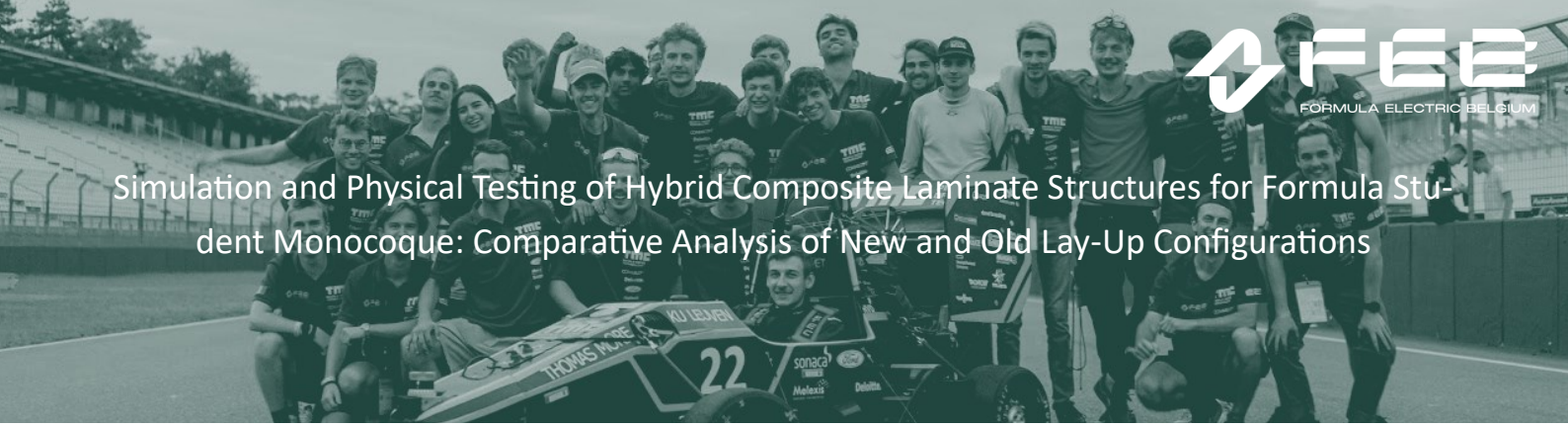

Simulation and Physical Testing of Hybrid Composite Laminate Structures for Formula Student Monocoque: Comparative Analysis of New and Old Lay-Up Configurations

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 aim of this thesis is to develop and validate a composite lay-up for the Formula Student monocoque that optimizes the strength-to-weight ratio while meeting the strict requirements of the competition. By integrating computational modeling and extensive physical testing, this research will determine the feasibility and performance of hybrid composite structures utilizing both carbon and flax fibers.

To achieve this, the following objectives are outlined:

1. **Material Research**: Perform an in-depth analysis of carbon and flax fibers, evaluating their advantages and disadvantages to determine suitability for different monocoque zones.
2. **Requirement Study**: Examine the specific mechanical and regulatory requirements of the monocoque zones such as the Front Bulkhead and Side Impact Structure, focusing on the loading conditions they experience.
3. **Simulation Model Improvement**: Refine the existing ANSYS simulation model to improve its representation of composite failure mechanisms. This includes incorporating more accurate damage models and simulating quasi-static shear tests using advanced parameters for flax and carbon fibers.
4. **Lay-Up Design**: Develop and test various lay-up configurations, both computationally and physically, to identify optimal sandwich structures that balance strength and weight.
5. **Validation and Comparison**: Perform physical tests, including 3-point bending, on the proposed hybrid configurations and compare their performance to historical monocoque designs made purely from carbon fiber.
6. **Optimization**: Experiment with different prepreg densities for both materials to pinpoint an ideal balance that satisfies all strength, weight, and regulatory constraints.

INTERESTED?

Send us your contact details and field of interest to

recruitment@formulaelectric.be

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.