

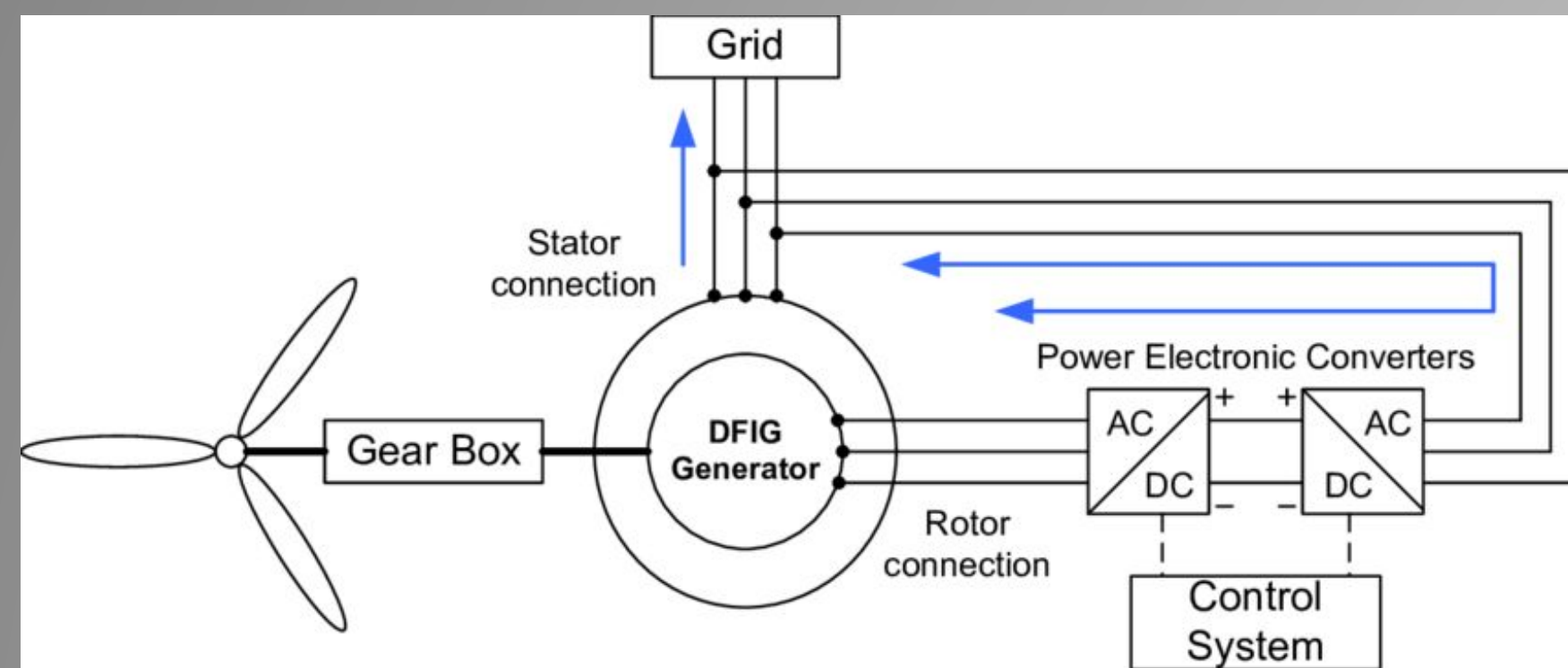


INTO THE WIND

DOUBLY-FED INDUCTION GENERATOR ROTOR SIDE CONVERTER DESIGN

Objective:

Design and implement a system to monitor a DFIG's Torque, Current and Voltage output in order to command an input waveform that will stabilize the DFIG with the grid at 60Hz.



Project Outline:

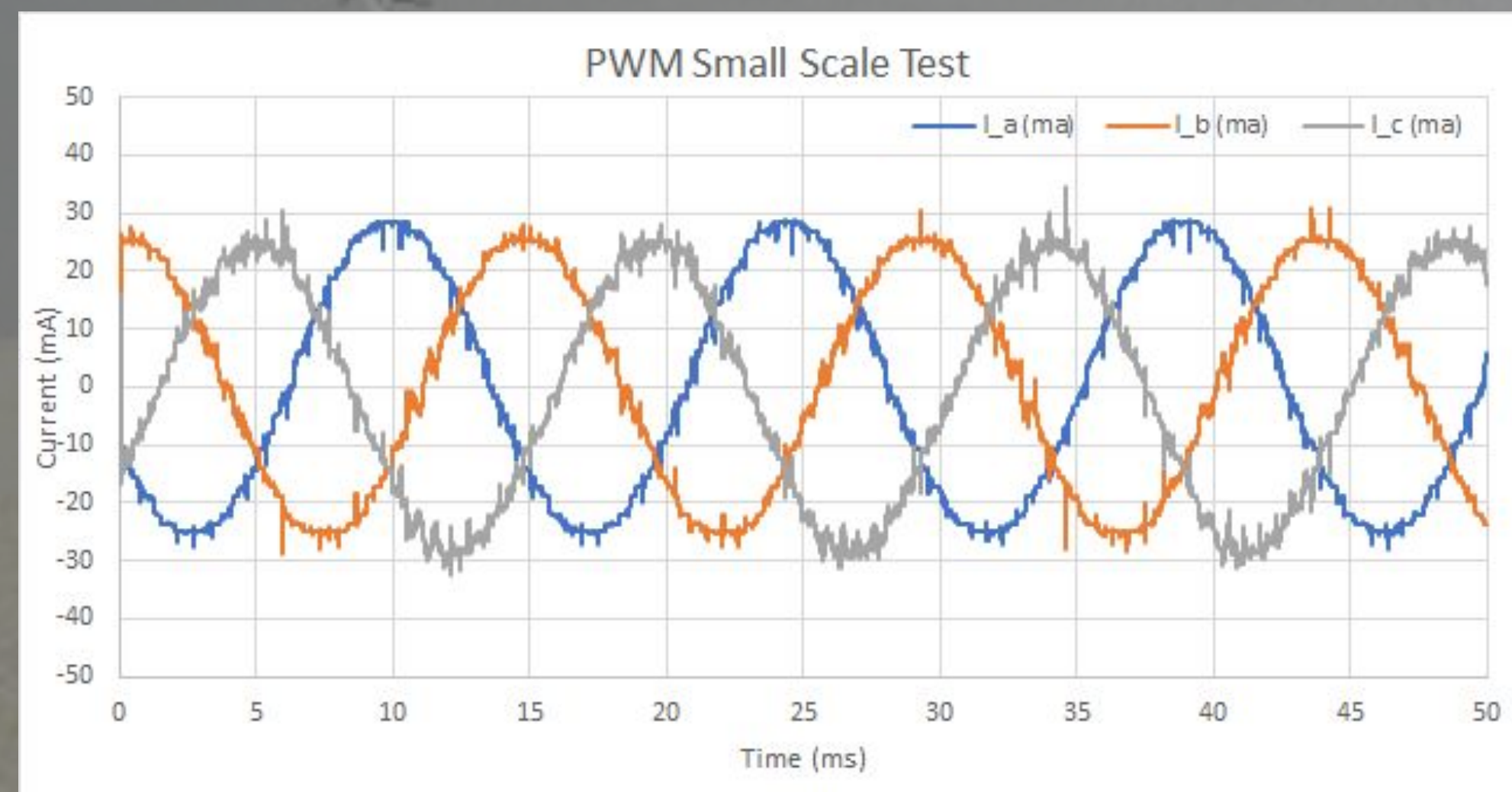
- Field Oriented Control + Space Vector Modulation
- 3 Phase Inverter
- Protection/Isolation
- Mounting/Integration

Project Requirements:

- Modular
- Robust

Software Design:

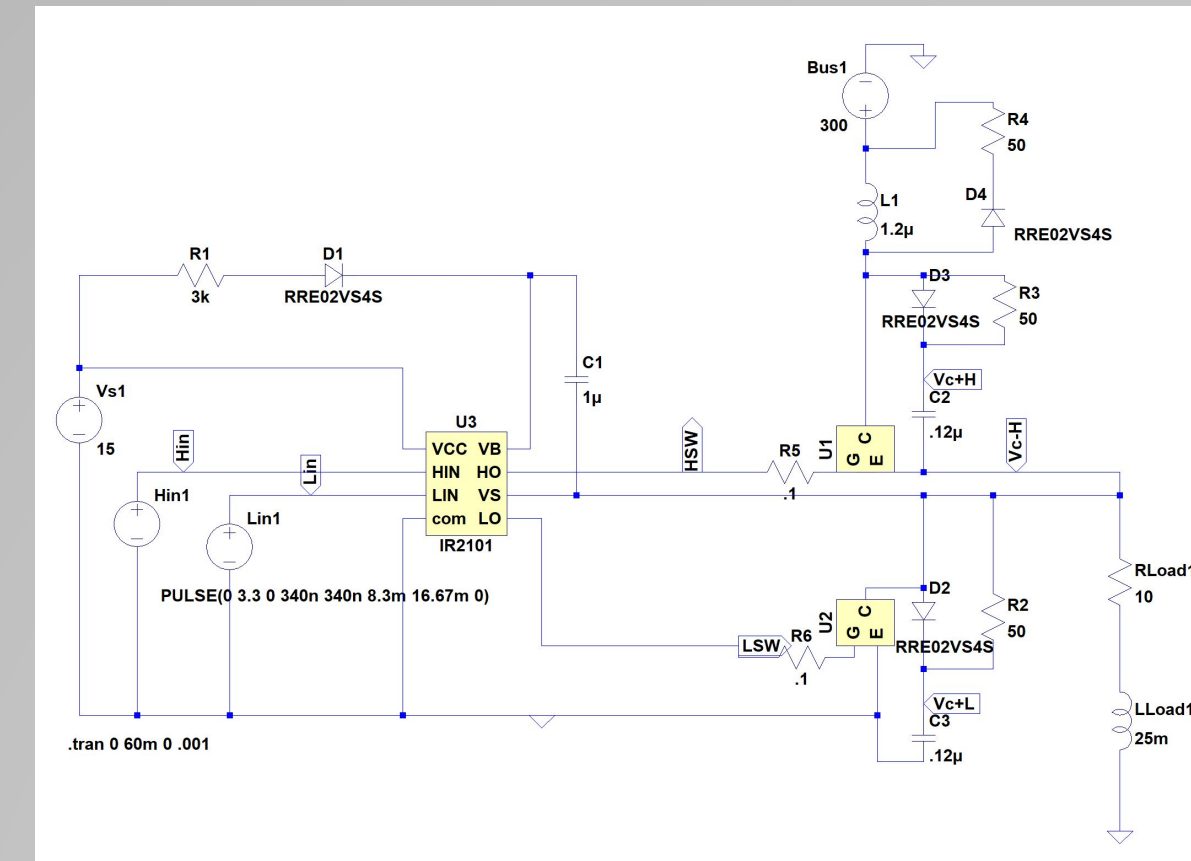
- Field Oriented Control (FOC) algorithm determines required phase/magnitude of rotor winding current.
- Space Vector Modulation (SVM) applies required 3-phase balanced current to rotor via PWM.



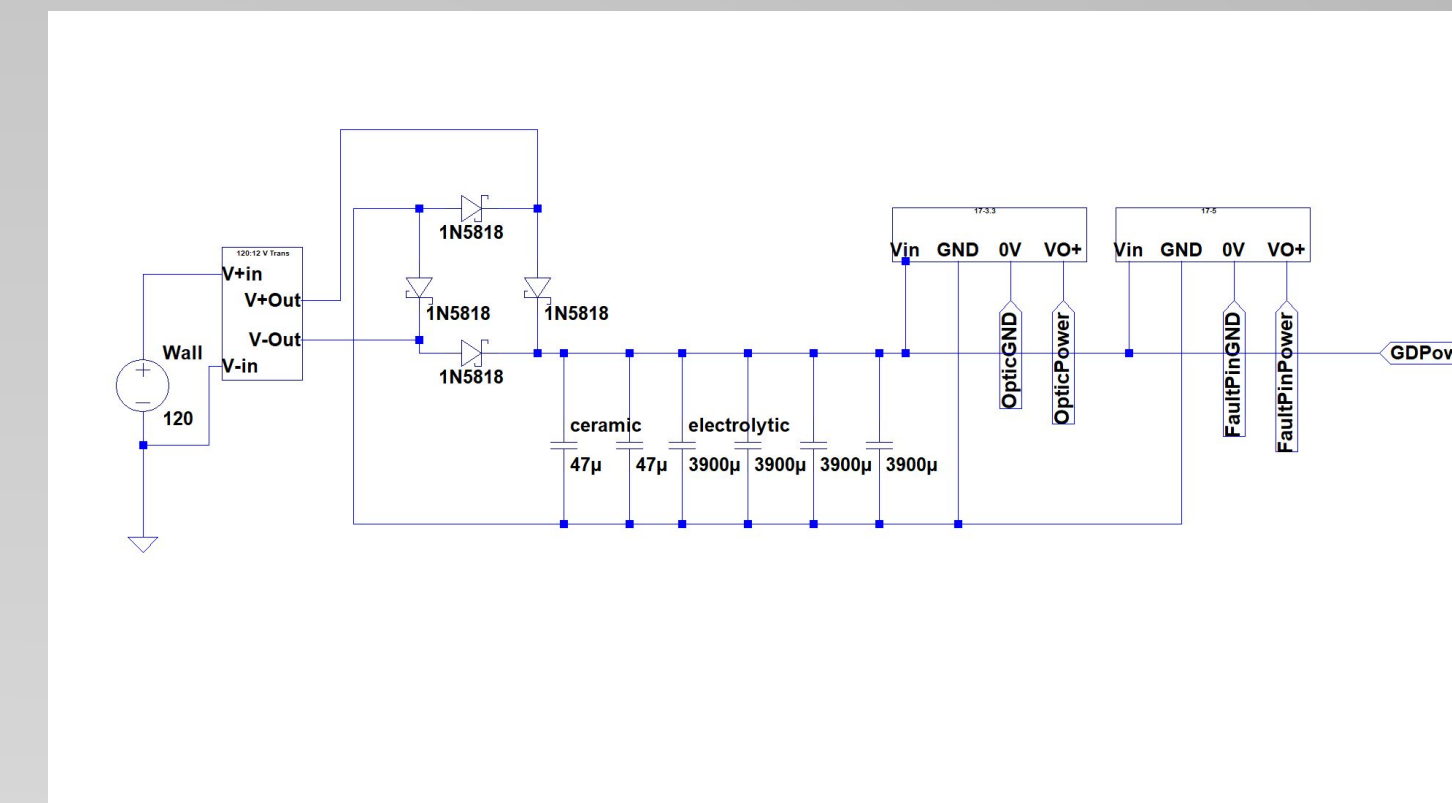
Current measured in a 3-phase Y-formation RL load while applying SVM

Hardware Design:

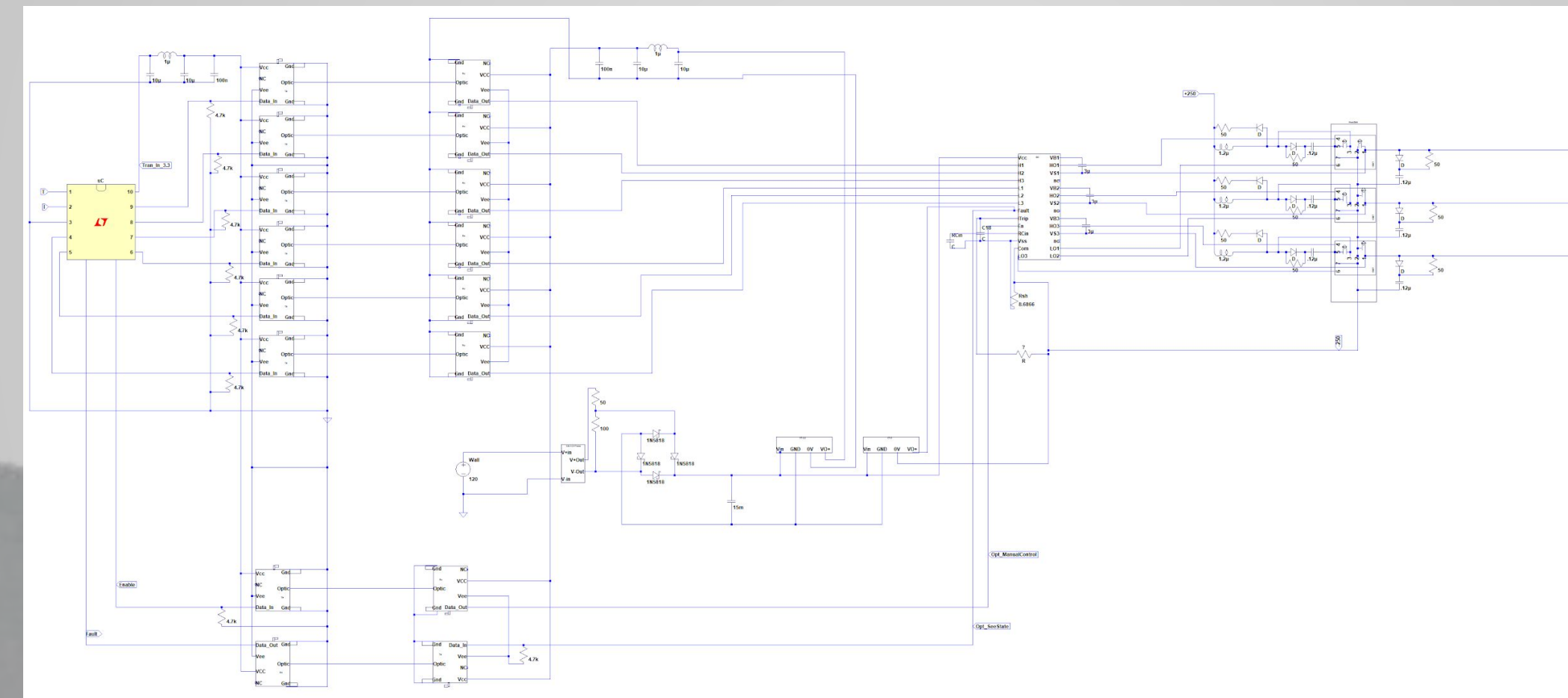
- Isolation (optical)
- Gate Driver (GD) & IGBT's
- HV Power Supply
- Protection



Snubber Protection Design



HV Power Supply



Full Circuit Schematic

Final Design:

Current Progress

- Optics mounted, HV side set up for plug into DC-DC Converter, and GD Fault and Enable optics ready for connection (integration of uC and optics tested)
- DC-DC Converter, Rectifier, and Transformer Mounted (integration of components tested)
- GD PCB mount set up as close to IGBTs as possible and ready for installation as soon as it gets fabricated (gerber files created)
- IGBTs in place with snubber components and MOVs in place and IGBT gates and emitter nodes ready for connection (IGBT and optics integration tested)
- Output cables connected, negative rail in place, and positive rail ready for connection. Outputs and rails ready to be plugged into source/load

(pictures of progress seen above and to the right)

Final Design:

Optics for gate commands and fault/enable pins of GD

GD mount location

Rectifier, DC-DC converter and transformer



Protection Components

Output Cables

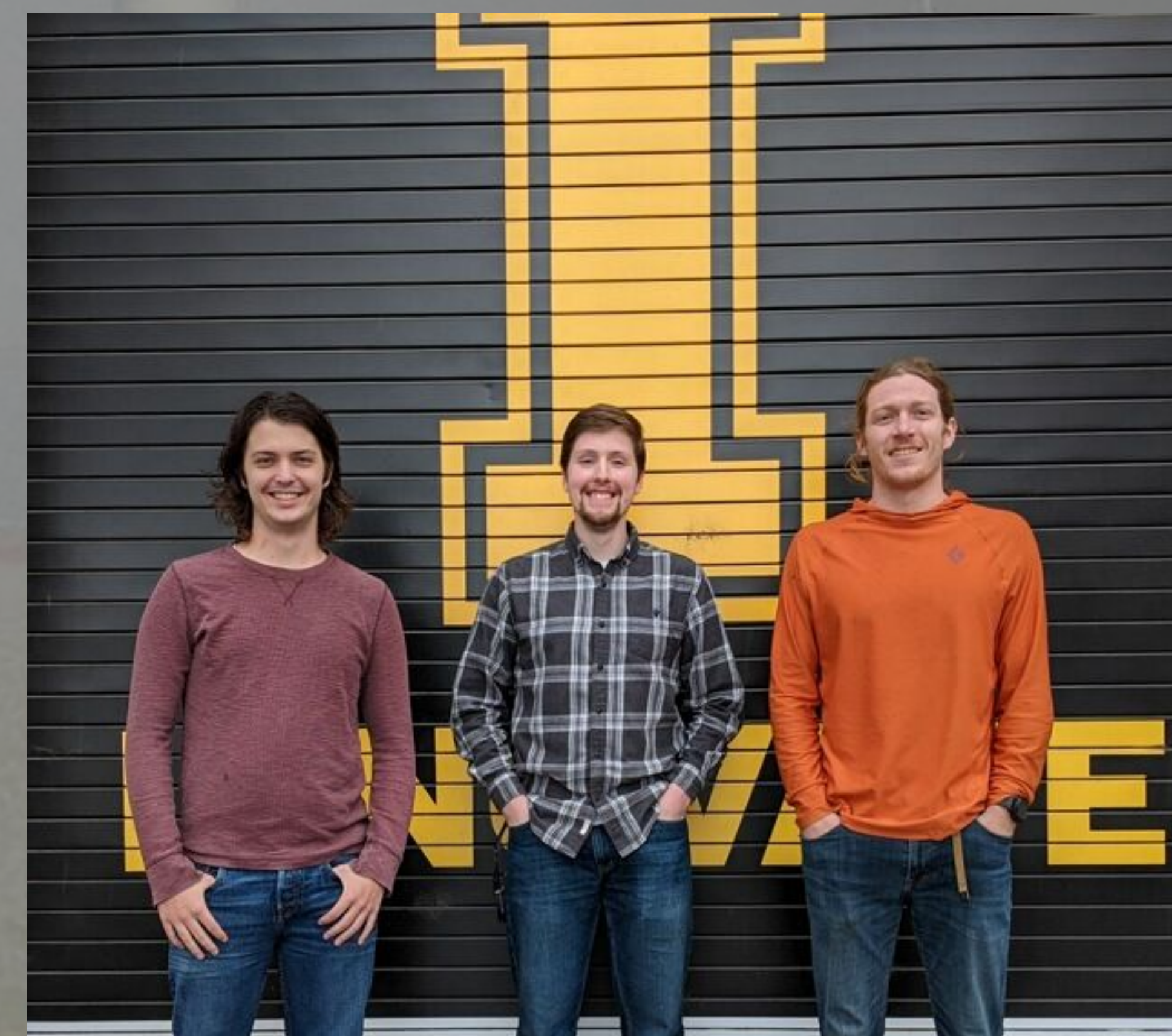
Negative Rail

Future Work:

- GD PCB Fabrication (gerbers provided)
- IGBT Heatsink Mounting
- LV Side Stand Configuration
- Field Oriented Control (FOC)
- Component Integration & System Testings with FOC
- Testings with Wind Turbine Simulator and Sensors

Special Thanks to:

Dr. Joe Law, Normann Fischer, Val Wold, Dr. Herb Hess, Mike McMenemy



Keegan Miley-Hunter, Mason Taylor, Mason Ulrich