

FSFEUP

NEWSLETTER

OCTOBER, 2024



A JOURNEY THROUGH
A FORMULA STUDENT
TEAM DREAM



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SOFTWARE PARTNERS



INSTITUTIONAL PARTNERS



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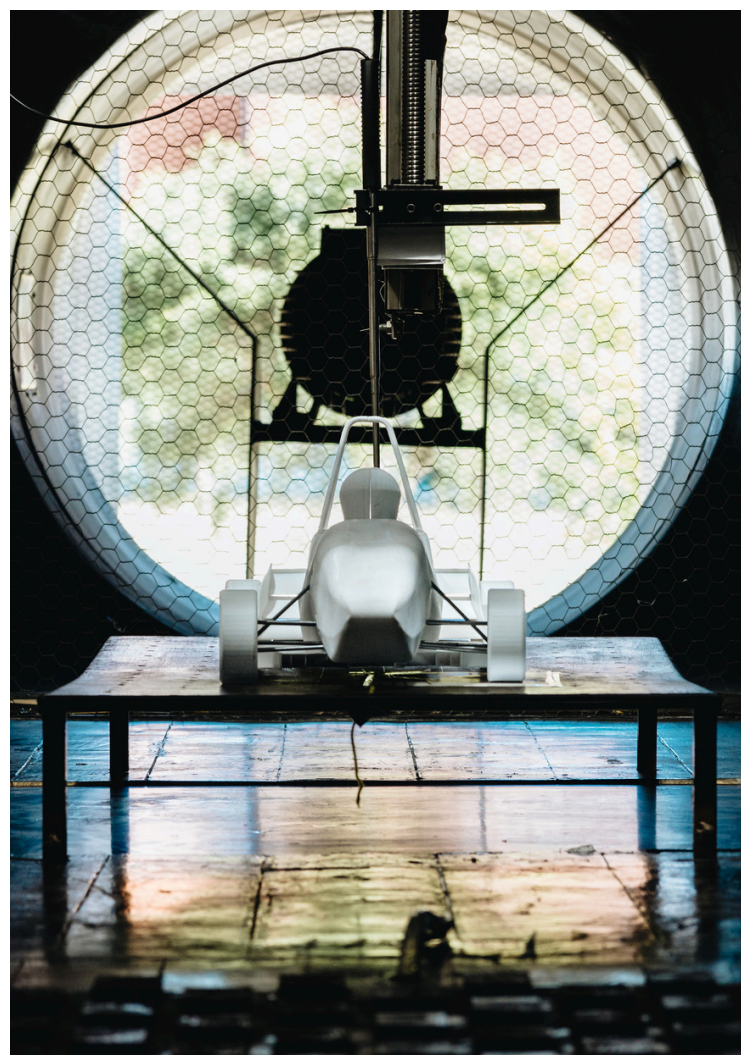
Summer Competitions

Events

Wind Tunnel UA

WITH UNIVERSIDADE DE AVEIRO

Wind tunnel testing served to validate advances in Computational Fluid Dynamics and aerodynamic design. To evaluate the accuracy of simulations, velocity was measured at various points using a 3D-printed model at a 1:5 scale. The team also tested the efficiency of different wing profile angles of attack and included vortex generators. This provided valuable data for aerodynamic performance, enhancing on-track performance.



Autonomous Racing Workshop

WITH TU HAMBURG

ARWo is an event organized to gather Formula Student teams to discuss the latest topics on autonomous driving. It's composed of discussions, presentations and lectures from companies. The goal was not only to acquire knowledge but also to validate the ideas and methodologies used. The experience confirmed the viability of the direction and generated new knowledge, soon to be put into practice.

Mostra U.Porto

WITH UNIVERSIDADE DO PORTO

Mostra U.Porto is an annual event that informs high school students about the opportunities the University of Porto offers among its 14 Faculties. The team was present with the FS FEUP 01, and some team members had the opportunity to explain FS and FS FEUP to many students interested. This event is an important milestone since this contact is important: some current team members got the chance to know FS FEUP there!



Internal Event

WITH ÁGUAS E ENERGIA DO PORTO

Águas e Energia do Porto is a corporate entity owned by Câmara Municipal do Porto, it provides for the sustainable management of the urban water cycle as well as the energy strategy regarding the Municipality of Porto.

The team had the chance of participating in an internal event and exhibiting the FS FEUP 01. With their support, the team will compete on track in 2025 with an innovative electric vehicle.

360 Tech Industry

WITH NORELEM

The 360 Tech Industry is an innovative event that invites professionals in the industrial sector to experience the necessary changes to monetize their business. It brings together different areas of industry such as automation, robotics and much more.

The team had the opportunity of being alongside norelem, a company that has helped the team manufacture the FS FEUP 01 and whose support will be crucial on the FS FEUP 02.



Electric Summit

WITH GALP

The Electric Summit is an event focused on debating the "Future of Energy": national specialists were gathered in this Forum, with the goal of debating the themes of energetic transition and mobility.

The team showcased its electric vehicle, the FS FEUP 01 alongside one of the Summit's Main Sponsors, Galp - a company which is supporting the team on the manufacturing of the FS FEUP 02.

02



FS FEUP 01

DRIVERLESS

TESTING TO VALIDATE

At the beginning of the current cycle, the team decided to take on the challenge of making the FS FEUP 01 driverless. By giving it autonomous driving capabilities, the team can develop and test all the software, electrical and mechanical systems in advance.

The vehicle is being put through a series of tests to validate the implementation. This shall be an important step towards ensuring the team can achieve the current cycle goals!

AUTONOMOUS SYSTEMS

The department has developed all software that allows for autonomous driving functions, from embedded software that ensures the vehicle's safety, interacting with the already existent logical systems, to the algorithms that process the sensors' data and generate driving control commands.

The algorithms have been validated through simulation and improved through careful analysis of the data generated by them, leaving the system in a confident place for in-vehicle trials.

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AN OPPORTUNITY
THAT WILL PROVIDE A
RELIABLE DRIVERLESS
SYSTEM ON THE
SECOND PROTOTYPE

MARCELO COUTO
CHIEF ELECTRICAL ENGINEER

ELECTRICAL SYSTEMS

Significant enhancements were made regarding the low voltage systems for this implementation, from the wiring harness to the newly developed printed circuit boards. These connections and circuits allow for a reliable vehicle.

For autonomous systems braking in service, regenerative braking has been implemented.

MECHANICAL SYSTEMS

The two mechanical systems developed are the braking and steering.

The braking system consists of a pneumatic and hydraulic system which is modular and easily transferable for the FS FEUP 02. It was added in parallel with the existing system and will serve for emergency braking situations.

The steering system consists of pulley and belt implementation directly on the steering shaft and an electric motor will be used to apply the desired rotation.



FS FEUP 02

SECOND PROTOTYPE

NEW CYCLE, NEW PROTOTYPE

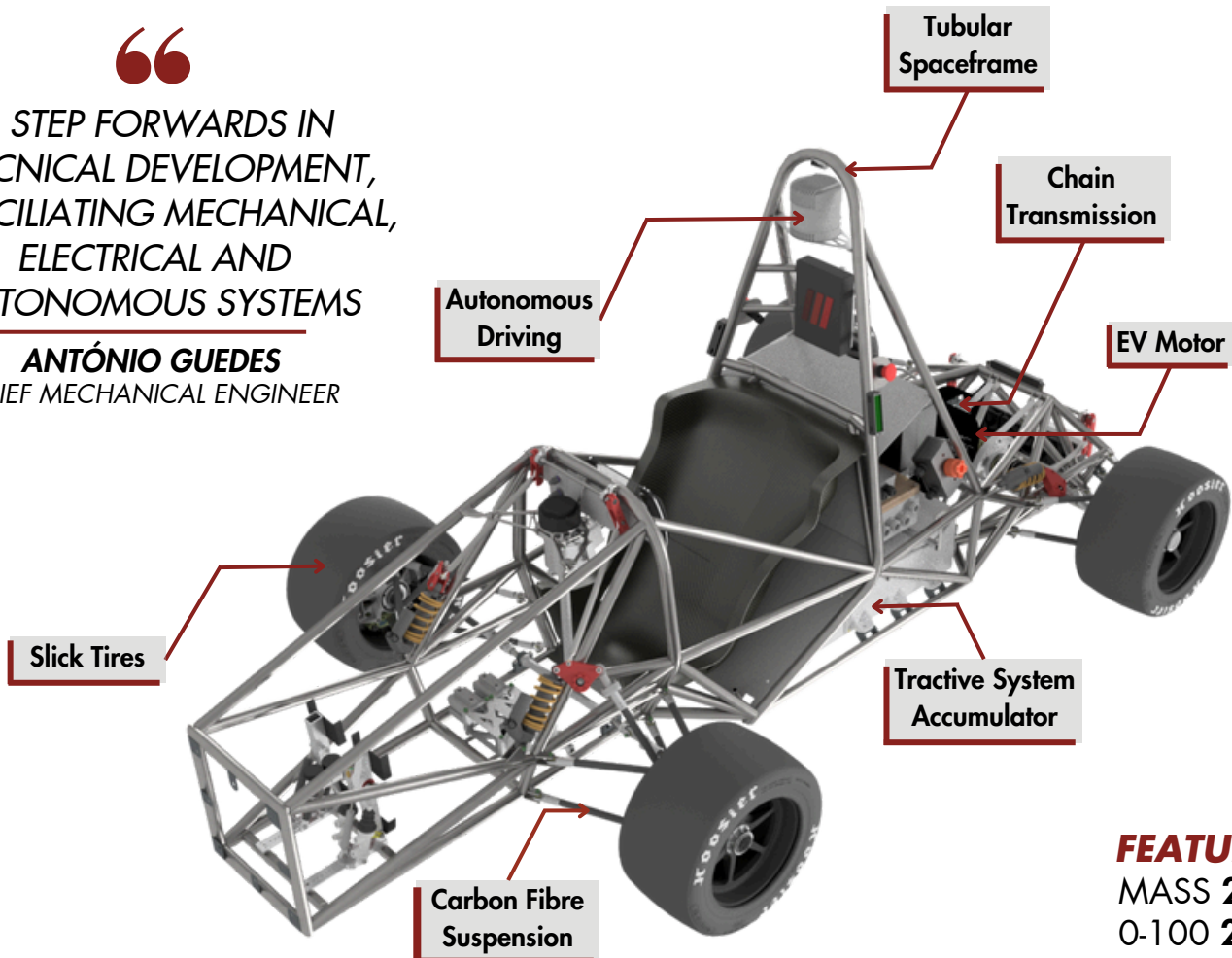
The FS FEUP 02 encompasses a crucial step forward in terms of overall vehicle performance, with a design targeted at a weight reduction of 20%, resulting in a total vehicle mass of 220kg whilst including autonomous-driving capabilities.

Once manufactured, the team aims at competing with it on several european competitions, with a focus on the Formula Student Germany, where the team aims to complete all dynamic events with the vehicle.



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A STEP FORWARDS IN
TEHCNICAL DEVELOPMENT,
CONCILIATING MECHANICAL,
ELECTRICAL AND
AUTONOMOUS SYSTEMS

ANTÓNIO GUEDES
CHIEF MECHANICAL ENGINEER



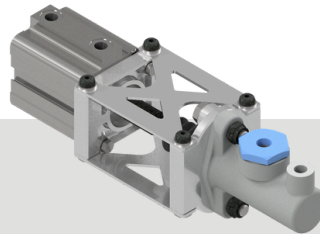
FEATURES
MASS 220 KG
0-100 2.9S

DEVELOPMENT



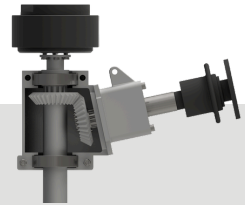
AERODYNAMICS

The Aerodynamic Package aims to maximise downforce for better grip and handling, minimising drag. It has $CL=-1.42$ and $CD=0.71$.



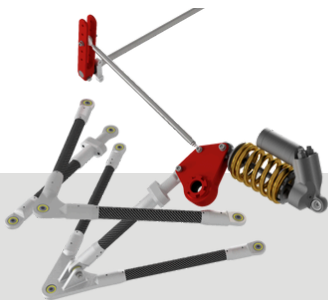
BRAKING

For driverless braking, Emergency Braking System Modules were developed, which encompass pneumatic and hydraulic systems.



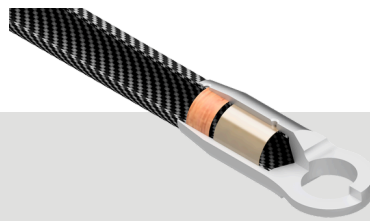
STEERING

Encompassing the driverless and manual steering systems, a gearbox was designed, incorporating an EV motor for steering.



VIBRATIONS

Changing from the previous air-shocks, coil-overs were chosen, using linear springs. Focus was also put into the packaging of components.



WISHBONES

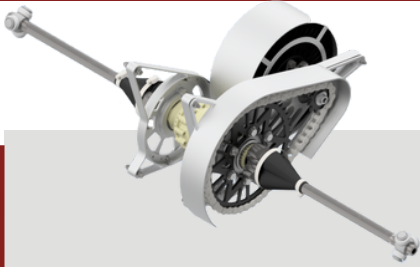
The linkage features an innovative bi-adhesive joint, with a rigid and ductile adhesive. This was later validated via experimental testing.



WHEEL ASSEMBLY

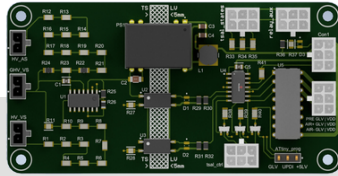
The rim size has reduced to 10", leading to integration challenges. For this, a topologically optimised upright was designed.

DEVELOPMENT



TRANSMISSION

A more accessible and adjustable chain transmission was developed, enabling the removal of the motor without full disassembly.



ELECTRONICS

New PCBs were developed, essential for processing data and controls. These execute the logic for the vehicle's operation.



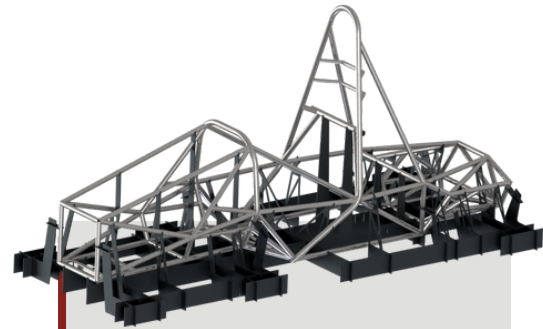
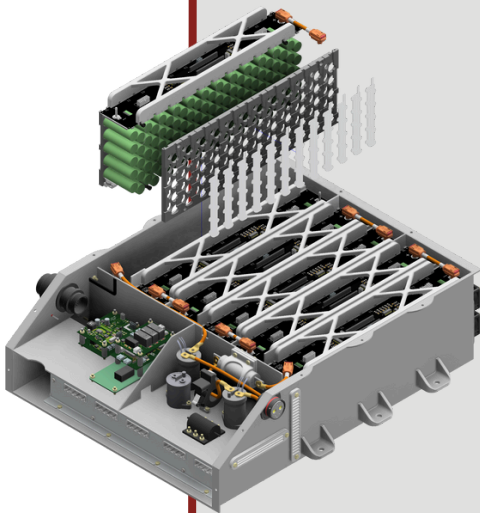
AUTONOMOUS SYSTEMS

A driverless pipeline was developed and implemented on the 01 for validation. This will permit the conclusion of all events at competitions.



TRACTIVE SYSTEM ACCUMULATOR

A completely new accumulator was developed. It is considerably lighter and with an air cooling solution, it was designed with manufacturability concerns. An innovative solution for temperature and voltage readings was developed, with a designed PCB placed on top of the segments which will collect all the data and reduces overall wiring.



FRAME

The Frame provides stiffness to support components, meeting FS regulations. It has a weight of 37kg and 2600Nm/° of stiffness.

04



SUMMER COMPETITIONS

COMPETING TO VALIDATE

As per the current team cycle planning, the team decided early on to compete during the 2024 summer in Concept Class competitions.

The team had the objective of presenting the design of the second prototype, and competing in other static events.

Entering the best competitions to important, and therefore the team trained throughout the past winter to achieve that.

The results were impressive and the team entered the Portuguese, Swiss and United Kingdom competitions.

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THESE SUMMER COMPETITIONS WERE CRUCIAL TOWARDS VALIDATING THE DEVELOPMENT MADE OVER THE PAST YEAR!

MIGUEL DAMIÃO
TEAM LEADER

AN AWARDS-WINNING SUMMER

The team was divided throughout the three competitions, such that every team member had the opportunity to experience at least one international competition.

After some months of preparation towards the competitions themselves, the team was ready to perform.

The preparation included creating documents on the design of the vehicle, developing a business plan and creating a cost report for the vehicle.

The focus was never on the results themselves, but rather on assuring that the right input was given for the team to advance into the manufacturing phase confident on the design developed.

That was achieved and minimal alterations have been performed. This, along with the overall results boosted the team's motivation and the team is now highly prepared to tackle the intense manufacturing phase!



FORMULA STUDENT SWITZERLAND

🏆 OVERALL WINNERS

ENGINEERING DESIGN EVENT
COST AND MANUFACTURING
BUSINESS PLAN PRESENTATION



FORMULA STUDENT UNITED KINGDOM

🏆 2ND OVERALL

ENGINEERING DESIGN EVENT
COST AND MANUFACTURING
BUSINESS PLAN PRESENTATION



FORMULA STUDENT PORTUGAL

🏆 OVERALL WINNERS

ENGINEERING DESIGN EVENT
COST AND MANUFACTURING
BUSINESS PLAN PRESENTATION



FSFEUP

DESIGN EDITION

NEWSLETTER

