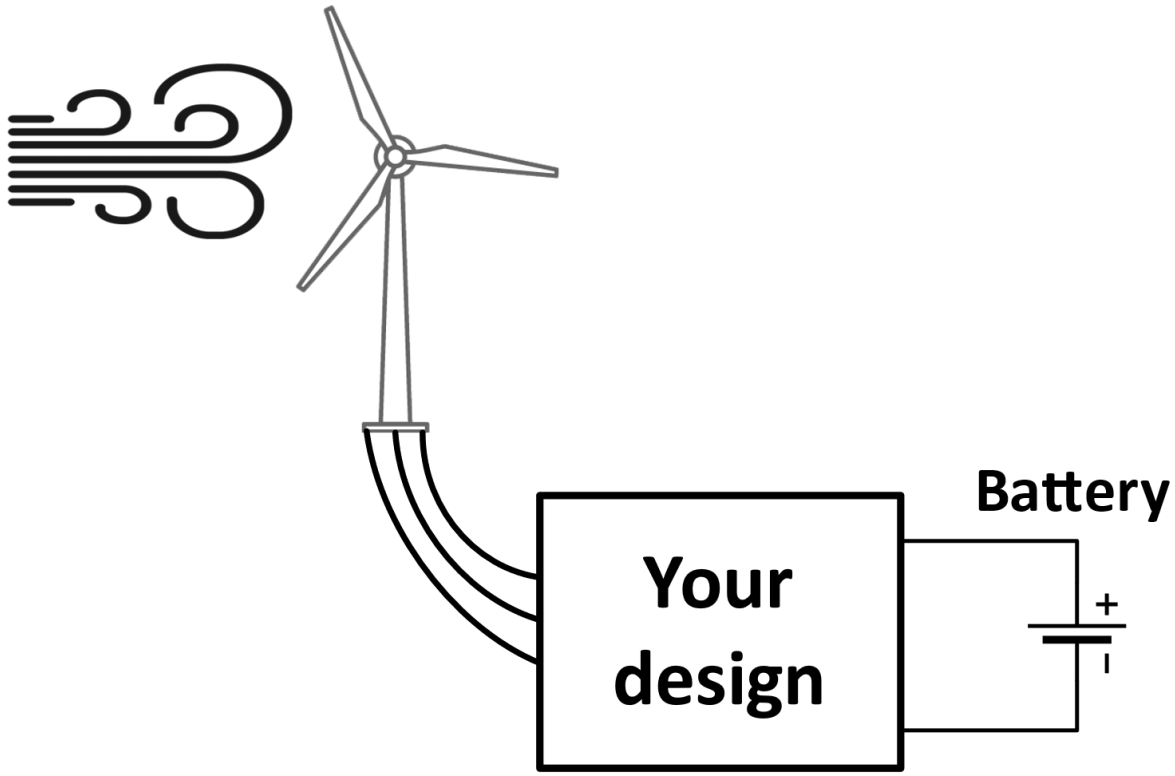
EE463
Term Project Presentation

Karakaya – Tokgöz

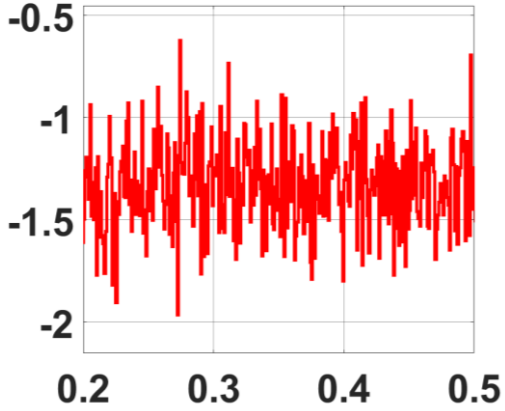
10.11.2020

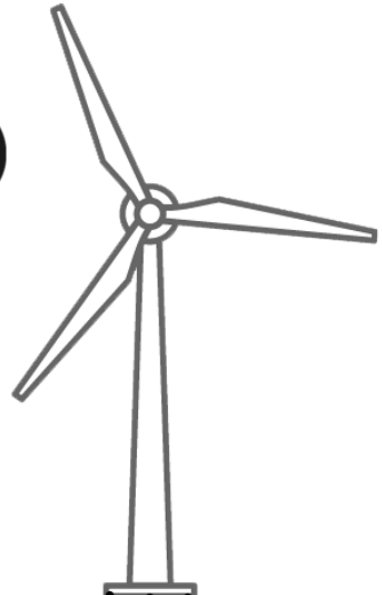
Project Specifications

- Changing wind speed
- Varying input voltage
- Constant current battery charge
- AC/DC converter

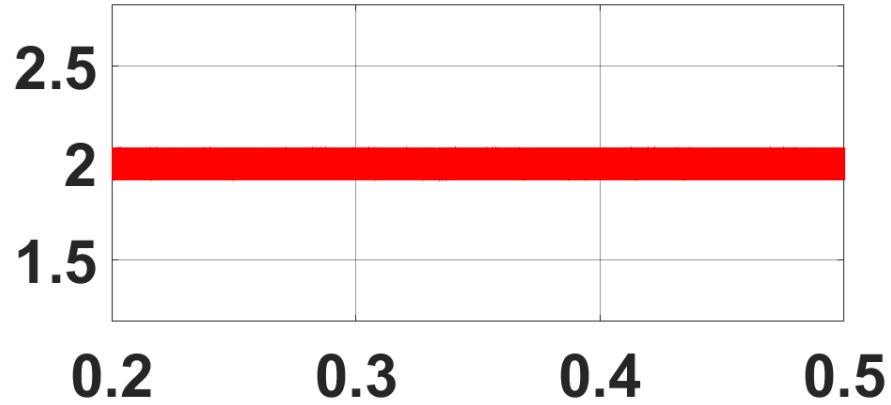


Input torque

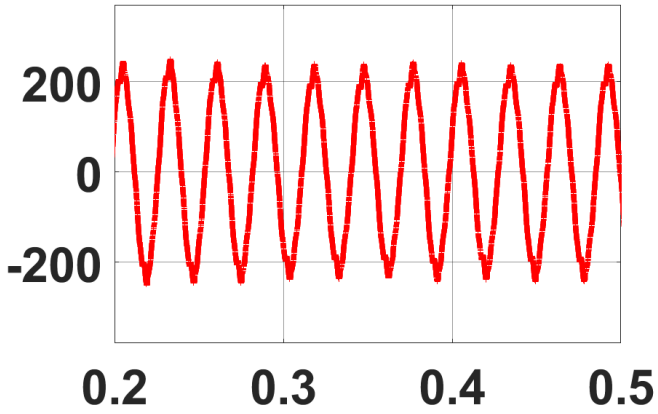


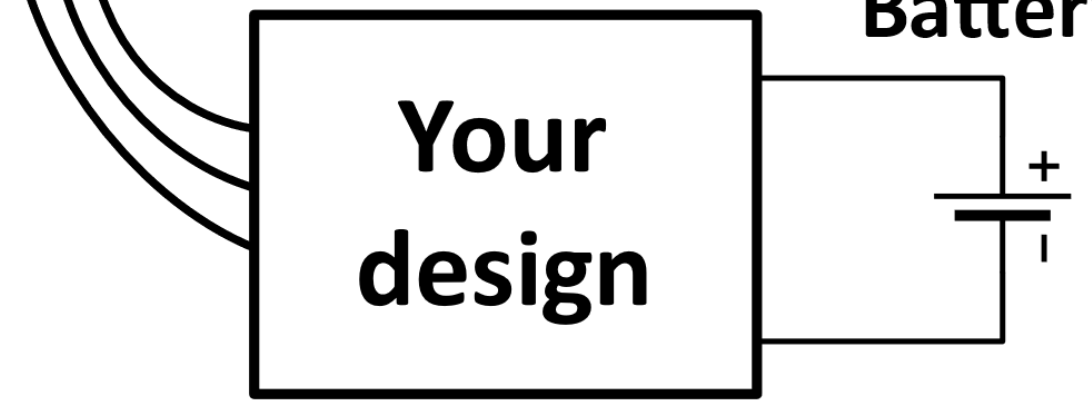


Battery current

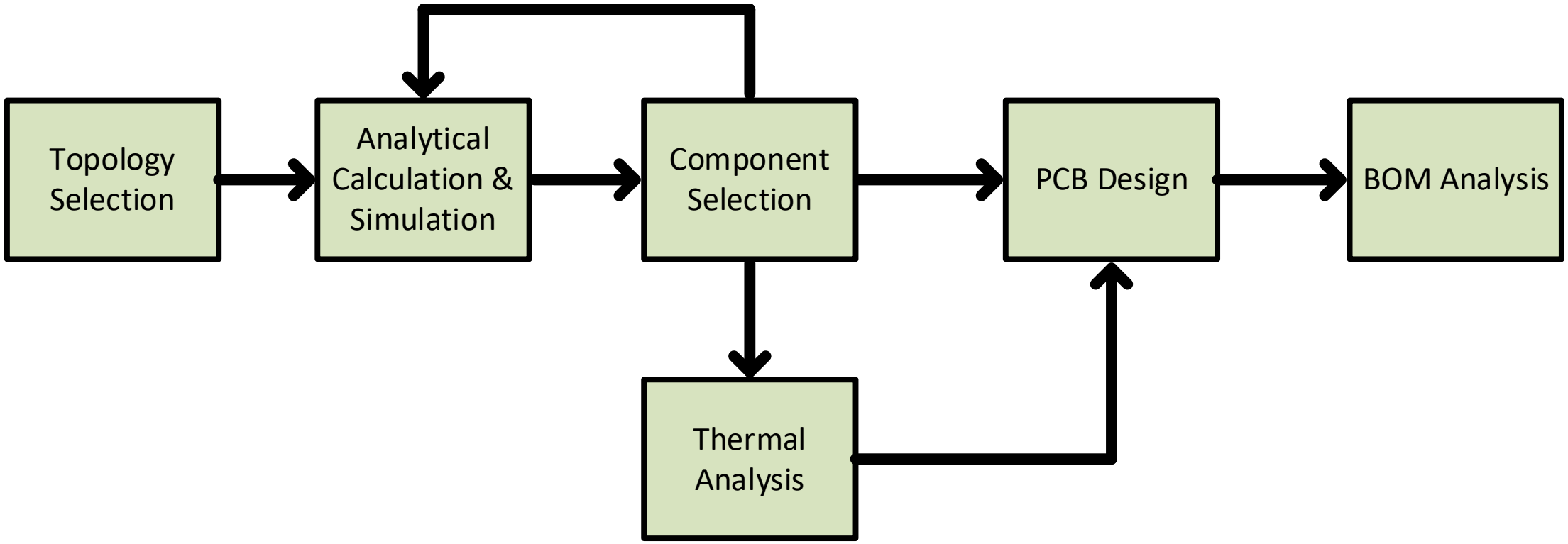


Terminal voltage



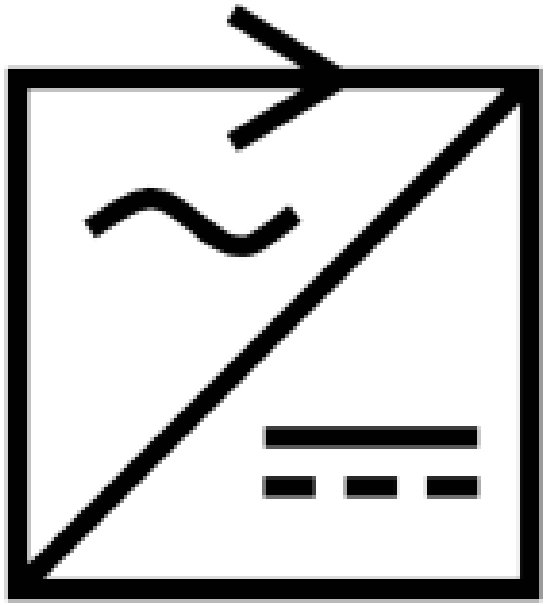


What to do?


Topology Selection
Analytical Calculation & Simulation
Component Selection
PCB Design
BOM Analysis
Thermal Analysis

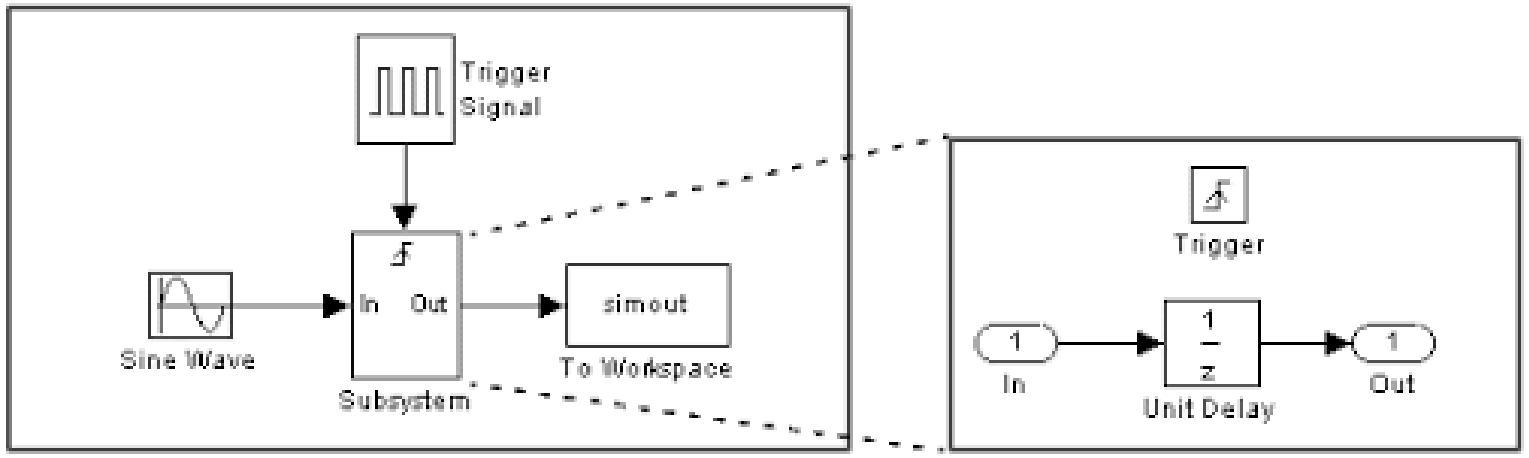
Topology Selection

- Diode Rectifier + Buck Converter
- Three-phase Thyristor Rectifier
- PWM Rectifier



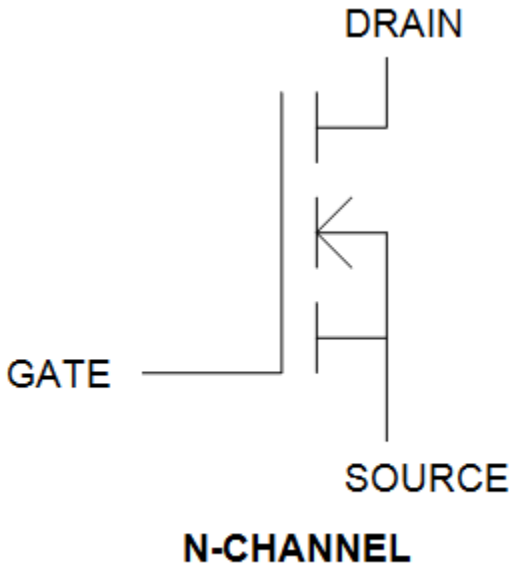
Analytical Calculation & Simulation

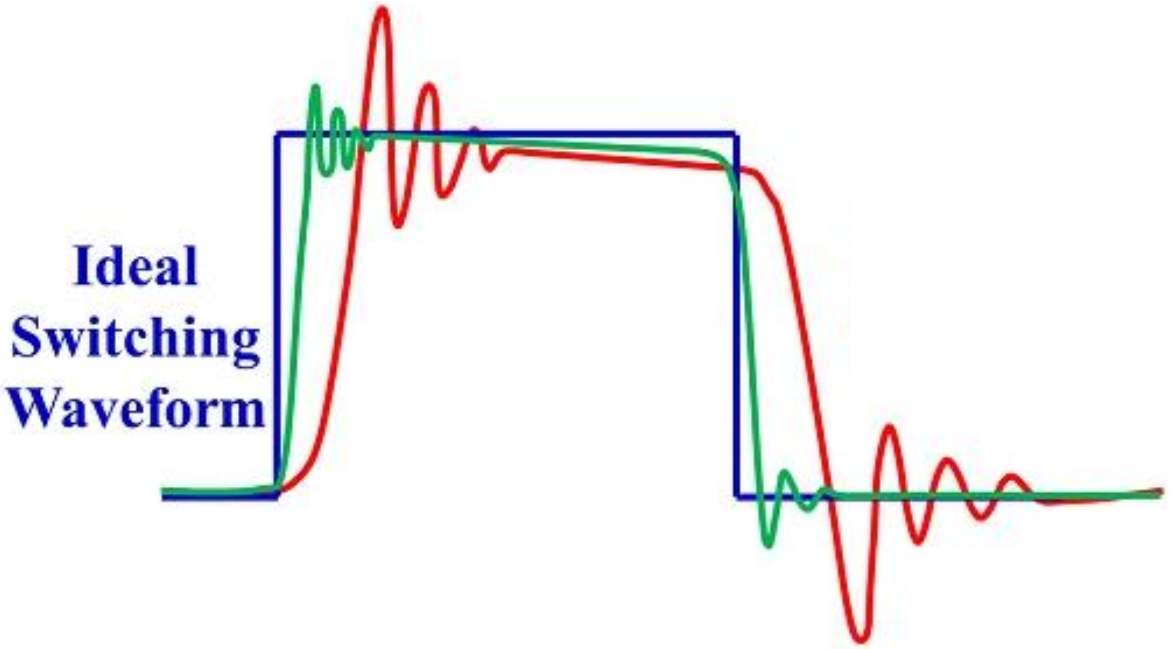
- From simple to complex
- Try to simplify and verify fundamental blocks
- Start with ideal case



Analytical Calculation & Simulation

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





Component Selection

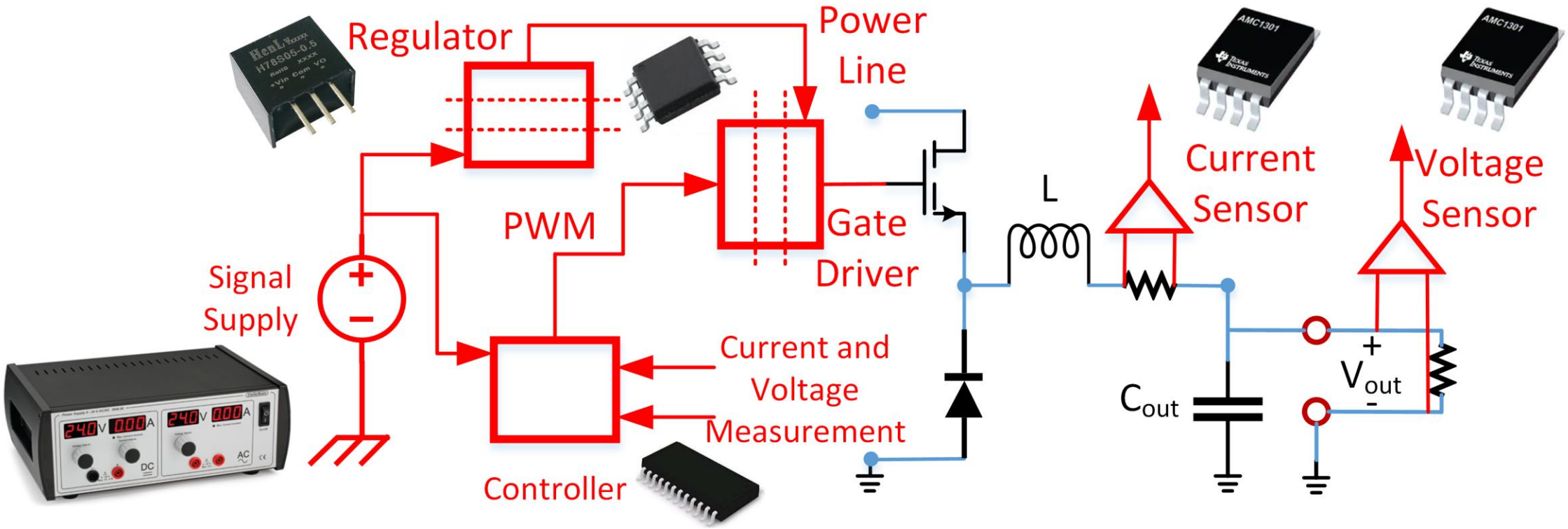
Ideal World

- MOSFET & Diodes
- Capacitor & Inductor

Real World

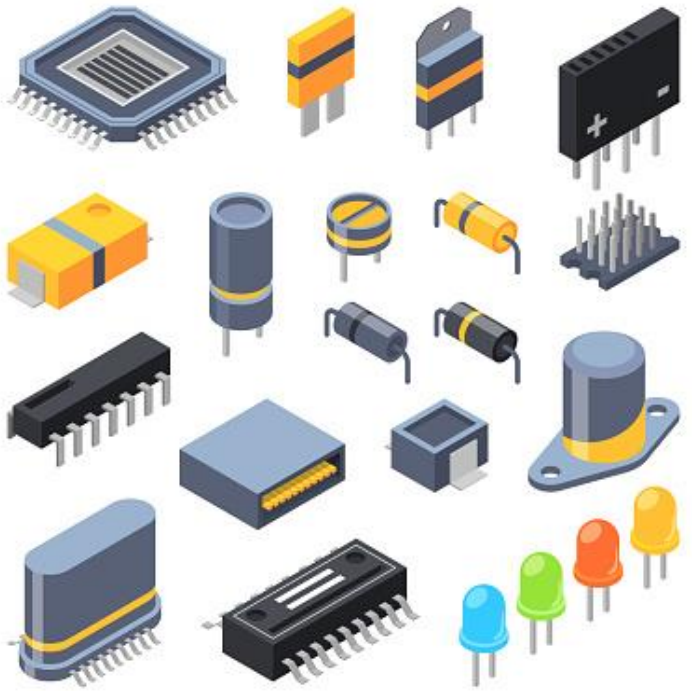
- MOSFET & Diodes
- Gate drivers
- Regulators
- Magnetic core & wires
- Electrolytic, ceramic… capacitors
- Controllers
- Isolators
- Current & voltage sensors
- Connectors
- Heatsinks & Fans

Component Selection



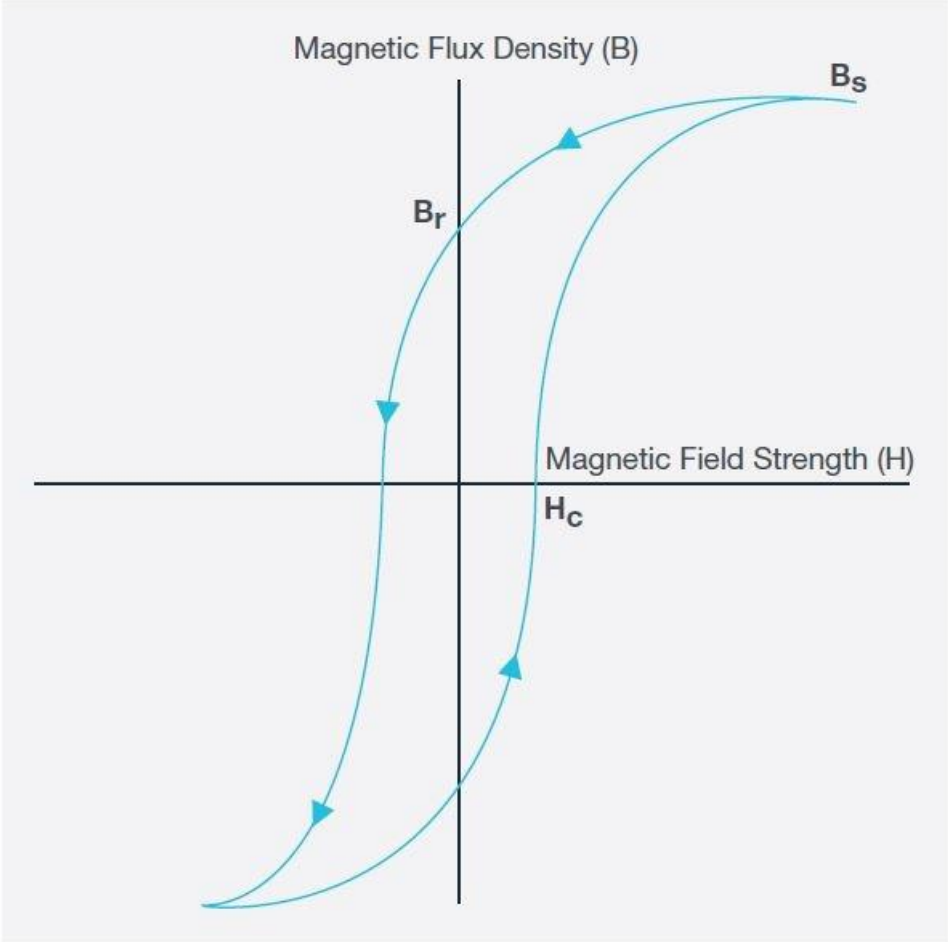
Component Selection

- Choose components according results
- Use Digikey
- Try to give some safety margin
- Use Magnetics for magnetic cores
- May require some iterations



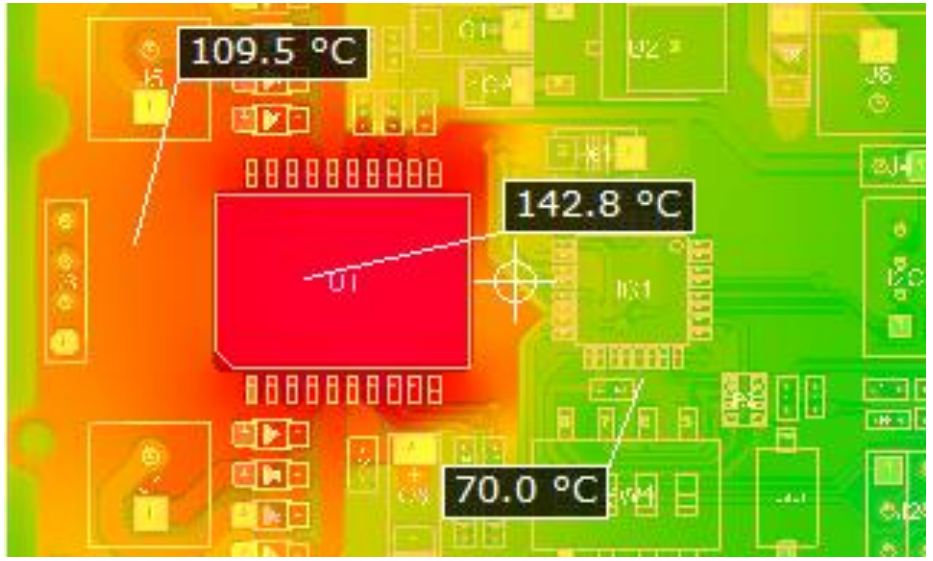
Inductor Design

- Choose a suitable core with the circuit parameters
- Calculate number of turns
- Find operating flux density
- Reiterate calculation steps



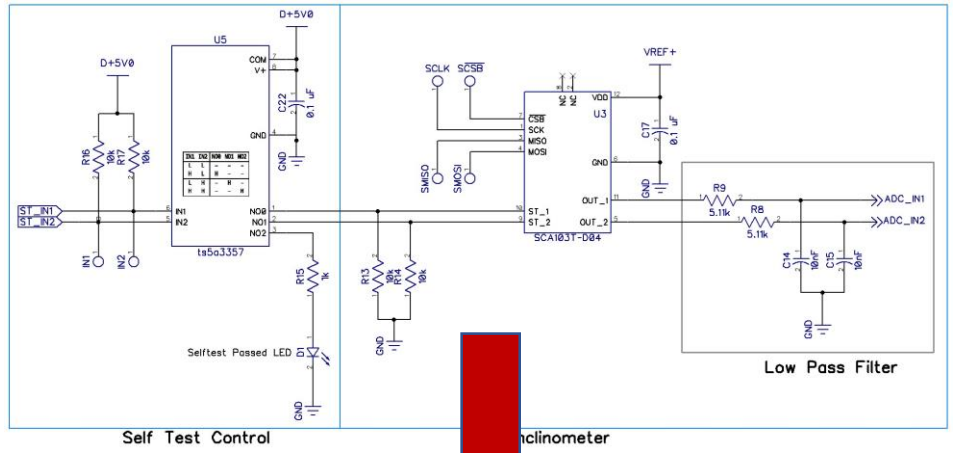
Thermal Calculations

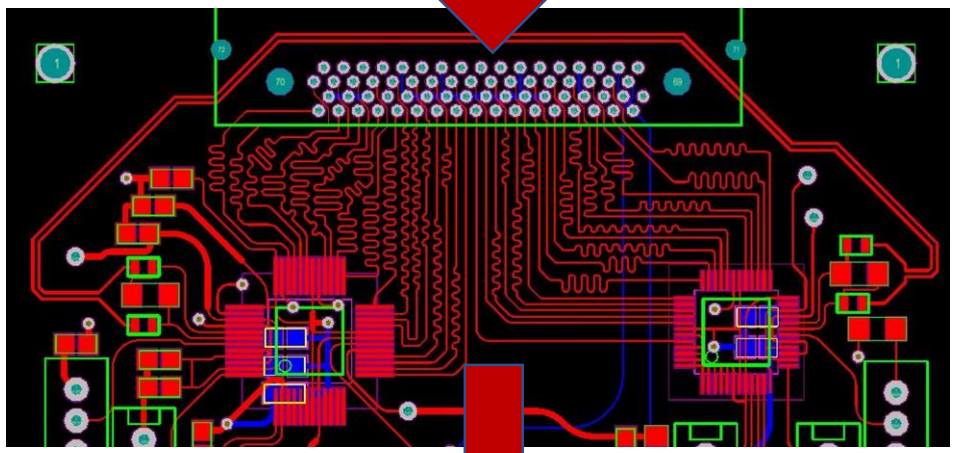
- Calculate the switching and conduction losses for semiconductors
- Use datasheets to find thermal resistances
- Calculate junction temperatures of ICs
- Calculate the losses on magnetic components
- Find the temperature of magnetic components

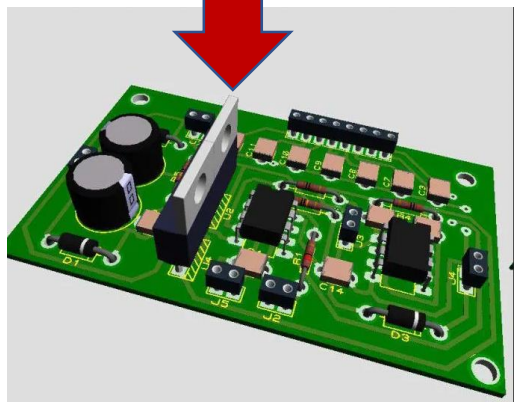


PCB Design

- Start from component symbols
- Create circuit schematic
- Add footprints of all components
- If you can find, add 3D models as well
- Draw PCB layout







Bonuses

- **Utilization Bonus:** To design/s with low semiconductor ratings.
- **Industrial Product Bonus:** To compact design/s within a box.
- **Cheapest Design Bonus:** To design with the smallest price.
- **Thermal Simulation Bonus:** To group/s who run thermal simulation.
- **Best Video Bonus:** To group/s with the most creative video.
- **Karma Bonus:** To the person who helps the most.

Deadlines

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

13th of November

- **Simulation Report and Presentation for Feedback Session**

25th of December

- **Final Report**

10th of January

- **Final Presentation**

17th of January

- **Video**

20th of January