



KRITI'25

MOTOR COOLING SYSTEM DESIGN

Organizer :
Automobile CLub



Mid Prep
| 400 Pts

Designing a Motor Cooling System

400 Points

Start : 20/01

End : 04/02

OVERVIEW:

Formula student electric vehicles are designed to provide high performance and efficiency. However a critical challenge that needs to be tackled is the thermal management of the heat generated at the motor and motor controller during operation at high speed for prolonged duration. Excessive heat can degrade motor efficiency, shorten its lifespan, and lead to performance issues or failures during races.

OBJECTIVE:

Consider yourself to be a part of the team working on designing a motor cooling system for formula student team. Develop a MATLAB/Simulink-based motor cooling system model that dynamically manages the motor's temperature while maximizing energy efficiency. The system should maintain the motor's operating temperature within a specified safe range during various drive cycles.

KEY CONSIDERATIONS:

- Consider that the vehicle cooling system includes an in-wheel motor (EMRAX 208) and a motor controller (BAMOCAR-D3) selected by your team.
- It can be assumed that the inefficiencies in the cooling system are directly converted into heat generated in the system.

- You are allowed to refer to datasheets provided by the manufacturer for the motor and motor-controller to estimate the cooling load.

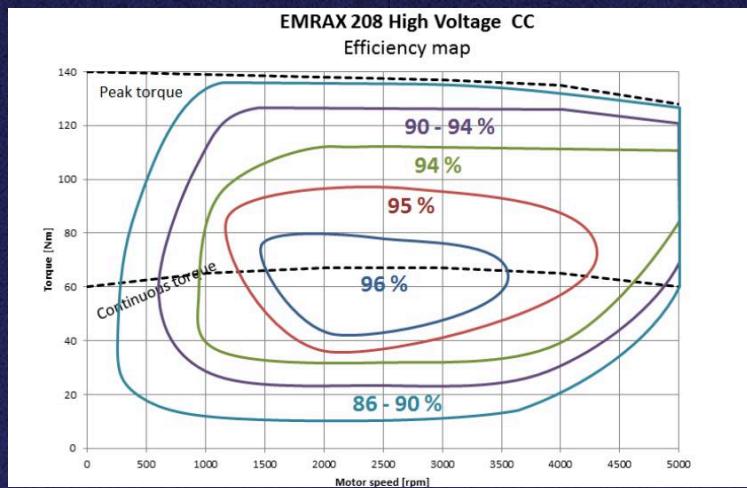


Fig1 Efficiency map of EMRAX 208

- Develop a control algorithm to regulate cooling system operation based on motor temperature and operating conditions.
- Minimize power consumption of cooling components while maintaining effective temperature control.
- TS components may only use plain water, air or oil as the coolant.
- Consider ambient air to be at 25°C and the maximum temperature of the motor must not exceed 45°C
- The volume flow rate of the coolant must not exceed the specified maximum value in the individual datasheets of the motor and controller.
- The pump and fan chosen by the team must be operated using a 12V Low voltage power supply
- Teams are encouraged to implement single/multiple radiators to achieve the desired cooling :)

RESOURCES:

- [Datasheet for EMRAX 208](#)
- [User Manual/Datasheet for BAMOCAR-D3](#)
- <https://youtu.be/pFKwL9Y5D6I?si=KTqlze39Nc1G0KI0>

EVALUATION CRITERIA:

- Teams must submit a functional model of the motor cooling system with detailed documentation and subsystem descriptions.[30]
- Motor temperature profiles over time.[20]
- Cooling system power consumption(Optional)[10]
- Presentation:
A concise presentation showcasing your model, results, and recommendations.[50]
- Report[30]:
 - Explanation of the design approach and assumptions.
 - Justification of cooling system selection and control strategies.
- Teams are also encouraged to further work on a CBOM(Costed Bill of Materials) for the final cooling system.[20]

WHO CAN PARTICIPATE:

- The team must consist of 6 members
- A minimum of 2 freshers must be a part of the team
- All 6 members must be present during the final presentation
- Only 1 team is allowed to participate from a hostel.
- The Core team members of the Automobile Club are not allowed to participate in this Problem Statement.

DEADLINE:

- Teams are required to submit the functional model of the system by **4th February EOD**
- Presentation dates will be shared to the participating teams soon.

ALL THE BEST!!