Simulation and Physical Testing of Hybrid Composite Laminate Structures for Formula Student Monocoque: Comparative Analysis of New and Old Lay-Up Configurations

OUR PROJECT

Formula Electric Belgium is a student-run electric race team which competes in Formula Student, the world's largest competition for engineering students. We aim to push the limits of performance, innovation and sustainability within electric racing every year, which is only possible with the help of our Thesis students. These pioneers are responsible for performance-defining innovations within the team, and we would love for you to join our team of highly ambitious and motivated engineers. As a Thesis student, you will research, design, prototype and test your innovations alongside the full-time members which make sure the team pushes itself and the car to new heights.

AIM AND OBJECTIVE

The objective of this thesis is to optimize the spine line in the monocoque chassis of Formula Electric Belgium cars, enhancing structural integrity while speeding up the laminating process. By integrating computational modeling, material analysis, and extensive mechanical testing, this research aims to refine chassis performance and safety for sustainable motorsports.

To achieve this, the following objectives are outlined:

- Structural Analysis: Investigate the current spine line design, assessing its influence on stiffness, strength, and overall chassis performance.
- Material Optimization: Evaluate the impact of carbon fiber orientation on structural efficiency, optimizing lay-up patterns to improve the strength-to-weight ratio.
- Mechanical Testing: Conduct comprehensive physical tests, including tensile testing, to assess material behavior and validate design improvements.
- Simulation & Validation: Utilize computational tools to simulate structural performance, complementing experimental results to refine the design.
- Iterative Design Refinement: Incorporate testing outcomes to progressively enhance the spine line, ensuring optimal weight distribution and mechanical performance.
- This study will contribute to the advancement of lightweight chassis design, providing insights for future implementations in electric racing applications.

PROFILE

We are looking for a motivated student with:

- A strong foundation in **composite materials** and **mechanics of materials**, preferably with coursework or prior experience in structural analysis and materials science.
- Proficiency in **simulation tools** such as ANSYS or Abaqus, and familiarity with composite failure models.
- Hands-on experience with **physical testing methods** for materials, including preparation and testing of composite specimens.
- Interest in sustainable engineering, particularly in hybrid composite materials like carbon and flax fibers.
- Excellent analytical skills, with the ability to document findings clearly and concisely.

RETURNS

By undertaking this thesis, the student will:

- Gain in-depth knowledge of advanced composite materials and their applications in high-performance automotive structures.
- Develop and refine practical skills in simulation, optimization, and physical testing, preparing them for roles in engineering research or industries like motorsports, aerospace, and sustainable material development.
- Contribute to the innovative field of hybrid composites by producing a validated model and configurations with potential real-world applications in Formula Student and beyond.
- Build a portfolio showcasing a comprehensive project that spans computational modeling, experimental testing, and optimization, providing a strong foundation for future academic or professional pursuits.

This thesis presents an exciting opportunity to be at the forefront of sustainable engineering while addressing the real-world challenges of competitive motorsport design.

INTERESTED?

Send us your contact details and field of interest to

recruitment@formulaelectric.be