Research on 3D Printed Core Materials for Local Reinforcement in Carbon Fiber Monocoques and Aerodynamic Components

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

This thesis aims to explore the potential of 3D-printed core materials for local reinforcement in carbon fiber monocoques and aerodynamic components. By leveraging the flexibility and complexity of 3D printing, the research seeks to optimize laminate sandwich structures for enhanced performance, weight savings, and production efficiency. Through simulation, manufacturing, and physical testing, the thesis will develop and validate innovative core designs for applications in Formula Student vehicles.

The specific objectives include:

1. **Design Exploration**: Investigate various 3D-printed core configurations and shapes, such as gyroid structures, for their structural and manufacturing advantages.
2. **Material Research**: Study composite laminate theory and evaluate different materials for 3D printing to achieve optimal strength-to-weight ratios for core components.
3. **Process Optimization**: Assess alternative 3D printing technologies to improve the production process and product quality.
4. **Simulation Refinement**: Develop advanced simulation models for 3D-printed cores, exploring configurations that enhance stiffness, strength, and adaptability.
5. **Physical Validation**: Manufacture sandwich panels using 3D-printed cores and perform physical tests, including 3-point bending and shear tests, to validate simulation results.
6. **Application in Critical Zones**: Evaluate the use of 3D-printed cores in high-stress zones such as monocoque corners and attachment points, where complex shapes are required for reinforcement.

Aerodynamic Integration: Explore applications in aerodynamic components, such as locally reinforced wing profiles or molds for complex shapes, to improve the aerodynamic package further.

INTERESTED?

Send us your contact details and field of interest to

recruitment@formulaelectric.be

PROFILE

We seek a candidate with the following qualifications:

- A background in **composite materials** and structural mechanics, with a strong understanding of sandwich panel theory and laminate design.
- Experience with **3D printing technologies**, including design, material selection, and process optimization.
- Proficiency in **simulation tools** like ANSYS or similar, with an ability to refine models and interpret results critically.
- Practical skills in **material testing**, including specimen preparation and mechanical testing methodologies.

An interest in advanced manufacturing and design technologies for motorsport or aerospace applications.

RETURNS

The student will gain:

- Comprehensive knowledge in the integration of 3D printing and composite materials for high-performance applications.
- Expertise in simulation and physical testing techniques, with practical experience bridging the gap between computational and real-world results.
- Opportunities to innovate in a rapidly advancing field, contributing directly to the development of cutting-edge Formula Student designs.
- A portfolio showcasing interdisciplinary work combining material science, advanced manufacturing, and engineering design, preparing for a career in motorsports, aerospace, or additive manufacturing industries.

This thesis offers a unique opportunity to push the boundaries of structural design and manufacturing, applying modern technologies to real-world challenges in competitive motorsport engineering.