Designing a Modular ELV Motor Driver for High Current Sensorless Motor Control

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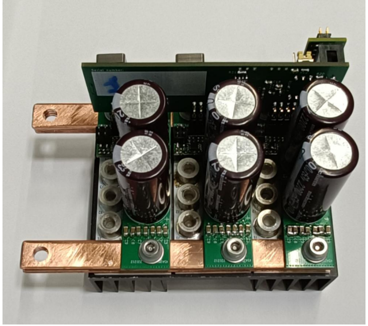
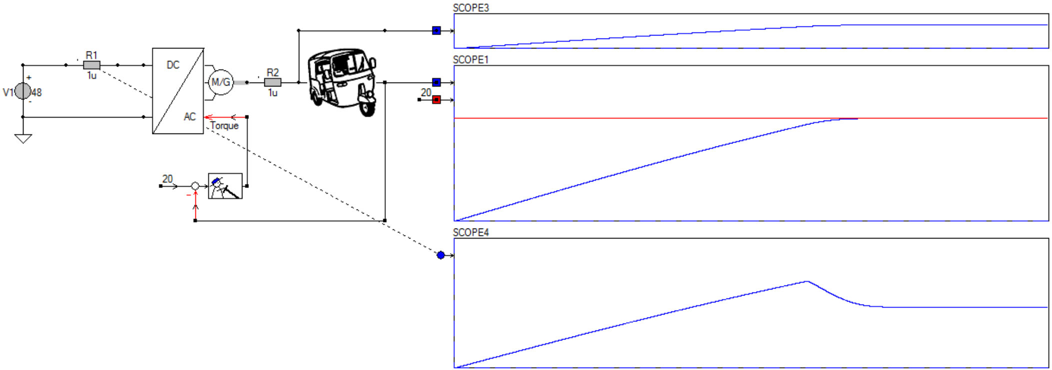


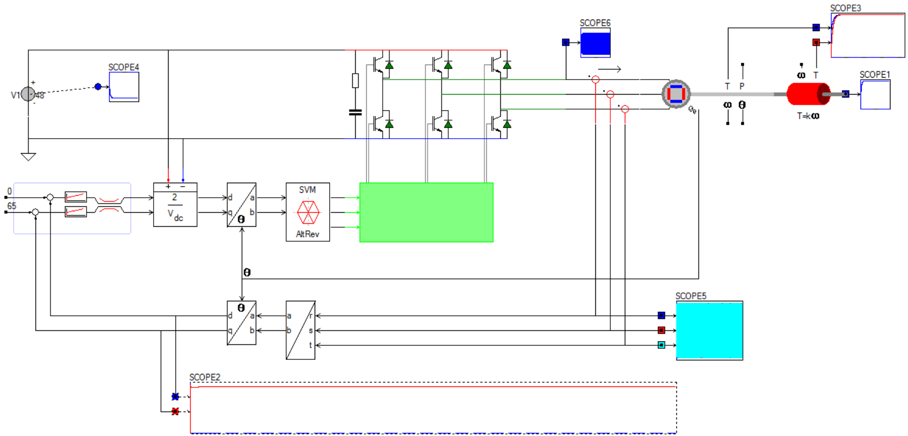
Introduction

Task: Design a motor driver for a Self-Sustainable ELV tuktuk, including PV and 48V batteries.

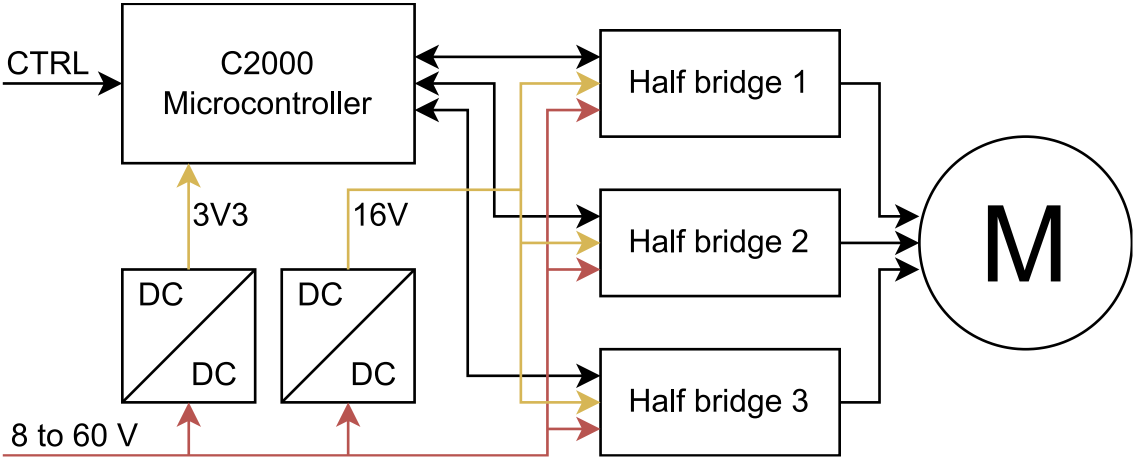
- Safe Extra Low Voltage 48V
- High current, up to 200A
- Modular configuration
- Improve thermal design



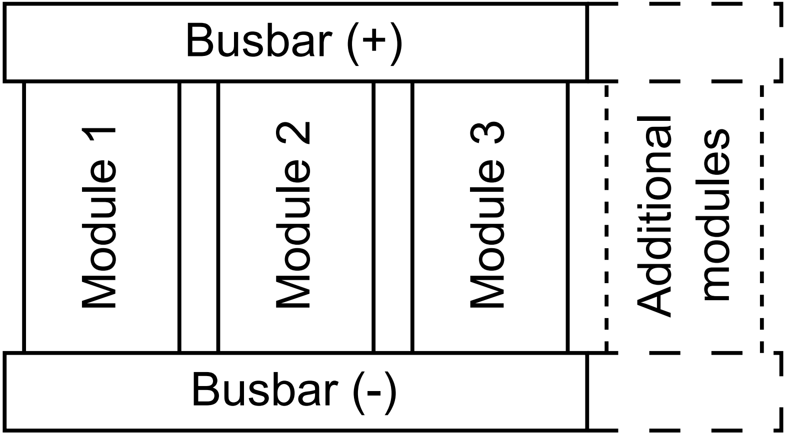
Caspoc simulation of the system design of the electrical drive and battery size.



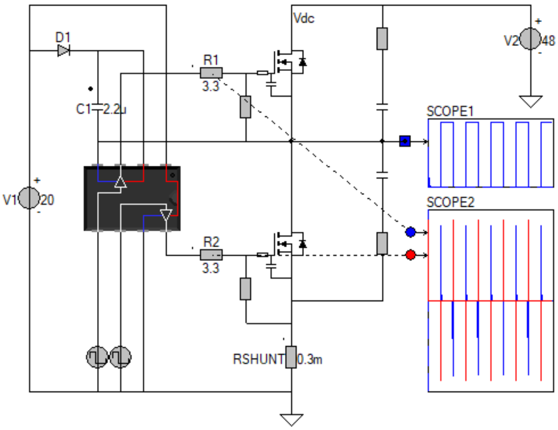
Caspoc simulation of the control structure for the three-phase inverter.



ELV motor driver hardware design overview



Modular power stage on a busbar system.



Caspoc simulation of the gatedriver UCC27282 in the Half-Bridge circuit

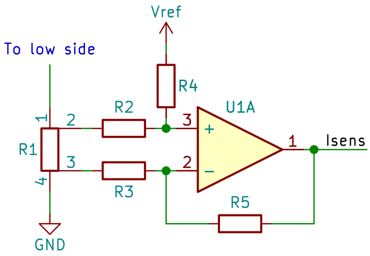


Figure: Current sensor circuit

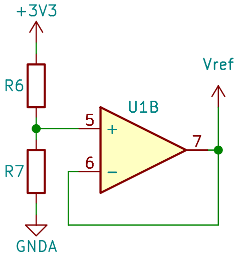


Figure: Reference circuit

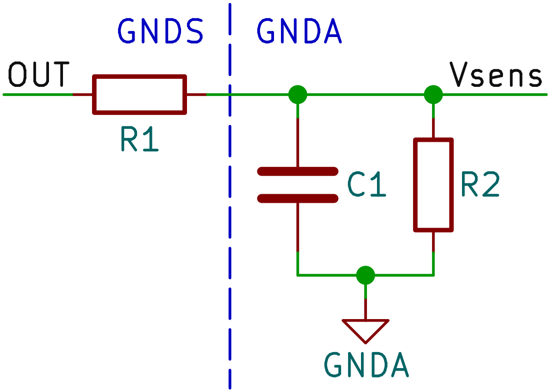


Figure: Voltage sensor circuit

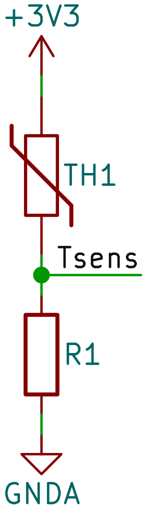
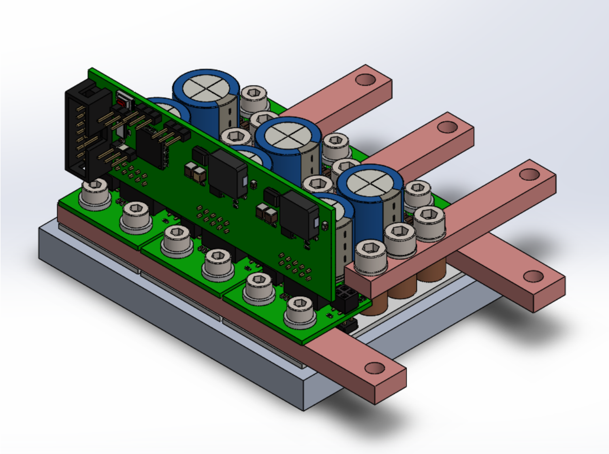
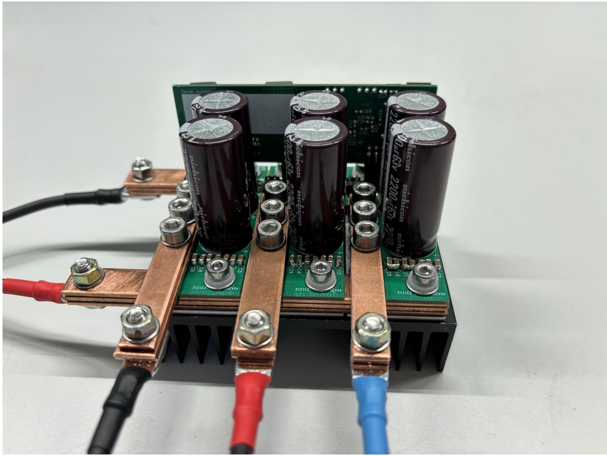


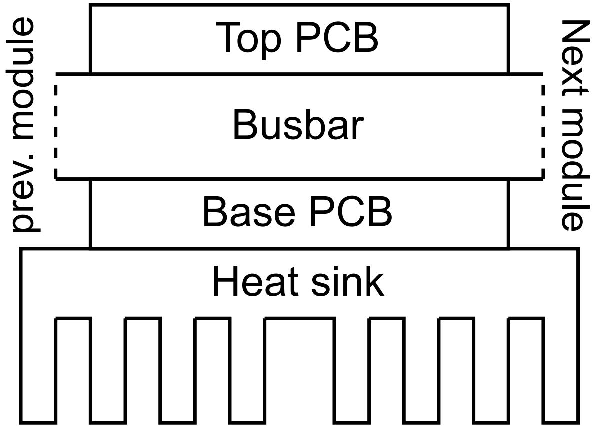
Figure: Temperature sensor circuit



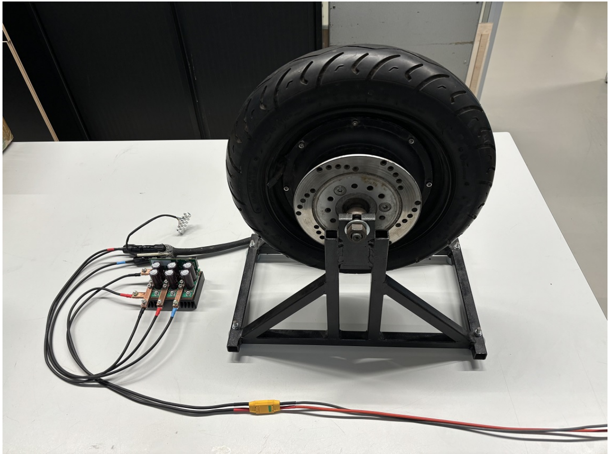
3D model



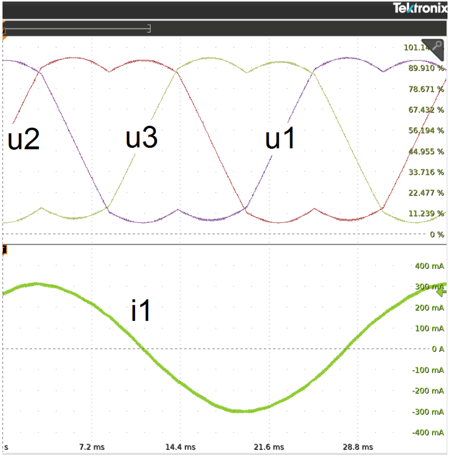
Final product



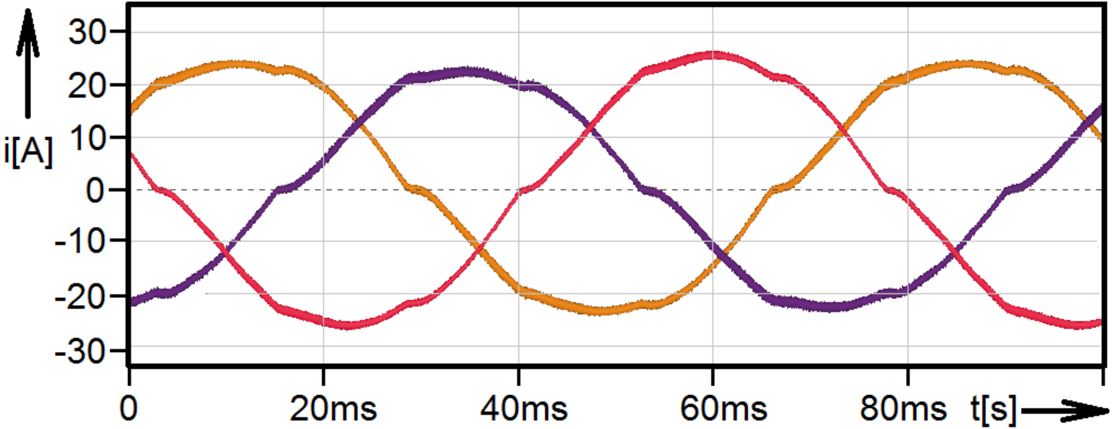
Half-bridge module stack-up



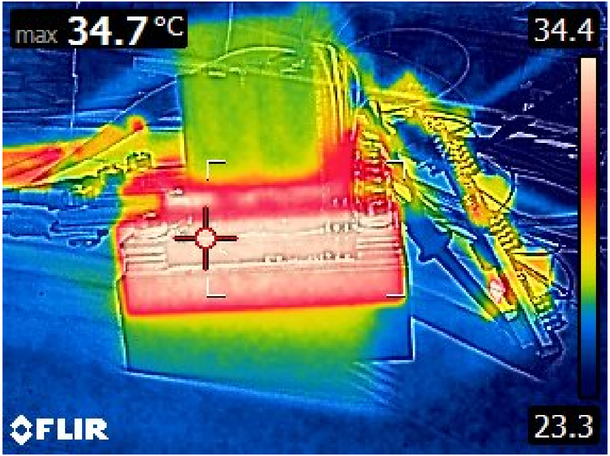
Driver connected to motor



Three-phase filtered motor voltages and scaled current through the first phase during the motor test.



Current measurement during thermal test.



Temperature of 34.7$^\circ C$ during a load current of max 20A

Conclusion

- Three phase converter build from three legs
- Voltage range: 8 to 60 volt
- Up to 200A
- Aluminum PCB design for improved thermal design

Thank you!

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