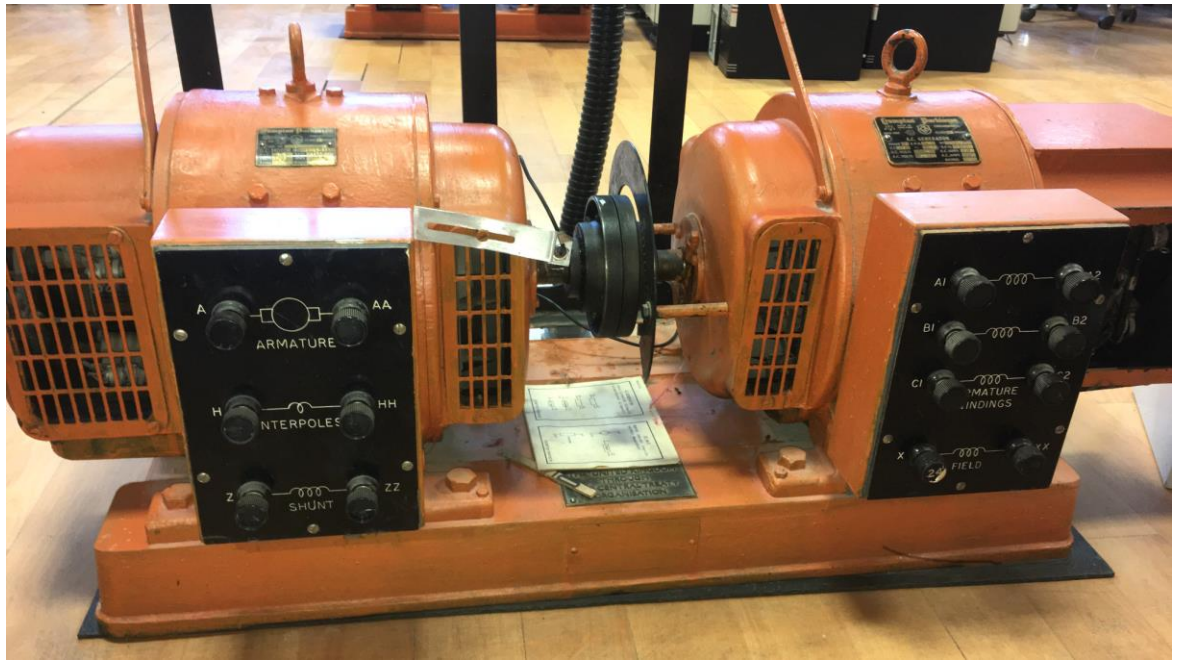
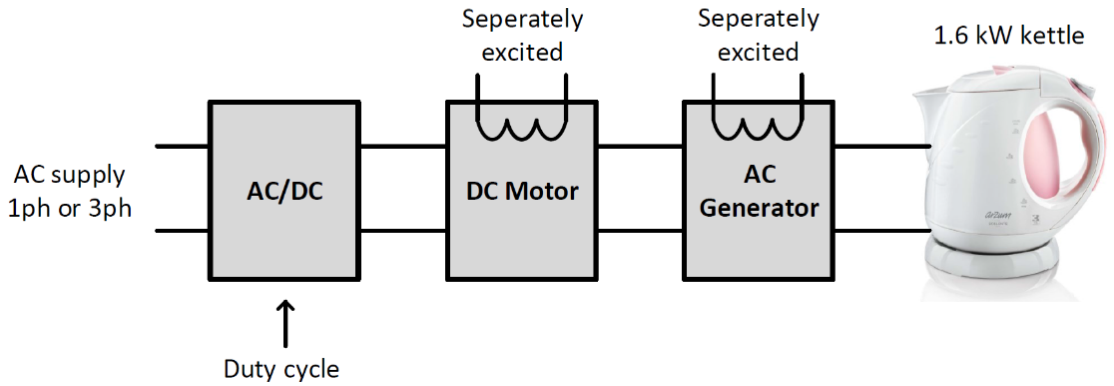
EE463 – DC Motor Driver Term Project Presentation

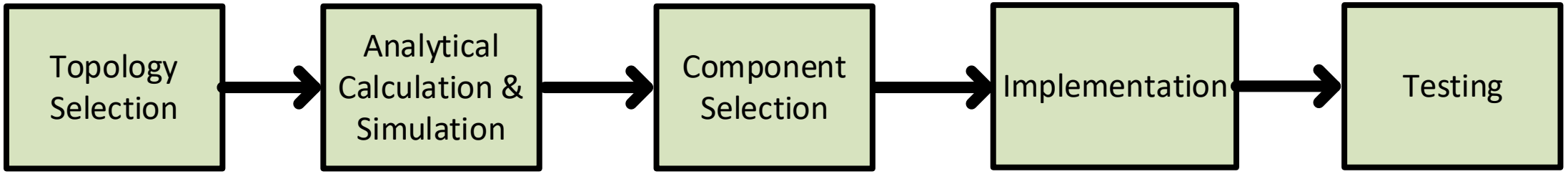


Project Specifications

- AC/DC converter
- Three-phase or single phase
- Adjustable output voltage up to 180 V
- Drive the motor from standstill

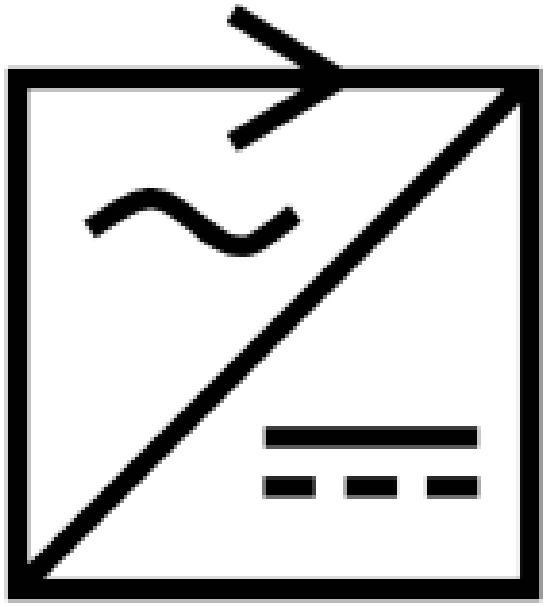


What to do?


Topology Selection
Analytical Calculation & Simulation
Component Selection
Implementation
Testing

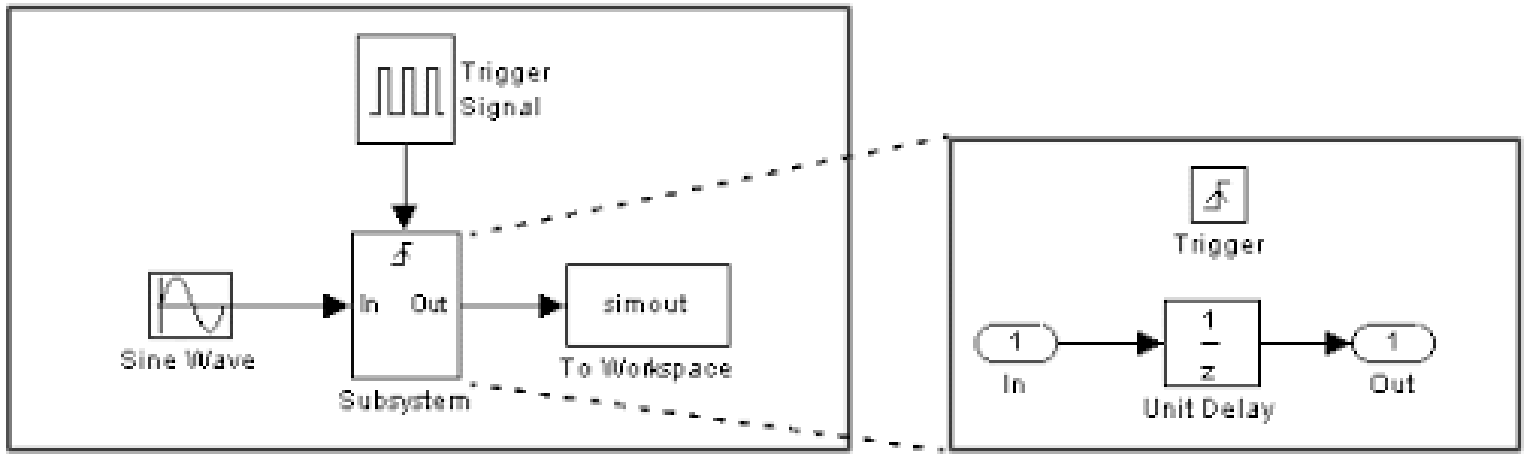
Topology Selection

- Diode Rectifier + Buck Converter
- Three-phase Thyristor Rectifier
- You can choose other topologies if you want (Topology Bonus)



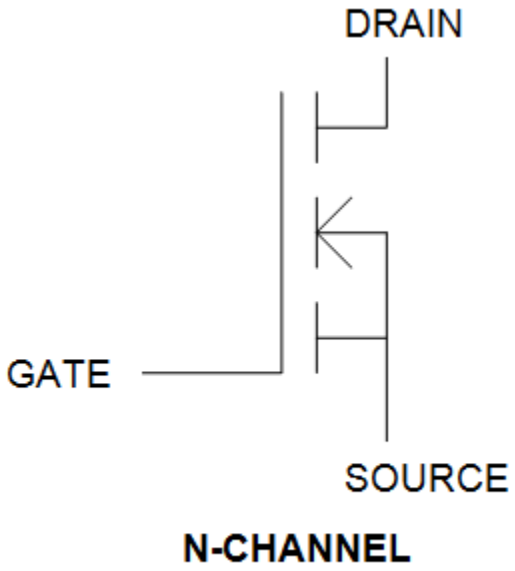
Analytical Calculation & Simulation

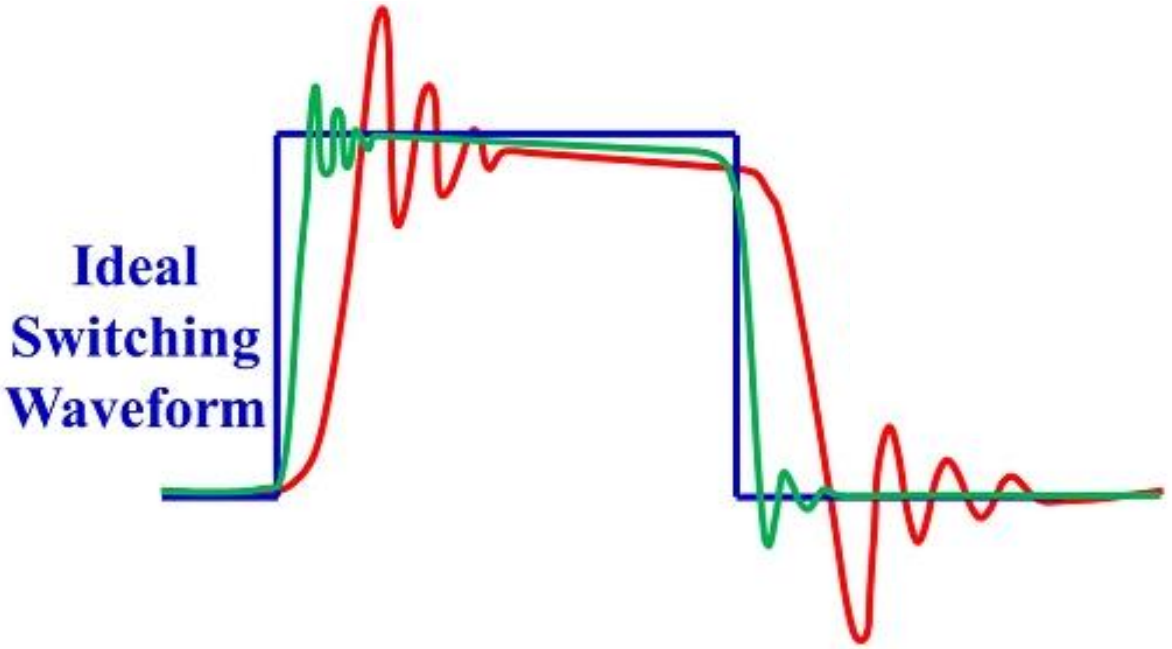
- From simple to complex
- Try to simplify and verify fundamental blocks
- Start with ideal case



Analytical Calculation & Simulation

- Include component parameters after component selection
- Include parasitics such as series inductances at switching components





Component Selection

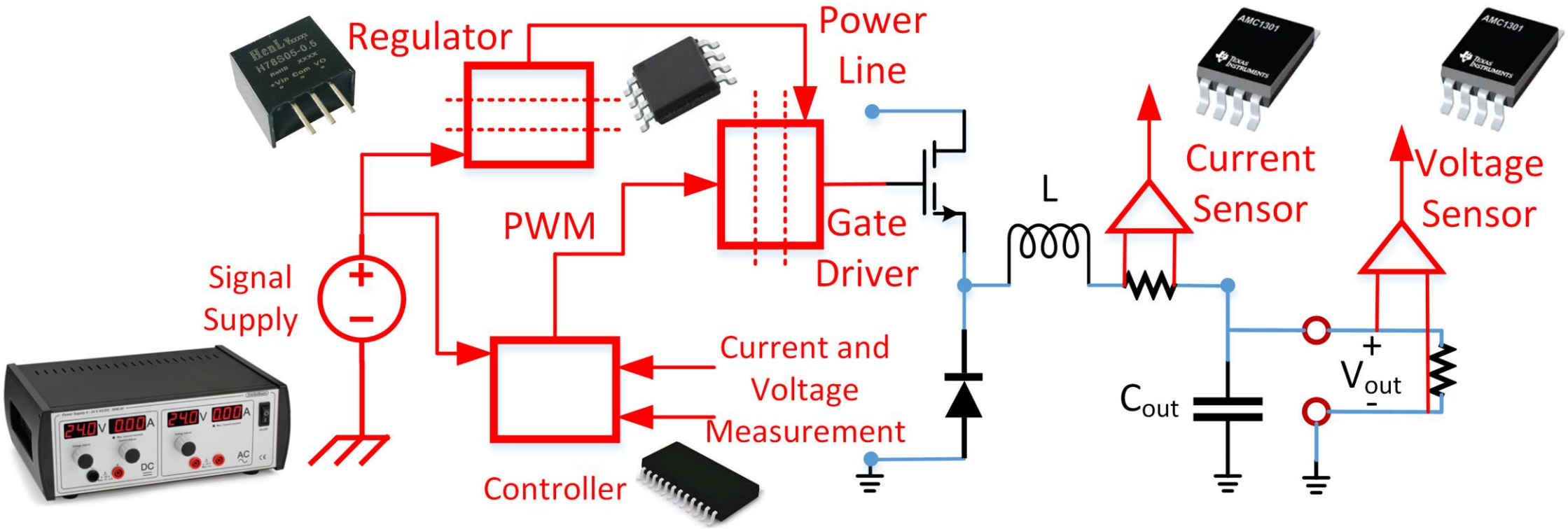
Ideal World

- MOSFET & Diodes
- Capacitor & Inductor

Real World

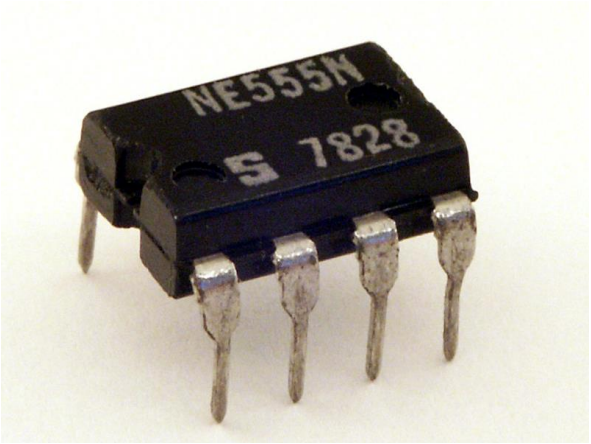
- MOSFET & Diodes
- Gate drivers
- Regulators
- Magnetic core & wires
- Electrolytic, ceramic… capacitors
- Controllers
- Isolators
- Current & voltage sensors
- Connectors
- Heatsinks & Fans

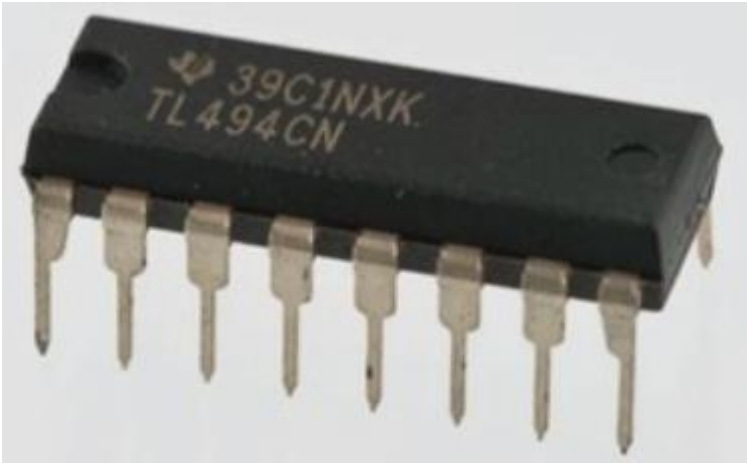
Component Selection



Component Selection

- Choose a controller
- Can be analog or digital
- You can use TL494 or other analog controllers
- You can use 555 timer to create PWM
- Check other controller ICs





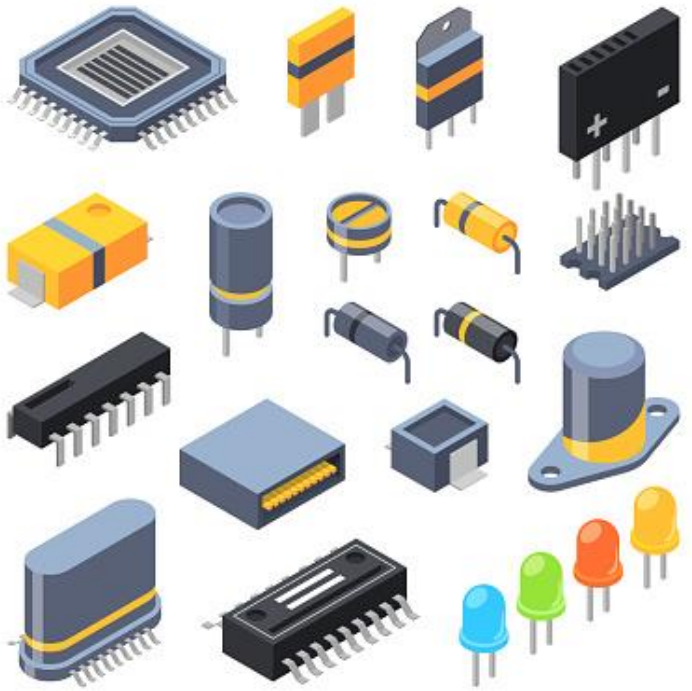
Component Selection

- Choose a switching frequency
- Higher the frequency, smaller the circuit
- Increases switching loss and AC losses of cables
- fs<100 kHz

500 kHz	1 MHz
	
MSS1260-103	MSS7341-502
PCB area = 144 mm^2	PCB area = 53 mm^2
Volume = 864 mm^3	Volume = 217 mm^3

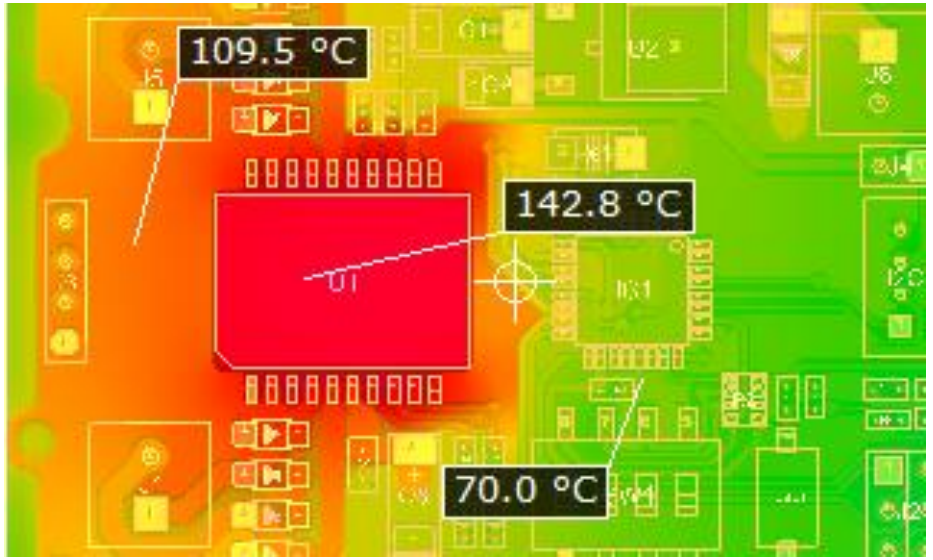
Component Selection

- Choose components according to results
- Calculate the voltage, current, and thermal stresses on critical components and try to give some safety margin
- Check the available component list
- Use Digikey (Ekom Elektrik), direnc.net, ozdisan.com
- Or visit Yıldırım Elektronik, Ser Elektronik, Konya Sokak
- May require some iterations



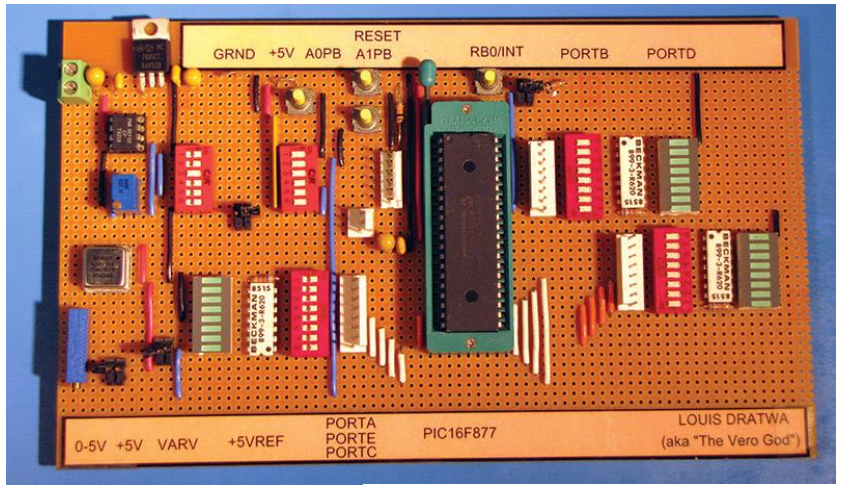
Component Selection

- Calculate the switching and conduction losses for semiconductors
- Use datasheets to find thermal resistances
- Calculate junction temperatures of ICs
- If necessary add a heatsink or fan to your design



Implementation

- Do not use breadboard for final design
- Can use stripboard but make sure connections are neat and rigid
- Can use connectors for ICs
- PCB is more professional, robust, and compact. (Also bonus)



Implementation

- Keep the gate path of the switches short and wide
- Keep power path wide
- Use fuses at the input side of the circuit
- Use optocouplers like TLP250 or other isolators between control stage and power stage
- Keep the design neat and compact to encounter fewer problems
- Use provided connectors for safe and easy tests
- Plan ahead and create spaces for the testing points

Lab Usage

- You can use the lab during work hours when there is no experiment.
- Book a slot at “*Lab Scheduler*” on Odtuclass.
- Put the equipment and cables back to its place after you are done.
- If you want to use available components, add the amount and the name of the component to shared document.
- Do not take any equipment out of the lab.

Testing

- Be careful
- Do not touch the live circuit
- Capacitor can hold charge for long time
- Make sure that variac is zero
- Start with resistive load at lower frequencies and voltages
- Increase the stress on circuit step by step

Deadlines

- **Deciding Group Members and Creating Github Repo:**

14th of November

- **Simulation Report**

24th of November

- **Presentation for Feedback Session**

TBA

- **Final Demo**

3rd of January

- **Final Report**

18th of January

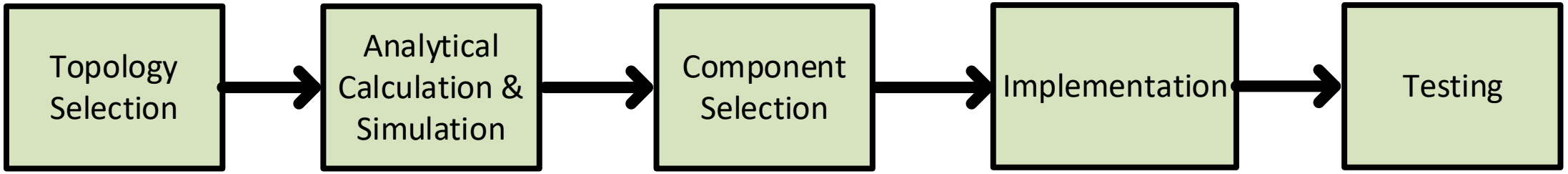
- **Video**

20th of January

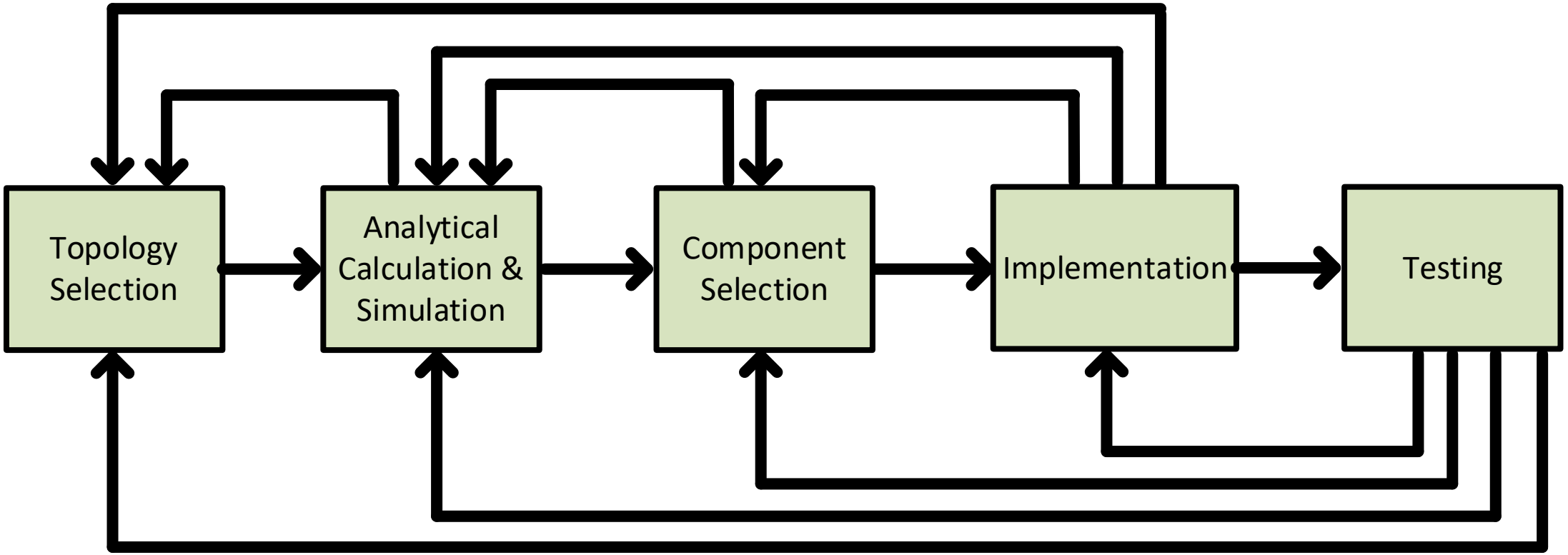
Bonuses

- **Topology:** To unique designs
- **Tea:** To design/s that can boil water at kettle.
- **PCB:** To design/s with PCB implementation.
- **Utilization:** To design with the tightest semiconductor ratings.
- **Efficiency:** To design with the highest efficiency under rated load.
- **Industrial Design:** To design/s with a proper enclosure and labels.
- **Compactness:** To design with the smallest volume.
- **Single Supply:** To design/s which uses single supply to feed all circuitry.
- **Analog Controller:** To design/s with analog controller.
- **Four-Quadrant:** To design/s with four quadrant drive capability.
- **Closed Loop:** To design/s with closed loop voltage/current or speed control.
- **Karma:** To the person who helps the most.
- **Best Video:** To the most creative and fun video/s.

Imagination



Reality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