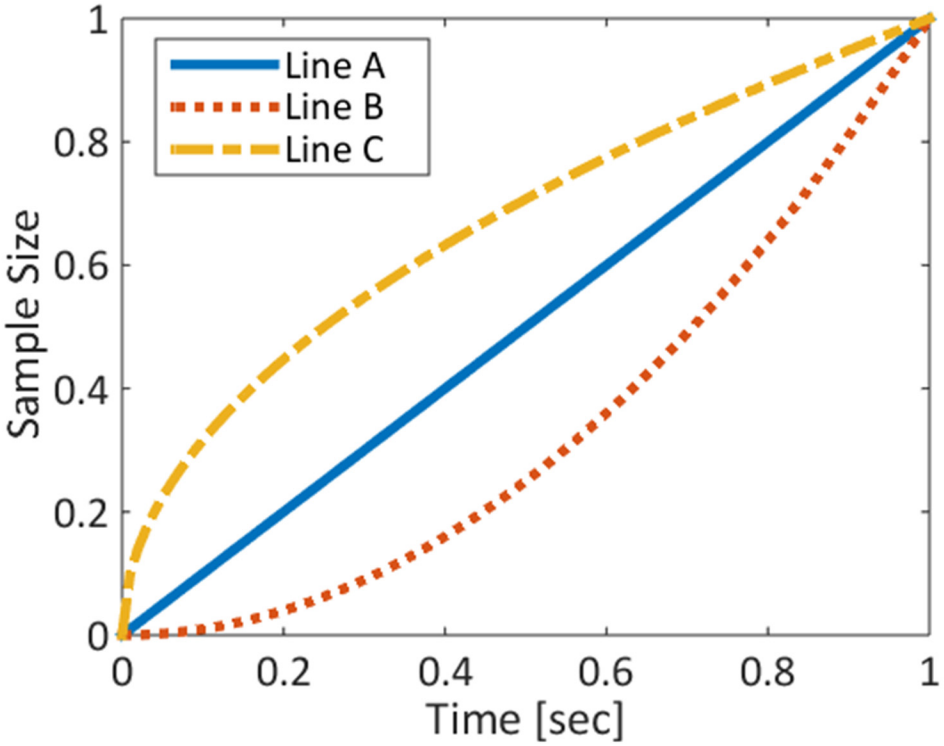
- Reduce saturation



- Use saturated colors only for extreme emphasis

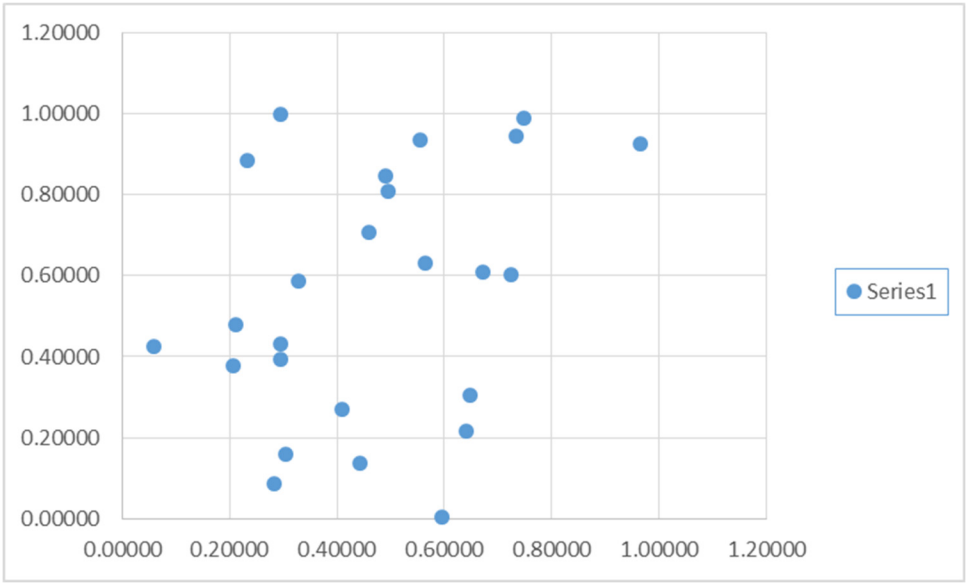
Figure Formatting



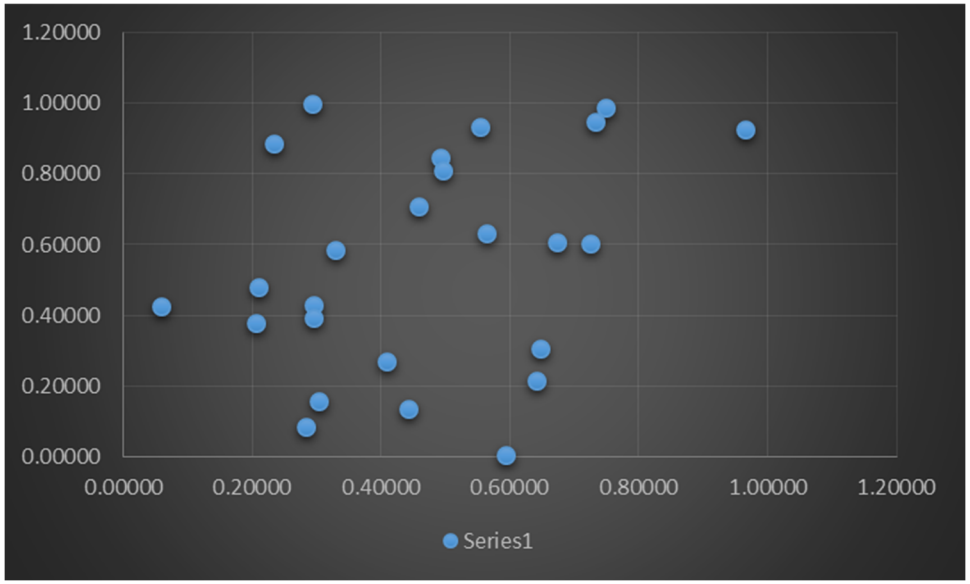


- Always
  - Label Axes
  - Include legend
  - Use color and line style
- Make font large enough to be readable

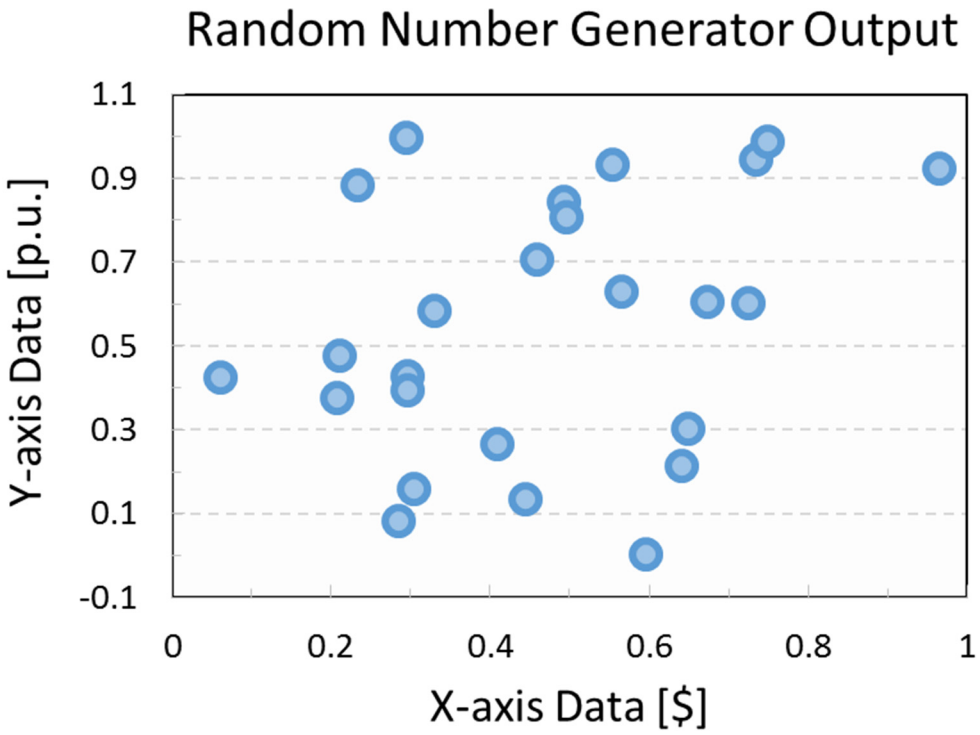
Plotting in Excel – Default



Plotting in Excel – Template Chart Styles



Plotting in Excel – Formatted



Formatting Tables

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

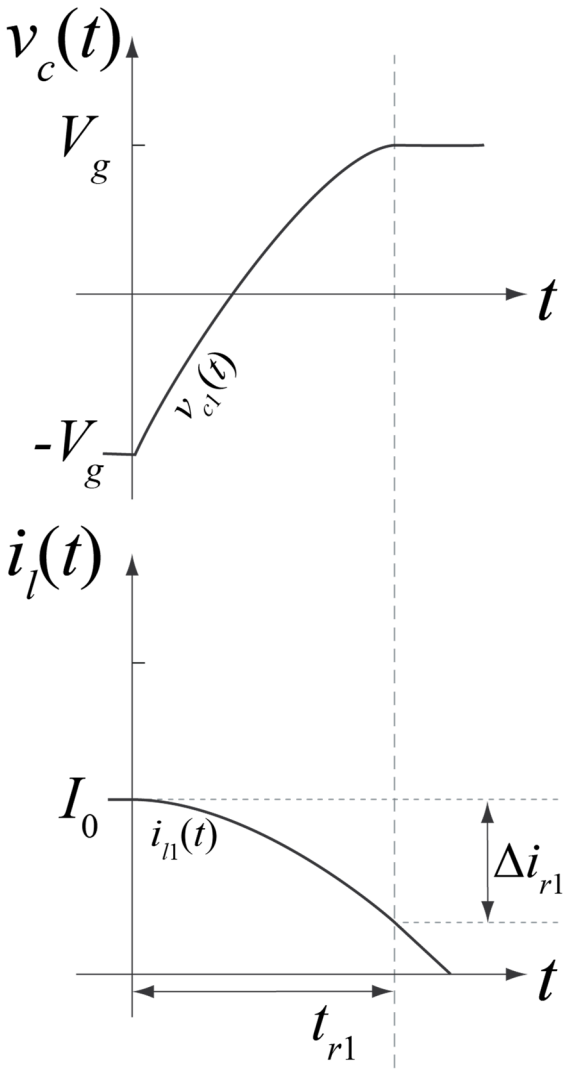
Experimental Results for Dual Active Bridge Converter

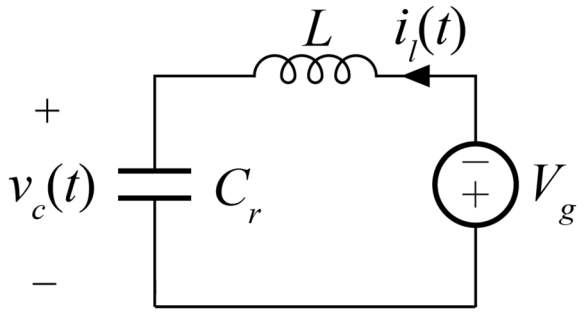
Parameter	Capacitor Used	Value		Error
		Analytical	Experimental	
Soft-Switched Time	$C_{eq,t}$	41 ns	39 ns	4.4 %
Minimum ZVS Current	$C_{eq,Z}$	820 mA	850 mA	3.6 %
Hard Switched Primary Loss	$C_{eq,Q}$	6.9 W	7.1 W	2.1 %

Animations

- This is distracting
- Use animation only to help clarify
  - Not to make it fancy
- Useful to help explain complex behaviors

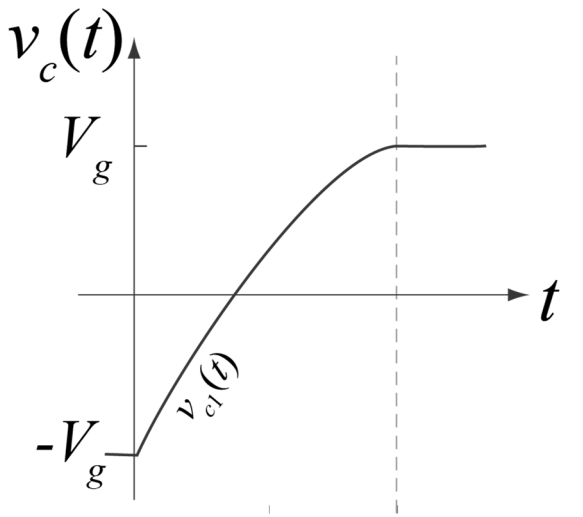
Example: ZVS Volt-Second Feedback

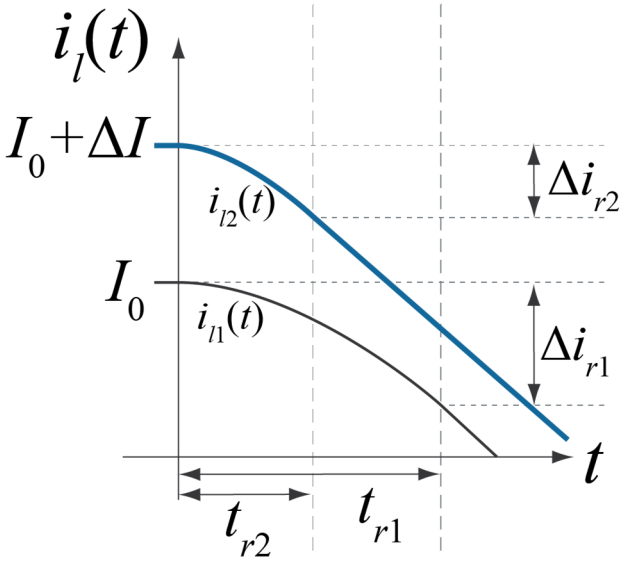


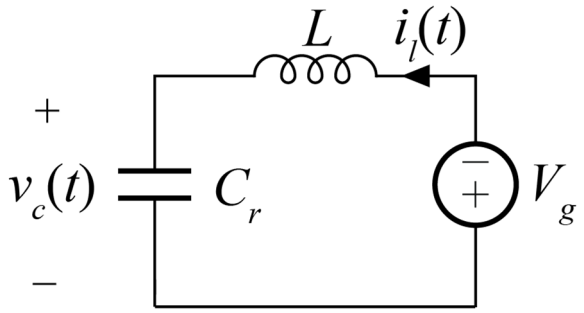


- Generalized ZVS transition
- Voltage $v_c(t)$ determined by initial conditions

Example: ZVS Volt-Second Feedback

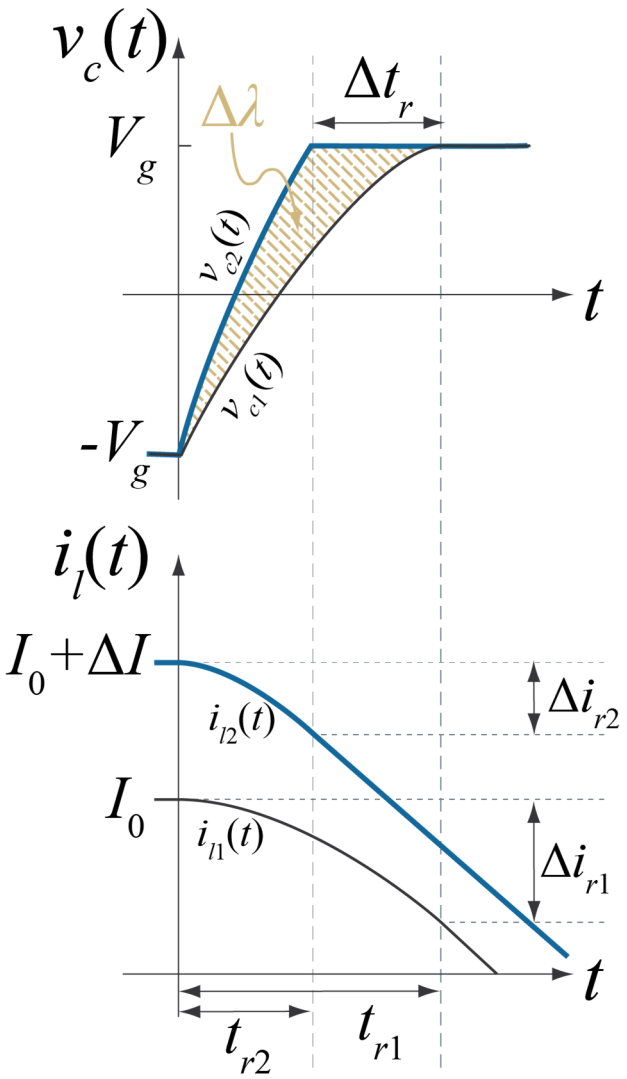


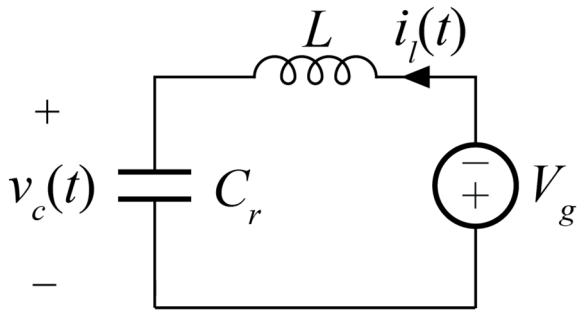




- Initial current I_0 increased by ΔI

Example: ZVS Volt-Second Feedback





- Initial current I_0 increased by ΔI
- 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

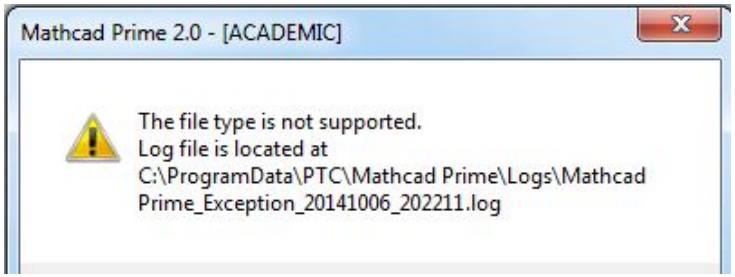
Tools of the Trade

- Know your setup before you begin
  - Is slide remote available?
  - Podium?
  - Presenter view?
- Avoid excess use of laser pointer

Getting There Early

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

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



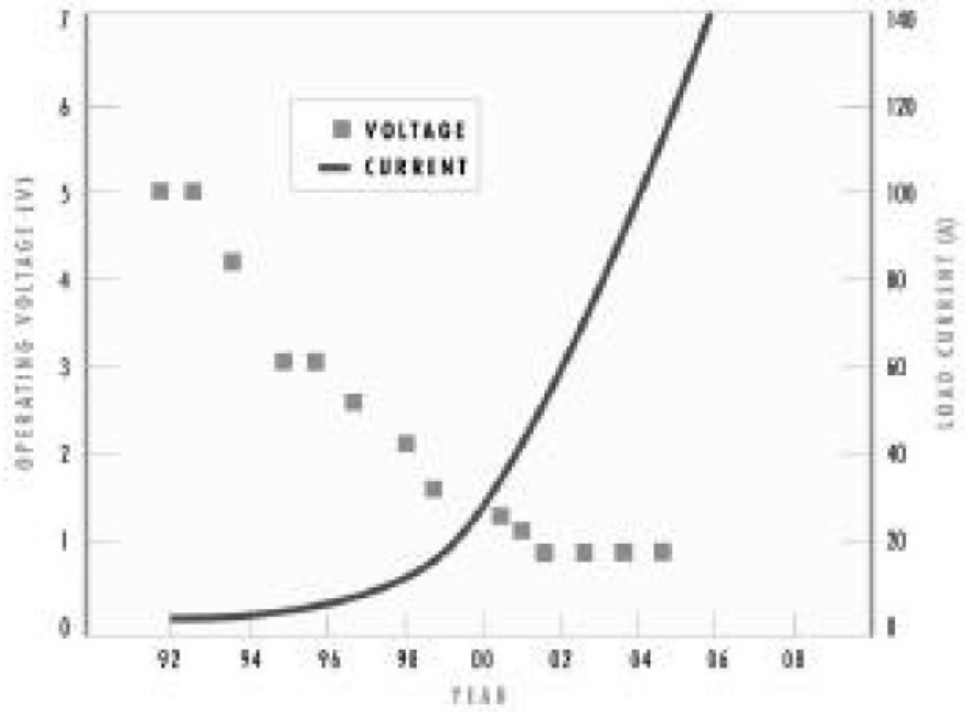


Figure 1 – Microprocessor Power Trends

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”

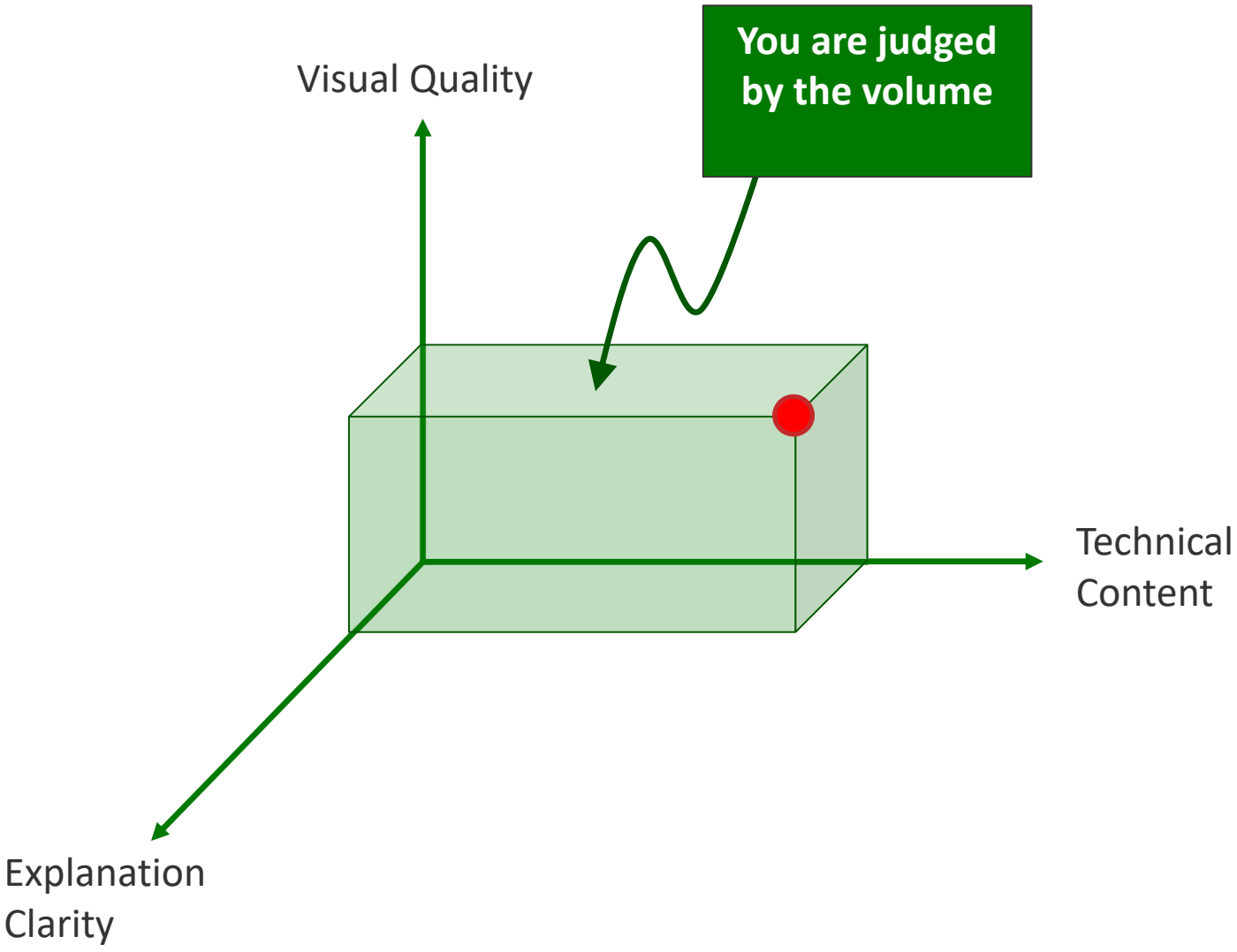
– Nobody, ever.

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

– Overheard at APEC 2012

Part IV: Conclusion

How Your Talk is Judged



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