

## Editorial Note

Welcome to the second issue of the Mechanical Engineering Department (DEM) Newsletter. As we approach the end of another academic year, we are thrilled to share with you the achievements of our academic faculty and students, as well as ongoing research in our Department.

In this issue, we celebrate the promotion of several faculty members. Their promotion not only reflects their individual accomplishments but also the collective excellence of DEM. Special congratulations to Professor Paulo Martins, who was honoured with the title of IST Distinguished Professor for his groundbreaking work in manufacturing, Professor João Costa Sousa and Dr. Ana Filipa Ferreira, who received Universidade de Lisboa/Caixa Geral de Depósitos Awards, and Professor Susana Vieira, who was distinguished with an honourable mention. We extend our felicitations to the many academic faculty and teaching staff of DEM distinguished for excellence in teaching in the academic year 2022/2023.

Our students continue to make us proud with their innovative projects and academic successes. We are pleased to highlight Duarte Palancha and Filipe Araújo, who received the Awards of best student in the Mechanical Engineering undergraduate programme and master's programme, respectively, in the academic year 2022/2023. This year, and for the first time, the students enrolled in the Integrative Project curricular unit (PIC) of the undergraduate programme in Mechanical Engineering presented a pitch and a poster in the PIC Symposium held at Técnico Innovation Center. The best project and the most innovative and sustainable ones received the Jerónimo Martins Merit Award.



PIC Symposium (Photo by Mário Violante)

This Newsletter also features updates on recent events, including our annual Day of DEM, which has been a hub of insightful discussions. We encourage all academic faculty of DEM to continue to participate and contribute to these enriching experiences.

We hope you find this issue informative and inspiring. Your feedback and contributions are always welcome, as they help us to continuously improve and better serve our Department.

**DEM President: Pedro Coelho**

Editorial Board: Pedro Coelho (DEM President), Filipa Moleiro (DEM Dissemination), Tiago Santos (CENTEC), Duarte Valério (IDMEC), Patrícia Baptista (IN+), Marcos Mateus (MARETEC).

## Day of the Mechanical Engineering Department

The Day of DEM was held once again at Centro de Caparide, on February 9. There were two invited talks during the morning, which were delivered by Professors Mário Figueiredo and José Santos-Victor, both of them professors of the Department of Electrical and Computer Engineering. Mário Figueiredo talked about artificial intelligence and its impact on teaching, research and society, while José Santos-Victor, who is the president of his department, addressed the relation between the departments and the research units. A fruitful discussion was held after each talk. In the afternoon, the results of a students' satisfaction survey, targeted to those who completed their master's degree in Mechanical Engineering in 2022/2023, were presented. The Day of DEM ended with short presentations by Professors Paulo Ferreira and Sofia Teixeira de Freitas on their experience abroad as university professors, followed by a round-table discussion.



Day of DEM in the Morning



Day of DEM in the Afternoon

## Academic Faculty Promotions

The following Assistant Professors were recently promoted to Associate Professors:

- Alexandra Moutinho – Scientific Area of Control, Automation and Industrial Informatics
- António Andrade – Scientific Area of Structural and Computational Mechanics
- João Henriques – Scientific Area of Thermofluids and Energy Conversion Technologies
- Paulo Gil – Scientific Area of Applied Mechanics and Aerospace Engineering

The following Associate Professors were recently promoted to Full Professors:

- João Melo de Sousa – Scientific Area of Applied Mechanics and Aerospace Engineering
- Nuno Maia – Scientific Area of Mechanical Design and Engineering Materials
- Virgínia Infante – Scientific Area of Mechanical Design and Engineering Materials

DEM congratulates these Professors for their promotion and wishes them continued success and many achievements in future endeavours.

## Retired Academic Faculty

The following Professors have recently retired:

- António Relógio Ribeiro – Scientific Area of Mechanical Design and Engineering Materials
- Fernanda Margarido – Scientific Area of Environment and Energy
- José Carlos Pereira – Scientific Area Thermofluids and Energy Conversion Technologies
- Leonel Fernandes – Scientific Area of Structural and Computational Mechanics
- Luís Guerra Rosa – Scientific Area of Mechanical Design and Engineering Materials

DEM expresses its gratitude for their dedication and wishes them all the best in this new chapter of their lives.

## Retired Administrative Staff

João Trindade, who spent more than 30 years working in the library of the Mechanical Engineering Department, recently retired. We appreciate his dedication to our Department and wish him all the best in his well-deserved retirement.

## Student Awards

### Hovione Award

The Hovione Award, which is sponsored by Hovione, is awarded to the best student of the undergraduate programme in Mechanical Engineering. It was awarded this year for the first time, to the best student in the academic year of 2022/23, in a ceremony held on May 16. The awarded student, Duarte Palancha, described his academic journey as a student of the undergraduate programme in Mechanical Engineering, thanking his family, colleagues and professors who he made a point of highlighting.

### APETRO Award

The APETRO Award, which is sponsored by APETRO, is awarded to the best student of the master's programme in Mechanical Engineering. This year, it was awarded to Filipe Araújo, who was the best student in the academic year of 2022/23, in a ceremony held on May 20. He thanked his family, colleagues and professors for supporting his academic performance as a student of the master's programme in Mechanical Engineering at Técnico, as well as DEM, as a whole, for the appreciation of its students. His Master's Dissertation, entitled "Alkaline Water Electrolysis: Ultrasonic Presence and Hydrogen Bubble Formation", was carried out within IN+, and supervised by Professor Ana Moita and Dr. Rui Costa Neto.

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## Student Awards



Hovione Award Ceremony



APETRO Award Ceremony

## Jerónimo Martins Merit Award

The Jerónimo Martins Merit Award, which is sponsored by Jerónimo Martins, is awarded to the best projects developed by the students enrolled in the Integrative Project curricular unit (PIC) in the last semester (i.e. sixth semester) of the undergraduate programme in Mechanical Engineering. It was awarded this year for the first time, at the end of the Symposium of the Integrative Project in Mechanical Engineering, which was held on June 7, at Técnico Innovation Center.



Jerónimo Martins Merit Award (Photo by Mário Violante)

## Academic Faculty Awards

### IST Distinguished Professor

Professor Paulo Martins received the title of IST Distinguished Professor during the Solemn Ceremony of the 113<sup>th</sup> anniversary of Técnico. This distinction recognizes his exceptional contributions to teaching, knowledge transfer and scientific leadership at national and international level in the area of manufacturing with emphasis on forming, joining by forming and hybrid additive manufacturing processes, which together with his contributions to university management, have promoted Técnico internationally.

## Academic Faculty Awards

### Excellence in Teaching

About 50 Professors of the Mechanical Engineering Department, including both academic faculty and non-permanent teaching staff, were honoured for excellence in teaching in the academic year 2022/2023 during the Solemn Ceremony of the 113<sup>th</sup> anniversary of Técnico. This distinction is based on the assessment made by students in the framework of the Course Unit Quality System.



IST Distinguished Professor Paulo Martins



DEM Excellence in Teaching

### Universidade de Lisboa/Caixa Geral de Depósitos Scientific Awards 2024

The Scientific Awards established by Universidade de Lisboa in collaboration with Caixa Geral de Depósitos, aim to reward scientific research activity and encourage the practice of international publication of recognized quality and impact. The awardees are professors, researchers with Ph.D. or post-doctoral fellows who have carried out research activities at the University of Lisbon for at least two years, and who are resident in Portugal. The following Professors of DEM received an award or an honourable mention in 2024:

#### Awards

- João Costa Sousa – Area of Mechanical, Naval and Aerospace (Aircraft Mechanics)
- Ana Filipa Ferreira – Area of Environment and Energy

#### Honourable Mention

- Susana Vieira – Area of Computer Sciences and Engineering

## Academic Faculty Awards

### Energies 2022 Best Paper Award

The paper entitled “Use of Sustainable Fuels in Aviation — A Review” co-authored by Professor João Melo de Sousa and Eduardo Cabrera (Master student of Aerospace Engineering) and published in the *Energies* journal was distinguished by the editors as one of the best review papers published in that journal in 2022.

## Students’ Organisations Rollouts

DEM is proud to highlight our students’ organisations new prototypes rollouts: Técnico Fuel Cell hydrogen-powered car on March 28, Técnico Solar Boat hydrogen-powered boat on June 12, Formula Student electric and autonomous car (FST13) on June 28, and AeroTéc Air Cargo Challenge aircraft (ACC24) on July 4.



Técnico Fuel Cell hydrogen-powered car



Técnico Solar Boat hydrogen-powered boat



Formula Student electric and autonomous car



AeroTéc Air Cargo Challenge aircraft

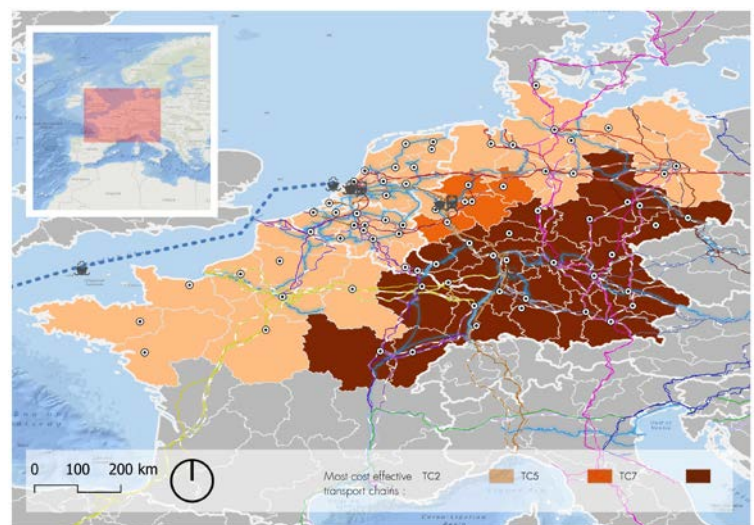
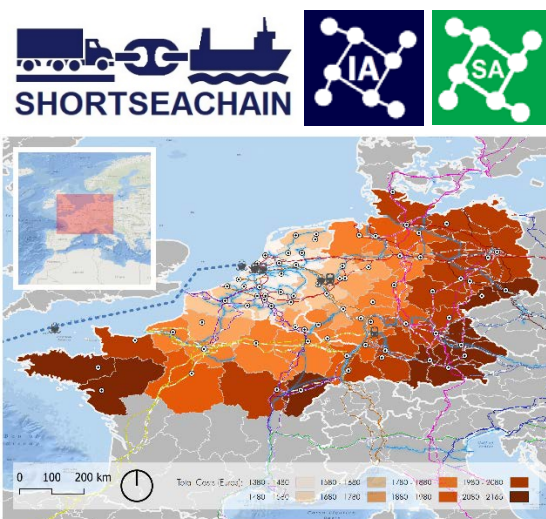
## SHORTSEACHAIN – Evaluation of short sea shipping services integrated in supply chains



Short Sea Shipping (SSS) has been promoted in the European Union (EU) as one of the alternatives for achieving a modal shift from road haulage to more sustainable transport modes. For peripheral countries such as Portugal, SSS remains a crucial mode of transportation with a significant unexplored potential. The EU proposed a Motorway of the Sea of Western Europe, that could reduce internal and external costs of transportation significantly, thus improving the sustainability of supply chains.

This project allowed the development of numerical tools, focused on containerized and general cargo, which calculate the transportation costs, travel time (Intermodal Analyst tool, *IA*) and external costs (Sustainability Analyst tool, *SA*) associated with intermodal or unimodal transport solutions. Entire door-to-door supply chains are considered, with different combinations of SSS, road, rail and inland waterways. The tool uses a model of the land and maritime transport networks from Portugal to Northern Europe. The transport parameters of the different chains are used to determine the modal split between chains using a discrete choice model. The analysis is carried out at the level of NUTS 2 regions, aiming at identifying the most competitive chains.

PI: Tiago A. Santos





## Eye in the Sky



Project Eye in the Sky developed a high-altitude solution for the detection and monitoring of forest fires. The platform is composed of a high-altitude balloon combined with a flying wing (a glider), carrying a camera and with the ability to relay communications. Launching the wing during flight allows a better survey of the region of interest when the balloon drifts away. The Eye in the Sky solution was successfully tested in June, during the ARTEX24 military exercises of the Portuguese Army, at the Santa Margarida Camp, Constância, Portugal, with the flying wing being released from the balloon at an altitude of 3104 m. ARTEX24 tests technology under development with the potential of improving the Army's current abilities.

PI: Alexandra Moutinho



## H<sub>2</sub> Green Valley

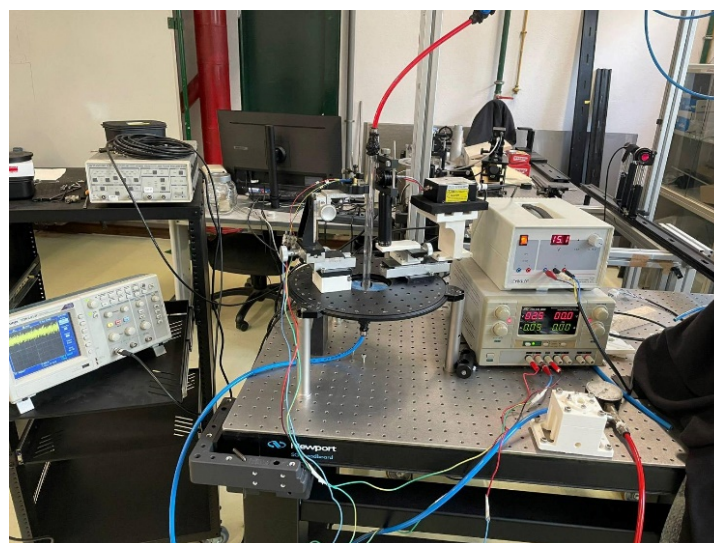


The H<sub>2</sub> Green Valley Agenda aims to develop, in a coordinated, scalable, and innovative way, a set of complementary projects in the green hydrogen (H<sub>2</sub>) value chain. It focuses on the development of H<sub>2</sub> transmission infrastructure (with H<sub>2</sub> storage capacity via line pack), compression and distribution, to create the first green H<sub>2</sub> hub in Portugal. H<sub>2</sub> Green Valley will also develop the injection of H<sub>2</sub> into the main gas pipeline, at the same time as it will adapt the Sines gas distribution network and implement a pilot program to convert end users to be able to use H<sub>2</sub>.

IN+ is involved in the R&D activities of the agenda in the analysis of blending of H<sub>2</sub> with natural gas in the distribution network, with special emphasis on the design of a H<sub>2</sub> injection device, as well as in the evaluation of gas mixture stratification and in the development of a sensor to quantify in real time the mixing process inside the pipeline.

H<sub>2</sub> Green Valley Agenda is led by REN Gás S.A. and gathers important players in the green hydrogen field, namely: Associação HYLAB – Green Hydrogen Collaborative Laboratory, Instituto Superior Técnico, Laboratório Ibérico Internacional de Nanotecnologia, Bosch Termotecnologia S.A. and Floene.

PI: Edgar Fernandes



## PLAST4H2 – Plastic circularity through an efficient detection, collection, and valorization into Hydrogen and value-added products



PLAST4H2 aims to fight plastic pollution in the Atlantic Area through circularity and sustainability, converting plastic waste into high-value-added products such as hydrogen and encouraging lifestyle changes. The central objective is to promote plastic valorisation in the Atlantic area into hydrogen, energy, and value-added products through the development of new and advanced systems to supply strategic sectors along the Atlantic coast. In addition, developing a world-leading position in the field of plastic circularity and sustainable fuel generation. The development of innovative technologies based on H<sub>2</sub> and the retrieval of plastic wastes can boost energy efficiency within the advantageous situation of the Atlantic region, creating flagship prototypes that are key for the production of low-carbon fuels, and motivating the Atlantic challenge posed by this project.

PLAST4H2 addresses global marine pollution and energy issues and focuses on the challenge of ensuring a sustainable and efficient energy supply with low carbon emissions while reducing plastic littering impact in the Atlantic region. The main activities are divided into 3 well-defined work packages. WP1 assesses ocean pollution, developing detection tools, litter flow patterns models, and implements an advanced plastic collection system with a pilot boat. WP2 demonstrates innovative solutions for plastic conversion into H<sub>2</sub>, energy, and ecoplastics. WP3 evaluates the sustainability of converting plastics into valuable products and raises awareness among society. Demonstrating their solutions via four pilot prototypes will reach thousands of people. PLAST4H2's technologies will be available to stakeholders and policymakers, promoting the adoption of green practices in the Atlantic region.

PI: Ramiro Neves

