

## Editorial Note

Welcome to the July 2025 issue of the Mechanical Engineering Department (DEM) Newsletter, focusing on the highlights of this first semester of the year. In this issue, we start by remembering our annual Day of DEM held on last February. Along with that, we welcome Professor Ana Filipa Ferreira, as new faculty of DEM, and we celebrate as well the recent promotions of Professor Shan Wang and Professor Tiago Farias. The excellence of our faculty and students continue to be recognized with several awards and distinctions. Special felicitations to Professor Susana Vieira, who received the Universidade de Lisboa/Caixa Geral de Depósitos Scientific Award, and Professor Carlos Alves da Silva, who earned an honourable mention. We congratulate all teaching staff distinguished for excellence in teaching in the academic year of 2023/2024. Our students keep on making us proud with their astonishing projects. In the framework of the Integrative Project curricular unit (PIC), both Mechanical Engineering and Aerospace Engineering PIC Symposia were successful and inspiring events. Besides that, our students' organizations also launched this June two new prototypes, the FST14 (from Formula Student) and the SG01 (from Técnico Solar Boat).



Mechanical Engineering PIC Symposium



Aerospace Engineering PIC Symposium

We also extend our thanks to Professor Helder Rodrigues and Professor António Moreira, who just retired, for their long-time dedication to DEM. Moreover, we learned with great sadness of the passing of Professor Viriato Semião (early this year) and Professor Cristóvão Mota Soares (in recent days). Both their legacies will remain in our memories for long time to come.

Lastly, this issue highlights outstanding projects developed by our Professors within the research centres CENTEC, IDMEC, IN+ and MARETEC. We hope you enjoy reading this Newsletter and we wish you all a pleasant summer of 2025 to face the new academic year with renewed energy.

**DEM President: Paulo Fernandes**

Editorial Board: Paulo Fernandes (DEM President), Filipa Moleiro (DEM Dissemination), Tiago Santos (CENTEC), Susana Vieira (IDMEC), Patrícia Baptista (IN+), Marcos Mateus (MARETEC).

## Day of the Mechanical Engineering Department

The Day of DEM was held at Centro de Caparide, on February 14, with the presence of the President of Instituto Superior Técnico (IST), Professor Rogério Colaço, in the opening session.

In the morning, we also welcomed the invited talk by Eng. Fernando de Almeida Santos, President of the Order of Engineers, regarding the valorisation of the engineers in Portugal. Later, in a roundtable chaired by Professor Elsa Henriques, three representatives of industrial companies, namely, Eng. Filipe Gaspar (Hovione), Eng. Joaquim Menezes (Iberomoldes Group) and Eng. Carlos Andrade (Galp) shared their thoughts about the role of engineers in society. After a pleasant lunch, we embraced, in the afternoon, the inspiring talk of Jerry Westerweel from TUDelft.



Day of DEM at Lunchtime

## New Academic Faculty and Promotions

Recent international recruitment competitions in DEM/IST led to the following new tenure-track Assistant Professor, aside from those previously announced, to whom DEM wishes likewise a bright academic career:

- Ana Filipa Ferreira – Scientific Area of Thermofluids and Energy Conversion Technologies

DEM also congratulates the following Professors for their promotions and wishes them continued success in future endeavours. Namely, the following Assistant Professor recently promoted to Associate Professor:

- Shan Wang – Scientific Area of Naval Architecture and Marine Engineering

Moreover, the following Associate Professor recently promoted to Full Professor:

- Tiago Farias – Scientific Area of Thermofluids and Energy Conversion Technologies

## Retired Academic Faculty

The following Professors have recently retired, to whom DEM expresses its gratitude for their dedication and wishes them all the best in this new chapter of their lives:

- Helder Rodrigues – Scientific Area of Structural and Computational Mechanics
- António Moreira – Scientific Area of Environment and Energy

## Student Awards

### Tekever Award

The Tekever Award is a merit distinction awarded to the best student finalist of the master's programme in Aerospace Engineering. This year, it was awarded to João Pedro Fialho Perdigão, as the best student finalist in the academic year of 2024/2025, in a first-time ceremony held on May 16.

### Hovione Award

The Hovione Award is, likewise, a merit distinction awarded to the best student of the undergraduate programme in Mechanical Engineering. This year, it was awarded to José Pedro Ribeiro da Silva, as the best student in the academic year of 2023/2024, in a ceremony held on June 23.

### EPCOL Award

Similarly, the merit distinction EPCOL Award for the best student of the master's programme in Mechanical Engineering in the academic year of 2023/2024, was awarded to Simão Vitoriano Lourenço Nieto de Castro, in a ceremony held on July 14.



Tekever Award Ceremony



Hovione Award Ceremony



EPCOL Award Ceremony

## Distinctions for Best PIC Projects

Closing the last semester of the undergraduate programmes of Mechanical Engineering and Aerospace Engineering, the students enrolled in the Integrative Project curricular unit (PIC) had the opportunity to be involved in the respective PIC Symposium held at Técnico Innovation Center (TIC) to present their projects.

## Student Awards

### Distinctions for Best PIC Projects

The Mechanical Engineering PIC Symposium took place at TIC, for a second time, on June 27, matching the success of the first edition. The event ended with the merit award sponsored by Jerónimo Martins for the best PIC Project, together with two honourable mentions. The Aerospace Engineering PIC Symposium also happened at TIC, on July 1, for the first-time. The event embraced invited talks by three representatives of renowned companies in the aerospace industry, namely, GeoSat, CEiiA and Beyond Gravity. In the end, the best PIC Project Presentation, one honourable mention and the best poster were also distinguished in this uplifting event.



Mechanical Engineering Best PIC Project



Aerospace Engineering Best PIC Project

## Academic Faculty Awards

### Universidade de Lisboa/Caixa Geral de Depósitos Scientific Awards 2025

The Scientific Awards established by Universidade de Lisboa together with Caixa Geral de Depósitos aim to reward scientific research activity and encourage the practice of international publication of recognized quality and impact. This year, the following two Professors of DEM were distinguished with one award and one honourable mention, respectively.

#### Award

- Susana Vieira – Area of Mechanical, Naval and Aerospace (Aircraft Mechanics)

#### Honourable Mention

- Carlos Alves da Silva – Area of Mechanical, Naval and Aerospace (Aircraft Mechanics)

## Academic Faculty Awards

### Excellence in Teaching

During the Solemn Ceremony of the 114<sup>th</sup> anniversary of Técnico, about 50 Professors of DEM, including both academic and non-permanent teaching staff, were honoured for excellence in teaching in the academic year of 2023/2024.

This distinction is based on the assessment made by the students in the scope of the Course Unit Quality System.



DEM Excellence in Teaching at Técnico Solemn Ceremony

### Distinctions by International Societies

Professor Pedro Coelho received the prestigious ICHMT Fellowship Award for the year of 2023 granted by the International Centre for Heat and Mass Transfer (ICHMT).

The Award Ceremony took place during the 11<sup>th</sup> International Symposium on Radiative Transfer (RAD-25) held in Kuşadası, Turkey, in June 2025. The ICHMT fellows are elected from ICHMT members in recognition of administrative or organizational services provided to the Centre.

### Best Paper Award

The Royal Institution of Naval Architects (RINA) has distinguished Professor Yordan Garbatov with the Medal of Distinction for the paper “Ship hull hybrid structural design accounting for reliability”, published in the International Journal of Maritime Engineering in the 2024 Transactions edition.

## Academic Faculty Awards

### Awards by National Societies

During the National Congress of Biomechanics held in Sesimbra last February, the Best PhD Thesis Award, as granted by the Portuguese Society of Biomechanics, was awarded to Luís Filipe Pratas Quinto for his PhD Thesis entitled “Design, implementation and analysis of a quasi-passive ankle exoskeleton to support military locomotion”, supervised by Professor Miguel Tavares da Silva.

In the same congress, the Best Oral Presentation Award by 1<sup>st</sup> or 2<sup>nd</sup> Cycle Students, was received by Carolina de Deus Guerreiro, with respect to the work entitled “Development of a gravitational compensation exoskeleton for the upper limb”, by Carolina de Deus Guerreiro, Sérgio B. Gonçalves and Miguel Tavares da Silva.

Furthermore, the Best Poster Award was received by Mariana Rodrigues da Silva, with respect to the work entitled “Computational and experimental study of the interaction between a crutch and a biomechanical human model”, by Mariana Rodrigues da Silva, Filipe Marques, Sérgio B. Gonçalves, Miguel Tavares da Silva and Paulo Flores.

## Students’ Organisations Rollouts

DEM is proud to highlight our students’ organisations new prototypes rollouts that took place this June.

It is with renewed pleasure that DEM supports their activities and brings to light their rollouts: Técnico Solar Boat electric-powered boat (SG01) on June 11, and Formula Student electric and autonomous car (FST14) on June 18.



Técnico Solar Boat electric-powered boat



Formula Student electric and autonomous car

## MoniTraffic – Monitoring and Surveillance of Maritime Traffic off the Continental Coast of Portugal



MoniTraffic project aimed to develop an integrated platform for maritime traffic characterisation and monitoring. The goal was to develop a more rational and informed approach to the planning, monitoring, safety, and security of maritime operations. The project successfully developed a set of tools to extract knowledge from historical ship trajectory data provided by the Automatic Identification System (AIS) and an innovative framework to detect abnormal behaviours of individual ships, thus contributing to safer and more efficient maritime navigation. These tools are integrated into a system prototype capable of extracting route properties and detecting and classifying abnormal ship behaviour in real time. This real-time detection capability is a key feature for generating alerts that support maritime traffic supervision and control tasks.

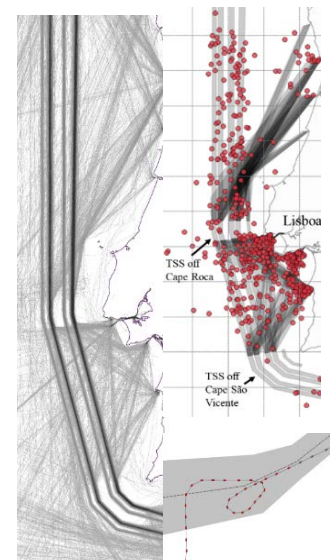
Additionally, MoniTraffic's analysis of maritime traffic patterns and the definition of safe navigation paths and operational profiles have strong potential to support future autonomous vessel traffic operations along the Portuguese continental coast.

PI: Ângelo Teixeira

The project consortium involved Instituto Superior Técnico (IST), Escola Superior Náutica Infante D. Henrique (ENIDH), the company Xsealence – Sea Technologies, in addition to Centro de Controlo de Tráfego Marítimo do Continente (CCTMC) of Direção-Geral de Recursos Naturais, Segurança e Serviços Marítimos (DGRM), which participated as an observer and provided AIS data for testing the tools.

Overall, MoniTraffic has made a significant impact on advancing research in maritime traffic safety and has established a solid foundation for future developments and collaborations at CENTEC.

Website: <https://monittraffic.tecnico.ulisboa.pt/>



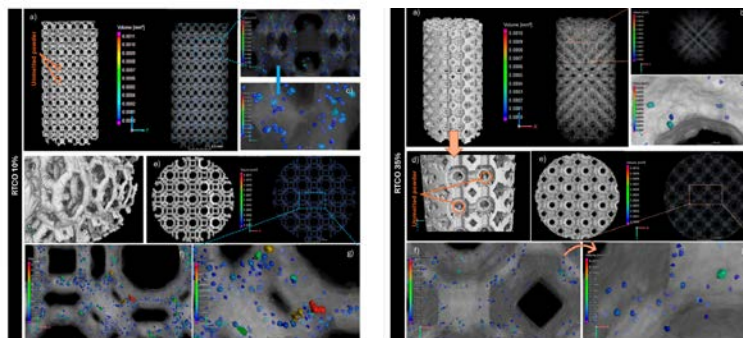
## Biodegradable implants in porous iron obtained by additive manufacturing



GradImp (PTDC/CTM-CTM/3354/2021) is a pioneering project at the forefront of the development of biodegradable iron scaffolds for temporary bone fixation, using Selective Laser Melting (SLM) to create structures that degrade as tissue heals. It addresses key European societal challenges by improving patient recovery (Health and Well-being), promoting sustainable materials (Circular Economy), and advancing additive manufacturing (Industry and Innovation). Biocompatibility and biodegradability tests ensure clinical suitability. This project not only advances biomedical technology but also supports key societal objectives set out in Horizon Europe and the UN Sustainable Development Goals by integrating health, sustainability, innovation, and education.

Biodegradable devices have the potential to become successful candidates for temporary medical implant devices, as they are able to degrade in the human body upon tissue healing, reducing the costs of additional removal surgery. To accomplish the challenge of producing such complex structures, an advanced method of additive manufacturing (AM), such as SLM will be used. This new line of research will evaluate the effect of the iron scaffold design, produced by AM in the resulting properties, to obtain the suitable characteristics for temporary bone implants. Prototypes will be developed and submitted to cytocompatibility and microbiology assays. The combination of biodegradable iron and AM leads to a revolutionary change of metal implants in many aspects including materials, design, manufacturing, and clinical applications. The project started in January 2022 and will end in December 2025.

PI: Fátima Vaz



Porosity analysis of RTCO10 and RTCO35 structures produced by L-PBF

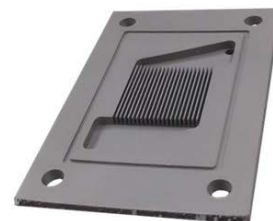
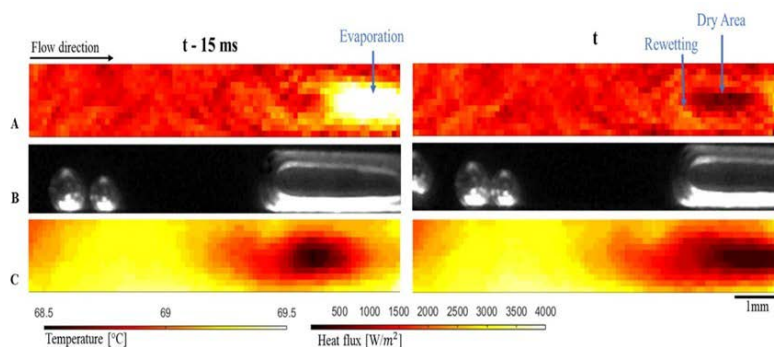
## Solarcool – High Concentration Photovoltaic panels integrated with microchannels based heat sinks



Solarcool is a joint project among Instituto Superior Técnico, Universidade Federal do Rio de Janeiro and GALP/Petrobras, aiming at the design, test and fabrication of a high concentration photovoltaic (HCPV) solar panel actively cooled by liquid forced convection in microchannels based heat sinks. Optimization custom made tools based on genetic algorithms were developed and combined with CFD to predict the optimal design of the heat sinks. Advanced experimental diagnostic techniques combining (micro)PIV – Particle Tracking Velocimetry, high-speed imaging, and time and spatial resolver thermography were used to test the heat sinks. Challenging working conditions were posed to manage two-phase cooling conditions, which would benefit cooling effectiveness. The rejected heat was further reused in a desalination process.

The first part of the project ran between November 2021 to March 2024 with the design, assembly and test of the panel, integrating the cooling system devised at IN+/IST, assembled with a small desalination unit. This system was implemented in a proof-of-concept facility currently running at COPPETEC – Universidade Federal do Rio de Janeiro, where 450 microchannel based heat exchangers, fabricated by additive manufacturing, were installed to the HCPV solar panel. The rejected heat was reused in a desalination process capable of producing 1000L of desalinated water per day. The second part of the work onwards until 2027 involves introducing alternative improved designs to the cooling systems. Besides industrial and commercial potential, the project aims at a societal impact, offering a clean energy source, and a way to deliver potable water in remote locations worldwide.

PI: Ana Moita



Project funded by



## Development of the Word Primary-Final-Useful Energy and Exergy Database (1800 – 2020)



The WPFU project, Development of the World Primary-Final-Useful Energy and Exergy Database (1800 – 2020), is now underway. The project’s goal is to build an open-access global database that tracks energy and exergy flows from primary sources to final and useful stages over the past two centuries, thus offering insights into long-term energy transitions and efficiency trends.

Using the Societal Exergy Analysis (SEA) framework, the database goes beyond energy quantities to include exergy, capturing the quality of energy and enabling deeper understanding of energy-economy dynamics. Existing datasets on electricity, muscle work, and railways have already been integrated, with further work ongoing on heating, other transport, and mechanical work. The project employs expert-based methods and machine learning to fill in historical data gaps and structures the information using Physical Supply-Use Tables (PSUT). A user-friendly web interface will support visualization and data downloading.

PI: Tânia Sousa

