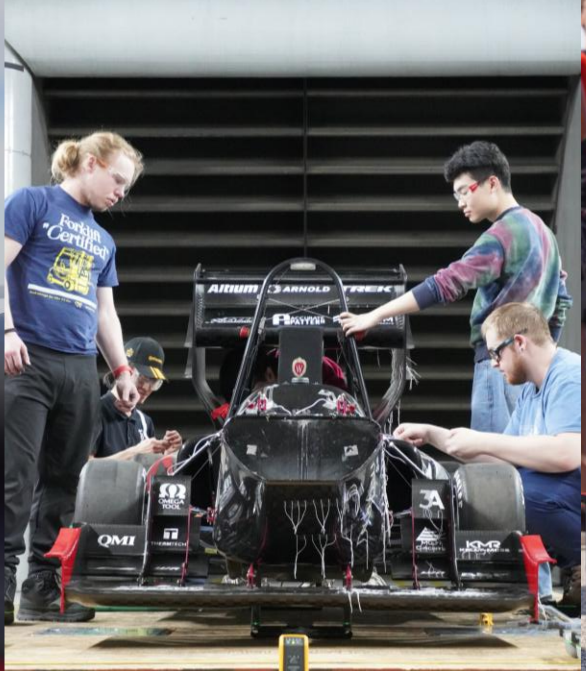
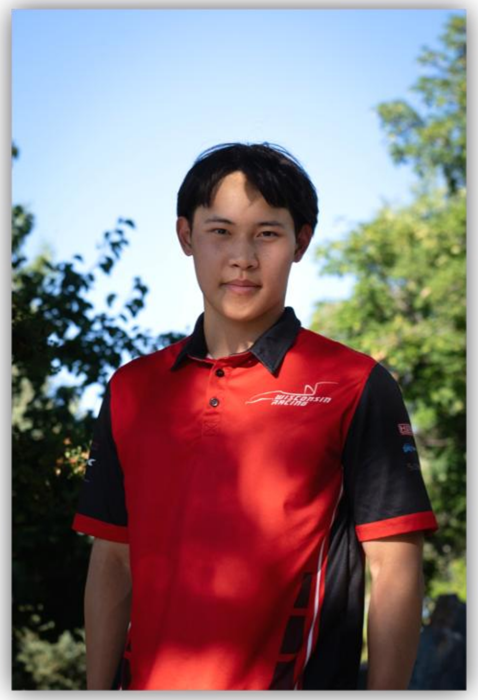




Alvin Hsieh

Engineering Portfolio

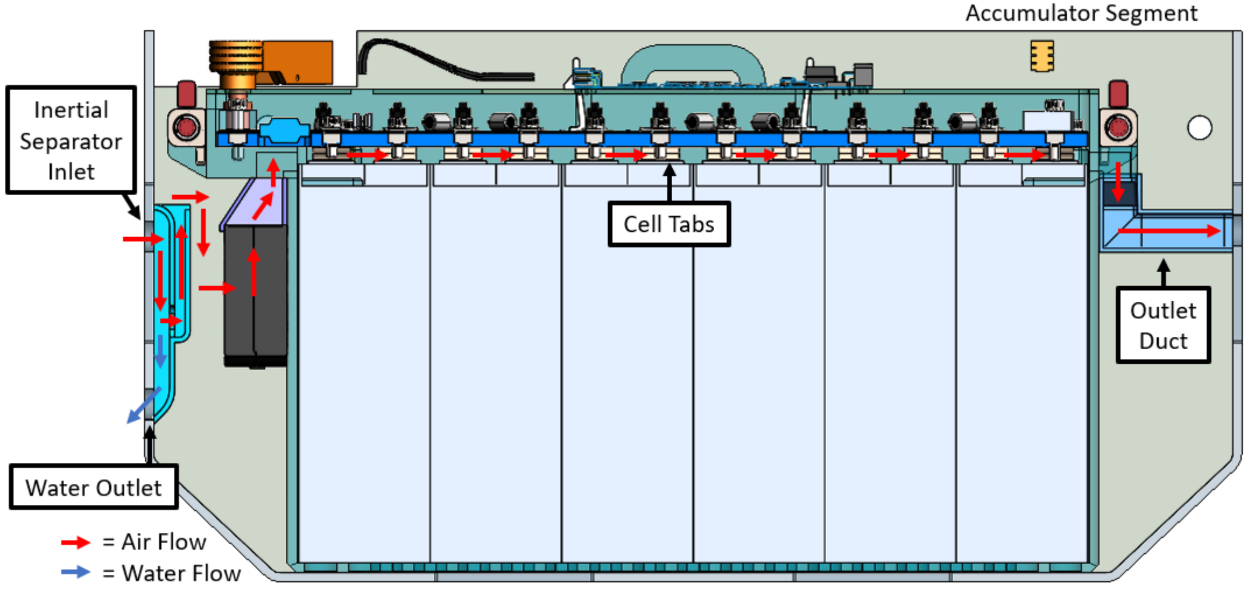
UW-Madison: Engineering Mechanics and Aerospace

arhsieh@wisc.edu | (608) 304-4001

Wisconsin Racing FSAE: Accumulator Cooling

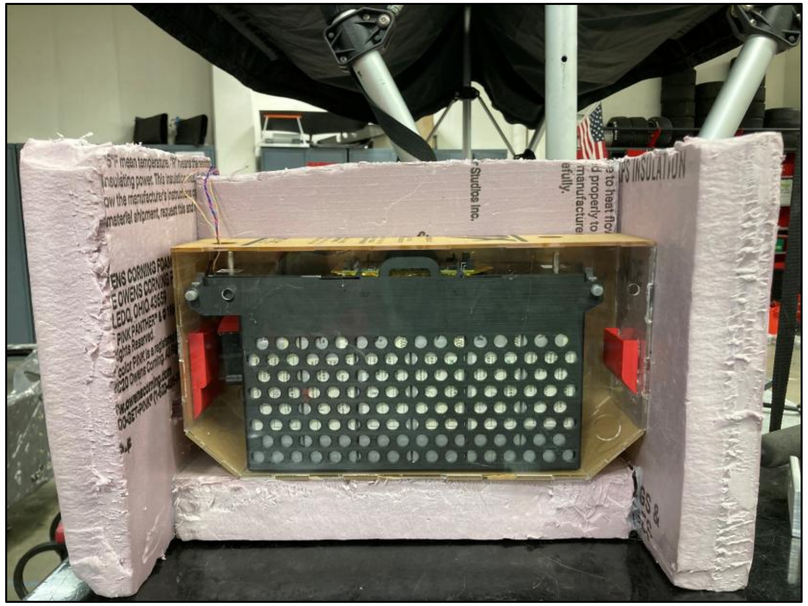
(Fall 2024 - Current)

- Introduced active air-cooled package into the HV Accumulator to keep cells under 45°C charging temperature limit due to the introduction of regenerative braking
- Identified chosen blower fan based on 1D thermal analysis and simulated heat transfer coefficient
- Design and tested inertial separator component to prevent water ingress into accumulator
- Led module thermal testing for characterization of air-cooled (11s3p) module temperatures vs SOC



Accumulator Cooling Design and Module Air Flow Path

Inertial Separator Testing



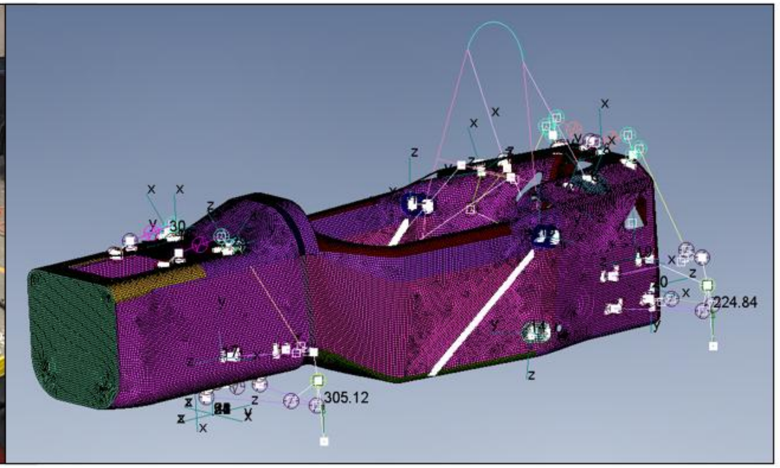
Module Thermal Testing

Wisconsin Racing FSAE: Monocoque Modal Tap Test

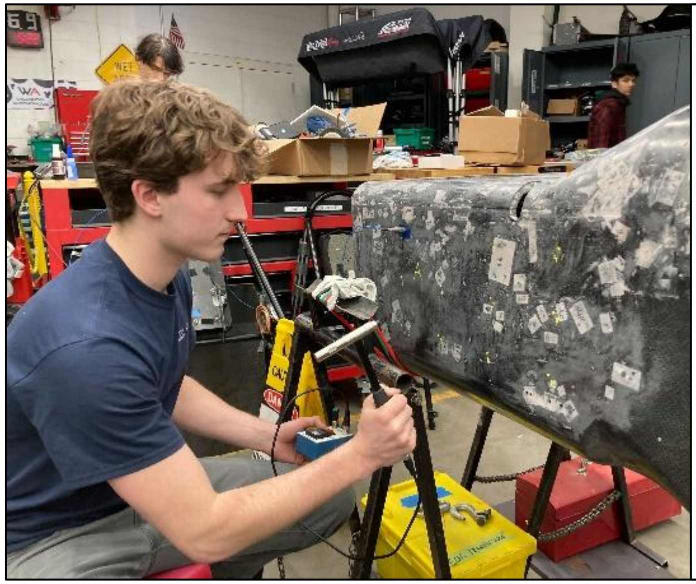
(Spring 2024)

- Conducted modal tap test for correlation of CFRP monocoque test modes to FEM modes
- Developed Python code for LabJack DAQ to record time domain data at 10 kHz, resolving frequencies up to 1 kHz
- Developed WR-TapTest, a Python package designed to post-process tap testing data
  - Trial run averaging
  - Take time domain forcing and response data to FRFs, storing in 3D tensor
  - Compare test modes to FEM modes with modal assurance criterion (MAC)
- Correlation of modes in 200 – 600 Hz range

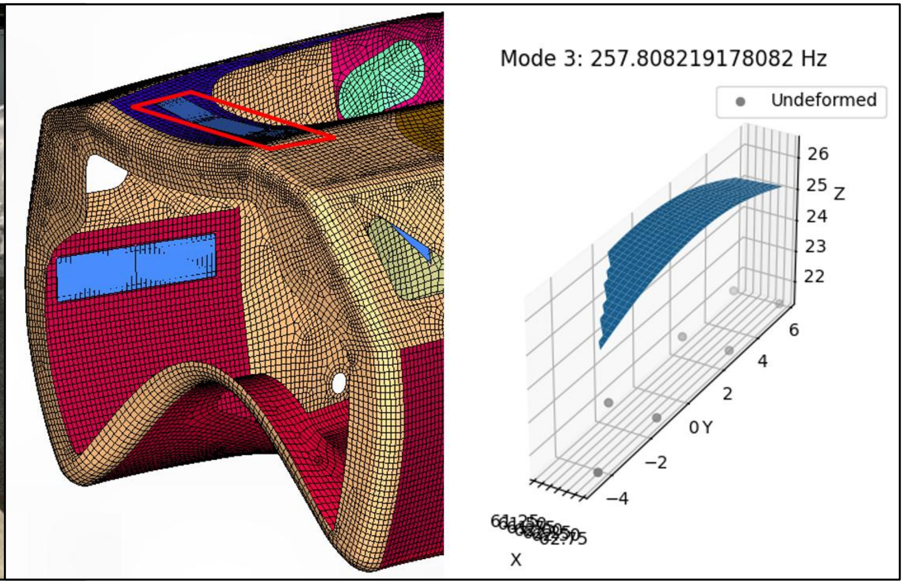
Free-free Boundary Condition Test Set-up



Monocoque Finite Element Model



Recording Forcing and Response Time Histories

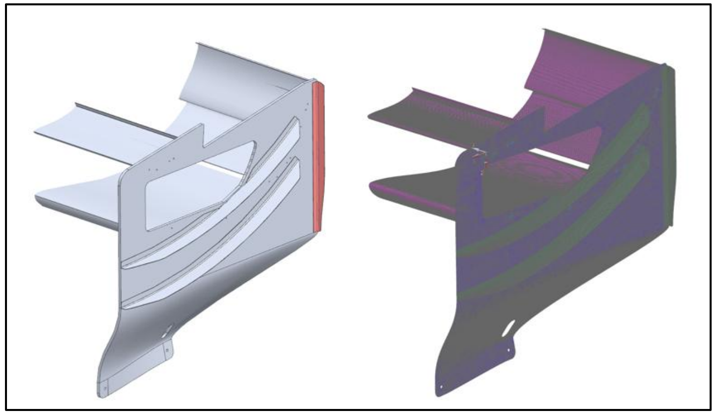


Comparing FEM Modes (left) to Test Modes (right)

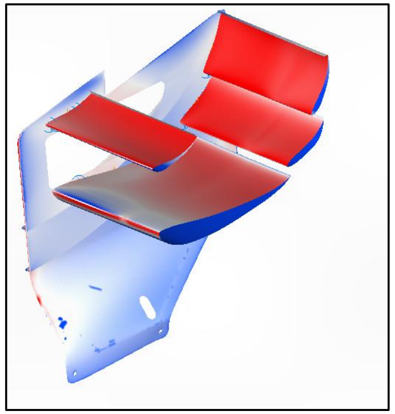
Wisconsin Racing FSAE: End Plate Mass Optimization

(Spring 2024)

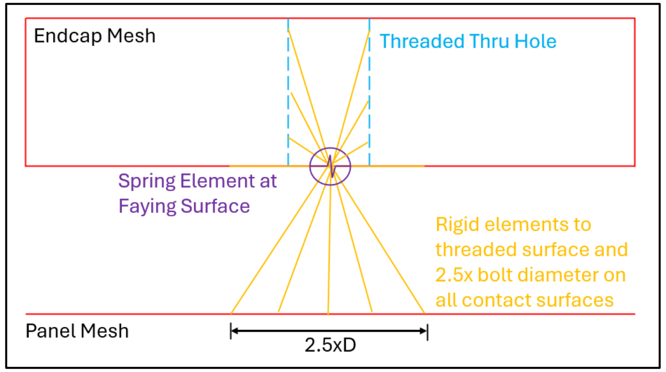
- Utilized Siemens NX and FEMAP as well as the NASTRAN finite element solver to optimize the mass of the rear wing endplates
- Plate meshed carbon fiber composites with PCOMP card
- Mapped pressure loading from CFD simulation of the car’s top speed to FEM
- Static design sweep resulted in 2.42 lbm decrease from original design
    - Global laminate: 0.25”
    - Global core density: 2.0 pcf
    - Chassis bolted connection core density: 6.0 pcf
    - Endcap bolted connection core density: 3.0 pcf



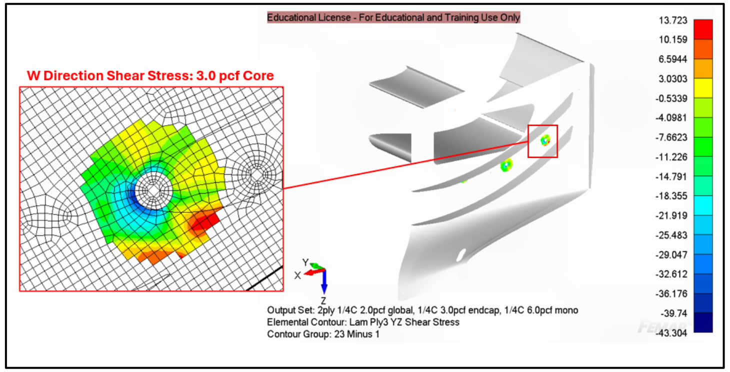
Geometry & Meshed Endplate under Symmetry BC



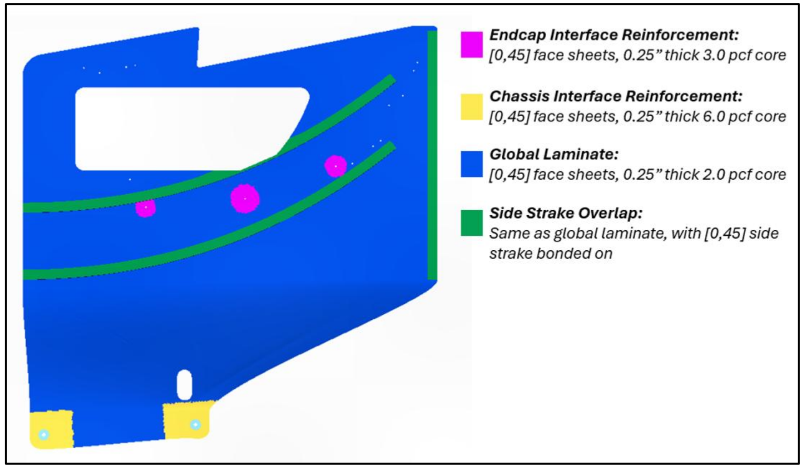
Pressure Mapping to FEM



Panel to Endcap RBE Connection



Driving Core Shear in End Cap Connection



Final Design Sweep Laminate and Core Specifications

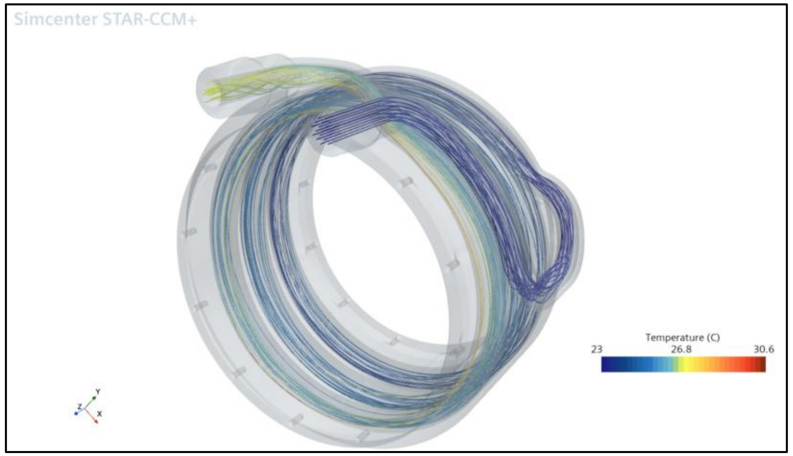
224C Rear Wing

Note that optimized endplates did not end up on the 224 aerodynamics package due to time constraint

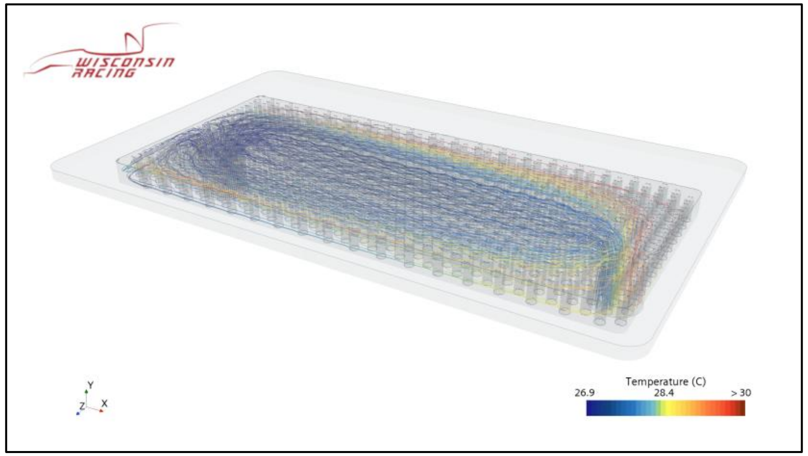
Wisconsin Racing FSAE: Cooling Loop Thermal Analysis

(Fall 2023 - Current)

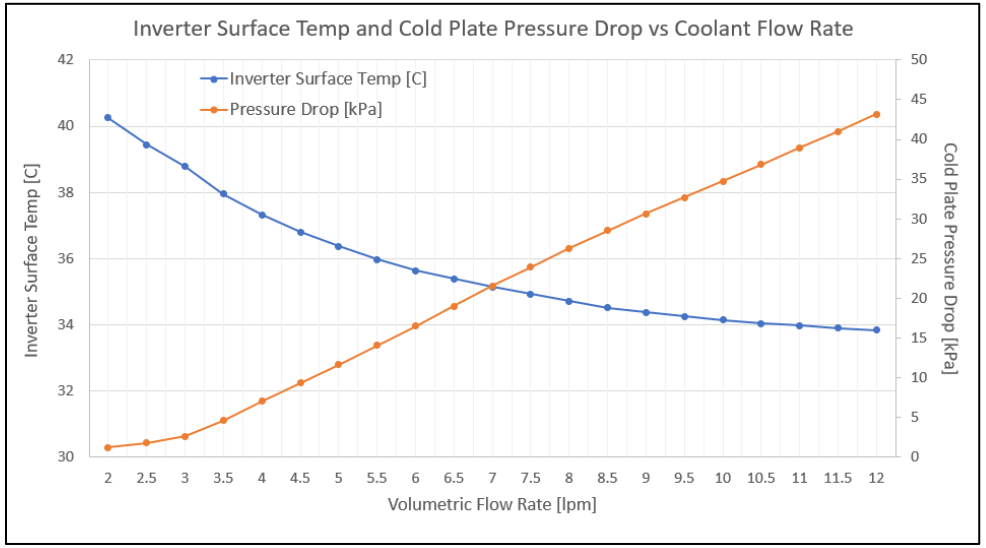
- Introduced Conjugate Heat Transfer (CHT) CFD simulations to Wisconsin Racing to analyze heat transfer within the cooling loop
  - Updated cooling jacket pressure drop for 1D Simulink cooling loop model
  - Worked with cooling design team to present optimized flow rate for the pump
- Utilized high performance computing (HPC) clusters to run simulations
- Developed StarCCM+ Java macros, batch scripts, and Python scripts to improve parallel computing for sweeps and to decrease post-processing time



Cooling Jacket Heat Transfer & Pressure Drop

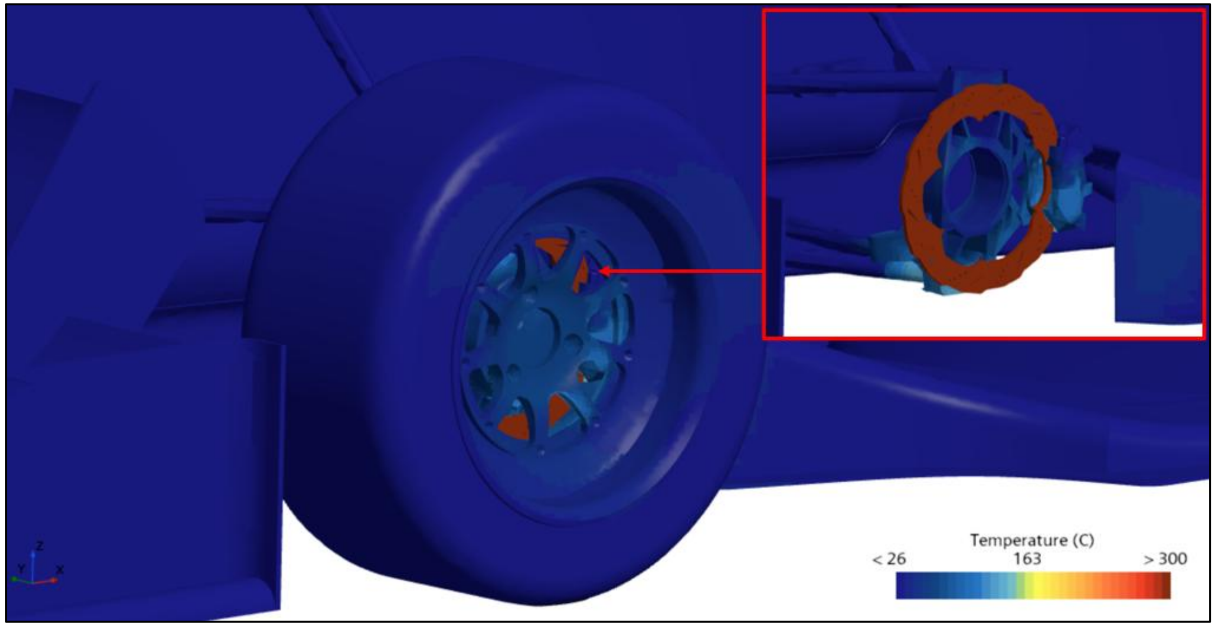


Cold Plate Heat Transfer Simulation

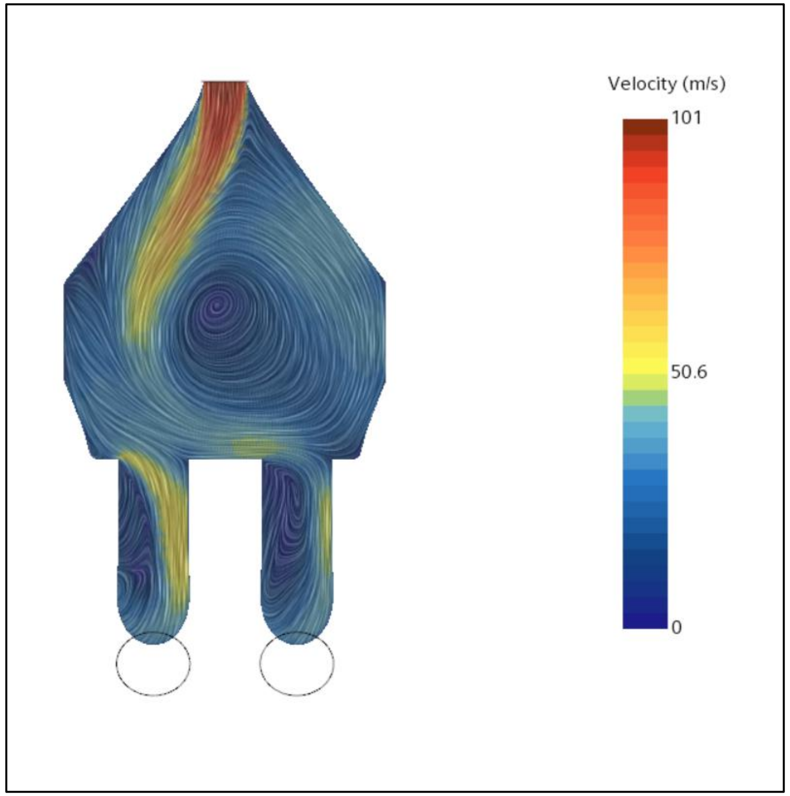


Cold Plate Flow Rate Optimization Study

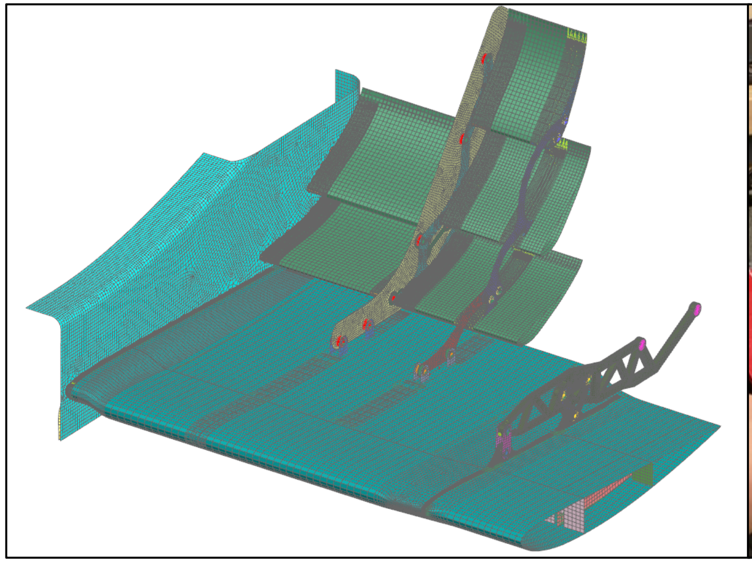
Wisconsin Racing FSAE: Other Analysis Projects

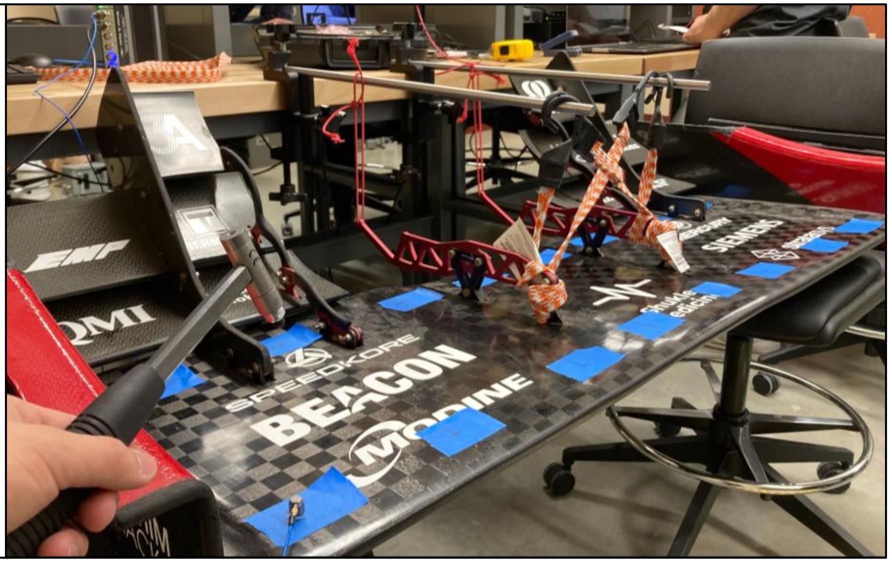


Brake Rotor Heat Transfer Coefficient Study



Custom Intake CFD Support





Front Wing Modal Tap Test Initial Correlation