MIT PORTUGAL

2025 Annual Report

MIT Portugal

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Executive Summary

MIT Portugal Program

A major milestone of 2025 was the agreement between the Portuguese Government and MIT to renew the MIT Portugal Program (MPP) for a further six years. Phase IV was officially launched on March 17, 2025, and will run through 2030. Building on the foundations of previous phases, it retains the Phase III research areas, while introducing four new priority areas reflecting global scientific and technological trends.

Areas continued from phase 3:

- Climate Science & Climate Change;
- Earth Systems: Oceans to Near Space;
- Digital Transformation in Manufacturing;
- Sustainable Cities;

New areas in phase 4:

- Energy;
- Chips/Nanotechnology;
- Space;
- Artificial Intelligence.

Research collaboration in MPP operates through two complementary funding instruments: seed projects, which provide financial support to MIT research teams (up to $200K per project) and exploratory projects, which fund Portuguese teams through FCT (up to €50K per project).

In 2025, MIT issued a call for seed grant proposals, attracting 46 submissions from researchers across MIT, each involving a Portuguese collaborator, from which 19 projects were selected for funding. Of these, four involved Portuguese teams that had previously received an exploratory grant in Portugal, reinforcing collaboration between the two teams. Sixteen seed projects awarded in 2024 continued in 2025 as well, bringing the total active seed project portfolio in 2025 to 35 projects.

On the Portuguese side, the results of the 2024 call for exploratory grants were announced in August 2025. Of 22 proposals submitted, eight projects were selected for funding, for a total allocation of €400K (€50K per project). These eight new projects replaced the eight exploratory projects approved in 2024 that concluded in March 2025. In total, four of the active exploratory projects had a corresponding seed project on the MIT side.

The active research portfolio generated a substantial body of scientific output in 2025:

- **130** peer-reviewed journal articles
- **49** conference papers
- **20** books and book chapters

In 2025, two Portuguese students (Sara Cerqueira and João Alves Ribeiro) participated in research exchange visits to MIT, deepening the program's commitment to training the next generation of researchers.

The sixth edition of the MIT Portugal Innovation Workshop took place at MIT.

The call for applications attracted 90 submissions. Following a competitive selection process, **35** students and researchers were chosen to attend, representing seven nationalities (Portuguese, Brazilian, Dutch, Indian, Italian, Lebanese, and Mexican) from a broad range of leading Portuguese institutions that included the Universities of Lisbon, Coimbra, Porto, Aveiro, and Minho; NOVA University Lisbon; Instituto Superior Técnico; INL; Gulbenkian Institute for Molecular Medicine; INESC-ID; and others.

The first edition of the Innovation Workshop Reunion was held in Lisbon on January 17, 2025, bringing together **34** participants (alumni of previous Innovation Workshop editions) to reconnect, share progress, and strengthen the network of innovation-oriented researchers and entrepreneurs with ties to the MPP community.

In 2021, João Borges de Sousa, the head of the Underwater Systems and Technologies Laboratory at the University of Porto, invited MPP to join the first edition of the Marine Robotics Summer School. Since then, the summer school in Horta, Azores has become one of the MPP's key educational initiatives in ocean and marine technology. The fifth edition of the Marine Robotics Summer School was held in July 2025 bringing together **28** students from an internationally diverse cohort representing ten nationalities (Portuguese, American, Argentine, French, German, Italian, Moroccan, Norwegian, Spanish, and Swiss).

Phase IV marks a new milestone in the collaboration between Portugal and MIT bringing renewed energy to the Program. For this next stage of the partnership, in October 2025, MPP welcomed new co-directors, **João P. Barreto** and **Alexandre Ferreira da Silva**, continuing the program's tradition of leadership rotation as it enters this new phase.

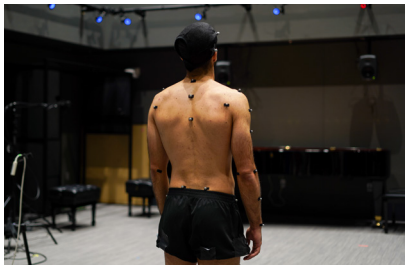
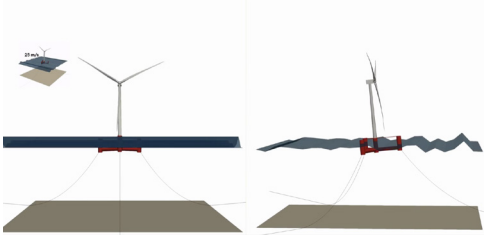


Figure 1. Sara Cerqueira, MIT Portugal PhD student at MIT.

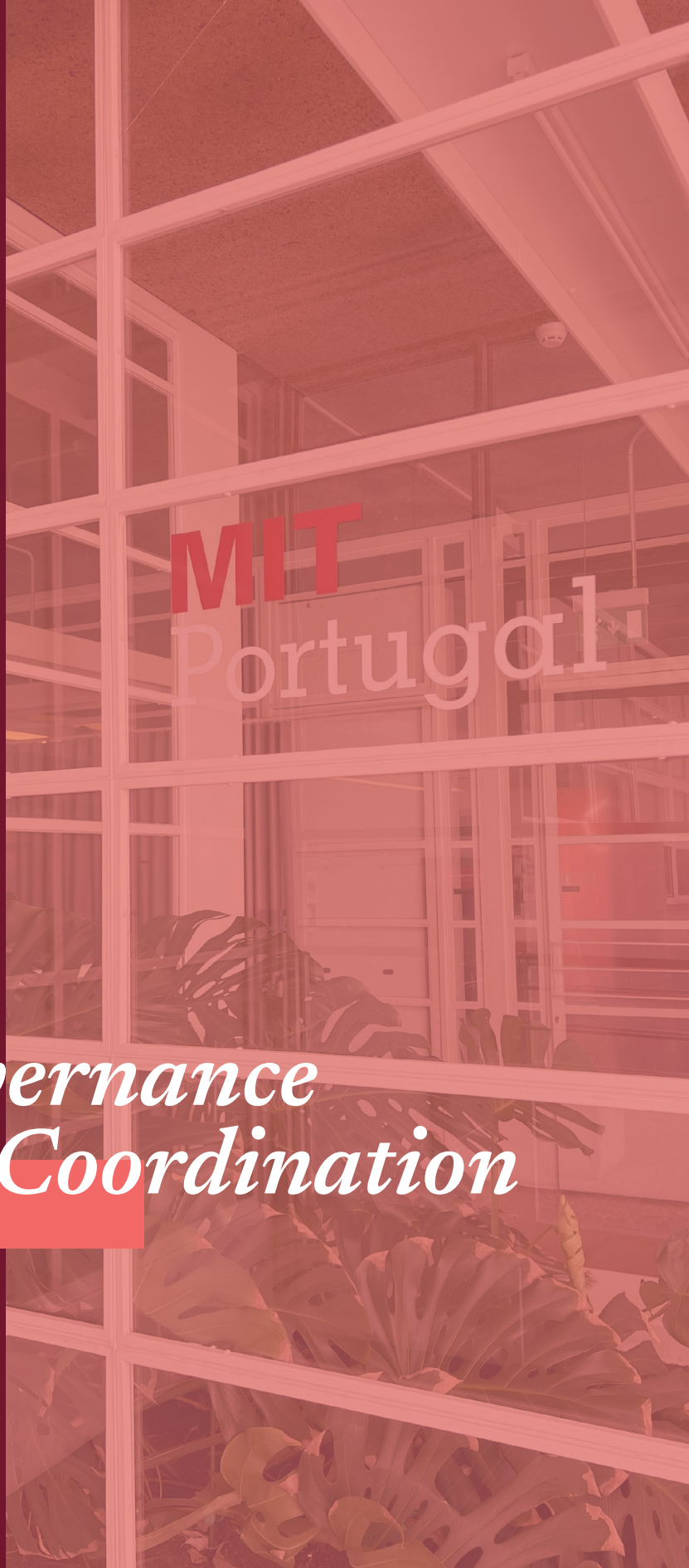
"My time at the Massachusetts Institute of Technology was a deeply enriching experience, both personally and professionally. Immersion in a international community deepened my understanding of different cultures and ways of thinking, which has directly strengthened my ability to collaborate across diverse teams. Hands-on work with advanced methodologies and state-of-the-art equipment further sharpened my technical skills, while the innovation-driven ecosystem of Boston gave me a practical and grounded appreciation for entrepreneurship."

Figure 2. João Alves Ribeiro, MIT Portugal PhD student at MIT.



"My visit to MIT was one of the best experiences of my PhD: excellent research, inspiring people, and a real sense of belonging that pushes you to do your best work. I even learned to sail."

02



Governance & Coordination

In 2025, the MIT Portugal Program welcomed two new National Directors.

The MPP collaboration is based on a contractual agreement between MIT and FCT. These institutions, in their respective countries, are responsible for appointing the **Directors of the Program** to oversee, direct, and coordinate the activities of all entities participating in the collaboration.

The governance structure of the Program is grounded in the **Program Board**, which is responsible for policy oversight with respect to the overall objectives of the relationship, as well as approving the annual plan and budget allocation for the proposed activities. In 2025, the Program Board for the fourth phase was not fully constituted and, as a result, did not convene.

An independent **External Review Committee (ERC)**, formed by members from the international scientific community, shall review the research program and make recommendations to the Program Directors and the Program Board. In 2025, the ERC for the fourth phase was not yet appointed.

The **Coordination Team**, a collaboration in both countries, oversees the day-to-day operations of the Program, manages the calls for proposals and distribution of grants, and organizes joint events and activities to ensure Program's effective development.

2.1 2025 updates

The composition of MPP's various boards and Coordination Team is illustrated in the next pages.

2.2 Meetings with external entities

Between October and December, MPP National Co-Directors **Alexandre Ferreira da Silva** and **João Barreto** participated in several meetings with government representatives, the Mission Structure , and FCT to discuss the framework for a new phase of the program.

In December, the MPP National Co-Directors also attended a meeting in Aveiro with the other two American partnerships, CMU Portugal and UT Austin Portugal, to discuss the new phase of the Programs.

Program Directors

Pedro Arezes

Professor in the Department of Production and Systems
National Director of MIT Portugal Program
(until September 2025)

Alexandre Ferreira da Silva

Professor in the Department of Industrial Electronics at UMinho
National Co-Director of MIT Portugal Program
(since October 2025)

João Pedro Barreto

Professor in the Department of Electrical & Computer Engineering
National Co-Director of MIT Portugal Program
(since October 2025)

Doug Hart

Professor of Mechanical Engineering at MIT
Co-Director of MIT Portugal Program at MIT

R. John Hansman

T. Wilson Professor of Aeronautics & Astronautics MIT
Co-Director of MIT Portugal Program at MIT

Coordination Team

Beatriz Silva

Communications Officer – Portugal

Chrissy Mullin

Financial Administrator II – MIT

Deliana Ernst

Administrative Lead – MIT

Lília Rocha

Project Officer – Portugal

Natalie Billings

Program Coordinator – MIT

03

Walk through the year 2025

JAN_

MIT Portugal Innovation Workshop - The Reunion

MAR_

MIT Portugal Program renewed for its fourth phase

APR_

Open call for Seed Grants Proposals

JUNE_

Innovation Workshop at MIT

JULY_

MPP sponsored MIT student internships in Portugal

Participation in "Encontro Ciência 2025"

Marine Robotics Summer School

AUG_

Awarded eight exploratory projects and 19 collaborative seed projects

MPP sponsored a student from Instituto Superior de Engenharia do Porto (ISEP) to participate in the MIT Summer Geometry Initiative

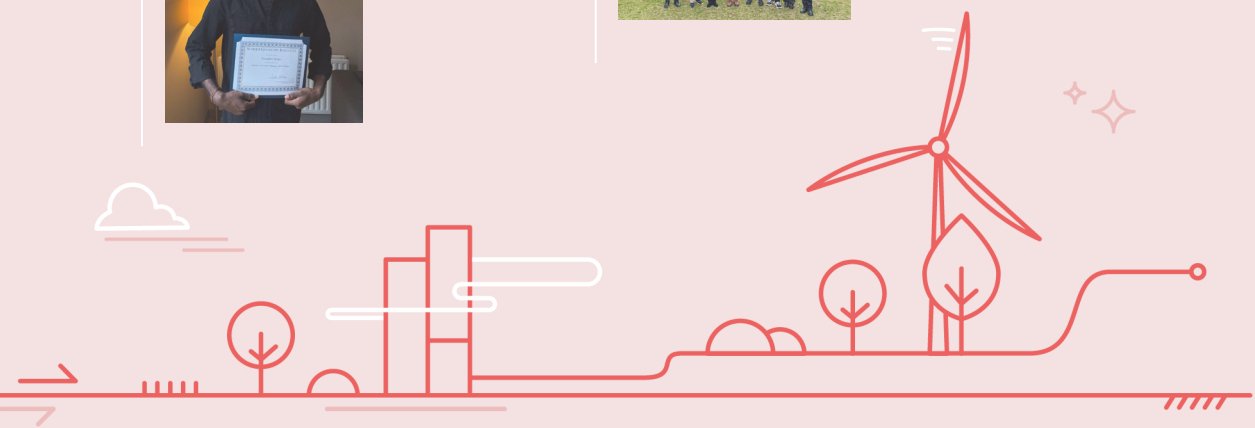
OCT_

New National Co-Directors of MPP assumed their roles

Winners of the Atlantic Junior Award visited MIT

DEC_

Meeting between MPP and UT Austin Portugal in Aveiro



SEPT_

End of the term of MPP National Director, Pedro Arezes

Portuguese Ambassador to the United States visited MIT

NOV_

New National Co-Directors of MPP visited MIT

Secretary of State for Science and Innovation, together with a delegation of representatives from various Portuguese institutions, visited MIT

MPP participated in the UT Austin conference "Resilience of the Electrical Systems in Portugal and Texas"

04

Facts & Figures 2025

130
Peer-reviewed articles

20
Books and book chapters

49
Proceedings/ conference papers

51 **Ongoing projects**

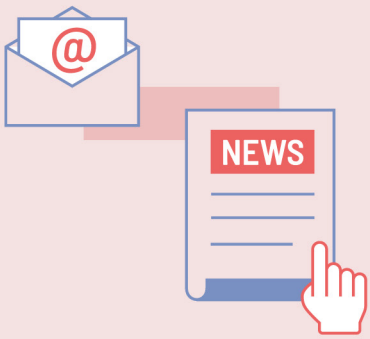
19
New Seed projects
(+ 9 still active from 2024 call and 7 still active from previous years)

8
*New Exploratory projects**
(+ 8 projects with no-cost extension from 2023 call)

**4 of 8 new Exploratory projects from 2024 are linked to the Seed projects from 2025*

12

PhD Students' in news articles in the press



Social media followers

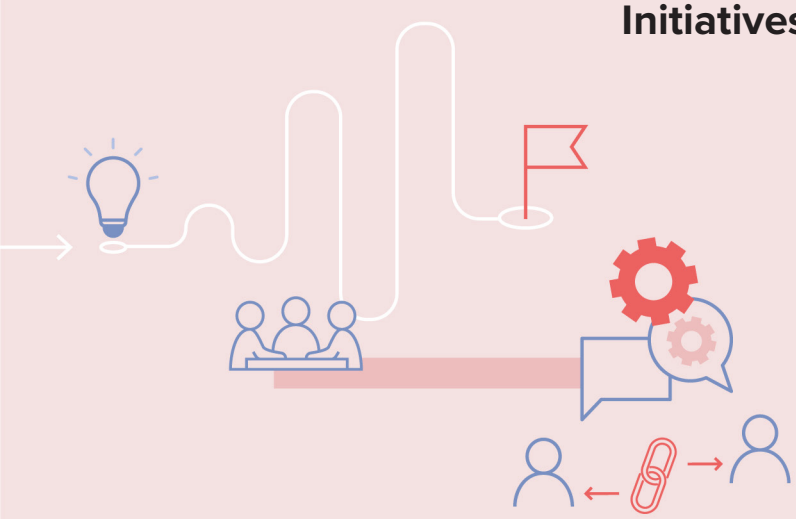
18,231

411

Social media posts

8

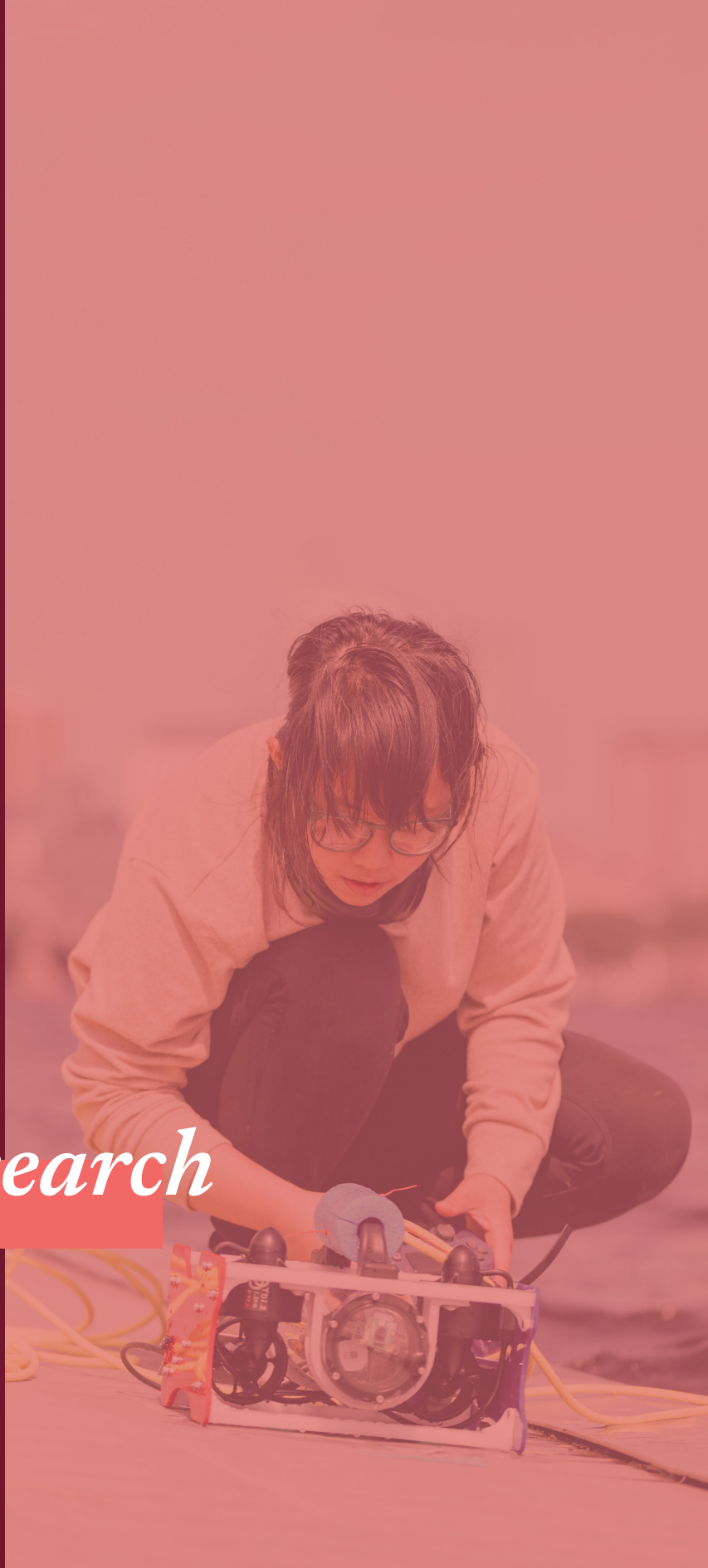
Initiatives



- **2** *High-level meetings*
- **2** *Educational courses (IW & MRSS)*
- **4** *Networking activities*

05

Research



Fostering collaborative research is at the core of the Program's mission. In 2025, the Program sharpened its focus on the following critical areas: Climate Science & Climate Change, Earth Systems: Ocean to Near Space, Digital Transformation in Manufacturing, Sustainable Cities, Energy, Chips/Nanotechnology, Space, and Artificial Intelligence.

For a more in-depth look at the projects supported by MPP in 2025, please see the following sections.

5.1

Overview of the Exploratory Projects

The fourth call for exploratory projects as part of MPP2030 resulted in funding **eight** projects.

The call opened in December 2024, and the funded projects were announced in August 2025.

The call welcomed projects from faculty and researchers affiliated or collaborating with Portuguese institutions of higher education and research in collaboration with MIT faculty. Projects supported the long-term objective of developing innovative solutions and systems, demonstrating and leading Portugal's international competitiveness and innovative capacity in science and technology.

Eight exploratory collaborative projects were funded in the following areas:

- **Climate Science & Climate Change:** 5 projects
- **Digital Transformation:** 1 project
- **Earth Systems (Ocean to near Space):** 1 project
- **Sustainable Cities:** 1 project

A concise overview of each project within its respective scientific area is provided below.

GNSS Atmospheric Tomography: Probing storms in a warming climate (GATO)

(extended until March 31, 2025)

Objectives

Deploy a continuously operating dense GNSS network in a key climatic region, with a high frequency of storms, capable of near real-time atmospheric monitoring;

Explore the advantages of tomographic data assimilation to improve the understanding of processes in developing storms, and the skill of weather forecasts.

Climate Science and Climate Change

49 428,64 €

Recommended Funding

Main Contractor

FCiências.ID – Associação para a Investigação e Desenvolvimento de Ciências

Principal Investigator

Pedro Mateus

FCiências.ID – Associação para a Investigação e Desenvolvimento de Ciências

MIT Principal Investigator

Dhiman Mondal

Research Scientist, MIT Haystack Observatory

Co-Principal Investigator

Pedro Miranda

FCiências.ID – Associação para a Investigação e Desenvolvimento de Ciências

PEATMAP: A prototype model for the study of peatland distribution, ecology, and carbon dynamics in the Iberian Peninsula (IP) landscape mosaic

(extended until March 31, 2025)

Objectives

Improve knowledge about the distribution of peatlands and swobs in the IP and its accurate mapping;

Assess the ecological status of the ecosystems and the existing peat types;

Develop a ground-truth peat-depth model across the peninsula;

Present a peatland classification that mirrors the real diversity and uniqueness of Iberian peatlands as a key nature-based solution to combat climate change.

Climate Science and Climate Change

32 055,08 €

Recommended Funding

Main Contractor

Instituto de Geografia e Ordenamento do Território da Universidade de Lisboa

Principal Investigator

César Dinis Capinha

Instituto de Geografia e Ordenamento do Território da Universidade de Lisboa

MIT Principal Investigator

Charles Harvey

Professor, MIT Department of Electrical Engineering and Computer Science (EECS)

Co-Principal Investigator

Johannes Hendricus Josephus Joosten

Institute of Botany and Landscape Ecology, University of Greifswald (Germany)

Accurate federated learning with uncertainty quantification for DER forecasting applied to power grid planning and operation

(extended until March 31, 2025)

Objectives

Develop technologies to facilitate the planning and operation of electric grids with high penetration of distributed energy resources (DERs), while ensuring consumer privacy, and addressing previously unexplored topics related to developing prediction algorithms based on federated learning (FL), such as solar production forecasting.

Tackle challenges related to uncertainty quantification, considering the calibration of epistemic and random uncertainty.

The models developed will then be integrated into planning and operation tools to be used by distribution system operators (DSO).

Data Science

50 000,00 €

Recommended Funding

Main Contractor

Associação do Instituto Superior Técnico para a Investigação e o Desenvolvimento

Principal Investigator

Amâncio Lucas de Sousa Pereira
Associação do Instituto Superior Técnico para a Investigação e o Desenvolvimento

MIT Principal Investigator

Anuradha Annaswamy
Senior Research Scientist, MIT Department of Mechanical Engineering (MechE)

Co-Principal Investigator

Hugo Gabriel Valente Morais
Universidade de Lisboa (UL) - Instituto Superior Técnico - Instituto de Engenharia de Sistemas e Computadores

Next Generation of Digital "Concrete": Performance mix design and assessment of sustainable and circular cementitious composites

(extended until March 31, 2025)

Objectives

Develop environmentally friendly cement-based materials that can satisfy the requirements for 3D printing. Pursue sustainability by partially replacing a significant fraction of the cement with locally available waste materials with no added value — namely glass powder, marble powder, and quartz powder, which already show promised results in previous works.

Digital Transformation in Manufacturing

49 945,00 €

Recommended Funding

Main Contractor

Faculdade de Engenharia da Universidade do Porto

MIT Principal Investigators

Randolph Kirchain
Principal Research Scientist, MIT Materials Research Laboratory (MTL) and Director, MIT Concrete Sustainability Hub

Hassam Azarijafari
Deputy Director, MIT Concrete Sustainability Hub

Principal Investigator

Ana Mafalda Matos
Faculdade de Engenharia da Universidade do Porto

Co-Principal Investigator

Mário Pimentel
Faculdade de Engenharia da Universidade do Porto

Pain and physical limitations perception for human-sensitive intelligent collaborative robotics

(extended until March 31, 2025)

Objectives

Fill the knowledge gap on how to develop a human-robot collaboration (HRC) framework to assist both healthy and workers with musculoskeletal disorders (MSDs). Achieving truly adaptive HRC that autonomously adapts to different workers and tasks requires beyond state-of-the-art advances in perception and cognition, integrated with robot motion and control.

Digital Transformation in Manufacturing

49 999,97 €

Recommended Funding

Main Contractor

Universidade do Minho

Principal Investigator

Cristina Manuela Peixoto dos Santos
Universidade do Minho

MIT Principal Investigator

Mercedes Balcells-Camps
Principal Research Scientist, MIT Institute of Medical Engineering and Science (IMES)

Co-Principal Investigator

Alexandre Ferreira da Silva
Universidade do Minho

Machine learning-aided polymer metallization for the automotive industry

(extended until March 31, 2025)

Objectives

Develop thin films of copper and chromium for the development of metallic surfaces on PLA and polycarbonate polymers, in a more sustainable and non-electrolytic way, through a good correlation between the experimental and machine learning outputs, using the magnetron sputtering (physical vapor deposition technique).

Digital Transformation in Manufacturing

49 990,49 €

Recommended Funding

Main Contractor

Universidade do Minho

MIT Principal Investigators

Rafael Gomez-Bombarelli
Assistant Professor, MIT Department of Materials Science and Engineering (DMSE)

Jeffrey Cheah
Career Development Chair, MIT School of Engineering

Principal Investigator

Sandra Mariana da Silva Marques
Universidade do Minho

Co-Principal Investigator

Maria José Bastos Pires de Lima
Universidade do Minho

Space operations, monitoring, and mapping explorer: a smart Orb-system

(extended until March 31, 2025)

Objectives

- Miniaturize and develop a robotic system based on UX-1Neo for Space;

- Integrate sensors and give the ability to fly and navigate;

- Test space maneuvers in a microgravity environment.

Earth Systems:
Oceans to Near Space

49 830,68 €
Recommended Funding

Main Contractor

INESC TEC
Instituto de Engenharia de Sistemas e Computadores, Tecnologia e Ciência

MIT Principal Investigator

Rohit Karnik
Tata Professor and Associate Department Head in Education, MIT Department of Mechanical Engineering (MechE)

Principal Investigator

Ana Cristina Pires de Oliveira
INESC TEC – Instituto de Engenharia de Sistemas e Computadores, Tecnologia e Ciência

Co-Principal Investigator

André Miguel Pinheiro Dias
INESC TEC – Instituto de Engenharia de Sistemas e Computadores, Tecnologia e Ciência

A digital framework to merge durability data, maintenance models, and energy retrofitting decisions

(extended until March 31, 2025)

Objectives

Create a modeling framework for cities that supports the maintenance of the buildings' envelopes (roofs, façades, and window frames) to meet occupants' needs while further ensuring that a city meets its building-related carbon emission reduction target for 2035 and beyond.

Sustainable Cities

49 786,07 €

Recommended Funding

Main Contractor

Associação do Instituto Superior Técnico para a Investigação e o Desenvolvimento

Principal Investigator

Ana Filipa Ferreira da Silva Cigarro Matos

Associação do Instituto Superior Técnico para a Investigação e o Desenvolvimento

MIT Principal Investigators

Christoph Reinhart

Professor, MIT Department of Architecture

Co-Principal Investigator

José Dinis Silvestre

Associação do Instituto Superior Técnico para a Investigação e o Desenvolvimento

Distributed Intelligent decision-making system of Multi Autonomous surface vehicles for sustainable ocean monitoring

Abstract

This project proposes the development of a distributed intelligent ocean monitoring system using multi-ASVs, with the long-term goal of enabling efficient and adaptive ocean observation. In collaboration with Dr. Michael Benjamin at MIT, the study focuses on creating an onboard distributed decision-making framework for optimal path planning. The system will employ multi-objective optimisation methods to ensure complete coverage of designated areas while avoiding collisions and accounting for the kinematic constraints of ASVs. Three custom-built ASVs at CENTEC and eight Heron ASVs at MIT will be deployed to conduct preliminary experimental tests, validating the proposed approach through evaluation of coverage efficiency and real-time navigation performance.

The project outcomes are expected to provide a cost-effective, scalable, and intelligent solution for sustainable ocean observation, with broader benefits for periodic monitoring and offshore inspection. By advancing distributed autonomy in multi-ASV systems, the project directly contributes to the development of measurement technologies aligned with Earth systems research priorities, particularly in ocean monitoring.

Earth Systems: Oceans to Near Space

49 947,26 €

Recommended Funding

MIT Principal Investigator

Michael Benjamin

Center for Ocean Engineering, Department of Mechanical Engineering

Principal Investigator

Haitong Xu

Centre for Marine Technology and Ocean Engineering (CENTEC), Instituto Superior Técnico

Energy-efficient Brain-inspired Computing with Ionic Devices

Abstract

This project will advance a novel ionic computing device that we call Electrochemical Ionic Synapse (EIS) that is inspired from how our biological synapses function. An EIS consists of three key functional layers: reservoir, electrolyte, and channel.

In order to reduce the operating voltage while operating at nano-second speed regime, we will explore promising materials based on binary oxides, such as HfO2 and CeO2. Use of a good proton conductor (nano-porous ferroelectric orthorhombic HfO2-based electrolyte), together with a Pr doped CeO2 channel will enable a high-quality interface with low resistance to proton transfer. High proton conductivity of the electrolyte and low interface resistance promise to improve the energy efficiency as well as reduce the operating voltage and improve the endurance of the EIS devices. In addition, while ferroelectric HfO2 is currently being investigated for low-power and ultra-fast in-memory computing and neuromorphic devices, the experimental demonstration of the potential use of these materials as electrolyte in EIS devices was not yet done. Therefore, we will use ferroelectric doped-HfO2 as the electrolyte (as we do in ferroelectric capacitors for memory and energy storage capacitors. Ultimately, this project will advance a novel device technology, to reduce the energy consumption and CO2 emissions of computing, while advancing the abilities of artificial intelligence hardware.

Climate Science and Climate Change

49 984,30 €

Recommended Funding

MIT Principal Investigators

Bilge Yildiz
Department of Materials Science and Engineering

Principal Investigator

José Pedro Basto da Silva
School of Sciences, University of Minho

Dual-Dye Optical Smart Sensor for Microplastic Monitoring

Abstract

The project develops a dual-mode strategy integrating smartphone-based time-gated luminescence for field use and laboratory-based quantitative spectroscopy for forensic analysis. The smartphone method enables real-time, on-site detection by capturing long-lived TADF emission through time-gated imaging. This builds on research by the MIT collaborator, who demonstrated that CMOS rolling shutter mechanisms in commercial smartphones can achieve sensitivity comparable to laboratory-grade instrumentation. Simultaneously, forensic quantification will employ steady-state and time-resolved spectroscopy, correlating emission shifts, luminescence lifetimes, and FRET efficiency to quantify concentrations and differentiate polymer types. These methods will be benchmarked against Raman, FTIR, and optical microscopy to ensure high accuracy, reproducibility, and regulatory applicability.

The project integrates the complementary expertise of the PI and co-PI. The PI recently demonstrated that these dyes exhibit FRET interactions when encapsulated in polymeric matrices, enhancing triplet formation and TADF emission. The MIT collaborator pioneered smartphone-based time-gated detection for portable sensing. Together, they will optimize detection wavelengths, time-gating conditions, dye concentrations, and polymer interactions across diverse aqueous conditions. The system will be validated using environmental samples from rivers, oceans, industrial effluents, and tap water. Integrating pre-concentration methods will ensure detection at environmentally relevant concentrations, contributing to scalable workflows for monitoring and regulatory enforcement.

Climate Science and Climate Change

49 968,22 €

Recommended Funding

MIT Principal Investigator

Timothy M. Swager

Department of Chemistry

Principal Investigator

João Avó

Associação para a Inovação e Desenvolvimento da FCT (NOVA.ID.FCT)

Green Resilient Indicators for Data-Driven urban Sustainability

Abstract

This project tackles that challenge by providing tools that enable cities to make informed, future-proof decisions.

Our vision is to create a comprehensive framework for Smart Sustainable Cities that integrates multiple domains—mobility, infrastructure, energy, and environment—through a dynamic, data-driven approach. By combining System Dynamics modeling, AI machine learning, and Digital Twin (DT) technology, the project will allow stakeholders to model complex urban systems, test scenarios in real time, and design adaptive strategies that evolve with changing conditions.

The framework will be grounded in quality and resilience indicators that help decision-makers evaluate projects not only by immediate outcomes, but also by their capacity to endure, scale, and deliver benefits over decades. Practical applications include optimizing electric vehicle (EV) charging networks, improving air quality, reducing congestion, and strengthening infrastructure planning. By addressing these challenges holistically, the project will contribute to cities that are not only greener, but also more resilient, inclusive, and equitable.

Ultimately, the project aims to bridge the gap between cutting-edge research and real-world application, empowering cities to make the Green Transition successful, sustainable, and durable.

Sustainable Cities

49 882,23 €

Recommended Funding

MIT Principal Investigators

Donna H. Rhodes
Sociotechnical Systems Research Center, Massachusetts Institute of Technology

Principal Investigator

André M. Carvalho
NOVA School of Science and Technology (FCT NOVA)

MIT Co-Principal Investigator

Eric Rebentisch
Sociotechnical Systems Research Center, Massachusetts Institute of Technology

Co-Principal Investigator

Lígia Conceição
Artificial Intelligence and Computer Science Laboratory, Faculty of Engineering, University of Porto

Adapting Precision Irrigation to Climate Change using low-cost sensors and information technology

Abstract

The objective of this study is to present an innovative contribution to DA that resides in the development of SOFIS (Smart Orchard Fertigation System) defined as a LC intelligent system. SOFIS hardware and software are designed to use LC approaches to control WU in orchards and vineyards, with the aim of establishing and validating a machine learning system for automated real-time data analysis.

The SOFIS hardware consists of a set of devices and sensors that estimate soil water directed to the plant and to the atmosphere. The system acquires sensor data and sends it to a web platform. In the soil, its sensors measure soil water content, evaporation, salinity, and temperature. The plant has sensors that measure sap flow (SF) and atmospheric sensors measure the air temperature and relative humidity inside the canopy. Soil water evaporation is assessed using an innovative automated weighing device (mLy), suitable for continuous use and Peltier cells estimate the latent heat flux in the soil. The present project will improve and validate LC SF and mLy sensors. Regarding data science (SOFIS software), it focuses on the Agriculture 4.0 approach, using AI for the treatment, processing, statistical analysis, and systematization of data in real-time and using a machine learning approach to take decisions about watering, frost, disease and forecasting events (pests). The aim of the project is to develop a LC, customizable, modular digital tool based on proximal sensors, useful in the context of irrigation management, allowing a quick reaction and adaptation to environmental conditions, with improved accuracy. The solution found allows an easy transition to the digital world due to its LC, open access, and specialized customer support.

Climate Science and Climate Change

50 000,00 €

Recommended Funding

MIT Principal Investigator

Amos G. Winter

Department of Mechanical Engineering

Principal Investigator

Maria Teresa Gomes Afonso do Paço

Instituto Superior de Agronomia (ISA)

SCALPEL - Understanding nanoscale properties of chalcogenide perovskite for emerging climate neutral photovoltaics

Abstract

The project leverages advanced thin-film samples of BZSSe provided by MIT, produced using molecular beam epitaxy with precise control of the sulfur-to-selenium (S-to-Se) ratio. These samples enable systematic investigation of the material's optoelectronic and surface properties. In addition, INL brings expertise in advanced scanning probe microscopy (SPM) techniques such as conductive atomic force microscopy (c-AFM) and Kelvin probe force microscopy (KPFM). These tools will provide high-resolution insights into charge carrier behavior, surface states, and defect characteristics.

The project is organized into two main tasks. First, the bulk properties of BZSSe thin films will be characterized to assess the impact of the S-to-Se ratio and preparation methods on charge transport properties. Second, surface behavior under environmental exposure will be studied to evaluate the effect of air-induced native oxide layers and light-driven processes on charge carrier dynamics. The correlation of surface photovoltage spectroscopy (SPV) with c-AFM will further elucidate the material's response to light at the nanoscale, offering critical insights into potential challenges for photovoltaic device applications.

The novelty of this work lies in its focus on BZSSe, a chalcogenide perovskite with unique structural and optoelectronic properties, and its comprehensive analysis of both bulk and surface phenomena. The project is expected to advance understanding of BZSSe stability and electronic properties, informing future device engineering strategies. Ultimately, this research seeks to accelerate the development of chalcogenide perovskites as high-performance active layers for PV devices, advancing the global transition to sustainable energy and addressing critical climate challenges.

Climate Science and Climate Change

50 000,00 €

Recommended Funding

MIT Principal Investigators

Rafael Jaramillo

Department of Materials Science and Engineering

Principal Investigator

Sascha Sadewasser

Laboratório Ibérico Internacional de Nanotecnologias (INL)

Model-Based Digital Twins Supported on Physics-Informed Machine Learning for Multiphysics Analysis

Abstract

This project explores and evaluates innovative model updating techniques to enhance the reliability of numerical simulations. By leveraging advanced machine learning approaches, such as Physics-Informed Neural Networks (PINNs) and Variational Physics-Informed Neural Networks (vPINNs), the project aims to enable more accurate model calibration and updating. These methods integrate available data with physics-based models developed during the design phases, bridging the gap between theoretical predictions and real-world performance.

Building upon the groundwork laid by the MIT seed project, "Geometric Deep Learning Enhanced Multiphysics Digital Twins for Complex Product Design," this project aims to foster synergies with TEMA-UA and INEGI, in the emerging fields of digital twins and machine learning for digital manufacturing applications, with a focus on multiphysics analysis. By advancing the precision and fidelity of virtualized multiphysics behaviors, the project is poised to drive transformative innovations across industries such as energy, aeronautics, and automotive, unlocking new possibilities for efficiency, sustainability, and design optimization.

Digital Transformation in Manufacturing

49 887,51 €

Recommended Funding

MIT Principal Investigator

Faez Ahmed
Department of Mechanical Engineering

Principal Investigator

Sérgio Manuel Oliveira Tavares
University of Aveiro

Mitigating Climate Change Through Urban Green Spaces: Nature-Based Solutions for Carbon-Neutral Cities

Abstract

Mitigating climate change demands urgent, collective action. Many cities have pledged carbon neutrality, yet achieving this goal is complex. Alongside emission reductions through infrastructure upgrades, strategies must also remove CO_2 already present in the atmosphere. Nature-based solutions (NBS)—approaches inspired and supported by nature—are recognized as cost-effective tools for carbon sequestration. However, their deployment is hindered by the lack of systematic, spatially detailed frameworks that guide selection, allocation, and communication of benefits. GreenCities will generate spatially explicit CO_2 maps from annual databases, identifying hotspots across sectors and prioritizing intervention areas. Urban GI (e.g. parks, forests, and green corridors) offers significant sequestration potential, yet research often overlooks soil carbon storage and urban-specific dynamics. GreenCities will address these gaps by assessing the carbon storage potential of various GI types, in both vegetation and soil reservoirs, and examining soil carbon flux dynamics. Advanced methods, including remote sensing, field data, and machine learning, will support this effort.

The project will deliver actionable recommendations for scaling NBS, focusing on hotspots while considering local socio-economic and physical contexts. By prioritizing suitable sites, GreenCities aims to maximize co-benefits, such as equitable green space access and long-term sustainability.

Using Coimbra, Portugal - a mid-sized European city committed to carbon neutrality - as a case study, GreenCities will validate the framework by tailoring emission reduction strategies and assessing the carbon mitigation impacts of NBS. The project will develop a GIS-based decision-support tool that integrates environmental and socio-economic data to guide stakeholders in optimizing GI planning. This tool will provide spatially explicit recommendations for scaling up GI interventions.

Climate Science and Climate Change

49 992,16 €

Recommended Funding

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Principal Investigator

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5.1 Overview of the Seed Projects

In 2025, new collaborative seed grants were awarded to 19 projects for one to two years to researchers from across MIT in close collaboration with Portuguese research teams. The 2025 call for proposals by MPP welcomed submissions for innovative projects that have the potential to benefit Portugal in the program's eight core research areas.

Of the 19 projects that were funded in 2025, four collaborate with a Portuguese team that had received an exploratory grant in Portugal.

The more specific research areas will be identified with a purple lamp.

Figure 3. Number of projects awarded 2025 seed grants, by research area.

Tracking ocean deoxygenation and climate change through shark migration

Climate is changing. As Earth warms, the oceans are projected to lose dissolved oxygen, with countless impacts on the distribution and productivity of global fisheries, the rates of respiration that governs natural carbon sequestration, and the flux of the potent greenhouse gas nitrous oxide from the oceans. Yet, the driving mechanisms escape science, preventing accurate climate predictions and precluding a scientific basis for maintaining robust fishery and conservation policy. Here we present a new mechanism for not only revealing the natural cycles and anthropogenic perturbation of oxygen in the ocean but also for monitoring into the future. We intend to deploy a prototype electronic tag that can measure dissolved oxygen, developed by our Portuguese collaborators, to monitor the ocean environment using sharks as ocean observing platforms. These novel measurements are critical for constructing a dynamic view of ocean change and making predictions for both fisheries management and climate change mitigation.

Earth Systems:
Oceans to Near Space

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Model-data fusion for the Azores region and the tropical Pacific

Near the sea surface, interactions between small-scale ocean processes, turbulence, and Earth's climate are not fully resolved by either models or observations. However, we can make decisive progress by fusing models with data through innovative AI techniques. We propose to advance understanding by integrating MIT's ocean models with satellite data from the Azores ESA Lab. Our focus is on two critical regions for climate change, where well developed AI techniques can help address key questions about small-scale processes. In the Azores region, we will forecast thermal fronts, mesoscale eddies, internal waves, and other mixing indices. Additionally, we will train AI to detect and predict internal waves at the equator during La Ninã seasons, where their interactions with thermal fronts have important implications for climate. In both cases, simulation data from MIT models will be used to train generative AI and fine-tune foundation models, which will then be applied to satellite data.

Earth Systems: Oceans to Near Space

MIT Principal Investigator

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Multi-Robot Collaborative Autonomy for Wide-Area Long-Duration Ocean Monitoring

In this project we proposed to develop algorithms and software for coordinated path planning of multi-robot marine robotic platforms. The goal of this work is to enable effective deployments of large numbers of vehicles, both at the surface and underwater, with very little need for operator control. The new algorithms will leverage MIT's unique software libraries for multi-objective optimization and decentralized decision-making available in MIT's online moos-ivp.org open-source project. The initial phase of this project will focus on collaborative surface vehicle autonomy, and the second phase will focus on nested swarm clusters of both surface and underwater vehicles. The end-of-project target experiment is deployment of surface and underwater vehicles in Pico Straight in Horta Portugal.

Earth Systems: Oceans to Near Space

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A new window into soil function with microbial biosensors

To answer urgent questions about climate change, food security, and sustainability, it is necessary to mechanistically understand microscale soil processes. From interviews with experts in soil microbial biogeochemistry, it is clear that current soil characterization techniques provide inadequate spatial resolution, analyte variety, and levels of perturbation to study dynamic processes in the challenging soil environment. We propose a novel sensing platform to detect diverse soil analytes in two dimensions on the microscale, composed of a planar matrix housing whole-cell microbial biosensors that contacts the soil through an engineered membrane interface. This project is divided into three stages: (1) designing and modeling the sensor platform; (2) building and validating three sensors to map three diverse soil analytes (a plant metabolite, a microbial electron acceptor, and a contaminant); and (3) testing the sensors by using them to investigate scientific questions of interest for the three model analytes.

Earth Systems: Oceans to Near Space

MIT Principal Investigator

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Early warning signals of vegetation and soil carbon tipping points in tropical forests

Tropical forests regulate Earth's climate, yet deforestation, mega-droughts, windthrows, seed-dispersal collapse and runaway fires threaten to push them beyond tipping points. We will fuse high-resolution remote-sensing data, causal machine-learning and resampling of legacy plots to pinpoint where and why these thresholds are crossed. A "twin-forest paradox" design - Amazonia's declining sink versus Africa's stable counterpart (Fig. 1)—isolates the disturbance combinations that flip forests from sink to source. Soil re-cores of 40 Amazon plots, first sampled two decades ago, will be isotopically analysed at INIAV laboratories in Portugal to test whether stressed soils buffer or amplify canopy loss. The project will result in driver-resolved early-warning indicators and a public dashboard ready for climate modeling and REDD+ accounting. Portuguese partners within the TERRA network contribute Europe's burn-scar atlas, fire-physics labs and Copernicus cloud, ensuring Amazon-derived alerts translate directly into wildfire-resilient management of Mediterranean pine and eucalyptus landscapes.

Climate Science and Climate Change

MIT Principal Investigator

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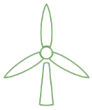
Developing chalcogenide perovskite diodes and solar cells

We propose to develop diodes and prototype solar cells using chalcogenide perovskite thin films. We will deposit BaZrS3 thin films, and BaZr(S,Se)3 alloys with tunable band gap, using previously-established methods of molecular beam epitaxy. We will select contact materials, and will develop methods to deposit and evaluate the contact materials as thin films. We will form p-n heterojunction diodes and test their electrical performance. Finally, we will evaluate the photovoltage and solar-cell performance of the top-performing diodes. Our project will build on a new collaboration between MIT and the International Iberian Nanotechnology Laboratory (INL), leveraging world-leading expertise in chalcogenide perovskite deposition (MIT) and in scanning probe microscopy (INL). We will be the first to characterize and optimize chalcogenide perovskite thin-film diodes and photovoltaic performance, which will be a major advance in this growing research field.



Energy

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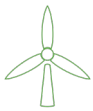
Assessing and mitigating blackouts: The case of Iberian 2025 blackout

The motivation for this project is the recent Iberian blackout. We study it by modeling and simulating multi-country interconnected electric power grid affected by this event using modified publicly available data of European Union grid known as PECASE. We will then use extended AC Optimal Power Flow software to assess the most vulnerable parts of the grid, and, to, consequently, reconstruct the events which led to massive loss of electricity service. Of particular interest will be to understand the role of coordinating inter-countries power exchanges, notably between France and Spain for preventing system voltages from collapsing. In parallel, we will introduce adaptive power electronically switched control of intermittent resources for stabilizing voltage and frequency during such extreme events. The study will set a basis for general framework needed in other parts of the world for the same purposes, including US. Results will be demonstrated using Power Digital Twin at MIT.



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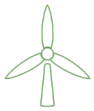
Multiphysics-Guided Generative AI for Designing Complex Structures

Offshore wind energy leverages the high intensity and consistency of oceanic winds, playing a key role in the transition to renewable energy. As energy demands grow, larger turbines are needed to optimize power generation and reduce costs. However, upscaling introduces structural design and manufacturing challenges. Designing better wind turbines is therefore essential. A key challenge is the time-consuming nature of multiphysics simulations, involving interactions between wind, waves, and ocean currents, limiting exploration of design alternatives. While AI provides a promising way to help alleviate this challenge, most current AI-accelerated models lack the capability to capture multi-physics, leading to untrustworthy or structurally invalid designs. We propose a physics-guided generative design framework that combines Graph Neural Nets (GNNs) and diffusion models, trained on high-fidelity multiphysics simulation data and validated against experimental data from full-scale offshore structures, to design and evaluate offshore structures. This approach enables faster development, improved accuracy, and scalable digital twins for Portugal's partners in the offshore wind sector.



Energy

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BOOST: Boiling Optimization of Eco-Friendly Refrigerants with Surface Engineering Technology

Boiling of refrigerants enables high heat dissipation and is critical in heat pumps, refrigeration, solar power systems, and emerging microsystems. Understanding refrigerant boiling can drive the development of clean technologies for process heat, cooling, and power while reducing greenhouse gas emissions by replacing harmful refrigerants with eco-friendly alternatives. This project aims to enhance boiling heat transfer using next-generation low-global-warming-potential refrigerants. We will conduct pioneering experiments using advanced optical and infrared diagnostics, paired with engineered surfaces, to identify designs that maximize performance. These surfaces will be tested in prototypical conditions, focusing on applications such as refrigeration systems, concentrated solar power and passive, thermally powered cooling. Insights gained will also benefit broader water-based thermal systems, including steam generation and solar cooking.

Energy

MIT Principal Investigator

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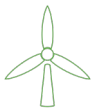
Catalytic Upcycling of Plastic Waste into Energy-Rich Streams

Poly(vinyl chloride) (PVC) waste presents a major challenge to circular materials management due to its high chlorine content and incompatibility with existing recycling systems. This project, a collaboration between Prof. Luís Branco (NOVA FCT) and Prof. Yuriy Román (MIT), will develop a catalytic process to convert PVC into energy-dense liquid fuels using mild thermochemical treatment in tailored solvent systems. The approach integrates solvents with tunable acid–base properties (NOVA FCT) and selective hydrogenolysis catalysts (MIT) to enable dechlorination and C–C bond cleavage under mild conditions. Key innovations include nucleophilic, low-volatility solvents that stabilize reactive intermediates and catalysts that promote high selectivity without over-cracking. Unlike existing chemica recycling methods, which suffer from low carbon yields, proof-of-concept results demonstrate dechlorinated PVC carbon recoveries approaching 80%. Portuguese PVC-containing waste streams will be used to validate the process and guide scale-up. This collaboration offers a high-yield, lowimpact route to valorize halogenated plastic waste while supporting national energy and sustainability goals.



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Scalable Stochastic Neuro-Inspired Computing with Spintronics

We aim to develop neuromorphic computing systems by exploiting the stochastic nature of nanoscale spintronic devices. Currently neural networks have achieved remarkable success in various application areas. However, existing silicon-based hardware exhibits inefficiency at processing compute-intensive models compared to the human brain. Bio-inspired computing models based on stochastic activations and learning rules provide new opportunities for developing efficient neuromorphic systems with complex cognitive capabilities. In this proposal, we will leverage the intrinsic stochasticity from the compact and energy-efficient spintronic devices for realizing stochastic neuro-mimetic components, and realize algorithms and architecture to achieve balanced performance among accuracy, robustness, synaptic memory requirements, and energy efficiency. Particularly, we will develop stochastic spin-orbit torque magnetic tunnel junctions for both neurons and synapses. Compared to state of the art, the proposed devices and circuits will minimize the influence of noises and device variations, leading to a scalable solution for robust and efficient implementation of stochastic neural networks.

Chips/
Nanotechnology

MIT Principal Investigator

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Microfluidic electronic chip system for assaying neutrophil function

Sepsis is a leading cause of death from infection, driven by a dysregulated immune response. There is a need for technology to monitor sepsis progression and guide treatment. Neutrophils are abundant and easily accessible immune cells, and their functional state holds promise as a real-time biomarker for sepsis and other diseases of the immune system. Here we propose to integrate a microfluidic electronic cellular analysis chip developed at MIT called isodielectric separation with a nanoelectronic graphene field-effect transistor chip sensor developed at INL that is capable of detecting reactive oxygen species, a key neutrophil effector function. This combined platform will provide high-resolution, multidimensional profiling of neutrophil function from a drop of blood. We will develop an integrated chip-based platform and validate the system using chemically activated human neutrophils. This work will enable more precise immune monitoring in sepsis and other immune-related conditions, advancing clinical applications and providing substantial commercial potential.

Chips/ Nanotechnology

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Novel 2D Materials for Next Gen Nanoelectronic Sensors

The advent of 2D crystalline materials has enabled the fabrication of novel devices with unique capabilities different from conventional 3D materials. Of particular interest are devices where the ability to control the stacking order and rotational alignment between 2D materials enables the engineering of novel tunable phases of matter. This proposal aims to investigate a new generation of nanoelectronic sensors based on novel 2D synthetic ferroelectric devices and twisted bilayer graphene devices. These sensors are expected to provide advantages such as ultra-fast switching speed, long endurance, biocompatibility, and compatibility with existing complementary metal-oxide-semiconductor technology.

This work will involve a close collaboration between MIT and Portuguese researchers at the International Iberian Nanotechnology Institute (INL) paving the way to advanced technology applications of interest to the health sciences and pharmaceutical industry in Portugal.

Chips/
Nanotechnology

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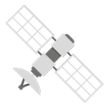
Advancing Plasma CO2 Conversion with Integrated Oxygen Extraction

This project advances a novel plasma-based reactor for carbon dioxide conversion (CO2) and oxygen production under Mars-relevant conditions, supporting in-situ generation of valuable resources on Mars. Building on a prior MIT Portugal seed grant, we propose to design, construct, and test a plasma reactor integrated with oxygenpermeable membranes to selectively extract oxygen from the reaction products. The plasma is produced using Nanosecond Repetitively Pulsed (NRP) discharges, an energy-efficient technique that can reach up to 100% CO2 conversion. The integration of separation-technology addresses one of the main bottlenecks of the technology: the inability of plasmas to produce a pure stream of products. The system will be characterized across key parameters, including pressure, plasma power, and feedstock composition with a focus on measuring reactorperformance metrics: conversion fraction and energy efficiency. The work aims to elevate the technology from NASA Technology Readiness Level (TRL) 3 to TRL 4 by demonstrating a functional laboratory prototype. In addition to enabling sustainable oxygen and fuel production on Mars, the insights gained will inform scalable CO2 conversion systems for Earth-based decarbonization.



Space

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AICube: Collaborative AI Enabled CubeSat for Ocean Monitoring

Earth's oceans are our planet's largest defining feature and an invaluable resource as they contain millions of algae and animals responsible for sustaining large ecosystems that supply oxygen and food. Monitoring key features of the ocean provides critical insight to how its behavior is changing and how that affects maritime industries and ecosystems. This seed proposal builds upon prior work with MIT Portugal's AEROS to take it to the next generation of development. We propose to use MIT's available NASA CSLI launch opportunity (a $300k value) and existing CubeSat hardware (see Figure to engage with our MIT Portugal collaborators in taking the next-generation step for remote sensing with CubeSats: testing an AI-optimized processor in space and running algorithms relevant to maritime industry, such as looking for ocean fronts, coastal morphology and color change, and harmful algal blooms.

Space

MIT Principal Investigator

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AI Maturity Impact on Social-Environmental Sustainability of Cities

Sustainable cities face persistent social-environmental externalities that cannot be resolved by urban strategies alone. The forestry sector offers strong potential to mitigate these impacts and generate benefits for urban sustainability. This project focuses on using AI to enhance the efficiency and resilience of forestry supply chains. While AI offers environmental and economic advantages, sociotechnical factors like adoption, trust, and systemic resilience are often overlooked. Building on our sociotechnical AI maturity model, we aim to refine it using evidence-based factors to support responsible AI integration. The rapid uptake of AI across supply chains creates opportunities for innovation and sustainability, yet adoption remains uneven. Existing AI maturity models rarely consider sociotechnical systems thinking or responsible AI. By applying our model to Portugal's forestry sector, a critical player in achieving Sustainable Smart Cities (SSCs) goals, we will assess current AI maturity and propose sociotechnical interventions, including digital twin concepts for SSCs ecosystems.

Sustainable Cities

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Low-Carbon, Large-Scale Additive Manufacturing Framework for climate-resilient construction in the Portuguese context

Rapid urbanization and extreme climate conditions are driving innovation in design and construction. At the global scale, the square footage of livable floor area must be doubled by 2060, a daunting goal made more challenging by the significant carbon impact of new construction and building operation. Research on Low Carbon Large Scale Additive Manufacturing (LC-LSAM) offers a potential pathway to simultaneously accelerate and decarbonize construction. Portugal's vernacular earth construction techniques offer time-tested climate adaptation strategies for thermal comfort in buildings, yet their integration with modern performance requirements requires new methods and experimental validation. This proposal combines MIT's Digital Structures research (led by postdoctoral associate Dr. Alexander Curth) on LC-LSAM, including material-aware computational design, multi-objective toolpath optimization, and zero-waste earth printing, with FEUP's expertise in Portuguese earthen construction, and low carbon printing admixtures to develop next-generation climate-resilient construction systems.

This work addresses a key barrier to scalable construction automation: making local materials a functional feedstock for the additive manufacturing of buildings. Current state of the art printing systems rely on carbon and cost intensive mortars with limited thermal performance. This collaboration will generate and test novel, architectural scale, climate and material adaptive computational design methods for the specific context of Portugal's urban development needs, leveraging historic passive cooling strategies and locally sourced soils in a reproducible framework for low-carbon additive construction. This research will culminate in full-scale prototypes in Porto to test cooling loads compared to conventional construction and the relative carbon Life Cycle impacts of the 3D printed system. This work establishes new paradigms for performance-based vernacular architecture through computational design, specifically focused on the contemporary needs of a rapidly changing Portuguese urban development.

Digital Transformation in Manufacturing

MIT Principal Investigator

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AI Designs to Enhance Bispecific Antibody Production

Bispecific antibody drugs provide transformative cures, but they are often refractory to modern bioproduction methods. Here, we will apply large-scale data and AI to integrate manufacturing with early bispecific antibody discovery. We will collect high-throughput manufacturability data and train an AI-based drug design algorithm to enhance drug activity, potency, and product quality. First, we will clone large libraries of bispecific antibody variants into manufacture-ready cell lines and growth conditions. Next, each bispecific antibody-producing cell will be captured emulsion microreactor droplets to analyze functional performance in manufacturing-like conditions. High-throughput sequencing will be used to analyze test results en masse, and AI models will be trained to identify critical features of manufacturable molecules. Finally, we will apply trained AI algorithms to generate new manufacturing-ready bispecific designs and evaluate their improvement related to controls. If successful, we will establish a seamless transition between early discovery and large-scale manufacturing for bispecific antibody drug products.

AI

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Advancing XAI: Rule-based distillation, trust and model utility

This project advances the frontiers of eXplainable Artificial Intelligence (XAI). Modern high-performance prediction models (e.g., random forests, gradient boosting, neural networks, LLMs) are complex black-box objects that are difficult to interpret and use in critical applications. One promising XAI approach is rule-based distillation where a large ensemble of trees is replaced by a small number of rules with model utility almost comparable to the original complex model. Despite their promise, the current scope of these approaches is limited. Our goal is to advance the frontiers of rule-based distillation. Our proposed framework (i) significantly generalizes the notion of rules beyond their traditional usage; (ii) allows the distilled rule ensemble to incorporate various user-defined notions of interpretability, trust, transparency, etc while maximally retaining model utility. We propose integrating these interpretable compact models into performant LLMs for improved in-context learning.

AI

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06

Education

6.1

Call for MPP2030-FCT PhD grants

Since its launch, MPP has prioritized ad vanced training by offering transdisci plinary education programs, including Phds and Executive Masters, across its key focus areas. in the program's third phase, a collaboration with Fct enabled awarding Phd research grants under MPP, fostering expertise in the five critical do mains of MPP2030. unlike previous pro grams, MPP2030-FCT fellows can pursue their doctoral degrees at any Portuguese university that aligns with their research interests.

In 2025, even though no new calls for scholarships were issued, 109 students continued to benefit from MPP PhD scholarships.

Detailed information of the MPP Phd Students can be found here (cohorts 2020, 2021, 2022 and 2023). Research areas are represented by their respective icons, as shown in Figure 5.

Figure 4. Research areas of the program.

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Development of optimized compressed earth blocks

Currently, with growing concern about adopting more sustainable technical solutions, interest in earth as a building material has been renewed. This project's main objective is to develop compressed earth blocks (CEBs) capable of meeting the safety and durability requirements commensurate with the expectations of the modern world, contributing to the circular economy. Thus, it is expected to optimize the thermal and mechanical behavior of CEBs by incorporating industrial waste and by-products, especially construction and demolition waste. Preliminary results demonstrated the potential of replacing soil with concrete waste, as well as ceramic tile waste, in improving the mechanical strength of the CEB, without neglecting its thermal performance. The completion of the entire experimental campaign, including the assessment of the life cycle of the products developed, are scheduled for 2024.

2020_

Energy, materials and health in regenerative processes of common architecture for sustainable cities

The Intergovernmental Panel on Climate Change urges industries to disrupt with changes. From design to build takes years, and decades to operate, making it a long-lasting machine that has a large impact on the climate and biodiversity and could be thought to regenerate the environment. The International Style, developed at the beginning of the 20th-century, paid no interest to climate or past knowledge. The digital turn in architectural design — computer simulation and performance optimization allows not only creating ideas and processes but also revisiting vernacular, historical, early-modern and counter-culture architecture and with accurate tools in the search for solutions for better daylight conditions, energy consumption or ventilation. This proposal looks for regenerative architecture schemes in three domains (Energy, Materials and Health) for rapidly changing: retrofitting and urbanizing, regions and those researching borders concepts like tradition/innovation, local/innovation to create a sustainable built environment. Finally, the proposal is in line with the New European Bauhaus and its local version the NEB Goes South that has been developed at the University of Porto and partners recently.

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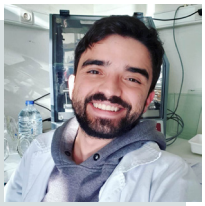
Optimization of municipal solid waste management systems towards sustainability

The project aims to develop (i) route optimization strategies using the northeast of Portugal as a model region and (ii) innovative technological solutions to valorize solid waste streams into carbon nanostructured materials (CNMs). So far, there has been a significant advance in the waste collection optimization. The best optimization algorithm, guided local search metaheuristic, was compared with other metaheuristic and heuristic algorithms and evaluated in terms of waste collection optimization. In addition, a project was submitted and approved, asking for financial support from Sociedade Ponto Verde to develop and explore a wireless sensors network to measure waste levels in dumpsters from Bragança. Regarding technological solutions for plastic recycling, real carbon nanotubes have already been synthesized using real solid plastic wastes as feedstock.

Thesis defended in 2025.



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2020_

Albano Martins
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Bioclimatic design in urban context through the recovery of vernacular solutions

The contributions of this project are important in that they help all those involved in urban design and the renovation of outdoor public spaces to raise awareness and to search for technological solutions and processes that lead to sustainable construction, with the aim of adapting the built environment to climate conditions. These construction solutions must take into account urban bioclimatic aspects, naturally using sustainable materials. Vernacular solutions can also be included, as long as they are applicable in an urban context and can optimise the quality of a given outdoor public space.

Thesis defended in 2025.

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Integrating the water-energy nexus in water supply systems optimization

Water supply systems are energy-intensive infrastructures that rely on water storage tanks and pumping systems to deliver water to consumers. The combination of three complementary trends offers water utilities opportunities for a novel positioning in the energy sector: the flexibility in scheduling pumping operations leading to implementing demand response strategies with benefits to water and energy utilities, current investments in renewable energy sources, new dynamic energy pricing in smart grids. Therefore, the main goal of this research is the development of novel mathematical programming models to cope with the increased complexity of real-time optimization of energy resources in WSS. One article has been published (10.1016/j.rser.2022.113140) and another is submitted. The model that has been developed has also been presented at prestigious research conferences.

Thesis defended in 2025.

Bio-inspired gyroid foams by machine learning optimization and meshless methods

An optimal multi-variable design can be achieved using machine learning (ML) by means of artificial neural networks, a core architecture of deep learning. A ML design will allow to estimate (based on geometric characteristics) the mechanical properties of gyroid foams. The ML framework will be combined with a bio-inspired tissue remodelling algorithm using meshless and will permit to propose optimized bone scaffold foams, aiming to design lighter and structurally optimized prosthesis.

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Framework for ergonomic assessment in collaborative robotic systems

Human-robot collaboration (HRC) has the potential to vastly improve the well-being of workers. The key lies in robots' understanding and adeptly responding to human cognitive and physical states, helping without overwhelming them. Thus, my focus revolves around creating a real-time ergonomic assessment framework. This innovative framework aims to foster HRC that proactively caters to human needs while being aware of their limitations and capabilities. Within the aim of this work, a human-centered methodology for selecting suitable industrial tasks for HRC was devised. This enabled the development of a test-bed prototype workstation to validate the proposed idea. Ergonomic thresholds for the physical aspects encompassed within this framework were already established. This entails creating cutting-edge technology and shaping a responsive system to enhance worker well-being in real-time.

Thesis defended in 2025.

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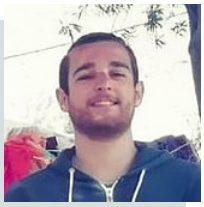
iBiogeography: harnessing and measuring the power of big, unstructured data for biogeographical monitoring

The use of 'Big' unstructured data to assess and monitor the distribution of the world's species (i.e., 'iBiogeography') is in its infancy. This project aims to expand this field of research to improve existing knowledge about the geographical patterns and trends of the 'Culicidae' family (i.e., mosquitoes), a taxonomic group of particular concern for disease transmission. Firstly, I have already identified the current practices and drivers of the geographical reporting of non-native species in the unstructured sources (checklists). Secondly, I will develop an artificial intelligence-based metodology that will allow us to overcome the challenges of big unstructured data in ecology, taking advantage of recent developments in this field (new large language models like GPT). Finally, I will test how the distribution of culicids has already reshaped their distributions in response to global climate change, using unsctrutured data sources.



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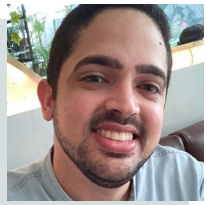
Intrusion detection system based on deep learning techniques for the internet of vehicles in smart cities

Modern vehicles are capable of sharing information (traffic conditions, entertainment services, and more) between other vehicles on the road. Because of this possibility, there are safety breaches that can put the vehicle and drivers/passengers at risk. Our work is focused on developing an intrusion detection system to increase security levels.



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Real time activation of ancillary services in the transmission network: enabling providers from the distribution system using a linear Model Predictive Control

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It is well known that the large-scale integration of demand side resources such as hydrogen electrolysers may provide useful to power grids' balancing. This thesis aims at analyzing the role of electrolysers on several ancillary services. Three distinct fields of knowledge are used in the thesis: (1) power systems dynamics, (2) energy markets and regulation and (3) control theory. Regarding (1) it was concluded that the existing ancillary services improve if provided by electrolysers, while results suggest that novel ancillary services provide may provide additional benefits in this regard. On (2) the economic analysis of integrating electrolysers in an existing international market is assessed. On (3) the goal is to provide novel control mechanisms to support the load frequency control problem.

Thesis defended in 2025.

The city "walking" to 2050. Braga as a Laboratory for a resilient and sustainable system

The Mobility concept, as an objective to achieve the Goals defined for 2050, is the catalyst pretext to explore matters intrinsic to the domain of Architecture. The central research laboratory is Braga. However, in order to incorporate the current best practices in Sustainable Urban Mobility (SUM), five cities have been selected – Bielefeld, Oxford, Pontevedra, Barcelona and Copenhagen – which will serve as a reference to the proposed research strategy. This approach aims to explore the role of Architecture in the paradigm shift in Mobility and to evaluate the level of commitment to the goals set for 2050 and its resilience in the face of calamity situations, such as COVID-19. The potentialities to combine theory and practice are underlying the methodological principles and imbued with urban acupuncture strategies and projects (SoláMorales, 2008), that have a greater influence on changing social behaviors for SUM and on the replication capacity.

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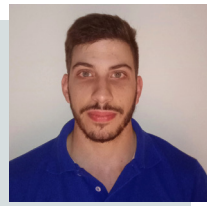
Promoting circular economy in buildings refurbishment – a methodological framework for design sustainability assessment

The lack of standardized practices for refurbishment design assessment in the context of Circular Economy (CE) is a challenge for decarbonizing existing building stock. To tackle this issue, this research develops a platform for practitioners, to facilitate standardized practices by assessing CE in building refurbishment design and global warming impact. It incorporates feedback from practitioners from early design stages, fostering a dynamic, multi-criteria process from a life-cycle perspective. A Circular Refurbishment Framework, already developed, employs an approach at building, neighborhood, and Urban Metabolism scales. A BIM-based plugin will automate quantitative CE assessment and the digital platform will characterize existing building stock and design refurbishment strategies, contributing to promoting CE practices for global warming mitigation.

2020_

AI based market model for renewable energy communities with storage sharing



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This work proposes an innovative Market Model suited to the concept of a renewable energy community, in which its members can interact through Energy Sharing and share, among themselves, the storage capacity of their stationary batteries or electric vehicles, Storage Sharing. In order to obtain an optimum energy planning for the community, the proposed multi-agent Market Model will be based on Artificial Intelligence (AI), with a hierarchical control structure, which will base their decisions on technical and economic aspects, considering the community load and renewable production forecasts and the restrictions, imposed by each member, for the community participation. To ensure the applicability of the proposed Market Model, a long-range wireless communication module will be developed, based on the Internet of Things (IoT), which will allow the monitoring and control, in real time, of the parameters of each member of the community.

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Neurostruct: machine learning in structural design

Scientific Machine Learning (SML) is a recent trend involving the application of physically or mathematically-informed Machine Learning (ML) techniques to speedup classical numerical computations that are central to many fields of engineering and science. The application of SML techniques to Structural Design (SD) allows designers to explore and assess different solutions quickly, avoiding the need to use traditional Finite Element Models, which, despite being very precise, are computationally expensive and quickly become the bottleneck for experimentation. My Ph.D. project will contribute to real-time 3D simulations in SD, which will facilitate the exploration of new designs and find optimal solutions without the need to have an expensive computational infrastructure. Furthermore, with this project, we will contribute to the connection of the Mechanical Engineering and ML community. These future cooperations will allow accelerating the digital transformation in manufacturing.

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InverseESA: inverse catalytic optimization for sustainable epoxide manufacture

This project aims to develop an inverse Machine Learning (ML) model to optimize industrial catalytic epoxidation of small alcohols and alkenes (ESA) towards sustainable manufacturig solutions. The project intends to embolden chemists and industries with a predictive model that eases reaction optimization, generating blueprints for optimal catalysts using biomass-based feedstock, avoiding fossil-fuel based raw materials. Thus far, we have developed an in-house ESA database, cataloging known ESA reactions with commercial and scientific value. We have built the first version of the ML model for predicting ESA reactions, validated by two proof-of-concept studies. The influence of various chemical features was studied and we are currently building the inverse generation tool based on the best chemical descriptors to design new catalysts.

Thesis defended in 2025.

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Climatecollab: a collaborative graph for reproducible evidence of climate change

Reproducibility is paramount to science, and therefore it is crucial that the research community can reproduce the same results achieved by previous experiments. However, achieving computational reproducibility is a difficult task due to the multitude of computational environments available. Recreating the exact setting involving the same code, data sources, programming languages, dependencies, and so on is a significant challenge. In this work, we propose to build a methodology supported by a software platform that allows researchers to create, configure, and execute a diversity of computational experiments in a systematic and user-friendly manner. Furthermore, we can use our approach to create a capsule of the research experiment containing all the relevant information needed to re-execute the experiment without the platform and achieve the results of the experiment.

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Methane biofixation by microalgae/ cyanobacteria systems

This project aims at evaluating the ability of microalgae and cyanobacteria to fixate CH_4 (and the resulting CO_2), in order to convert it into biomass and high-value bio-compounds. We evaluate the impact of an atmosphere batch cultivation system and different gas mixtures O_2, CH_4 and CO_2 concentrations on cell growth, morphology and pigment composition of *Synechocystis sp.* and *Chlorella vulgaris*. Only the conditions with CO_2 and CO_2 & CH_4 promote cell growth. However, CH_4 consumption does not occur. O_2 concentrations of 40% had a limiting effect on the cell growth of *C. vulgaris* and *Synechocystis sp.*. The headspace composition strongly affected the morphology and pigments content of *Synechocystis sp.* cells. We also move forward to the contingency plan related to cocultivation of methanotrophic bacteria (*Methylococcus geothermalis*) with cyanobacteria (*Synechocystis sp.*).

Optimization of electric vehicle charging for sustainable energy systems

As the world transitions to Electric Vehicles (EVs), a critical concern arises — the potential force on grids due to uncoordinated charging. This PhD focuses on developing decision-making approaches for EV charging scheduling, incorporating the intricate dynamics of user behavior, preferences, and the operational needs of grid. Our approach covers both economic and Quality-of-Service dimensions, ensuring overarching solutions for both users and grid. Active participation in international conferences has facilitated the dissemination of our findings and discussions on future applications. Additionally, a submitted review paper examines influential factors shaping EV charging behavior, proposing effective methods for addressing them. This PhD serves as a crucial link between academic research and real-world applications, contributing to the sustainable evolution of EV charging strategies.

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Mobility mining – from individual to group urban mobility patterns

An adequate description of travel demand in an urban area is crucial for mobility management, fostering an efficient urban metabolism. However, to this day, traditional data gathering was unable to effectively provide the needed decision support backed by statistically unbiased evidence for all kinds of trips. This thesis proposal takes a radically new perspective to demand characterization, relating the user' profile to a predictable trip pattern, herein using all big data from Online Social Media (OSM), namely text, images, social links, and geodata. From here, the definition of homophily relationships (clusters) for associated users concerning mobility will allow, much more than usual, adequate characterization of transportation demand within a specific urban area. The ultimate goal is to provide the needed data-backed tools to allow governance to successfully fulfill users' mobility needs, providing conditions to have a better sustainable environment for a city.

Multiple benefits of energy efficiency policies: exploring new assessment tools

Energy efficiency funding projects often rely on cost-benefit analysis, primarily focusing on energy and emissions savings during the operational phase while overlooking impacts across other lifecycle phases inherent to energy efficiency strategies. To address this limitation, our project seeks to pioneer a holistic approach. By combining mathematical programming models with Hybrid Input-Output Lifecycle Analysis (HIO-LCA), we aim to assist public decision-makers (DMs) in selecting and evaluating energy efficiency measures for the residential sector. This approach considers potential economic, energy, environmental, and social benefits throughout the lifecycle of EE measures, offering a more comprehensive assessment and enhancing their overall appeal. Testing will be conducted in the Portuguese residential sector, with plans for extension to any country with available supporting data.

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RNNs for operator occupational risk analysis based on multimodal biosignal

My PhD thesis has two major objectives: 1) Build a Deep Learning framework for Biosignals processing and knowledge extraction. 2) Develop algorithms for occupational risk evaluation from physiological data. Deep Learning architectures for timeseries have shown to be effective in biosignal processing and knowledge extraction, outperforming traditional methods. As such, I am building a biosignals processing "neural library", which comprises networks that execute functions such as signal denoising or filling missing values. These trained networks "learn" the basic characteristics of the signals and, by fine-tuning them to perform different tasks (namely, risk detection from physiological data), it is possible to transfer prior knowledge. So far, the major advances that were reached in my PhD thesis were: the development and publication of a systematic review that organized the existing methodologies regarding the assessment of cardiovascular load in the workplace; the creation of 2 physiological signal databases: one in a laboratorial context (n=24) and a second in a real industrial environment (n=46); the development and publication of a denoiser network for ECG signals, based on Gated Recurrent Units, which was the first step in the creation of the "neural library".

Microbiome therapy for improved coral health and reef resilience

Microbiome manipulation has been proposed as a key strategy to improve coral health. This project aims to examine the role of aquarium facilities in microbiome conservation, and to develop probiotics to promote octocoral health. Tropical octocoral species were sampled from a long-term aquarium and from the Red Sea. The bacterial taxonomic composition was assessed through cultivation-dependent and -independent analyses. A total of 152 bacterial strains were isolated and grouped into 27 genera. The collection comprised "hard-to-cultivate" genera such as Endozoicomonas and Flammeovirga. Phenotypic screenings for host-beneficial properties were performed on 25 bacterial isolates. Twenty-two isolates presented antioxidant properties, 19 antimicrobial and 15 carbohydrate degrading activities. Aquarium mesocosm experiments are ongoing to determine the putative probiotics effects on octocorals.

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A decision-making tool for the renovation of buildings in coastal cities under future climate scenarios of the Middle East

Middle East countries lag in renovating their built environment to counteract the impact of climate change. The main reason for this is the low tax policy on fossil fuels, contributing to global warming. This project aims to identify clean energy technologies that reduce the buildings' dependence on fossil fuels. The project will analyze the energy and environmental impacts, which have not yet been assessed in this region. As coastal cities are more susceptible to global warming impacts, Bandar Abbas, a coastal city in Iran, is considered a case study. Energy simulations are employed to investigate the performance of a set of reference buildings and determine the most effective measures to cope with this impact under different climate scenarios. A tool will be developed to assist in the decision-making process of planners and it ultimately influences policymaking in those coastal cities.

Thesis defended in 2025.

The indoor environment of heritage buildings: monitoring and simulation

Nowadays several heritage buildings have been suffering operational changes over the last decades. Most cultural places are victims of their own success and suffer from being intensively explored as touristic sights. Therefore, it is urgent to study ways to characterize the indoor environmental conditions, identify the impact of tourism and define strategies that support preservation of collections. In this context, the doctoral research explores monitoring and simulation procedures to identify causes of inappropriate indoor environment conditions (hygrothermal, lighting and pollutants), and the associated risks of degradation, and discuss the most appropriate strategies to preserve heritage patrimony. The project will contribute with new scientific approaches to preventive conservation giving insights into the appropriate control of the indoor environment in heritage buildings.

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Digitalization of the footwear industry using artificial intelligence

Objectives: Develop a computer based system to choose the best arrangement of dampers on a shoe sole to improve comfort. Study the behavior of different geometries of the damper for further use. *Main achievements*: CFD (Computational Fluid Dynamics) model of damper compression mechanics. Achieved great shortening computational times testing 3D mesh complexity. Tests of model geometry influence. Dampers with front rib tend to offer more resistance to applied force. Use of AI (Artificial intelligence) technics to reduce the number of evaluated variables. The geometry influence and AI results indicate that the front rib is the most influent studied characteristic of the damper to obtain optimal comfort. After the data analysis results, we conclude that this problem can be optimized. A group of better results can be obtained using an optimization process. The next step is the study of the optimization algorithm. Test a multi-objective evolutionary algorithm and/or a neural network to find a pool of the best results to help both a human or an automatic decision-making process.

Using large-scale optimization methods to drive digital transformation: models for introducing additive manufacturing processes into complex manufacturing processes

This project addresses the challenges associated with the industrialization of additive manufacturing (AM). The first step involved a classification method for AM technologies to assist in selecting suitable technologies for specific use cases, which culminated in a peer-reviewed publication. The second step consists of tackling the challenges associated with nesting and production scheduling in AM. A Constraint Programming model was first developed, leading to a conference paper. Further advancements were made using logic-based Benders decomposition, resulting in more effective methods to handle larger instances. These improvements produced a paper that proposes exact methods for the AM nesting and scheduling problem considering irregular-shaped parts, which is under revision. The next goal is to refine these methods to be able to tackle real-world instances.

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An integrated multiscale fatigue methodology applied to ocean structural systems

In Portugal, the production of marine renewable wind energy started in 2011, with the installation of a floating wind turbine platform. Besides, there is an interest in re-power decommissioned oil and gas offshore structures for wind energy generation, or extend the service life of wind turbines in operation. In this sense, this work intends to develop a fatigue methodology applied to support structures for wind towers in offshore environment. Thus, fatigue behaviour of S690 structural steel for longer service lives has been assessed, within the scope of optimize offshore structures and reduce material waste. Topics such as mechanism of failure, notch effect and load frequency effect were already addressed. At present, the influence of material degradation due to seawater corrosion and complex loads in structural integrity of offshore structures is the challenging task to fulfil.

Thesis defended in 2025.

A new adaptive design approach for active and improved performance pacifiers

Pacifiers are excellent to calm babies, but there are numerous risks about its prolonged use. The main goal of this project is to develop an innovative pacifier design methodology and adaptive pacifier with support of computational modeling tools, to monitoring its operation in real-time. Data mining will identify patterns in collected data to parameterize pacifier usage limits, considering individual suction patterns for continuous supervision. Key achievements include developing realistic pacifier computational models, optimized commercial pacifier models, compile a proof-of-concept technical report, outline prototyping steps and contacts, and regular meetings with pacifier producer to establish effective approaches. Prospects include a digital transformation in pacifier manufacturing and an intelligent, impactful pacifier in society, medical practices, and product industrialization.

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Virtus in medium est – history and planning towards an urban-rural future

The future of cities will depend on their formal and functional relationship with nature. Thus, operative concepts are needed for addressing specific realities and challenges, informing integrated strategies for sustainability. This proposal starts from an evolutionary analysis of the concept of "urban-rural space". Three case-studies will serve as reference: Lisbon, Barcelona and Bucharest; studying in each one the historical urban fabric, the planned expansion and the dominant architectural types, as well as their relationship with green spaces (public/private, leisure, agricultural production or environmental preservation). The study of the historical development and genesis of each territory will enable an inventory of solutions suited to their characteristics, which, given their diversity, allow us to think about other cities. This study will result in a monograph, a handbook and an exhibition, aimed at academic and general audiences.

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A supportive, ergonomic, and human-aware human-robot collaboration framework

Each year, Work-Related Musculoskeletal Disorders lead to an economic burden of EUR210 billion and represent 53% of all occupational diseases. Also, with an aging workforce, prioritizing improved conditions is crucial. This proposal aims at the development of an industrial Human-Robot Collaboration framework that brings innovation in ergonomic interventions by integrating artificial intelligence and wearable technology. Novelty includes bi-directional interaction between human and robot by identifying and monitoring in real-time the worker's motion, fatigue, and physical limitations, during a collaborative task, and tailoring the robot collaboration accordingly. Expected benefits include the operator's well-being, healthier and safer working environments, increased productivity and reduction on the costs derived from WRMSDs, while fostering companies' industrial competitiveness.

The role and value of aggregation of demand-side flexibility

The aim of my PhD project is to understand the role and value of a newfound entity in the power system called "aggregator" in managing the responses of the residential end-users to the incentives they will receive if they change their consumption pattern. From the energy transition perspective, the role of the aggregator is essential. In my PhD project, the performance of different electrical appliances have been modeled using physically-based modeling which is the most accurate method considering the state of the art. The energy management and operation scheduling of the electrical appliances are performed aiming to get the most advantage of the incentives paid by the aggregator to minimize the energy cost and discomfort of the end-users. However, the aggregator is seeking to maximize its profit by managing and trading the consumption changes (flexibilities) in the relative markets.

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Operational forecasting platforms based on morpho-hydrodynamic emulation methods

Extreme weather events, such as floods and droughts, are becoming more frequent and severe owing to climate change, leading to catastrophic consequences. Therefore, the development of methodologies to anticipate losses and identify vulnerable areas is crucial. In this context, numerical models provide reliable solutions for forecasting the effects of future events; however, they require considerable computational resources. The PhD project "Operational forecasting platforms based on morpho-hydrodynamic emulation methods" aims to develop artificial intelligence models to reduce the computational costs of numerical simulations. The developed methodology reduces the simulation time of the numerical simulations by 86% and preserves the accuracy of the original model. Moreover, it can be applied to estuarine and coastal models using two different software packages, Delft3D and XBeach.

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Understanding the relationship between perceived and objective bicyclist safety

We are witnessing a shift towards diverse transportation, including cycling, yet safety remains a significant hurdle due to inadequate infrastructure. To enhance cycling's appeal, cities must be reimagined and equipped with suitable facilities. However, cyclists' perception of safety may not align with the infrastructure's actual safety. The project seeks to explore the correlation between objective and subjective safety, identifying indicators for detecting areas where cyclists misjudge risk. The ultimate goal is to propose affordable safety interventions that enhance cyclists' perception of risk. Additionally, the research suggests a computer-assisted approach for decision-making on cycling infrastructure improvements, along with compiling potential corrective measures.

Monitoring of municipal waste streams and their transformation into geopolymers.

This research explores the synthesis and applications of geopolymers from fly ash for construction materials and their eco-friendly potential in wastewater treatment. The Box-Behnken design systematically refines production processes for both applications, manipulating key parameters. A notable formulation demonstrates exceptional compression (25.4 MPa) and flexural strength (6 MPa), offering insights into diverse construction needs. Simultaneously addressing escalating waste generation, the study valorizes fly ash from municipal solid waste into cost-effective adsorbents. Characterization techniques confirm improved properties compared to raw fly ash, validating geopolymerization success; amorphous nature and calcite prevalence are revealed, and acid-base characterization indicates electrostatic attraction, with a 75.83 mg/g adsorption capacity for phenolic compounds.

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Digital twin implementation for heritage buildings subjected to natural hazards

The research work aims to propose a holistic methodology for the structural integrity preservation of Built Cultural Heritage (BCH) to be framed in the broader scope of a Digital Twin (DT) paradigm implementation. The design of new DT processes and technologies for buildings requires holistic thinking. Therefore, a multidisciplinary framework will be proposed to make the BCH structures' conservation process less expensive, more efficient and more reliable than existing approaches.

2021_

The implications of additive manufacturing technology adoption for supply chain resilience

Additive manufacturing technology adoption is changing the state of supply chains around the world, thus affecting their resilience. The focus of this PhD project is to investigate this phenomenon using a mixed-methods research approach. Frameworks are put forward for practitioners and academics to examine the effects of adopting additive manufacturing on the state and resilience of supply chains.

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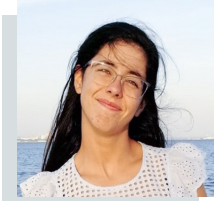

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Climate Change in the Western Iberian Coast: from the sea to estuaries

The main aim of my PhD is to assess long-term physico-chemical changes along the Western Iberian Coast (WIC) and study their relation to climate change, focusing on the adjacent coastal ocean and the WIC estuaries, with the final purpose to propose a set of measures to help manage possible effects of climate change in the region. So far, I have focused on looking for evidence (e.g. trends and changes) of the possible effects of climate change along the coastal ocean and have managed to cover changes in sea surface temperature and mean sea level. Slowly, I am migrating to estuarine systems, which are more complex due to their high dynamic and because there is less data available. In the near future, I hope to be able to portray the WIC estuarine scenario, regarding long-term variations in the physicochemical and biological parameters of the water column.

ALGTERNATIVE - AlGae To EneRgy aNd wAsTewater and GHG cleaning 4 Increasing ValuE

The use of fossil fuels is directly related to environmental impacts concerning atmospheric emissions and aquatic pollution. So, many strategies have been discussed to the development of sustainable energy process based on renewable sources, aiming at a circular economy approach. The ALGTERNATIVE project aims at developing a low carbon, simple, technically feasible, inexpensive and replicable process for biomass conversion into biofuels. Urban wastewater (WW) will be used as a feedstock for microalgae cultivation, which will be directly converted into drop-in liquid biofuels and bio-based products through Hydrothermal Liquefaction (HTL). The main advantage of HTL process is that there is no need to dry the biomass slurry prior the thermochemical conversion pathway, saving energy and costs. An upgrading of bio-oil will be carried out in order to deliver a product as close as possible to petroleum fuels or biodiesel. A significant global reduction in green house gases (GHG) emissions is expected as well as cleaned water which can be reused or discharged in compliance with the current EU legislation. Profits obtained from the WW treatment process, low cost feedstock and carbon credits will allow a reduction in production costs. It is expected that this research can be replicated with different types of wastewater and in different locations within the EU.

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Experimental campaign on the out-of-plane behavior of masonry structure by means of static and dynamic tests

My PhD project belongs to the civil engineering department and it is part of the STAND4HERITAGE project, which engages in introducing new standards for safeguarding built cultural heritage. The project is divided into four work packages, which aim to pursue the same goal giving insight into different aspects, i.e. from seismic signals to experimental, numerical and analytical points of view. My PhD project is focused on the experimental work package, which aims at experimentally investigating the dynamic response of masonry structures. The research question leading the work is: which are the key parameters that characterize the out-of-plane seismic response of historical masonry structures? Such a research question leads to addressing the main objective of the research, which consists of providing an extensive experimental campaign to improve the knowledge of masonry dynamics.

Thesis defended in 2025.

2021_

A platform strategy for cycling analytics in urban environements

Cycling is increasingly recognized as a fundamental element in urban mobility, and municipalities need new strategies to make better-informed decisions and investments. In recent years, there have been a growing volume of cycling data, and new mobility models have emerged trying to assess the cycling ecosystem from many perspectives. However, no model has become widely accepted to supporting decision-making. This seems mainly due to their development paradigm, which is usually a self-contained process, making these models difficult to generalize, reproduce and repurpose to other scenarios or datasets, if not at all impossible. The main objective of this work is to propose a new mobility model development paradigm, focused on incremental innovation, where new elements (models, visualizations, transformations, ...) are developed focusing on integrating and complementing existing ones.

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Power generation expansion planning for the large-scale integration of renewable energy sources in developing countries: the case of Angola

Angola presents an electrification rate of 43% corresponding to 18 million people without electricity access and has defined the expansion of the power system mainly with hydropower plants because there is a huge potential estimated at more than 18 GW. However, this dependence does not ensure the reliability of the power system in drought periods, being important the integration of the other non-conventional power plants like renewables energies sources (RES) also with high potential. The present research proposal aims to develop a power generation expansion planning model with large-scale RES integration for developing countries. The case of study will be the Angolan power sector. The model will take into account aspects such as the costs of expanding the electrical grid, the integration of intermittent RES into the electrical grid, the complementarity between RES and regions, distributed generation, and storage options. It will provide solutions to help power sector decision-makers.

Improving the service life of Engineered Wood Products

Timber biological degradation process is strongly correlated with the climate and exposure conditions and, despite wood being one of the most traditional building materials, the durability of EWP in various climates is still either questionable or unknown. Thus, this thesis program will quantify the predictable reduction, due to biological deterioration, in the service life of CLT considering different exposure conditions. Preventive measures, and maintenance plans to improve the service life will be defined as Guidelines for durability. To date, an extensive review of the literature on the topic has been carried out, identifying gaps in knowledge on the subject. Additionally, a wood degradation risk map was prepared considering the climatic conditions throughout the national territory. Finally, laboratory testing methods are being developed to create conditions for wood degradation.

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UV-filters from insular ocean-cities. Impact on the marine sustainability.

Organic UV filters (OUV-F) are chemical compounds that are found in Personal Care Products (PCPs). These compounds reach the ecosystem through activities such as skin washing during aquatic activities, sewage treatment discharges, and freshwater sources. Due to their characteristics, they are persistent in the ecosystem. Over time, they can accumulate in animal tissues, disrupting the endocrine system and becoming persistent pollutants. This project explores the possible bioaccumulation and biomagnification of 11 OUV-F through two marine trophic chains (coastal and pelagic). Also, it aims to evaluate how human pressure can affect the quantity of these contaminants in the marine environment. Samples collected from three locations with varying tourism pressures will be analyzed using HPLC-MS/MS.

2021_

Uncertainty interpretations for the robustness of object detection in self-driving vehicles

This research project aims to study uncertainty interpretations for deep learning-based object detection models in self-driving vehicles. We have achieved 2/3 of the project through the fulfilment of: our first goal, to study connections between uncertainty and interpretability including the analysis of the relationship between uncertainty and model underspecification with two papers awaiting review; the second one, to develop new uncertainty interpretations in object detection models, almost fully achieved through a method to generate uncertainty maps, has one paper in preparation and more to come. We also have worked with other students in the application of uncertainty to scarcely labelled settings and the use of deep reinforcement learning for planning tasks. This last work will be a bridge to start our study of error recovery in a planning layer when objects are missed in object detection.

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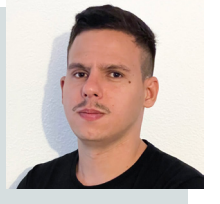
On the development of earth observation products for complex waters in support of water quality monitoring

This PhD project aims to develop improved satellite products to monitor water quality changes in transitional waters by using an innovative approach based on optical water classes, in which each pixel is classified and the most appropriate bio-optical algorithm is applied. The core of this research will be the identification of the water quality features associated with the different optical conditions and the analysis of their variability through space and time. Satellite products and methodologies developed within this project could also serve as support to water management applications, as an integration to the traditional costly in-situ monitoring programmes. We have been doing sampling campaigns, as in-situ measurements are essential for the development, calibration, and validation of satellite-derived data. Data collected allowed for the validation of existing methodologies and for a better understanding of the role of tidal fluctuations on the variability of water quality in transitional systems (i.e. estuaries).

Seaweed nanofluids for cooling photovoltaic solar panels used in space missions

Motivated by the contemporary space race, space missions face challenges with excessive heat in confined environments. Technological advancements for space exploration encounter limitations from heightened heat production. In space, extreme temperature variations require complex solutions. Nanofluids (NFs) are explored to optimize heat transfer. Conventional fluids with added nanoparticles (Nps) show enhancements, e.g., a 13% increase in thermal conductivity of water with 0.1% (wt%) aluminum hydroxide Nps. Progress in green synthesis, using algae like Chlorella vulgaris and Porphyra umbilicalis for Np production, is ongoing. An optimized transparent material serpentine facilitates heat exchange testing, enabling detailed fluid behavior observation.



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Ergonomic and sustainable criteria for human centered design of autonomous cars interiors

2021_

With the advent of autonomous vehicles (levels 3 to 5), the classic concept of the car interior must be redefined to fit the new requirements that are expected in terms of customisation, comfort, human-machine interface (HMI), adaptable interaction, and infotainment. Currently, the need to rethink the role of the car interior is a hot topic and represents several research challenges. The scope of this Ph.D. project is to provide criteria based on ergonomic methodologies to be integrated into innovative car interior, adaptable to the new mobility paradigms, specifically level 4 and Level 5 autonomous vehicles interior according to ergonomic principles and evaluations. In order to achieve that as a first step developed a questionnaire to understand the desires of the Portuguese users for autonomous car interior and evaluated usability of one autonomous car console.

An ecodesign approach to enhance the sustainability of novel bio-based technologies

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Ex-ante life cycle assessment (LCA) is a future-oriented approach to assess the environmental impacts of novel technologies (at early R&D stages), involving process scale-up and scenario analysis. This PhD thesis aims to develop an ecodesign approach for bio-based products and technologies at lab/pilot scale and provide recommendations for improvement. It integrates ex-ante LCA with multi-criteria decision analysis (MCDA) to incorporate other technical and (socio-)economic performances and deal with trade-offs. The main achievements of this PhD work so far are: i) the LCA-MCDA framework for biomaterials (published); ii) Life cycle industrial-scale models for several products and processes (biopolymers/nanomaterials); Broad literature review on iii) ecodesign of novel bio-based films (published) and iv) ex-ante LCA (book chapter – under review).

Thesis defended in 2025.

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Sustainable production of bioactive metabolites from octocoral symbionts

This project explores one of the most prolific sources of natural products of our planet, the microbiomes of corals, to harvest novel chemical structures with potent bioactivities of promising use in biomedicine and biotechnology. The research addresses the current realization that marine host-associated bacteria produce many of the active compounds found in their host. It aims to uncover antibacterial and antifungal activities against notorious human- and aquaculture pathogens from a unique collection of symbiotic bacteria of octocorals from Portugal. Chemical extraction protocols will be optimized, and active metabolite extracts subjected to state-of-the-art LC-MS metabolomic profiling and analytical chemistry assessments. Up to now, a comprehensive review of compounds derived from coral-derived microbes has been developed and a major coral sampling event is being planned.

Development of an optimized system for wind energy prediction in Portugal

According to APREN, in 2019, wind energy was the main source of electricity in Portugal, with a weight of 27% when compared to other national electricity sources. However, current methods of mapping the wind resource and forecasting wind production still present considerable errors, resulting in the waste of significant amounts of wind energy produced. It is crucial to develop tools that minimize these errors, contributing to the development of new wind farms and greater use of the wind energy currently produced. This project aims to develop a wind production forecasting system in Portugal that significantly reduces the errors obtained with current tools. This modelling system will be based on a mesoscale meteorological model optimized for Portugal considering its physical parameterization options according to the present atmospheric situation. As this research is a pioneer in Portugal, it is expected a strong scientific impact and political-socio-economic benefits for the country.

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Study of flexible perovskite solar cells for street furniture

Perovskite solar cells (PSCs) are seen as the next generation of power source, contributing for fostering the use of photovoltaics in urban environments. Their features offer an opportunity to conquer markets that are not attainable by silicon solar cells. Inverted PSCs are attracting increasing attention due to their easy-fabrication processes. However, the efficiencies obtained so far remain insufficient to justify the move to industrial-scale. The limitations reside in the yet to be proven long-term stability and the evidence that PSC can be produced at large-scale and low-cost. This workplan follows a research strategy that extends from fundamental research to applied technology development, including focus on stability, upscaling and cost. So far, inverted PSCs with 17% of efficiency were obtained. Substitution of the metallic back-contact with carbon-based materials is under study.

2021_

Development of an ecological thermal insulation product for a regenerative design

Global environmental awareness is leading the building industry to shift to a circular production model. Bio-based insulation is an eco-efficient alternative, stores CO_2 and has lower embodied energy, contributing to climate goals. The research work aims to develop a bio-based thermal insulation product based on *Cortaderia selloana* stems, an invasive species in Portugal. Its use has a positive impact in controlling the spread and creates a value chain for this resource. The objectives include developing prototypes of insulation panels and evaluating its thermophysical properties; and analyzing its environmental and economic life cycle performance. Until now, stems were thermophysical characterized, and more material is being manipulated to create a panel of crushed reeds. The research work expects to contribute by creating a bio-based material to be used by the building industry.

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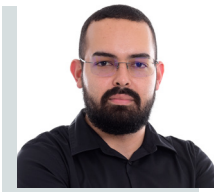

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Geosynthetics for sustainable cities: 3D models and mechanical damage

The goal of my project is to revolutionize the field of geosynthetics by enhancing our understanding of their mechanical behavior and their interaction with soil. Geosynthetics are innovative materials used in civil engineering for various applications, such as soil reinforcement, erosion control, and drainage systems. By improving our knowledge of these materials, we aim to optimize their use in geotechnical structures and construction projects, ultimately leading to safer and more efficient infrastructure development. Here are the key achievements obtained so far: i) I have conducted in-depth research in the field of numerical modeling and simulation of geosynthetics' mechanical behavior; ii) I have performed experimental campaigns to characterize the mechanical properties of geosynthetics, including their response to tension; iii) I have developed and numerically implemented constitutive models to describe the anisotropic behavior of geosynthetics. These models help us predict how geosynthetics will behave under various conditions.

A cyber-physical prototype for on-demand perfume optimal design and production

Perfume design is a complex task that normally relies on expertise from perfumers, which affects its ability to adapt to paradigm changes. Thus, a novel smart Cyber-Physical System (CPS) is proposed as an innovative solution. The main goal of this project is to build a CPS intended for on-demand optimal design and production of perfumes. The CPS will be powered by Deep Neural Network (DNN) surrogate models. All of the components together will compose a disruptive CPS with self-managing and cognitive abilities. These components will be concisely interconnected through the Internet of Things (IoT) and use Cloud Computing as engine. Some of the main achievements realized so far include the development of neural network-based surrogate models for prediction of important properties for perfume development.

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Energy and data science: evaluating the energy performance certificates of existing buildings

The problems of improving existing buildings' energy performance, reducing energy consumption, and improving indoor comfort with its many consequences are well known. Considering increasing urbanisation and climate change, governments define strategies to enhance and measure buildings' energy performance and energy efficiency. This work aims to improve buildings' energy performance and energy efficiency by using machine learning techniques to analyse energy performance certification data. This study has the following two main objectives. First, to perform automatic classification of the energy performance certification of buildings analysing energy performance certification data and second to perform automatic proposals of energy-efficient retrofitting measures to improve the energy performance of buildings whose energy performance has been classified by achieving the first objective. The main contribution is to inform private and public building sectors on achieving enhanced energy performance and predicting energy-efficient retrofit measures towards improving their energy performance.

Integration of performance indicators and digitalization for the railway assets management

This PhD project aims at developing a framework for the integration of performance indicators on a holistic and sustainable management of the railway system. These indicators are going to be defined considering the railway system reliability, safety and availability as well as the cost analysis and environmental impact. The decision-making process is going to be supported by the use of digitalization of the system.

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Wooden buildings as a strategy for carbon neutrality in Portugal

The project addresses the development of a constructive system based on prefabricated wooden panels intended for buildings and the Portuguese context. It aims to design and validate the system behaviour in structural, functional, and logistic terms. By using a renewable, carbon sink material in association with prefabrication and modular construction concepts, it is expected to provide a sustainable alternative solution to conventional materials as a tool for meeting carbon neutrality targets. Progress of Task 1: review of the state of the art on relevant topics for the development of the constructive system; Progress of Task 2: preliminary development of the constructive system panels and feasibility analysis of a 3D modular system made from the 2D panels developed; Progress on Task 3: preliminary evaluation of the structural, thermal, and acoustic behavior of the constructive system panels; Dissemination of results; Defense and approval of the Thesis Project.

Road asset management considering connected and automated vehicles

This project explores the benefits of connected and automated vehicles in transportation systems, focusing on their impact on mobility, environment, safety, and economy. It emphasizes the need for asset management processes to optimize performance, resource allocation, and risk mitigation. The study also aims to identify how road design may evolve with the adoption of automated vehicles, potentially reducing construction costs. The primary goal is to develop a methodology for managing road assets in the context of automated vehicles. At the moment, it is identified four areas that involve the link between road asset management and vehicle automation: physical infrastructure; communication and navigation; policy and legislation; and innovation. Within these areas, it is possible to better help transport managers be prepared for the vehicles of the future.

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Reducing uncertainties in groundwater modeling to forecast long-term effects of climate change on water resources.

The work focuses on determining state, pressures, and driving forces that induce water quality issues between the aquifer system of Faro (South Portugal), when forecasting the effects of climate change. This resulted already in: Participation of a monitoring campaign for the eGROUNDWATER research project; Presentation of an abstract titled "Using remote sensing and FAO methodology for the determination of irrigation water needs in a semi-arid climatic region" at the 16º Congresso da Água; Collaboration in writing scientific report titled "Report on groundwater conceptual models for case studies" (eGROUNDWATER); Poster presentation at the 2023 Annual conference of the MPP; Acquired skills in groundwater modeling; Inscription to Portuguese language course. Considering the activities carried out and those planned, it is considered that the objectives set in the work plan have been achieved.

2021_

Human acceptable artificial intelligence for ergonomics recommendation

Addressing work-related disorders (WRDs) is crucial for ensuring employee well-being and productivity. WRDs lead to reduced productivity and more sick days, resulting in increased costs for companies and society. This work aims to develop multimodal, AI-based occupational health recommendation systems that address the complexity of WRDs. The foundation for these systems is everyday smart devices to assess workplace risks and provide personalized recommendations. So far, multimodal data has been collected from 40 participants over a span of a week with a self-developed Android app. The data was processed and analyzed to generate individualized reports for workers and organizations, including data visualizations and recommendations. Currently, the dataset is prepared for publication and an open-source Python toolbox for occupational health data visualizations is being developed.

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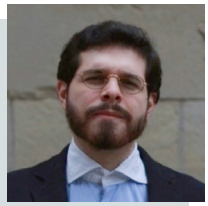
Harnessing technology to peatland landscapes & GHG in the Iberian Peninsula

Peatlands are unique ecosystems that provide key contributions to climate regulation. Over the last decades, multiple factors have accelerated peatland degradation in the Iberian Peninsula, including climate change, the spread of invasive plant species, and human-driven changes in land use and land cover (LULC). This project aims to forecast the impacts of these degradation drivers on Iberian peatlands and on the soil-atmosphere greenhouse gas fluxes. To develop task 2 and assess the LULC dynamics in the Iberian peatlands over the last 30 years, we have quantified and characterized the LULC transitions, based on a comprehensive database of peatland distribution records from the literature and fieldwork. Our main results showed that lowland littoral and sublittoral peatlands demonstrated higher susceptibility to LULC changes and must be an object of focus attention.

Which Resilience? The Agro-insurance nexus under a changing climate

Adverse impacts of climate change disrupt stable conditions globally, leading to resilience erosion. Crop systems crucial for socioeconomic development are threatened. Urgent solutions are needed to address increasing volatility. Agricultural insurance emerges as a tool for adaptation and resilience. The industry's understanding remains unclear, despite awareness of transformative impacts. Resilience-building measures often fall short, with research focusing disproportionately on small-scale farms. Large-scale and non-family industrial farms, significant in developing nations, are overlooked. Most resilience literature originates from developed countries. This thesis explores insurance's role in promoting crop system resilience, addressing specific capacities and its catalyst effect.



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The behavior of laminated glass (LG) panels under various impulsive loads

The continuously increasing use of glass in buildings as well as the higher frequency of accidental or man-induced blast events has motivated significant research effort in recent years (Zhang and Bedon (2017)). The proposed research is established in this framework and aims to contribute to the characterization of the behavior of glass façade panels subjected to blast action. The work plan addresses aspects that haven´t been tackled yet and will pave the way for the establishment of design guidance regarding blast action in glass structures, aligned with Eurocodes design philosophy. The work entails an extensive parametric analysis, based on Finite Element Models (Abaqus software) calibrated with experimental data, covering the most representative structural parameters, leading to a large enough data for statistical validation regarding the typologies and material commonly used in practice and a vast extent of blast actions.

2021_

Sustainable transition in urban water management: the contribution of urban water communities

In the context of water scarcity and climate change, water efficiency, NbS and the circular economy are key to urban water management. The effective application of these principles is crucial for the sustainability of urban water and sanitation systems in order to fulfil national and international objectives. The research aims to develop an innovative model to promote sustainable urban communities, integrating natural approaches and valuing the circularity of water. Inspired by the need for intelligent and sustainable solutions, and faced with the consequences of climate change, the model will be validated in the context of urbanisation in Portugal. Comprehensive analyses will address the sizing and management of these solutions in urban contexts, making it possible to assess the economic and environmental impact of improving existing water and sanitation networks. This research will contribute to the development of approaches that promote sustainability, equity and security in water systems and guide future public policies in the sector.

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Risk-informed transport infrastructure network management

Transportation systems have a significant impact on the sustainability of urban areas. The economic impact on budgets, travel time and distance due to climate change is evidence of this. The present thesis aims at defining a holistic framework for the risk-based management of transport infrastructure networks. To anticipate the effects of climate change and ensure that service levels and resilience remain at acceptable levels, it is necessary to consider the level of exposure to disruptive events. In addition, transportation systems are composed of different types of assets, which react differently depending on the surrounding environment. The proposed work intends to establish an alternative infrastructure risk assessment procedure by accommodating, in a single methodology, the performance of different asset types, subjected to different hazards, independently of their characteristics.

Mod City. Transmedia projects for a sustainable and playful urbanism

“Mod City” is an innovative PhD project led by Tiago Mindrico, aiming to transform urban spaces through playful experiences. The project creates community workshop frameworks (like “Cassandra”), merging digital and physical realms, to foster community engagement and sustainable urban development. Some playful speculative workshops have been held in Nairobi, Athens, and Lisbon, showcasing the tangible impact of ludic urban experiences. Tiago has also contributed to academic discourse and collaborated with the National Network for Support to Victims of Domestic Violence. As an assistant lecturer at Instituto Politécnico de Leiria, Tiago is committed to knowledge dissemination. “Mod City” pioneers transmedia projects for sustainable and playful urbanism, propelling the discourse and application of ludic interventions for an equitable and sustainable urban future.

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Integrating land management into the energy transition: spatial dynamics, challenges and policies

2022_

The energy transition from fossil to renewable sources is a worldwide strategic goal. However, land-use conflicts associated with the increase of renewable energy production sites have led to the loss of natural and semi-natural areas. In addition, there is also a concern to increase efficiency between renewable energy production and consumption sites. Therefore, this PhD project aims (i) to assess the land-use changes caused by the implementation of the renewable energy production facilities; (ii) to analyse the connection between the evolution of urban form and renewable energy consumption patterns; and (iii) to create different spatial explicit future scenarios for 2050 to identify the land-use optimization between urban form and renewable energy patterns. The results are expected to contribute to integrated spatial and energy planning policies.

Hierarchical methodology to support decision-making in infrastructure managment

In the context of ongoing climate change, awareness about transport infrastructure exposure to extreme events has been increasing. Likewise, the urgency of climate adaptation is also at the top of priorities, particularly in developed countries that have large transport networks to preserve. The main efforts conducted in the past have focused on the development of advanced models to tackle single hazards affecting one or two transport assets. While recognizing the importance of such efforts, a way to analyze several consecutive hazards affecting several assets simultaneously is still missing. Therefore, reality is actually what isn't being simulated. This thesis proposes a hierarchical methodology to create the most probable scenarios, the vulnerability of the transport assets affected by each scenario, as well as the consequences that their failure may introduce into the transport network functionality. The results will contribute to the resilience of the transport network and decision-making improvements.

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Urban stream rehabilitation for sustainable cities

Developing models to simulate the biological results of hydromorphological rehabilitation on urban streams.

Full Digital Twin: integration of open BIM IFC and facility management database.

The Industry 4.0 revolution has grown the necessity of the Facility Management (FM) discipline to deal with data from diverse sources, including real-time ones. Building Information Modelling (BIM) implementation in FM has arisen in this context. The use of BIM models to integrate real-time data is equivalent to the concept of Digital Twins (DT). Therefore, the Digital Twin (DT) technology can significantly support the FM sector. In this circumstance, practitioners of the FM sector need guidance on implementing an efficient integrated management system necessary for the current industry demands. Currently, through a partnership with a Portuguese city hall, the researcher is developing a web management platform that integrates visualization features and their existing FM management platform. This case study works as a smaller-scale sample of the final results intended for the project.

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Data-driven sustainability assessment for affordable housing in Portugal

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The urge of reverting climate change has made sustainability assessment a mandatory requirement within the AEC industry. The adoption of sustainable parameters by housing design becomes inevitable. However, in affordable housing, the investment in sustainability is quite restricted due to the highly constrained budget limitations. Furthermore, Lifecycle assessment (LCA) adds difficulties to many conceptual aspects of affordable housing because by definition it considers sustainability over the entire lifecycle of the building (from construction to operation, maintenance, demolition, and materials reuse or recycling). Digitalization in the AEC industry and the use of the data in digital format creates opportunities for collection and analysis of data that may help LCA and provide information on which solutions provide better sustainability performance, hence guiding design towards more optimized solutions. This research aims at using Data-driven techniques including machine learning and based on BIM models develop tools for optimizing design decisions that improve LCA results.

2022_

Marine microplastics identification and quantification through a microfluidic photoacoustic autonomous sensor

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Comsol Simulation Tests sought to validate the photoacoustic principle but were unsuccessful. Further study deemed the photoacoustic phenomenon impractical for determining polymer types. Throughout the year, key activities included literature review on spectroscopic methods. Raman tests on pellets and beach litter, ATR tests and Transmission/reflection tests were undertaken on thin films. A sophisticated system of ratios at four wavelengths was constructed to discern plastics in transmission mode. The prototype based on transmission/reflection, focusing on ratios between wavelengths with higher NIR radiation absorption, only differentiated two plastic types, resulting in abandonment. UV fluorescence tests assessed a UV Raman prototype's feasibility. Challenges and equipment availability issues caused about 5 months of delays. Consequently, the resolution approach shifted towards the UV Raman phenomenon.

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Ecodesign of plastic products: a novel approach and applications

This research project aims to develop a novel ecodesign approach using applications from the plastic industry to improve their life-cycle performance. The project involves exploring different ecodesign strategies, such as incorporating alternative materials. The ecodesign approach will integrate methodologies, such as Life Cycle Assessment & Costing, with Multi-Criteria Decision Analysis and Uncertainty analysis. The main milestone of this project has been to conclude the Life Cycle Assessment & Costing of three plastic applications (nutraceutical bottle, car interior door handle and carrier frame for instrument cluster) in partnership with industries in Portugal. The Stochastic Multi-Attribute Analysis is being explored to compare the environmental and other criteria and evaluate different weighting preferences (or decision makers with conflicting priorities).

Nature-based Solutions for coastal defence

Coastal areas are complex environments challenged regarding its resilience. Coastlines have mostly been protected by hard structures, yet these lead to sedimentary imbalance, hence the increased popularity of Nature-based Solutions (NBS). This work studies the implementation of oyster reefs in Ria Formosa (RF), in combination with the restoration of the existing ecosystems (dunes and marsh) – to dissipate wave energy and erosion, while providing additional co-benefits (e.g. water quality improvement). The research is divided into 3 tasks: 1. Literature review of NBS for coastal protection and associated co-benefits (ending); 2. RF-area stakeholder engagement workshops to assess their perception and preference of different NBS for coastal using a multicriteria analysis (starting: jan24); 3. Cost-benefit analysis to determine the most cost-efficient and sustainable coastal protection alternative.

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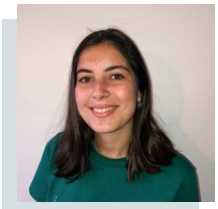
Bottom-up mobilization: the role of social movements in sustainable mobility transitions

To address climate change, many global cities and international organisations aim to accelerate the transition towards sustainability. Mobility is often cited as a crucial element in achieving this goal. Practice, cultural, and structural changes are necessary to transition successfully through different phases. This study draws on two theoretical and practical frameworks for analysing sustainable transitions: the multilevel perspective (MLP) and socio-practice theory (SPT). This academic research field has mainly focused on state and market actors, neglecting the potential role of social movements in mobility transitions. Public participation is often considered a crucial factor for sustainability transitions. Therefore, this research analyses the role of social movements in sustainable transitions in urban mobility, specifically the starter cycling cities in the global North and South.

2022_

Urban spatial data analysis: towards safe, inclusive, and sustainable spaces

Commonly, cities are organized into areas with different socio-economic dynamics. Understanding these dynamics is of main interest to promote urban livability and sustainability. This research aims to model and understand the urban dynamics, identifying how space is used and if there are potentially isolated zones. We collected semantic information on the different areas, including socio-economic behavior and Points of Interest (POIs). Mobile phone data was also collected to perceive dynamics and recognize the population's mobility and homophily patterns (home, work, and other meaningful places are being identified). The areas were characterized in terms of POIs/services and socio-economic information will be added to complement this characterization. Next, we will analyze areas and groups of individuals, identify similar dynamics, cross this information, and analyze space and patterns.



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Prefabricated wood system for sustainable renovation of RC building envelopes

With the goal of reducing CO_2 emissions and making buildings more sustainable and energy efficient, this project aims to develop a prefabricated wood-based system to optimize the rehabilitation of reinforced concrete (RC) buildings, contributing to a more resilient and eco-friendly built environment. The primary objective is to create a new exterior envelope, that improves energy efficiency and structural safety, while incorporating new spaces and uses into the interior of the dwellings. Main achievements include the characterization of post-1960s RC structures by assessing perceptual and physical characteristics, and anomalies of several case studies. This achievement is significant as it helps us understand the physical requirements of these buildings and the residents' needs, ensuring that the prefabricated system enhances both buildings' performance and residents' quality of life.

Technological contributions to patellofemoral instability management

This Ph.D. aims to develop a set of clinical decision support tools for the diagnosis and treatment of patellofemoral instability (PI): (i) a diagnostic system for fully automated PI indexes estimation; (ii) a computer-assisted orthopaedic surgery system addressing PI related surgical interventions; (iii) a mixed reality-based module for surgical navigation and non-invasive techniques for registration procedure. So far, I developed and presented the Thesis Project in Biomedical Engineering, a component of the Doctoral Programme, obtaining a grade of 19. Two revisions were also accomplished, one of which was recently submitted to a journal. Concerning diagnosis, a dataset of knee medical images was gathered and labelled for later use in deep learning algorithms for automatic PI diagnosis. The planning of one of the surgeries to correct the pathology has also begun, in a customised way for each patient.

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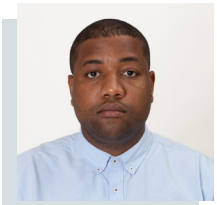

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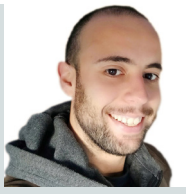
Heat transfer enhancement of thermal solar systems

Solar thermal energy systems have been considered a promising solution to achieve carbon neutrality by 2050. Concentration Solar Power (CSP) is recognized as a renewable energy technology that can make a sounder contribution to the transformation of the energy sector since it captures the sun radiation in the form of heat, which can be used to produce electricity, steam, and serve other purposes in industry. From the different CSP technologies, the parabolic dish solar concentrator (PDSC) is considered one of the most promising solutions since it can be applied in several applications from the electricity production to the cooking, desalination, and irrigation. This versatility makes PDSC suitable to be implemented in regions in which the access to electricity is very scarce, improving the quality of life of rural population. This system composed of a solar concentrator, solar receiver, heat exchange fluid, and the solar tracking system.

Materials, design and biomechanics for a safer micromobility

This project comes in line with the research on the development of new liners for lightweight energy absorption systems, eco-friendly materials and biomechanics of brain injuries. Following the guidelines of UN2030 goals, it aims to provide enhancements in the domains of biomechanical injury assessment, propose and validate new design solutions for helmets focusing on the requirements of urban commuters resorting to micro-mobility transport solutions. Experimental campaigns have been done to test liners based on cork agglomerates and shear thickening fluids, and a numerical framework developed with the most promising solutions. After good preliminary results from the finite element analysis, a product design is being carried out to apply these materials into a convenient, practical and sustainable helmet. The first proof of concept was made and tested for impacts, with promising results.



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Hybrid and distributed guidance and control for cooperative On-Orbit Servicing

An ever-increasing number of satellites is being deployed each year, which negatively impacts the lifetime of satellites, as more debris is created and collisions occur, rendering the systems inoperative and further worsening the problem. On-Orbit Servicing (OOS) is the key to solving this issue and enabling a sustainable growth in the number of satellites. This work aims to explore hybrid and distributed approaches to allocation, guidance, and control of satellites for cooperative OOS missions. We will investigate how innovative sensors can help in estimating the motion of inoperative satellites, study formation planning strategies for multi-agent systems of satellites and develop hybrid model-based control techniques to achieve the OOS mission objectives.

Causal neural networks prediction for automated driving systems

To this date, several Tasks identified in the Workplan were completed. Starting with Task 2, called Autonomous Driving Simulation and Scenario Generation. To this end, the CARLA open source software was used and it was integrated with other software tools, such as the Apollo Open Autonomous Driving Platform and SUMO software (Simulation of Urban MObility), which allows general driving scenarios to be managed. In parallel with Task 2, Task 1 Reinforcement Learning in architectures with explainability was carried out, to properly integrate the algorithms under study in the simulation environment mentioned. Currently, there is a reassessment of the Work Plan being carried out on the works, as well as Literature Reviews being written for subsequent publication, concurrent with the rest of the tasks being carried out.

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Increasing urban resilience through a Productive Urban Green Infrastructure in Great Porto

This research addresses urban challenges intensified by climate change and the Covid-19 pandemic, urging strategies for resilience. Despite the increasing demand for urban agriculture (UA) in Europe, integration into planning is limited. The research aims to develop a planning methodology, proposing a network of multifunctional green spaces with UA, termed Productive Urban Green Infrastructures (PUGI), adapted from existing plans. Through public and municipal engagement, it aims to gauge acceptance, focusing on the Metropolitan Area of Porto. Prototypes and design guidelines will be developed, assessing the contribution of PUGI to urban resilience via an indicator system. The initial and current stage involves a literature review on concepts and case studies for designing UA and a survey mapping UA in Portugal

Strategies for smart ecosystems restoration and oceans sustainability

This project is focused on developing biomimetic marine structures that support marine ecosystem restoration, coastal protection, renewable energy production or monitoring of ocean and geological dynamic systems. This approach is based on the use of cement-based composite especially made for the marine environment and with smart properties. The study includes the development and characterization of a structure prototype made of this smart material, and the study of the new paradigms, and approaches that this innovation could enable, in the context of global changes. Due to its high-level characteristics, these strategies are expected to serve as future climate adaptation alternatives, providing various benefits, essentially, for ocean biodiversity, climate regulation, coastal protection and renewable energy production.

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Monitoring maintenance management system for an infrastructure implementing MEMS sensor and novel BIM methodology

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Assessing and predicting structural health is one of the most important aspects of an infrastructure's life cycle. The devices that are used in the modern era have enabled us to predict the future of the structure using various monitoring techniques and also various maintenance and management methodologies to prolong the life span of the structure and to have a healthy structure to be utilized by the user. The most contemporary system for monitoring with low installation and maintenance cost with high reliability is Micro-Electro-Mechanical Systems (MEMS) technology and Internet of Things network using LTE (4G Long Term Evolution). The management aspect can be developed using computerized systems such as Building Information Modelling (BIM) that help in the planning, designing, implementation and maintenance of the building. Present research work will use open source software and a standard file transfer data format to transfer information.

Deep-sea acustic transducers development

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Acoustic technology has the potential to develop new methods for underwater communications, and soundscape. Specifically, this project proposes solutions using piezoelectric transducers to be implemented in artificial reefs, autonomous probes, ROVs, or underwater optical cables, empowering these systems with deep-sea communications, geopositioning and soundscape. Activities conducted this year included reviewing hydrophone technology and underwater signal transmission, studying literature on underwater acoustic phenomena and piezoelectricity, and outlining requirements for developing hydrophones, categorized into transmitters and receivers. Simulations using Comsol were initiated to model piezoelectric materials. Additionally, modifications were made to sensors, such as perfecting a salinity sensor and creating a wave sensor to measure dynamic water pressure caused by surface waves.

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Telework frequency and its effects on travel behavior in the post-COVID-19 era

Mandatory telework was one of the social distancing measures adopted during the COVID-19 pandemic. This resulted in changes in travel patterns. Telework effects on travel patterns are still contentious. Telework could change travel behavior and location patterns and increase sprawl. This work aims to study the impacts of telework on travel behavior. A Structural Equation Model was estimated using data collected in 2021 from three metropolitan areas, Lisbon (LMA), Istanbul, and Porto Alegre Metropolitan Areas, aimed at studying telework effects on weekly trips by transport mode, resulting in a paper submitted to Transportation Research Part A. Previously a qualitative analysis based on interviews made in the LMA was submitted to the Journal of Transport Geography. The next step will evaluate telework effects on travel patterns using data collected in the LMA during 2023.

Thesis defended in 2025.

2022_

I4F Intelligent Fish Farming for Future

Weight dispersion is a problem that affects all phases of the aquaculture production cycle. It leads to losses due to opportunistic diseases and reduces revenue at sale. To minimize such problems, farmers regularly sort their fish stock. This is costly because it requires equipment, is labor-intensive and causes stress for the fish. The Fish Farming for Future project aims to develop a breakthrough and innovative machine learning-based platform that can predict weight distribution during the growth cycle based on rearing conditions (temperature, salinity, dissolved oxygen) to plan and determine optimized feeding and grading cycles that reduce costs, increase product quality and price, reduce risks, improve animal welfare, and reduce ecological impact. This is a breakthrough technology to improve aquaculture productivity, enhance sustainability and reduce the environmental footprint.

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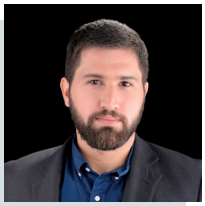

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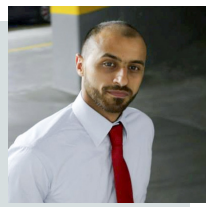
Vulnerability assessment of masonry arch bridges due to flood events

Masonry arch bridges (MABs) are crucial to Europe's infrastructure but face increasing vulnerability to extreme weather, notably floods intensified by climate change. This project pioneers a risk-informed management framework to assess and enhance MAB performance during and after flood events, optimizing resource allocation for long-term preservation. The main achievements include a comprehensive State of Art Review on flood and structural modelling. Through Finite Element Method (FEM) and Discrete Macro-Element Method (DMEM) analyses, Engineering Demand Parameters (EDPs) were quantified. Sensitivity analyses identified key structural parameters.

Towards national implementation of BIM object data rules and compliance checking

Building Information Modelling (BIM) objects are at the heart of the transition of the Architecture, Engineering and Construction industry toward digitalization. BIM object creators are expected to comply with BIM object standards, taking into account compliance to Construction Product Regulations, standardization and interoperability requirements. This heavy task is limiting the widespread worldwide adoption of BIM processes. This work addresses this issue by (i) applying a systemized approach for clarifying the data needs of BIM objects for stakeholders using the definitions of Product Data Templates(PDT) and the Level of Information Need, (ii) creating a tool for the automation of the process of verifying if BIM objects are compliant to the latest standards and regulations, and (iii) implementing an open-source PDT query platform for the industry.



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Color-based road nanosensors based on thermochromic and self-cleaning abilities

Materials Science has been employed in the domain of road engineering to confer new capabilities and advantages for the environment and society. The objective of this doctoral project is to develop smart road marking endowed with thermochromic and self-cleaning capabilities, aiming to enhance road safety and extend the service life of these elements. To date, efforts have been dedicated to the literature review and the development of smart road markings, with an emphasis on self-cleaning capability. As a result of these endeavours, scientific publications, participation in scientific events, and awards have been achieved.

2022_

Anomaly detection models to improve the sustainability of water companies

The increase in data from the diversity of computing devices at our disposal is a precious element for extracting knowledge. In this work, I have been applying Machine Learning techniques in the context of anomaly detection and predictive models for time series problems to improve sustainability and decision-making in Wastewater Treatment Plants (WWTPs). Throughout this year, my work has focused on collecting and treating water from different sectors of several WWTPs, particularly in the analytical and energy control sectors, in addition to the flow of water that reaches these facilities. Furthermore, I have applied anomaly detection models, particularly for analytical control substances, and predictive models in the energy consumption and flow sector. As these infrastructures are part of our society, optimizing their sustainability will develop more sustainable cities for our community.

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Nature-inspired micro reinforcement of coarse granular aggregates

My PhD project aims to develop understanding of the micromechanics of micro-reinforced coarse granular materials, used, for example, as a road base or railway ballast. Through fundamental experimental studies centred on element testing of scaled and full-size materials in loading paths representative of traffic conditions, the form of the micro-reinforcement will be optimised to increase its effectiveness. Until this moment, 1st year of 4, packing test, that easily validate the effectiveness of the reinforcement shape were performed. A statistical framework to compared different sized specimens were developed. The resulting understanding of how different micro-reinforcements interact with grains will be used to develop analytical models which will be used to further optimise the form of the micro-reinforcing elements (at industrial scale) and inform future design guidance.

Autonomous agents for job shop scheduling optimization

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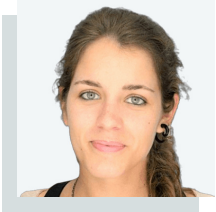
MAG-NET: an advanced framework for distributed plantwide process monitoring

The research introduces the MAG-NET (Multilevel and Multiscale Aggregation of Causal Networks) framework designed for statistical process monitoring within complex industrial systems. Grounded in causality, MAG-NET intends to effectively discern primary fault origins, facilitating fault diagnosis tasks. Furthermore, the framework streamlines variable aggregation and leverages multiscale analysis methodologies to pinpoint pertinent time scales for fault identification and prognosis of system degradation. Key achievements include inferring the causal network of the system, performing the functional decomposition of the network, and integrating it into fault detection and diagnosis. These accomplishments led to improved performance in detecting low-magnitude faults and conclusively diagnosing them.

2022_

AI applied to Earth observations of the Arctic Sea ice melt ponds

The project main goal is to enhance the understanding and information retrieval of the seasonal formation of melt ponds on the Arctic Sea ice. Melt ponds have a great importance in the context of climate change and Arctic energy budget. They lower sea ice albedo (fraction of incident radiation that is reflected by the surface) contributing to further ice melt. However, information on these features is currently very scarce. To tackle this issue, this research aims at using a combination of differente types of satellite sensors (namely Synthetic Aperture Radar and optical) and Artificial Intelligence (AI) methods, to help generate new, timely and more accurate information on these Arctic sea ice features.



Sara Aparício
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2022_

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Addressing material efficiency in building renovation scenarios: a BIM-based decision support tool

The construction industry faces a significant increase in renovation processes, which are still inefficient in time, cost, and material. High-performance renovations can significantly reduce a building's operational and embodied environmental impact. However, as Designers adopt the BIM methodology, they lack computational tools and data crucial for supporting life cycle analysis and circular economy goals. This research supports informed decision-making in building renovation during early design. Specific goals include defining criteria that guide informed decisions, developing BIM-based tools to identify optimal design scenarios, and optimising these tools through AI techniques. Expected outcomes are enhanced BIM-based methodology streamlining the identification of optimal renovation scenarios and a database featuring the environmental characterisation of various renovation scenarios.

Influence of masonry pattern on the out-of-plane behaviour of masonry structures

Historic masonry structures (HMS) are often constituted by the assemblage of blocks with variable dimensions engendering complex arrangements. Furthermore, cross-sections' walls are sometimes made by more leaves, connected through the thickness in a more or less efficient way such that the real out-of-plane (OOP) behaviour is difficult to predict. Such geometrical uncertainties suggest investigations based on probabilistic approaches where masonry patterns are characterised by certain statistical variations. Through this PhD thesis the influence of masonry arrangements on the structural behaviour of HMS is investigated. At first, masonry pattern generators were developed to create random patterns and subsequently investigated. Afterwards, advanced numerical models based on the discrete element method (DEM) are adopted to perform parametric and sensitivity analyses aiming to develop easy-to-use analytical tools and provide useful guidelines for researchers and practitioners.

Thesis defended in 2025.

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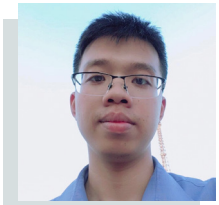
Advanced MOF-based materials towards dual carbon dioxide capture and conversion

My main goal is to develop porous Metal-Organic Frameworks (MOF)-based platforms to capture and convert CO_2 in added-value chemical products, such as cyclic carbonates, with applicability in the pharmaceutical industry. A series of defect-engineered porous MOFs was prepared by introducing linker and/or metal center deficiencies, under ambient conditions. Different strategies were followed to obtain materials with distinct crystallinity. The synthesized materials are mainly based on UiO-66, MOF-808, MOF-818, MOF-74 and ZIF-8 structures. The silica SBA-16 and zeolite ZSM-5 were synthesized to prepare MOF-hybrid composites. Structural characterization of all the materials was carried by FTIR, powder XRD and SEM/EDS. In the following year, we hope to start preliminary catalytic studies of CO_2 conversion to evaluate the catalytic performance of the materials, close to ambient conditions.

2022_

The digital twin of critical infrastructures for developing sustainable cities

Digital twin (DT) is one of the most modern and promising technologies in realizing smart manufacturing and implementing Industry 4.0, DT offers an opportunity to integrate the physical world with the digital world with a seamless data source. DT technology has the potential to transform and improve the exploitation and management of infrastructure in civil engineering. Based on DT model, managers and maintenance operators can test different scenarios, improve efficiency, and make accurate decisions in maintenance of the structure, leading to reduction of management and other regular monitoring costs, as well as accurate prediction of risks in the service phase. This research focuses on building a digital twinning model for the continuous structural health monitoring of critical infrastructure in the service phase.



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2022_

Modelling and optimization for sustainable INCONEL machining processes

Ni alloys, particularly INCONEL alloys, present very low machinability, making them a popular subject for machining studies. Generally, using high amounts of cutting fluid is needed to machine INCONEL alloys, however, the use of these coolants is extremely hazardous for the environment and worker safety, while increasing the overall process cost. To minimize these issues, many solutions can be adopted, such as the use of coated tools, lubrication techniques or even by trying to optimize the process itself. In this work, different sustainable INCONEL machining techniques will be tested, evaluating tool-wear, process vibrations and cutting forces, as well as the machined surface integrety of the workpiece material. Data obtained from these tests will be used to develop and validate process optimization models, with a focus on improving the process's sustainability while retaining good production quality, as well as predicting tool-wear and produced surface quality.

Vítor Sousa

Portuguese

–

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Electricity everywhere in the ocean through wave energy self-powered buoys

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–
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2023_

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Quantitative modelling of the ocean with acoustic waves

Seismic oceanography has proven its value to imaging the ocean in high-resolution using conventional multichannel reflection seismic data (MCS). The recorded acoustic responses depend on contrasts in ocean temperature and salinity. The processed data enable tracking interfaces between thermohaline layers and the study of fine-scale processes spatially. However, their interpretation has been focused on qualitative methods, and integration with dynamic ocean models is still unexplored. In this PhD, I will develop and implement methods to predict spatially ocean temperature and salinity through the integration of MCS data with direct observations (e.g., CTD, ARGO) in a spatial data science framework. These methods will be applied to existing data from Gulf of Cadiz. As a complementary and exploratory approach, and since MCS data acquisition is complex and expensive, I will look at using high resolution echosounders mounted in autonomous underwater vehicles to model in real-time the ocean.

2023_

Crop-watershed modelling of future agricultural water availability in Portugal

Although climate change impacts on agricultural crops in Portugal have already been extensively studied, research is still lacking on water availability for agriculture, as well as on its irrigation demands, under a climate change future. Therefore, the goal of my PhD project is to predict the future crop irrigation needs and agricultural water availability in Portuguese watersheds, using a coupled crop-watershed modelling system forced by state-of-the-art regional climate data. The outcomes of my research will be used to define climate change adaption strategies for the agricultural sector, that will be made available to farmers and other agriculture professionals through a web-based platform.

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Impact of climate change-driven wildfires on the life cycle of wood materials

Life cycle assessment (LCA) is an approach that can support decision-makers in implementing efficient solutions for the construction industry and reducing carbon emissions. Recently, wood has gained popularity as a sustainable alternative material. However, most LCA studies of wood materials currently rely on old studies, not accounting for the dynamic of forests and the effects of climate change, like wildfires, on the carbon cycle. The Mediterranean region has always been prone to Wildfires, constituting a significant source of carbon emissions, and climate change exacerbates this problem by drastically increasing the frequency, intensity, and duration. Therefore, this study aims to analyze the effects of wildfires on the carbon cycle of forests for the current and future climate change scenarios and to assess the effects of it on the built environment. Finally, the goal of this project is to develop a dynamic LCA of wood-based products considering the effects of climate change on Southern Europe, using Portugal as a case study.

Methodologies and tools for BIM-based calculation of the Whole Life Cycle Assessment emissions of NZEBs

The European Architecture, Engineering, and Construction (AEC) sector is currently undergoing a smart transformation, driven by the increased use of Building Information Modelling (BIM). This is particularly crucial today, as buildings need to present Net Zero Emissions (Net-ZEBs) during their whole life cycle, and BIM is an essential tool for the construction industry to improve the information flow. This project will develop a BIM-enabled LCA method that can facilitate low-carbon design under the transition for a smart AEC in Portugal. The findings of this project contribute to the achievement of UN Sustainable Development Goals related to sustainable cities and climate action targets, and the goal of reducing carbon emissions in the AEC sector.

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2023_

Supporting the development of climate smart marine spatial planning in Portugal

Marine spatial planning (MSP) has become the prime focus for many policy-makers, being considered an important tool for promoting a better management of the oceans, through spatial and temporal planning of different maritime activities. Among the many threats faced in MSP development, climate change is considered to be one of the biggest. The intensification of climate-related impacts will continue to cause numerous problems to marine ecosystem services and depending human activities, thus affecting the development of a sustainable blue economy. Developing climate-smart marine spatial plans that properly integrate knowledge on climate risks and opportunities is fundamental. Hence, the main objective of the present proposal is to support such integration of knowledge by exploring the Portuguese case study to assess the vulnerability of national MSP initiatives and the blue economy to climate change.

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The role of large-scale patterns in climate extremes in a changing climate

Extreme weather and climate events occur in complex dynamic conditions. Understanding the role of large-scale patterns in these extreme events is paramount to increase our knowledge on their impacts and future evolution in the context of climate change. In this context, this PhD work aims at studying large quasi-stationary areas of high atmospheric pressure, or atmospheric blockings, which are known for their links to temperature extremes, as well as the induction of dry or wet areas in the mid-latitudes by affecting the tracks of cyclones. Methodologically, this PhD aims at introducing machine learning in the identification and classification of these blockings as well as in the association with extreme weather. Furthermore, this study aims at assessing the past and future changes in the evolution of these large-scale events through the use of state-of-the-art paleo and climate models, respectively.

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Towards climate change mitigation by sustainable wire-arc additive manufacturing

Wire-Arc Additive Manufacturing (WAAM) is an emerging additive manufacturing (AM) process that uses wire as the feed-stock and an electric arc to melt it. WAAM has a promising sustainability potential due to its better material efficiency, higher build rates, and low cost. However, research on its sustainability from a Triple-Bottom-Line perspective i.e., environmental, economic, and social impacts is still new. This PhD plan proposes to evaluate the WAAMÂ´s environmental, economic, and social sustainability using Life Cycle Assessment (LCA), Life Cycle Costing (LCC), and Social Life Cycle Assessment (S-LCA) methodologies, respectively. Based on these assessments, process parameters, variables, and production scenarios ensuring sustainable production by WAAM will be recommended. Furthermore, an online platform will be created to quickly calculate and compare the environmental, economic, and social impacts of WAAM and other manufacturing processes to select the most sustainable approach.

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07

Events, Networking Activities & Outreach

During 2025, MPP continued to foster meaningful opportunities, each designed to create a positive impact on our community. These included the first edition of the Innovation Workshop reunion in Lisbon; the sixth edition of the Innovation Workshop at MIT; the fifth edition of the Marine Robotics Summer School at Azores; and other network and outreach activities, including "Encontro Ciência 2025.

A few highlights from 2025 can be found below:

JANUARY_

MIT Portugal Innovation Workshop - The Reunion

January 17, FLAD - Lisbon

Figure 5. Innovation Workshop - The Reunion at FLAD

The first edition of the Innovation Workshop reunion was held at Luso-American Development Foundation (FLAD) , in Lisbon on Jan. 17, 2025. The event was attended by 34 participants.

This reunion brought together five cohorts of participants from 2016 to 2024 who had previously participated in the Innovation Workshop, creating an afternoon full of exchange, inspiration, and celebration of accomplishments.

This first reunion provided attendees with a valuable opportunity to reconnect, share their progress and accomplishments, and explore potential collaborations. Many of the participants have taken bold steps in their personal and professional careers: some have founded their own companies, others have established themselves as successful professionals in their fields and, most excitingly, some have returned to their studies to expand their horizons even further.

"I believe this reunion was important to uplift the sense of belonging within the community, particularly between the different cohorts of the program," said one participant. "Networking and brainstorming are vital for the community's knowledge exchange and future impact," said another.

The event was hosted by Christina Chase (co-founder and managing director of the MIT Sports Lab, and the workshop's leading instructor), Doug Hart (Co-Director, MIT Portugal Program, professor of mechanical engineering) and Nuno Arantes-Oliveira (adjunct professor at NOVA School of Business and Economics (NOVA-SBE)). The keynote speaker was Paulo Dimas, VP of product innovation at Unbabel and chief executive at Center for Responsible AI. The reunion also included a Q&A with Innovation Workshop Alumni Carlos Henriques (2016 cohort) and Pedro Fraga (2019 cohort), and a networking reception.

JUNE_

Innovation Workshop

June 9-13, MIT

Figure 6. 2025 Innovation Workshop Students

This MPP workshop is a hands-on program designed to expose participants to critical elements of venture creation and the potential commercialization of high-impact research and technologies.

The workshop took place June 9–13 on the MIT campus. It included seminars by MIT and Portuguese innovators, entrepreneurs, and visionaries who have gone through the process of commercialization. It was hosted by Christina Chase (co-founder and managing director of the MIT Sports Lab) and Doug Hart (Co-Director, MIT Portugal Program, professor of mechanical engineering). It included talks by renowned guests such as Dava Newman (director of the MIT Media Lab, and Apollo Program Professor of Astronautics), Marina Hatsopoulos (entrepreneur and writer), Gary Schall (lawyer and co-chair, Emerging Company and Venture Capital Practice), Melissa Pickering (senior director of consumer product management at Bose), Elaine

Chen (Cummings Professor of the Practice in Entrepreneurship and director of the Derby Entrepreneurship Center at Tufts University), Sorin Grama (co-founder and CEO of Transaera), Dip Patel (CTO of Soluna).Mentors included Pedro Rocha Vieira (co-founder and global CEO of Beta-i) and Nuno Arantes-Oliveira (adjunct professor at NOVA-SBE).

Participants also had an opportunity to connect with the Lisbon MBA fellows and attend a Portuguese American Postgraduate Society networking event that included a talk by Ricardo Perdigao Henriques, managing partner and co-founder of the Biovance Capital.

90
Student applications

35
Selected applicants

7 *Nationalities*

(Portuguese, Brazilian, Dutch, Indian, Italian, Lebanese, Mexican)

The call for MIT Portugal Innovation Workshop 2025 resulted in 90 applications, and 35 students and researchers from Portuguese institutions were selected to attend. Participants came from various Portuguese institutions, including the University of Lisbon, University of Coimbra, University of Porto, University of Aveiro, University of Minho, NOVA University Lisbon, and Nova School of Business and Economics, CIIMAR, Instituto Superior Técnico (IST), Gulbenkian Institute for Molecular Medicine, NOVA School of Science and Technology, Polytechnic University of Lisbon, INL - International Iberian Nanotechnology Laboratory, ITQB Nova, Iscte - University Institute of Lisbon, and INESC-ID.

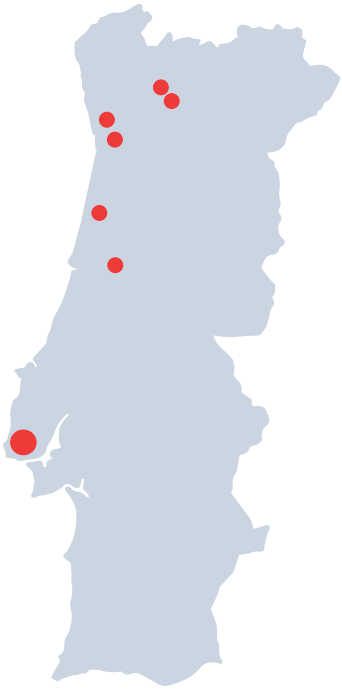


Figure 7. Facts and figures of the 2025 Innovation Workshop, illustraded above

"Attending the MIT Innovation Workshop was a truly unique and transformative experience. It exposed me to new perspectives and changed the way I think about the relationship between academia and real-world impact, particularly the commercialization and practical application of knowledge. The insights I gained about entrepreneurship, innovation, and problem-solving are lessons I will carry with me for the rest of my life. I am also deeply grateful for the incredible team behind the workshop, whose kindness, support, and dedication made the entire experience even more meaningful."

– Mohamad El Sibaii, University of Minho

Figure 8. Mohamad El Sibaii, 2025 Innovation Workshop Student

Encontro Ciência 2025

July 9, Carcavelos - NOVA SBE Campus

MPP, along with the CMU Portugal Program and UT Austin Portugal Program, hosted the "FCT's Partnerships with U.S. Universities: Shaping the Future through Impactful Science" session at the "2025 Encontro Ciência" Summit on July 9. The 90-minute session offered an opportunity to unveil the next chapter of the three programs while reflecting on the legacy they have built over nearly two decades.

The session was structured in two main parts. In the first, attendees were introduced to the core features of the Phase 4 Partnerships by Portuguese Minister of Education, Science and Innovation Fernado Alexandre and Secretary of State for Science and Innovation Helena Canhão. The second part consisted of a panel of invited speakers with diverse forms of engagement in the partnerships. Through their testimonials, they highlighted the distinctive value of these collaborative frameworks and their contribution to advancing science, capacity-building, and promoting entrepreneurship in Portugal.

Representing MPP, **John Hansman** (MPP Co-Director at MIT) served as moderator, and **Hélder Silva** (Principal Investigator of the MPP flagship project AEROS) participated as a guest speaker.

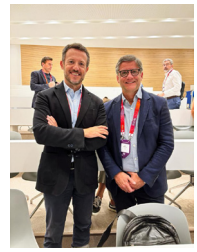


Figure 9. Speakers of the International Partnerships Session at Ciência 2025

JULY_

5th Marine Robotics Summer School

July 7-18, Faial - Azores

For two weeks, attendees acquired expertise in marine robotics and oceanography — more specifically, in applications for ocean observation and ecosystem mapping.

Figure 10. Students and some instructors of the Marine Robotics Summer School, in the Azores, in July 2025

The lecturers included Doug Hart (MIT), Francisco Campuzano (CoLAB +ATLANTIC), Gui M. Menezes (OKEANOS - University of Azores), João Tasso (LSTS-FEUP), Renato Mendes (CoLAB +ATLANTIC and LSTS-FEUP), Alexandra Moutinho (Técnico - U Lisboa), Charlene Xia (MIT), Clara Ribeiro (Flanders Marine Institute), Marco Dutra (Azores School of the Sea), Rui Guedes (Azores School of the Sea), Jorge Fontes (University of Azores), João Balsa (Azores Deep-Sea Research Group), and Rui Prieto (OKEANOS - University of Azores).

This summer school was jointly organized by MPP, Instituto de Investigação em Ciências do Mar – OKEANOS, University of Azores, LSTS – Underwater Systems and Technology Laboratory, Faculty of Engineering of University of Porto (FEUP), and CoLab +ATLANTIC. The partner entities for this edition were School of the Sea of the Azores (EMA), Instituto do Mar, Gaspar Frutuoso Foundation, the Portuguese Navy, Técnico ULisboa, and FCT. The sponsors were the Regional Government of Azores and FLAD.

"The Marine Robotics program shaped me in so many different ways. I got to use my mechanical engineering skills in a new field while also deepening my knowledge of robotics, especially through hands-on work with design, prototyping, and testing. I met so many passionate people who love the ocean as much as I do, and built great connections with both students and staff. Working with people from different backgrounds, like electrical engineers and marine biologists, helped me improve my communication and teamwork skills. It also opened my eyes to how much we've already explored in the ocean, and how much more there still is to discover and protect. And having this program in Faial gives it something extra special, it's one of those places you visit and think, "I could see myself living here."

– Nada Aiouche, Massachusetts Institute of Technology (MIT)

Figure 11. Nada Aiouche, Marine Robotics Summer School 2025

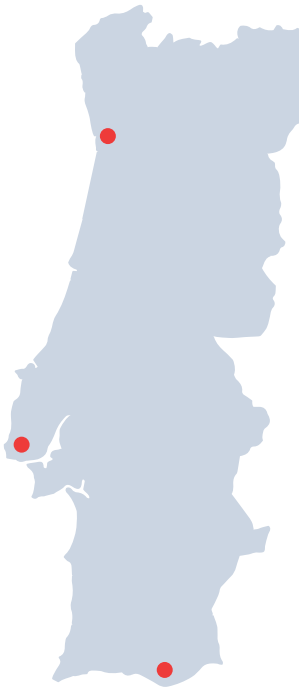
Figure 12. Ian Lindberg, Marine Robotics Summer School 2025

"My experience at the MIT Portugal Marine Robotics Summer School can be described as nothing short of exceptional. Having the opportunity to work collaboratively in small groups with students in both marine sciences and engineering from MIT as well as Portuguese universities facilitated an incredible environment for innovation and creative problem solving. The lectures delivered by subject matter experts in marine robotics and marine sciences were engaging and provided valuable and pertinent information to all students regardless of their educational background. In addition to the ROV project and knowledge gained itself, the experience of being in Faial and interacting with the local community rounded off an incredible two weeks which amounted to a truly unforgettable time with many lasting connections made."

– Ian Lindberg, Massachusetts Institute of Technology (MIT)

115
Student applications

28
Selected Grad students in Engineering and Science fields



10 *Nationalities*

(Portuguese; American; Argentine; French; German; Italian; Moroccan; Norwegian; Spanish; Swiss)

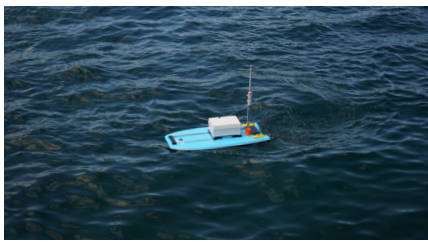
12 *Students from MIT, of which 6 female and 6 male*

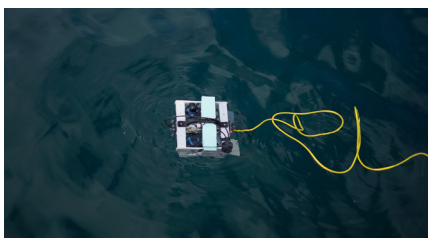
12 *Students from Portuguese universities, of which 7 female and 5 male:*

University of the Azores; University of Algarve; Faculty of Engineering University of Porto; Instituto Superior Técnico (IST); University of Madeira (represented as red dots in the map)

4 *Students from Portuguese Navy, of which 4 male*

Figure 13. Facts, photos and figures of the 2025 Marine Robotics Summer School, illustraded above

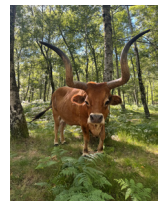




Sponsoring MISTI Portugal Student Internships

Through MIT International Science and Technology Initiatives (MISTI) Portugal, MPP sponsored four MIT students for internships in Portugal in 2025.

Student interns included Sophia Augier, mechanical engineering, who was hosted by Oceanscan Marine Systems & Technology in Porto; Stephen Hong, computer science and engineering and Chen Li, system design and management, who were both hosted by Hostelworld, a global online booking platform in Porto; and Paulo Henrique dos Santos Silva, computer science and engineering, who was hosted by the Laboratory for Large Scale Computer Systems at the University of Lisbon.



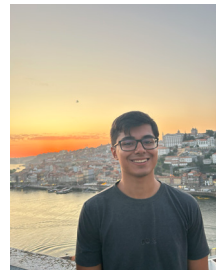


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Figure 14. Sofia Augier

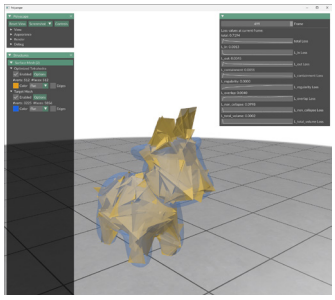
"I had the opportunity to work on meaningful engineering problems while reconnecting with my family's culture and learning how to navigate the unfamiliar with confidence and curiosity. This experience lit a fire in me to continue working abroad – to take the knowledge I gain at MIT and carry it as far as a plane can take me. Your generosity didn't just fund an internship, it opened up the world to me, and I'm endlessly thankful for that."

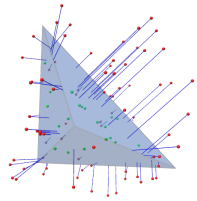
– Sophia Augier, Mechanical Engineering Student (MIT)

Summer Geometry Initiative (SGI)

Erendiro Pedro, a master's student in artificial intelligence engineering at the ISEP, was sponsored by MPP to join the Summer Geometry Initiative.

SGI is a six-week summer research program introducing undergraduate and graduate students to the field of geometry processing. The program was organized by Justin Solomon, associate professor at the MIT Department of Electrical Engineering and Computer Science, and principal investigator at the Geometric Data Processing Group. Erendiro spent more than a month attending hands-on tutorials introducing the theory and practice of geometry processing, working in teams on research projects, and attending talks from top researchers and industry members in the field.





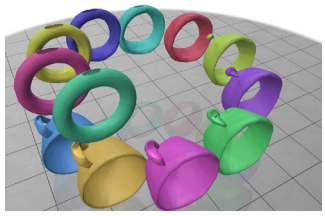


Figure 15. *Erendiro Pedro*

SEPTEMBER_

Portuguese Ambassador to the United States visits MIT

September 29, MIT

On September 29, 2025, Ambassador **Francisco Duarte Lopes** visited MIT as part of the MPP. He was accompanied by João Caixinha, coordinator for Portuguese teaching in the United States, André Encarnação, economic diplomacy trainee, and Tiago Araújo, consul general of Portugal in Boston.

During his visit, Ambassador Duarte Lopes learned in detail about the ongoing research work, meeting with MIT Provost **Anantha Chandrakasan**, Vice Provost for International Activities **Duane Boning**, and MPP Co-Directors **Doug Hart** and **R. John Hansman**. The delegation also met with professors **Thomas Peacock** and **John Leonard** from the Department of Mechanical Engineering and had a chance to watch a research demonstration at the MIT Sailing Pavilion.

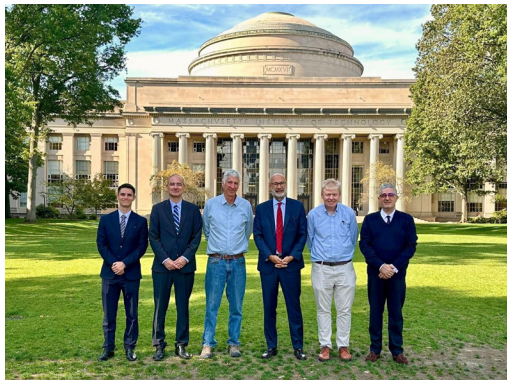


Figure 16. *Francisco Duarte Lopes visits MIT*

OCTOBER_

Winners of the Atlantic Junior Award visits MIT

October 29, MIT

FLAD, together with Ciência Viva, organized again this year the "Atlantic Junior Award," an initiative that aims to spark curiosity and interest for science and technology among high school students.

This year's big winner was Colégio Valsassina, in Lisbon. On October 29, the winning team had the opportunity to visit MIT and explore Professor **John Leonard**'s Marine Robotics lab, which is centered around the problems of navigation and mapping for autonomous robots operating in underwater and terrestrial environments.

Students Miguel Pinéu, Hugo Bizarro, and João Castro, guided by Professor Pedro Jorge, developed an impressive project in the field of environmental and ocean sustainability: ecranoplane, an aircraft that combines characteristics of ships and planes, designed to fly at low altitude over water or land, taking advantage of the ground effect generated by proximity to water/ground.

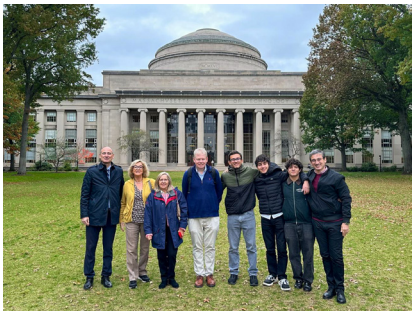


Figure 17. Winning team from Colégio Valsassina (Lisbon)

NOVEMBER_

Visit by the new MPP Co-Directors, Portugal's Secretary of State for Science and Innovation, and representatives from various Portuguese institutions to MIT

November 11-12, MIT

On November 11 and 12, a delegation consisting of Secretary of State for Science and Innovation **Helena Canhão**; President of the Foundation for Science and Technology **Madalena Alves**; President of the National Innovation Agency **António Grilo**; Coordinator of the Mission Structure for International Partnerships J**osé Manuel Mendonça**; Advisor **Maria João Jacinto**; Director of the International Relations Department of FCT **Ana Quartin**; MPP's new Co-Directors, **Alexandre Ferreira da Silva** and **João Pedro Barreto**; and the Consul General of Portugal in Boston, **Tiago Araújo**, visited MIT to learn about the latest developments of MPP and to discuss the next phase of the Program.

They met with MIT Provost **Anantha Chandrakasan** and Vice Provost for International Activities **Duane Boning**, and MIT Portugal's board members **Evelyn N. Wang** and **Dava Newman**. The group had an opportunity to watch research demonstrations by professors **Michael Benjamin** and **Rafael Jaramillo**, MPP seed grant recipients who collaborate with the exploratory grants, and tour the MIT.nano building with **Vladimir Bulovic**, Professor of Engineering and MIT.nano director. At lunch, the delegation met with more than 20 MPP researchers and several students from Portugal visiting MIT as part of their Fulbright scholarship.

Figure 18. Visit to MIT by the new national directors of the Program and a delegation representing the Portuguese government

NOVEMBER_

MPP's participation in the UT Austin conference "Resilience of the Electrical Systems in Portugal and Texas"

November 13-14, University of Texas - Austin

On November 13, Marija Ilic, senior research scientist and adjunct professor at the MIT Institute for Data, Systems, and Society and MPP's seed grant awardee in the fields of Energy and Climate Science & Climate Change, presented at the UT Austin's Portugal Program conference on "Resilience of the Electrical Systems in Portugal and Texas."

This high-level gathering brought together leading experts from Portugal and the United States to address key challenges such as cybersecurity, operational security, physical security threats, black start and system recovery, renewable energy integration, emergency response, data analytics, and policy coordination.

Figure 19. A Week that Strengthened the Portugal-Texas Bridge in Science, Energy and Innovation - group photo

08

Communications Overview

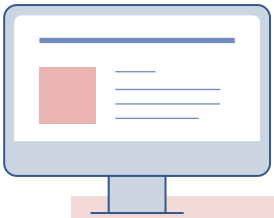
The main areas of communication over the last year are listed below.

MIT Portugal website

https://mitportugal.org/

The MIT Portugal Program (MPP) website is the central hub for all official communication, providing accurate, structured, and easily accessible information to researchers, students, industry partners, policymakers, and the general public. Unlike social media, which is dynamic and fast-paced, the website serves as a permanent, reliable resource.

In 2025, we received 27,485 visits. As in 2024, the most visited pages, according to Google Analytics, were related to student training and education initiatives, namely the 2025 Marine Robotics Summer School and the MIT Portugal Innovation Workshop.



27,485
Active Visitors

Among the 27,485 active users, we observed that 9,120 are in Portugal, 5,171 in the United States, 4,166 in China, and the remaining users are spread across several locations worldwide.

The MIT Portugal website is the backbone of its digital communication strategy. While LinkedIn and Facebook help with engagement and outreach, the website houses official information, research insights, and academic resources. A well-structured and frequently updated website ensures MIT Portugal remains accessible, authoritative, and impactful in the global innovation ecosystem.

Social media

Social media has become an indispensable aspect of modern communication, enabling the rapid dissemination of information and playing a vital role in reaching our audience.

For this reason, through the years, MPP has been committed to building a strong online presence and network, with an active presence in four social media channels: Instagram, LinkedIn, Facebook, and YouTube.

› **Facebook**
https://www.facebook.com/MIT.Portugal.Program

› **LinkedIn**
https://www.linkedin.com/company/mit-portugal-program

› **Instagram**
https://www.instagram.com/mitportugal/
MIT Portugal (@mitportugal)

› **YouTube**
https://www.youtube.com/@mitportugalvideo

To reach a wider and more diverse audience, we launched a MIT Portugal Instagram account in January 2025.

The number of publications (through the four channels) exceed 400 posts. These posts are mainly related on Program initiatives (events, research and education calls); and relevant news regarding MPP projects, Directors, and community.

The number of followers on the four social media channels continued increasing in 2025. As of this report, we are connecting with over 18,000 followers.

LinkedIn amassed the greatest number of followers. The other channels registered more modest growth.

Social media platforms can evolve, and their popularity may fluctuate over time, but even with a small following it is important to have an established presence on multiple platforms that will contribute to MPP's online credibility and visibility. By publishing new content, MPP has the potential to reach a larger audience through shares and interactions.

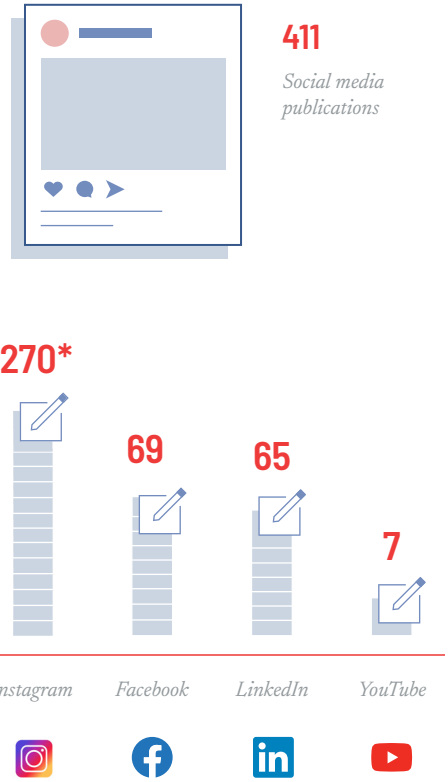


Figure 20. Number of social media publications through the four channels (total 411)

** Posts + Instagram Stories*

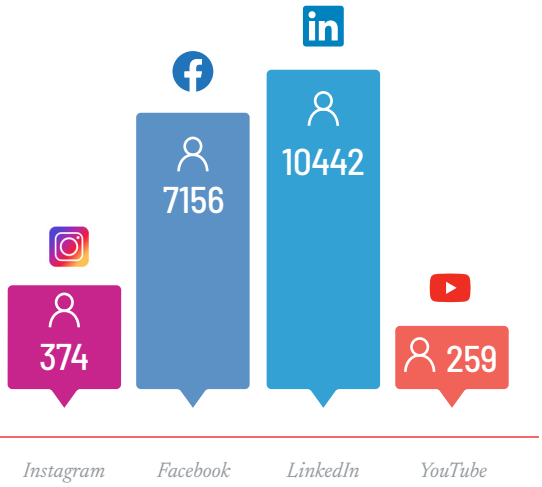


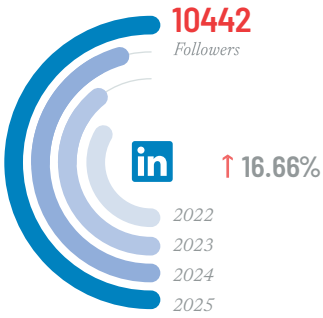
Figure 21. Number of social media followers (Total 18 231)

LinkedIn

For MIT Portugal, LinkedIn is more than just a social network; it's a strategic communication tool that supports visibility, engagement, research dissemination, and talent attraction. Leveraging LinkedIn effectively ensures that MIT Portugal continues to make a global impact in science, technology, and innovation.

LinkedIn is the social network that generates the most interaction with our community, reaching 10,442 followers in 2025.

The top three sectors in which our visitors are engaged are Higher Education, Information Technology Services, and Scientific Research & Development.



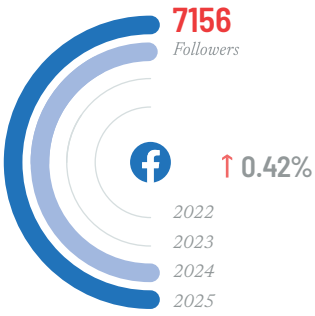
Instagram

Creating an Instagram account for MIT Portugal has been an important step in strengthening the Program's communication and visibility. It enables the dissemination of research, activities, and achievements to a broader and more diverse audience, while fostering closer engagement with students, researchers, and partners. In 2025, a total of 374 was achieved, with the expectation that this number will increase in the coming years.

Facebook

While LinkedIn is essential for professional and academic networking, Facebook plays a different but equally important role in MIT Portugal's communication strategy. Facebook has a massive global user base, making it an effective tool to reach not only researchers and industry leaders but also students, alumni, the public, and policymakers interested in science and innovation.

However, Facebook continues to show very slow growth. In 2025, it gained only 30 new followers, reaching a total of 7,156 people. Of these, 53.30% are men and 46.70% are women.



YouTube

In 2025, the MIT Portugal YouTube channel reached 259 subscribers (growth rate of 5.31%). Throughout the year, seven new videos were released, including an interview with Director Pedro Arezes, a video illustrating a day in the life of a PhD student in the lab, a recap of the Marine Robotics Summer School, and several others highlighting the Program, as well as the research and collaboration developed over time.

In total, the channel had about 1,300 views.

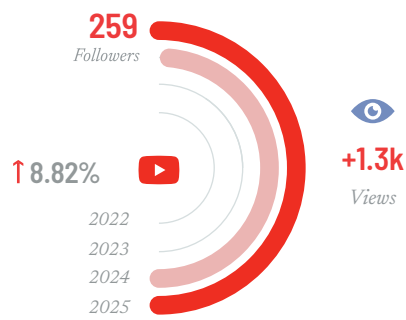


Figure 22. Number of followers by year, and growth rate of each social media channel.

Media Communication

In 2025, MIT Portugal partnered with a full scale production company to showcase the work developed over nearly 20 years of collaboration between Portugal and the United States. This initiative aimed not only to increase the Program's visibility, but also to communicate the real-world impact of its research and strengthen its international presence.

These videos explored a wide range of topics, including an overview if the MPP an its research areas , and dived deeper into the areas of sustainable cities, deep-sea mining, space exploration, entrepreneurship, and innovation. By presenting complex scientific topics in an accessible and engaging way, this content helps bridge the gap between academia and society, inspire future talent, and foster stronger connections with partners and stakeholders.

Figure 23. Some of the people interviewed - Dava Newman; Doug Hart; Steven Leeb; Charlene Xia; Thomas Peacock; Kerri Cahoy and John Hansman.

09

Outputs of the Program

9.1 Peer-reviewed Publications

MPP Projects

Peer-reviewed publications

Almquist, E.T., Bruno, S.J., Langham, A.W., Buchanan, M.C., Powell, T., Leeb, S.B., Green, D.H. (2025). Fast Shipboard Electric Power Systems Simulation: Applications of Behavioral Modeling. *ASNE Intelligent Ships Symposium*.

https://emsg.mit.edu/wp-content/uploads/2025/04/SPARCS_ASNE_ISS_2025_3.28.2025_1344_Submission.pdf

Seed: Continuing Continuous Commissioning for Energy Efficient Buildings

Bernevig, B.A., Fu, L., Ju, L., MacDonald, A.H., Mak, K.F., Shan, J. Fractional quantization in insulators from Hall to Chern. Nature Physics. 21, 1702–1713 (2025).

https://doi.org/10.1038/s41567-025-03072-8

Seed: Engineering Quantum Spin Hall Effect in Graphene

F. Jeldres, J. Cruz, and D. P. Hart. (2025) Aluminum Fueled Buoyancy Engine. *OCEANS 2025 Brest*. 1–7.

doi: 10.1109/OCEANS58557.2025.11104611

Seed: Buoyancy Engine for Extended Underwater Operation

Fernandes, R., Geraldes, M., Chico, G., & Capinha, C. (2025). *A geographical database of Iberian peatland and SWOB records. Data in Brief*, 111971.

Exploratory: PEATMAP - A prototype model for studying the distribution, ecological dynamics, and carbon of peatlands in the landscape mosaics of the Iberian Peninsula

Fesenmyer, K.A., Poor, E.E., Terasaki Hart, D.E. Veldman, J.W., Fleischman, F., Choksi, P., Archibald, S., Armani, M., Fagan, M.E., Frickle, E.c., Terrer, C., Hasler, N., Williams, C.A., Ellis, P.W., Cook-Patton, S.C. (2025). Addressing critiques refines global estimates of reforestation potential for climate change mitigation. *Nature Communications*. 16, 4572.

https://doi.org/10.1038/s41467-025-59799-8

Seed: Unlocking Carbon Sequestration in Abandoned Croplands with Satellites and AI

Gomes, E., Esteves, A., Morais, H., & Pereira, L. (2025). *Leveraging explainable artificial intelligence in solar photovoltaic mappings: Model explanations and feature selection. Energies*, 18(5), Article 5

https://doi.org/10.3390/en18051282

Exploratory: ALAMO: Accurate federated Learning with uncertainty quantification for DER forecasting Applied to sMart Grids planning and Operation

Kombargi, A., Bao, B., Ellis,E., Hart. D.P. Life-cycle assessment and cost analysis of hydrogen production via aluminum-seawater reactions. *Cell Reports Sustainability. 2.8* (2025). Publisher: Elsevier. issn: 2949-7906.

https://doi.org/10.1016/j.crsus.2025.100407

Seed: Buoyancy Engine for Extended Underwater Operation

Korolovych, D., Xu, V., Lyu, Y., Aslarus, J., Flores-Hernandez, D.R., Pajovic, S., Heller, W., Sihver, L., Boriskina, S.V. (2025). Warpage Resistant, Under-extrusion Free, High Surface Quality Additive Manufacturing Process for Polyethylene-Based Composite Radiation Shielding Material. *ACS Applied Polymer Materials*. 7 (18).

https://doi.org/10.1021/acsapm.5c02057

Seed: Ocean-derived pollution-reducing fabrics for healthcare and space applications

Matos, A. M., Milheiro, P., & Varum, H. (n.d.). *Predicting stabilized soil mixture proportions for 3D printing: Preliminary study using DOE. Journal of Materials in Civil Engineering*.

https://doi.org/10.1061/JMCEE7/MTENG-19825

Exploratory: NEXT GENERATION OF DIGITAL "CONCRETE": performance mix design and assessment of sustainable and circular cementitious composites

Matos, A. M., Milheiro-Oliveira, P., Fonseca, M., & Pimentel, M. (n.d.). *Ternary blends of white cement, limestone and waste glass for 3D printing. Journal of Materials in Civil Engineering.*

Exploratory: NEXT GENERATION OF DIGITAL "CONCRETE": performance mix design and assessment of sustainable and circular cementitious composites

Matos, A. M., Milheiro-Oliveira, P., Pinto, N., & Pimentel, M. (2025). *Formulações ternárias de cimento, filler calcário e resíduos de vidro moído para impressão 3D*. RPEE, Série III, (29).

https://doi.org/10.34638/rpee-sIII-n29

Exploratory: NEXT GENERATION OF DIGITAL "CONCRETE": performance mix design and assessment of sustainable and circular cementitious composites

McKinney, L., Silva,T., Guerra V., Guerra-Garcia, C. (2025). Kinetic modeling of nanosecond repetitively pulsed discharges in CO2: insights for reactor design. *Journal of Physics D: Applied Physics. 59* (1).

https://doi.org/10.1088/1361-6463/ae233c

Seed: Advancing Plasma CO2 Conversion with Integrated Oxygen Extraction

Pereira, L., Monteiro, D., Apina, F., Scuri, S., Barreto, M., Quintal, F., & Morais, H. (2025). *Longitudinal dataset of net-load, PV production and solar irradiation from Madeira Island, Portugal. Scientific Data,* 12(1), 1892.

https://doi.org/10.1038/s41597-025-06118-x

Exploratory: ALAMO: Accurate federated Learning with uncertainty quantification for DER forecasting Applied to sMart Grids planning and Operation

Seo, J., Cotton, A., Xu,M., Sedeh, O., Weldeyesus, H., Han, T., Lu, Z., Wu, Z., Ye , S., Xu, W., Yang, J., Aitken, E., Liong, P.P., Hadjri, Z., Gazizulin, R., Watanabe, K., Taniguchi,T., Li, M., Zumbühl, D.M., Ju, L. (2025) *Family of Unconventional Superconductivities in Crystalline Graphene.* arXiv preprint arXiv:2509.03295

Seed: Engineering Quantum Spin Hall Effect in Graphene

Xia, C., Champenois, B., Campuzano, F., & Mendes, R. (2025). *Drifter challenge: A low-cost, hands-on platform for teaching ocean instrumentation and sensing. Oceanography*, 38(3), 80–87.

https://doi.org/10.5670/oceanog.2025.e312

Seed: Identifying Microbiome's Health in Marine Environments from Data Collected via a Real-Time Opto-fluidics Monitoring System

Yang, Z., Yin, Y., Jing, Q., Shao, Z., Haitong, X., & Guedes Soares, C. (2025). *Unsupervised deep image stitching based on cascaded warping and multi-scale seam prediction for USV wide field-of-view generation. Autonomous Transportation Research.*

https://doi.org/10.1016/j.atres.2025.09.001

Exploratory: Distributed Intelligent decision-making system of Multi Autonomous surface

vehicles for sustainable ocean monitoring

Zhang, X., Tian, R., Haitong, X., Liu, X., & Guedes Soares, C. (2025). *Ship manoeuvring model identification using mutual information clustering with stepwise regression structural optimisation under small-sample constraints. Ocean Engineering,* 341(2), 122594.

https://doi.org/10.1016/j.oceaneng.2025.122594

Exploratory: Distributed Intelligent decision-making system of Multi Autonomous surface vehicles for sustainable ocean monitoring

MPP PhD Candidates

(Authorship by MPP2030 students is underlined)

Articles

Akpolat, A. N., Cundeva, S., Todorovic, J., Rexhepi, V., Okhay, O., Bakoń, T., Finger, D. C., Dursun, E., Hadjistassou, C., Tsami, M., Koca, K., Rajic, M., Todorovic, I., Tesch, L., Rebelo, C., & Borg, R. P. (2025). Modular floating energy islands with green hydrogen integration: Design of a small-scale P2X scheme. IOP Conference Series: Earth and Environmental Science, 1552(1), 012035.

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9.2
Books or Book Chapters

MPP Projects

Matos, A. M., Milheiro de Oliveira, P., & Varum, H. (n.d.). *New technologies for earth construction: 3D printing, a reality or a mirage? In Sustainable materials for the built environment.*

Exploratory: NEXT GENERATION OF DIGITAL "CONCRETE": performance mix design and assessment of sustainable and circular cementitious composites

Matos, A. M., Milheiro de Oliveira, P., Pinto, N., & Pimentel, M. (2025). *Cementitious blends for sustainable 3D concrete printing.* In *Lecture Notes in Civil Engineering*. Springer.
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Exploratory: NEXT GENERATION OF DIGITAL "CONCRETE": performance mix design and assessment of sustainable and circular cementitious composites

Matos, A. M., Milheiro-Oliveira, P., Fonseca, M., & Pimentel, M. (2025). *Design of eco-efficient "concrete" for digital fabrication*. In *Proceedings of the RILEM Spring Convention and Conference 2025* (Vol. 1). Springer.

Exploratory: NEXT GENERATION OF DIGITAL "CONCRETE": performance mix design and assessment of sustainable and circular cementitious composites

MPP PhD Candidates

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Alves, A., Marques da Costa, E., Gomes, E., & Niza, S. (2025). Insights from Portugal's solar energy transition in the framework of cohesion policy (2014–2020) implementation. In D. Casavola, F. van der Hoeven, & L. Radisavljević (Eds.), Transformative

action in an age of planetary crisis: Book of abstracts – AESOP Annual Congress 2025 (pp. 74–75). AESOP

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computational chemistry and physics (pp. 117–138). Springer Nature Switzerland.

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Lucas, D., Oliveira, P., & Bessa, A. (2025). Towards efficient biogas production: Deep learning-based methane forecasting in anaerobic digesters of wastewater treatment plants. In Highlights in practical applications of agents, multi-agent systems and computational social science (Vol. 154). Springer.

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Parece, S., Resende, R., & Rato, V. (2025). Current trends and challenges in BIM–LCA integration. In L. M. M. Domingos & M. J. Sousa (Eds.), *Swarm intelligence applications for the cities of the future* (1st ed., pp. 198–229). CRC Press.

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9.3 Proceedings or Conference Papers

MPP Projects

Freitas, F., Zimmermann, R., Freires, G., Couto, F., Fontes, C., Soares, A.L., Dalmarco, G., Rhodes, D., Gomes J. Jr. (2025). Socio-Technical AI Maturity in Supply Chains: Insights from the Pulp and Paper Sector. Proceedings of the Working Conference on Virtual Enterprises, pp. 169-184. Cham: Springer Nature Switzerland.

Seed: AI Maturity Impact on Social-Environmental Sustainability of Cities

Haitong, X., & Guedes Soares, C. (2025, August 25–28). Path following control for an underactuated autonomous ship model using an L1 adaptive controller. In *Proceedings of the 16th IFAC Conference on Control Applications in Marine Systems, Robotics and Vehicles* (Wuhan, China).

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Exploratory: Distributed Intelligent decision-making system of Multi Autonomous surface vehicles for sustainable ocean monitoring

Honnet, C., Babatain, W., Luo, Y., Afsar, O., K., Bensahel, C., Nicita, S., Zhu, Y., Danielescu, A., Gershenfeld, N., Paradiso, J. (2025). FiberCircuits: A Miniaturization Framework To Manufacture Fibers That Embed Integrated Circuits. In *Proceedings of the 38th Annual ACM Symposium on User Interface Software and Technology* (pp.1-18).

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Seed: Modernizing photovoltaic textiles for scalability and wearable applications

Matos, A. M., Fonseca, M., Milheiro de Oliveira, P., & Pimentel, M. J. (2025, March 25–28). *Design of eco-efficient "concrete" for digital fabrication. In Conference on Durability of Building Materials and Systems in the Transportation Infrastructure, RILEM Spring Convention 2025* (Mendrisio, Switzerland).

Exploratory: NEXT GENERATION OF DIGITAL "CONCRETE": performance mix design and assessment of sustainable and circular cementitious composites

Matos, A. M., Milheiro Oliveira, P., & Pimentel, M. (2025, November 16–17). Misturas cimentícias ecoeficientes para impressão 3D: Do laboratório ao mobiliário urbano. In Congresso Nacional Pré-fabricação de Betão (Coimbra, Portugal).

Exploratory: NEXT GENERATION OF DIGITAL "CONCRETE": performance mix design and assessment of sustainable and circular cementitious composites

Meng, Y., Zhang, X., Haitong, X., & Guedes Soares, C. (2025, August 25–28). *Offline prediction of 3 DOF ship motions based on relevance vector machine and free-running test data with noise. In Proceedings of the 16th IFAC Conference on Control Applications in Marine Systems, Robotics and Vehicles* (Wuhan, China).

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Exploratory: Distributed Intelligent decision-making system of Multi Autonomous surface vehicles for sustainable ocean monitoring

Pires, A., Coutinho, J., Santos, A., Persad, A., Dias, A., Moura, R., & Almeida, J. (2025). *Propulsion control system in microgravity for SENTINEL-Orb* [Final report]. MIT Portugal Program / FCT.

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Exploratory: Sentinel-Orb - SpacE operatioNs, moniToring, and mappINg ExpLorer: a smart Orb-system

Pires, A., Coutinho, J., Santos, A., Persad, A., Dias, A., Moura, R., & Almeida, J. (2025, September–October). SENTINEL smart orb-system: A scout robot for space operations and monitoring (IAC-25-A3. LBA.7.x103452). In *Proceedings of the 76th International Astronautical Congress* (IAC 2025) (Sydney, Australia). INESC TEC.

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Exploratory: Sentinel-Orb - SpacE operatioNs, moniToring, and mappINg ExpLorer: a smart Orb-system

MPP PhD Candidates

(Authorship by MPP2030 students is underlined)

Aldao, E., Fontenla-Carrera, G.,

Veiga-López, F., González-Jorge, H., Morais, M. J., & Matos, J. C. (2025). Evaluating the influence of wind on UAV path planning for bridge inspections. In *Proceedings of the 2025 International Conference on Unmanned Aircraft Systems* (ICUAS) (pp. 236–242). IEEE.

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Alves, A., Marques da Costa, E., Gomes, E., & Niza, S. (2025, May 6–9). Understanding the drivers of utility-scale solar energy development in continental Portugal. Paper presented at the RSA *Annual Conference 2025: Navigating Regional Transformation*, University of Porto, Portugal.

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Alves, A., Marques da Costa, E., Gomes, E., & Niza, S. (2025, November 19–21). Transição energética e ordenamento do território: Evidências sobre a localização de centrais solares fotovoltaicas em Portugal. Paper presented at the *XV Congresso da Geografia Portuguesa: Geografia Propositiva, Dinâmicas Territoriais e Justiça Sócio-Espacial*, Évora, Portugal.

Alves, A., Simões, S. G., & Santos, E. (2025, November 19–21). Energia solar e conflitos territoriais: Um índice de avaliação espacial integrando perspetivas de stakeholders. Paper presented at the XV *Congresso da Geografia Portuguesa: Geografia Propositiva, Dinâmicas Territoriais e Justiça Sócio-Espacial*, Évora, Portugal.

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Pais, A., Alves, J. L., & Belinha, J. (2025). Data-driven bone remodelling after screw insertion. In Congresso Nacional de Biomecânica 2025.

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Vlachakis, G., Colombo, C., Giouvanidis, A. I., & Lourenço, P. B. (2025). The role of boundary conditions and overburden mass on the rocking dynamics of vertical spanning strip walls. In 14th International Conference on Structural Analysis of Historical Constructions (SAHC).

9.4
PhD Thesis

Aly Kombargi
Massachusetts Institute of Technology
Optimized sustainable hydrogen generation from liquid metal activated aluminum–water reactions
February 2025

Adriano dos Santos Silva
University of Porto
Optimization of municipal solid waste management systems towards sustainability
September 2025

Albano Martins
University of Porto
A Comprehensive Model for Assessing Construction Solutions in Outdoor Public Spaces: Enhancing Urban Quality Through the Integration of Modern Technology and Vernacular Knowledge
July 2025

Ana Reis
University of Coimbra
Integrating the water-energy nexus in water supply systems optimization
May 2025

Carla Colombo
University of Minho
Experimental static and dynamic evaluation of the out-of-plane response in block-type masonry structures
July 2025

Fernando Ribeiro
University of Porto
Load-Frequency Control considering Hydrogen Electrolysers' response
July 2025

Jade Muller Carneiro
University of Coimbra
Ecodesign of Novel Technologies in the Bioeconomy
November 2025

João André Cardoso
University of Minho
Framework for ergonomic assessment in collaborative robotic systems
December 2025

José Caetano
University of Porto
InverseESA: inverse catalytic optimization for sustainable epoxide manufacture
December 2025

Laísa Kappler
University of Coimbra
Telework frequency and its effects on travel behavior in the post-COVID-19 era
December 2025

Nazanin Fereidani
University of Coimbra
A decision-making tool for the renovation of buildings in Middle East coastal cities under future climate scenarios
December 2025

Nuno Saraiva
University of Coimbra
The indoor environment in heritage buildings: Monitoring and modelling approaches for collections preservation
December 2025

Rita Dantas
University of Porto

An integrated multiscale fatigue methodology applied to ocean structural systems
June 2025

Teresa Filipa Corais
University of Minho

The city "walking" to 2050. Braga as a Laboratory for a resilient and sustainable system
December 2025

Samruddha Kokare
University of Lisbon

Towards climate change mitigation by sustainable wire-arc additive manufacturing

April 2025

Simon Szabó
University of Minho

Influence of the masonry pattern in the safety assessment of historic masonry structures
July 2025

9.5 Oral Communications

MPP Projects

Brudner, A., Patricio, A., Duarte Santos, G., Antunes, A., and Ben-Akiva, M. (2025, January). *How Driving Automation Will Save Demand Responsive Transit*. [Conference presentation]. Transportation Research Board (TRB) Annual Meeting, Washington, D.C.
Seed: Demand responsive transit - why do they fail, and how (and if) can they succeed?

Pires, A. (2025, October 7–9). *Propulsion control system in microgravity for SENTINEL-Orb* [Oral presentation]. 18th Symposium on Advanced Space Technologies in Robotics and Automation (ASTRA), European Space Agency (ESA), Leiden, The Netherlands.
Exploratory: Sentinel-Orb - SpacE operatioNs, moniToring, and mappINg ExpLorer: a smart Orb-system

Pires, A. (2025, March 14–15). *Coupling geotechnologies and geotechnical analysis towards the exploration and mapping of lava tubes: Terceira (Azores, Portugal) and La Palma (Canarias, Spain) experimental fields* [Oral presentation]. MICROVOLCAVE'25 – 2nd European Meeting on Geological Active Processes and Geomicrobiology of Volcanic Environments.
Exploratory: Sentinel-Orb - SpacE operatioNs, moniToring, and mappINg ExpLorer: a smart Orb-system

Cicone, L., Roy, E. M., Monteiro, A., Miranda, A., Gama, C., Osswald, T., & Selin, N. E. (2024, October). Global and regional wildfire emissions of toxic pollutants contribute to health risks. International Technical Meeting on Air Pollution Modelling and Its Application, Copenhagen, Denmark.
Seed: Quantifying toxic air pollution and exposure from wildfires

Ju, L. (2025, November). *Fractional Quantum Anomalous Hall Effect and Chiral Superconductivity in Crystalline Graphene*. [Conference presentation]. International Conference Layered Materials and Devices: From Atoms to Chips!, International Iberian Nanotechnology Laboratory, Braga, Portugal.
Seed: Engineering Quantum Spin Hall Effect in Graphene

Gianotti, S., Trigo, D,I., Entekhabi, D. (2025, December). *Stability of biosphere-climate coupling*.[Conference presentation]. American Geophysical Union Fall Meeting, New Orleans.

Seed: Landcover Stability: Heating and Drying of Plants and Soils

Haitong, X. (2025, August 25–28). *Path following control for an underactuated autonomous ship model using an L1 adaptive controller* [Oral presentation]. 16th IFAC Conference on Control Applications in Marine Systems, Robotics and Vehicles, Wuhan, China.
Exploratory: Distributed Intelligent decision-making system of Multi Autonomous surface vehicles for sustainable ocean monitoring

Haitong, X. (2025, August 25–28). *Offline prediction of 3 DOF ship motions based on relevance vector machine and free-running test data with noise* [Oral presentation]. 16th IFAC Conference on Control Applications in Marine Systems, Robotics and Vehicles, Wuhan, China.
Exploratory: Distributed Intelligent decision-making system of Multi Autonomous surface vehicles for sustainable ocean monitoring

MPP PhD Candidates

(Authorship by MPP2030 students is underlined)

Abraham, J. (2025, November 21). *Unsupervised learning–based system for bridge structural health monitoring: Detecting anomalies and deviations from normal behaviour* [Conference presentation]. 8th PDEC Workshop, University of Minho, Guimarães, Portugal.

Alves, A. (2025, April 9). *The geography of photovoltaic energy in continental Portugal: Analysis of planned projects* [Invited talk]. Debate "Fotovoltaicas no Alentejo, Entre o Sol e a Terra", Portugal.

Alves, A. (2025, May 22). *From machine learning to land management: Explaining solar siting decisions in continental Portugal* [Invited talk]. 4th MOPT Conference – Spatial Modeling for Sustainable Cities and Territories, IGOT-ULisboa, Lisbon, Portugal.

Anjos, R. (2025, September 15). *Microgrid reinforcement of scaled railway ballast* [Conference presentation]. 8th European Conference on Geosynthetics (EUROGEO 8), Lille Grand Palais, Lille, France.

Antunes, H., Martinho da Silva, I., & Costa, S. (2025, June 11–13). *Towards resilient cities: Reviewing resilience parameters to guide the integration of urban agriculture into green infrastructure* [Conference presentation]. AESOP Sustainable Food Planning YAP Event, Montpellier, France.

Antunes, H., Martinho da Silva, I., & Costa, S. (2025, September 6–11). *Mapping productive landscapes over time: A methodological approach to identify and classify food production areas* [Conference presentation]. ECLAS Conference 2025, Nitra, Slovakia.

Azimi Fereidani, N., Rodrigues, E., Rosa, N., & Gaspar, A. R. (2025, July). *Integrating climate change adaptation into building design codes: A focus on multi-story residential buildings in Iran* [Conference presentation]. 5th International Conference on Evolution of Cities, University of Southampton, Southampton, United Kingdom.

Bona, S., Silva-Afonso, A., Gomes, R., Silva, P., & Rodrigues, F. (2025, June 11–13). *Nature-based solutions to improve water and energy efficiency and social equity in low-income communities* [Conference presentation]. Conference on Construction, Energy, Environment and Sustainability (CEES 2025), Bari, Italy.

Bona, S., Silva-Afonso, A., Pimentel-Rodrigues, C., Gomes, R., & Rodrigues, F. (2025, June 11–13). *Castelo Rodrigo cisterns: A model for urban water*

communities contributing to sustainability [Conference presentation]. Conference on Construction, Energy, Environment and Sustainability (CEES 2025), Bari, Italy.

Bona, S., Silva-Afonso, A., Rodrigues, F., & Gomes, R. (2025, May 14–16). *Strategies for sustainable water efficiency practices in the built environment: A case study of Leiria* [Conference presentation]. International Conference on Water Energy Food and Sustainability (ICoWEFS 2025), Leiria, Portugal.

Carrelhas, A. A. D., Heleno, J. M. M., & Gato, L. M. C. (2025, September). *Experimental noise characterisation of different geometries of Wells turbines* [Conference presentation]. European Wave and Tidal Energy Conference (EWTEC 2025), Madeira, Portugal.

Castro, A., & Capinha, C. (2025). *The extraordinary contribution of social media and media to map rare and endangered species: The Mediterranean monk seal in Madeira and Porto Santo Islands* [Conference presentation]. III SIBECOL & XVII AEET Meeting, Pontevedra, Spain.

Claro, A. (2025, July 16). *Hydrological modelling as a tool for future agricultural water prediction in Southern Portugal* [Oral communication]. Inov4Agro Sustainable Agrifood Production Seminars 2025.

Claro, A. (2025, March 24–26). *Hydrological modelling of the Sado River Basin to assess future agricultural water availability* [Conference presentation]. 13th Portuguese Meteorology and Geophysics Association Symposium & 23rd Luso-Spanish Meteorology Meeting.

Claro, A. (2025, November 24). *Are future Portuguese agricultural water reserves at risk? A hydrological modelling assessment of the Sado River flow* [Oral communication]. Inov4Agro Scholarship Researchers Day 2025.

Colombo, C. (2025, September 15–17). [Oral communication].14th International Conference on Structural Analysis of Historical Constructions (SAHC), SwissTech Convention Center, Lausanne, Switzerland.

Constantino, E. (2025, November 16–20). *Flow dynamics analysis of air jets on porous surfaces* [Conference presentation]. ASME 2025 International Mechanical Engineering Congress and Exposition (IMECE2025), Renasant Convention Center, Memphis, TN, United States.

Corais, F. (2025, May). *Citizen engagement and socio-cultural transformation in the development of a walkable city in Braga* [Conference presentation]. The Future Design of Streets Conference, 2025.

Corais, F. (2025, May). T*ransition management, backcasting and urban design as tools for defining a methodology for promoting sustainable urban mobility* [Conference presentation]. STS Conference 2025, Graz, Austria.

Corais, F. (2025, May). *Transitioning to a new culture of mobility: The contribution of the future thinking methodology* [Conference presentation]. STS Conference 2025, Graz, Austria.

Corais, F. (2025, November). *Living labs as future models: Transition management and behavioral change in urban sustainability. The case of Braga, Portugal* [Conference presentation]. RSA 2025, London, United Kingdom.

Cordeiro, A., Müller-Carneiro, J., & Freire, F. (2025, March 20). *LCA of an ammonia stripping-scrubbing pilot technology for nitrogen recovery from urban wastewater* [Oral communication]. WaINUT Project General Assembly, University of Southern

Denmark, Odense, Denmark.

Dantas, R. (2025, December 4). *Influence of marine corrosion in fatigue performance of a structural steel for offshore wind energy industry* [Conference presentation]. NEXUSxD2XCEL International Innovation Conference 2025, Porto de Sines, Portugal.

Dantas, R. (2025, July 30). *Frequency effect in multiaxial fatigue performance of a structural steel* [Conference presentation]. Doctoral Congress in Engineering (DCE25), Porto, Portugal.

Dantas, R. (2025, October 28). *An analysis of the frequency effect in fatigue data: From uniaxial to multiaxial loading* [Conference presentation]. 6th Meeting of the Young Researchers of LAETA, Porto, Portugal.

Dantas, R. (2025, September 1). *Stress concentration effect induced by marine corrosion in fatigue behaviour of a structural steel* [Conference presentation]. 6th International Conference on Structural Integrity, Funchal, Portugal.

Dantas, R. (2025, September 12). *Frequency effect in multiaxial fatigue behaviour of a structural steel for offshore wind turbine support systems* [Conference presentation]. 3rd International Symposium on Risk Analysis and Safety of Complex Structures (IRAS), Wrocław, Poland.

Duarte, A. F., Bernacchi, L., Mendes, R., Borges de Sousa, J., & Azevedo, L. (2025, April 27–May 2). *Uncertainty maps as a tool for efficient AUV data collection* [Conference presentation]. EGU General Assembly 2025, Vienna, Austria.

https://doi.org/10.5194/egusphere-egu25-971

Fernandes, R. (2025, November 19–21). *Padrões de distribuição de plantas exóticas invasoras em Portugal continental* [Conference presentation]. XV Congresso da Geografia Portuguesa, Évora, Portugal.

Fernandes, R. (2025, November 19–21). *Turfeiras em risco? Primeira análise espaço-temporal da expansão de acácias em turfeiras do sudoeste da Península Ibérica* [Conference presentation]. XV Congresso da Geografia Portuguesa, Évora, Portugal.

Fernandes, S. (2025, December 15–16). [Poster and pitch presentation]. ETE2025 – 2nd Workshop on Emerging Technologies for Energy. FCUP, Porto, Portugal.

Dâmaso Duarte, A. F. (2024, September). *Geostatistical modelling of the Madeira Abyssal Plain* [Oral presentation]. GeoStats 2024 Congress, Azores, Portugal.

Fernandes, S. (2025, July 16). *Improving the CO_2 capture and conversion potential of MOF UiO-66 through sustainable creation of defects* [Oral communication]. LAQV Webinar (LAQV-REQUIMTE, Materials for Sustainability and Wellness Research Group, Online).

Ferraz-Caetano, J. (2025, June). *Epistemic automation: Using machine learning to scale and interpret agent-based models of scientific inquiry* [Conference presentation]. 1st International Online Conference of the Journal *Philosophies* (MDPI, Online).

Ferraz-Caetano, J. (2025, June). *Ser Fulbrighter: O papel da diplomacia pública e a pertença à comunidade* [Oral communication]. Fulbright Commission Pre-Departure Session 2025, Lisbon, Portugal.

Ferraz-Caetano, J., Teixeira, F., & Cordeiro, M. N. D. S. (2025, August). *Inverse design of ligand–metal interfaces in vanadyl epoxidation catalysts* [Conference presentation]. 38th European Conference on

Surface Science, Braga, Portugal.

Ferraz-Caetano, J., Teixeira, F., & Cordeiro, M. N. D. S. (2025, April). *From data gaps to catalytic maps: Augmenting machine learning for epoxidation yield optimization* [Conference presentation]. 9th Portuguese Young Chemists Meeting (PYCheM), University of Algarve, Faro, Portugal.

França, B. T. (2025, March 5–8). *Microalgae-based biofuels: A sustainable approach for circular economy* [Conference presentation]. World Sustainable Energy Days (WSED), Austria.

Kappler, L. B. (2025, September 1–3). *Telework adoption and CO2 emissions: Analysis from the Lisbon metropolitan area* [Conference presentation]. 27th Euro Working Group on Transportation Annual Conference (EWGT 2025), Edinburgh Napier University, Edinburgh, United Kingdom.

Lima, D. (2025, June 22–26). *Moisture uptake in CLT during the construction phase: Real construction conditions versus specimens exposed to the environment* [Conference presentation]. IRG56 Scientific Conference on Wood Protection, Yokohama, Japan.

Lima, D. (2025, June 23). *Durabilidade da madeira em construções portuguesas: Classes de uso e durabilidade natural* [Oral communication]. 4as das Madeiras, TimLab (Online).

Lima, D. (2025, October 23–24). *Arduino based low-cost wood moisture content data logger: Setup, code and validation* [Conference presentation]. International Conference on Moisture in Buildings (ICMB25), Guimarães, Portugal.

Lima, M. (2025, April 2). *The increasing danger of tropical cyclones in the Northeastern Atlantic* [Oral communication]. STREAM Group Seminar, Universidade Complutense de Madrid, Madrid, Spain.

Lima, M. (2025, June 13). *Systematic approach for global identification of extreme weather events associated with atmospheric blockings and subtropical ridges* [Conference presentation]. IV Encuentro Extremeño de Climatología, Badajoz, Spain.

Lima, M. (2025, May 2). *Systematic approach for global identification of extreme weather events associated with atmospheric blockings and subtropical ridges* [Conference presentation]. European Geosciences Union General Assembly 2025, Vienna, Austria.

Lima, O., Jr. (2025, April 23). *New abilities for road infrastructures elements and life cycle analysis* [Oral communication]. BIP International Week, Gdańsk University of Technology, Gdańsk, Poland.

Lima, O., Jr. (2025, July 1). *Smart thermochromic road markings for real-time ice and snow detection* [Conference presentation]. 6th Doctoral Congress in Engineering (6th DCE), Universidade do Porto, Porto, Portugal.

Lima, O., Jr. (2025, June 3). *Advancing road safety with thermochromic road markings* [Oral communication]. Jornadas da Linha 3 – Functional and Smart Materials and Surfaces for Advanced Surfaces, University of Minho, Portugal.

Lima, O., Jr. (2025, May 14). *Marcações horizontais termocrómicas: Sensores à base de cor para alertar condutores sobre a presença de gelo e neve em pavimentos rodoviários* [Conference presentation]. 11º Congresso Rodoviário

Português, Lisbon, Portugal.

Lima, O., Jr. (2025, May 23). *Enhancing road safety with smart road marking paints: Self-cleaning and thermochromic capabilities* [Conference presentation]. 4th Coatings and Interfaces Online Conference (MDPI).

Marques, M. (2025, July 28). *Climate change impacts on octocorals: Emergent pathogens, symbiont preservation and probiotic solutions* [Oral presentation]. 4th iBB Workshop, Instituto Superior Técnico, University of Lisbon, Lisbon, Portugal.

Marques, M., García, F., Santos, E., Baylina, N., Villela, H., Peixoto, R., Keller-Costa, T., & Costa, R. (2025, July 14–17). *Climate change impacts on octocorals: Emergent pathogens, symbiont preservation and probiotic solutions* [Conference presentation]. FEMS Micro 2025, Milan, Italy.

Meireis, C. (2025, February 12). *A envolvente habitável: Uma mudança de paradigma na reabilitação de edifícios.* [Oral communication]. *Mais do que casas STARBURSTING*. Faculdade de Arquitetura da Universidade do Porto.

Mindrico, T. (2025, October 1). *Ambientes urbanos híbridos: Design, brincadeira e especulação* [Workshop presentation]. Workshop de Gestão Territorial (WGT), IGOT-ULisboa, Lisbon, Portugal.

Morais, M. J. (2025, June 15–19). *Presentation of the 36th European Safety and Reliability Conference (ESREL 2026)* [Oral communication]. European Safety and Reliability Conference (ESREL) & Society for Risk Analysis Europe (SRA-E) 2025, Stavanger, Norway.

Müller-Carneiro, J., Simon, L., Cordeiro, A., Saerens, B., Dockx, L., Birkved, M., & Freire, F. (2025, September 9–12). *Consequential life cycle assessment of alternative technological pathways for nitrogen recovery from municipal wastewater* [Conference presentation]. 12th International Conference on Life Cycle Management (LCM 2025), Palermo, Italy.

Nascimento, P. (2025, September 8). *Efficient nesting via fast Fourier transforms to solve the production scheduling problem in additive manufacturing* [Conference presentation]. XXIV Congress of the Portuguese Operational Research Society.

Oliveira, P. (2025, February 14). *Impacto da inteligência artificial na ação ambiental* [Oral communication]. Vitrus Talks, Guimarães, Portugal.

Oliveira, P. (2025, July 21). *Artificial intelligence for a greener tomorrow: Predictive and explainable models in environmental monitoring* [Oral communication]. University of Salamanca, Salamanca, Spain.

Oliveira, P. (2025, November 12). *Synthetic data augmentation for COD prediction in WTTPs: A comparative study of deep learning models with VARMA and TTS-GAN* [Conference presentation]. IDEAL 2025, Jaén, Spain.

Pais, A., Alves, J. L., & Belinha, J. (2025). *A convolutional neural network to generate unit cell geometries with target elastic properties* [Conference presentation]. SYMCOMP 2025 7th International Conference on Numerical and Symbolic Computation Developments and Applications, Lisbon, Portugal.

Pais, A., Alves, J. L., & Belinha, J. (2025). *Neural networks to surrogate bone remodelling analysis in the calcaneus* [Conference presentation]. SYMCOMP 2025 7th International Conference on Numerical and Symbolic Computation Developments and Applications, Lisbon, Portugal.

Pais, A., Alves, J. L., & Belinha, J. (2025). *Scaffold design with neural networks* [Conference presentation]. Congresso Nacional de Biomecânica 2025, Portugal.

Paredes, R. (2025, June 16–19). *Decentralized causal-based monitoring for large-scale systems: Sensitivity and robustness assessment* [Conference presentation]. 14th IFAC Symposium on Dynamics and Control of Process Systems (DYCOPS 2025), Bratislava, Slovakia.

Penso, C. (2025, December 17). *CMEMS scientific Christmas gathering* [Oral communication].

Príncipe, J. (2025, June 30–July 1). *Cost-effective carbon paper electrodes for inverted perovskite solar cells* [Conference presentation]. 6th Doctoral Congress in Engineering 2025, Faculty of Engineering of the University of Porto (FEUP), Porto, Portugal.

Príncipe, J. (2025, November 10). *Inverted flexible perovskite solar modules for sustainable urban integration* [Conference presentation]. Simpósio "Produção e Armazenamento de Energia", XXIX Encontro Luso-Galego de Química, Fórum Braga, Braga, Portugal.

Probst, P. (2025, February 20–22). *Effects of class imbalance in unsupervised human activity recognition for office work task characterization* [Conference presentation]. 18th International Conference on Bio-inspired Systems and Signals Processing (BIOSIGNALS 2025), Porto, Portugal.

Rocha, J. (2025, December 17). *CMEMS scientific Christmas gathering* [Oral communication]. University of Minho, CMEMS, Portugal.

Rubel, M., Müller-Carneiro, J., & Freire, F. (2025, March 20). *LCA of an innovative technology for dairy wastewater treatment with the production of phosphorus-rich fertilizer* [Oral communication]. WalNUT Project General Assembly, University of Southern Denmark, Odense, Denmark.

Sent, G. (2025, December 3). *Can optical water types be used as ecological indicators? Insights from a temperate estuary* [Conference presentation]. International Ocean Colour Meeting (IOCS 2025).

Serra, G. (2025, February 24). *Do protótipo ao MIT: Inovando a segurança na micromobilidade* [Oral communication]. Mec in Touch – Jornadas de Engenharia Mecânica e Automação, University of Aveiro, Aveiro, Portugal.

Tenório, M. (2025, November 21). *Wooden buildings as a strategy for carbon neutrality in Portugal* [Oral communication]. 8th PDEC Workshop, University of Minho, Guimarães, Portugal.

Tenório, M. (2025, November 7). *Influence of framing density and insulation materials on the airborne sound insulation of prefabricated timber wall assemblies* [Oral communication]. 3rd Symposium on Acoustics and Vibrations (Itecons).

Tesch, L. L. (2025, September 9–12). *Impact of climate change-driven wildfires on the biogenic carbon of Pinus pinaster forests in Portugal* [Conference presentation]. 12th Life Cycle Management Conference (LCM 2025), Palermo, Italy.

Tufoni, P. (2025, April 9). *Uncertainty analysis of conceptual groundwater models* [Oral communication]. PhD Annual Seminar 2025, University of Algarve, Faro, Portugal.

Vuoto, A. (2025, September 15–17). *Towards data-informed modelling of historical masonry structures: A questionnaire-based approach for spatial characterisation of mechanical properties*

[Conference presentation]. Structural Analysis of Historical Constructions (SAHC 2025), Lausanne, Switzerland.

Zerega, A. (2025, July 7–9). *Cidades sustentáveis começam com ribeiros saudáveis: Modelação hidrológica-hidráulica de ecossistemas ribeirinhos urbanos* [Conference presentation]. 4º Congresso Internacional de Engenharia Ambiental, Coimbra, Portugal.

9.6 Prizes and Honors

MPP PhD Candidates

Carla Colombo
RILEM Award for Best Experimental Paper at the International Conference SAHC 2025

Best PhD Doctoral Thesis 2025 Awarded by "The Masonry Society (TMS)

Daniel Lima
Ron Cockcroft Award at the International Research Group on Wood Protection

Gareth Williams Award at the International Research Group on Wood Protection

Orlando Júnior
Best Poster Award at the 4th Coatings and Interfaces Online Conference (CIC 2025)

Rafael Anjos
IGS student Award by International Geosynthetics Society

9.7 Courses and Workshops Organized

MPP PhD Candidates

André Alves
32nd APDR Congress – Sustainable Transformation and Spatial Interaction of People and Places: Urban and Rural Landscapes for Mobility, Migration and Tourism

Session: The Spatial Dimensions of Decarbonisation: Challenges and Pathways for a Low-Carbon Future (Session)
Venue: Porto, Portugal
July 8–11, 2025

André Claro
13th Portuguese Meteorology and Geophysics Association Symposium & 23rd Luso-Spanish Meteorology Meeting

Venue: 13th Portuguese Meteorology and Geophysics Association Symposium & 23rd Luso-Spanish Meteorology Meeting
Organizers: Portuguese Meteorology and Geophysics Association (APMG)
March 24–26, 2025

3rd Inov4Agro Scholarship Researchers Day

Venue: UTAD, Vila Real, Portugal
Organizers: Inov4Agro Associated Laboratory

November 24, 2025

Catarina Jóia Santos
Prioridades em Proteção Costeira – Construir a Resiliência da Costa da Caparica (Workshop)

Venue: Sala Ágora, NOVA School of Science and Technology (NOVA FCT), Portugal

Organizers: Catarina Jóia Santos; Prof. José Carlos Ferreira; Prof. Michael W. Beck
February 13, 2025

Cláudia Rodrigues
Workshop de Análise de Dados

Venue: Departamento de Engenharia Informática, Faculdade de Ciências e Tecnologia, University of Coimbra, Portugal
Organizers: Carlos Bento and Cláudia Rodrigues
May 22, 2025

Daniel Lima
International Conference on Moisture in Buildings

Venue: University of Minho, Guimarães, Portugal
October 23–24, 2025

Giulia Sent
Observação da Terra: Análise da Cor do Oceano (Workshop)

Event: Encontro MARE 2025
Venue: Faculty of Sciences, University of Lisbon
September 12, 2025

Heloisa Antunes
Mapping School Food Literacy: A Tool for Teaching Food Sustainability (Course)

Event: CLEVERFOOD Summer School "Schools as enablers for a fair, healthy and sustainable food system"
Venue: Marathon, Attica, Greece
June 29–July 4, 2025

Jardim Puzzle 3D (Course)

Event: Universidade Júnior
Venue: Faculty of Sciences, University of Porto, Portugal
July 6–31, 2025

José Ferraz Caetano
Modelos experimentais em toxicologia – Computational chemistry & data science models for theoretical and laboratory development in toxicology

Venue: Cooperativa de Ensino Superior Politécnico e Universitário, Portugal
January 2025

Laísa Braga Kappler
Teletrabalho e transições urbanas na Área Metropolitana de Lisboa (Session)

Event: Workshop final do projeto REMOBIL – Rethinking Mobility, Location Patterns and Urban Form after the COVID-19 Pandemic
Venue: Centro de Transferência de Tecnologia e Valorização do Conhecimento da Universidade de Lisboa, Lisbon, Portugal
Organizers: João de Abreu e Silva, Paulo Morgado, Patrícia C. Melo, Eduarda Marques da Costa, Rui Colaço, Laísa Braga Kappler, Ana Louro
December 12, 2025

Luana Lübe Tesch
4th Training School Modenerlands: Sustainability and Resilience Assessment of Floating Energy Islands

Venue: Kayseri, Türkiye
February 14, 2025
April 14–17, 2025

Matheus Gomes Correia
Introduction to OpenStreetMap (Workshop)

Venue: Department of Geography, Federal University of Ceará, Fortaleza, Brazil
Organizers: Matheus Gomes Correia, Narcélio de Sá
February 14, 2025

Miguel Lima
IDL-FCUL Weekly RG1 Seminars

Venue: FCUL, Lisbon, Portugal

Phillip Probst
Co-development of Occupational Health Data Visualization

Venue: Câmara Municipal de Lisboa, Lisbon, Portugal
Organizers: Ana Paula Leal, Phillip Probst, Hugo Gamboa
May 9, 2025

Sci-Vi Seminar 2025 – Sustainable AI Prompting for Research Visualisation

Venue: FCT NOVA, Portugal
Organizers: Ágota Vegső, Phillip Probst, Hugo Gamboa
November 28, 2025

Tiago Mindrico
Rethinking Statuary in Digital Geographies: A Speculative Design Workshop (Session)

Event: 4th Digital Geographies Conference
Venue: IGOT-ULisboa – Instituto de Geografia e Ordenamento do Território da Universidade de Lisboa, Lisbon, Portugal
November 3, 2025

9.8 Outreach Activities

MPP PhD Candidates

Ana Paula F. da Silva
Presentation session for research and development projects

Topic: Valorization of municipal solid waste through high value-added materials
Venue: Resíduos do Nordeste & IPB (Polytechnic Institute of Bragança), Portugal
Audience: Sociedade Ponto Verde (SPV) and community/institutional stakeholders
August 5, 2025

Andreina Marques
CresceRio (Volunteering Project)

Venue: Coimbra, Portugal
Activity: Schoolchildren are taken to natural streams to raise social awareness of freshwater ecosystems and promote their preservation and restoration
June 22 & October 30, 2025

European Researchers' Night – Activity 75: Urban Freshwater Ecosystems in a Changing World

Venue: Coimbra, Portugal
Activity: Several didactic games developed to raise awareness of urban streams among the wider audience
September 26, 2025

XI meet.Eco – Associations Fair (Outreach Event)

Venue: Coimbra, Portugal
Activity: MARE-Freshwater Ecology Group outreach to biology students interested in future research collaboration
November 30, 2025

Camila Penso
VEM 2025 - Vamos Experimentar a UMinho 2025

Session: Fazer a Água dar à Luz
Venue: Universidade do Minho - Campus de Azurém
Organizers: Camila Penso, João Rocha e Professor Luís Gonçalves
December 18, 2025

Eva Iñiguez
Ciência Viva no Verão 2025 – Expedição Subaquática: Aventura e Biodiversidade para Jovens Exploradores

Venue: Praia dos Reis Magos, Centro Mergulho Cipreia, Portugal
Organizers: Eva Iñiguez Santamaria
August 29, 2025

João Rocha
VEM 2025 - Vamos Experimentar a UMinho 2025

Session: Fazer a Água dar à Luz
Venue: Universidade do Minho - Campus de Azurém
Organizers: Camila Penso, João Rocha e Professor Luís Gonçalves
December 18, 2025

Gil Serrano
26º Aniversário do Pavilhão do Conhecimento – Circuitos Abertos (Showcase)

Venue: Pavilhão do Conhecimento, Portugal
Activity: Showcasing robotics research conducted in portuguese universities and institutes
July 25, 2025

Raquel Fernandes
BIOCHANGE Bioblitz – 2nd Edition

Event: Invasive Species Week 2025
Activity: Promoted the detection and recording of native and invasive plants across the University Campus, raising awareness among both academic and non-academic communities about issues related to invasive species
Venue: University Campus, University of Lisbon, Portugal
May 7, 2025

Carlos Hernandez
COP30

Representation: MADES Paraguay Advisory Group
Venue: Hangar Convention Centre in Belém, Brazil
November 2025

Simone Fernandes
Dias Abertos da Faculdade de Ciências da Universidade do Porto (Outreach Presentation)

Venue: Faculty of Sciences, University of Porto, Portugal
Topic: Catalisador: um aliado para um planeta mais saudável – presentation of CO2 capture and conversion research and demonstration of MOF-based catalyst synthesis
Audience: Portuguese high school students from various cities
February 13–14, 2025

Vahid Rasouli
O papel dos agregadores da flexibilidade da procura (Lecture)

Event: Dia Nacional da Energia
Venue: Convento São Francisco, Coimbra, Portugal
May 29, 2025

9.9
News in Media & Social Media

MPP Projects

Exploratory: NEXT GENERATION OF DIGITAL "CONCRETE": performance mix design and assessment of sustainable and circular cementitious composites

1. Notícias UPorto – BIP PROOF investe mais de 100 mil euros em 11 projetos da U.Porto

2. Notícias UPorto – Três projetos made in FEUP entre os vencedores do BIP PROOF

Exploratory: Sentinel-Orb - SpacE operatioNs, moniToring, and mappINg ExpLorer: a smart Orb-system

3. BIP - INESC TEC – INESC TEC prototype represented at the world's leading Space event is days away from a parabolic flight

4. BIP - INESC TEC – Robotic system developed by INESC TEC successfully completes microgravity flights

5. BIP - INESC TEC – Viver no Espaço: reflexões a partir do Centro de Controlo da primeira missão análoga a Marte em Portugal

6. INESC TEC – INESC TEC prototype represented at the world's leading Space event is days away from a parabolic flight

7. INESC TEC – Robotic system developed by INESC TEC successfully completes microgravity flights

8. PROVA ORAL – by Fernando Alvim, Antena 3 - under the scope of ALTO MINHO SCIENCE FEST

MPP PhD Students

Adriano dos Santos Silva

9. Ponte Verde Lab – O "lixo" que interessa à NASA: quando o plástico se transforma em nanotubos de carbono

Albano Martins

10. Sustainable Construction Review – Portugal Pioneers Urban Space Model for Sustainable, Thriving Cities

Ana Paula Ferreira

11. Ponto Verde – An interview about the work developed during the PhD

12. Resíduos do Nordeste - Sessão de apresentação dos projetos de investigação e desenvolvimento

Andry Castro

13. RTP Madeira – Mais de 300 avistamentos de lobos marinhos nos últimos 15 anos (áudio)

Eva Iñiguez

14. Observador – Especialistas alertam que protetores solares protegem a pele mas não o ambiente

Filipa Corais

15. CrAFt – The Transition Experiments in Braga

Jade Müller Carneiro

16. Futuro Sustentável – Avaliação de Ciclo de Vida

José Carlos Ferraz Caetano

17. Fulbrighter Podcast – Is AI Actually Dangerous? A Chemist-Philosopher Answers the Hard Questions?

Matilde Marques

18. Público – Descoberta uma nova espécie de bactéria em corais do Oceanário de Lisboa

19. RTP Notícias – Descoberta no Oceanário bactéria que pode salvar os corais

Miguel Lima

20. FCUL – Estudo da Nature analisa 150 anos de dados sobre precipitação no Mediterrâneo

21. Público - Afinal, a chuva ainda não abandonou o Mediterrâneo, mostra artigo da Nature

22. Observador - Far-se-á a primavera debaixo de chuva?

Mohamad El Sibaii

23. MIT Portugal Program – Meet our PhD Students!

Rafael Anjos

24. UAveiro Notícias – Estudante do DECivil distinguido com o Student Award da International Geosynthetic Society

25. University of Southampton News – Royal recognition for rail research keeping UK on the move

26. Geosynthetic News Alert – Rail Research with Geosynthetics Recognized by Queen Elizabeth Prize

9.10 Patents & Invention Disclosure

MPP Projects

Salamatian, S., Medard, M., Cohen, A., D'Oliveira, R., (2025). Network coding-based post-quantum cryptography. Application No. 19/056018.
Filing date: 2/18/25
Publication date: 6/12/25

[Status: Pending]

Salamatian, S., Medard, M., Cohen, A., D'Oliveira, R., (2025). Network coding-based post-quantum cryptography. Application No. 19/056018.
Filing date: 8/30/21
Publication date: date: 3/3/22
Issued date: 3/25/25

[Status: Granted]

MPP PhD Students

Mesquita, N.; Célia Costa Cabral; Varela, Carla; Cristina Rufino; Portugal, Antonio; Baía Saraiva, Nuno; Fernandes, Luís. (2025). *ZEROPEST - Zero Oxygen Pest Eradication with Essential Oils for Sustainable Treatment.* (Patent No. 120165).

Invention Disclosure – Projects

Jeldres, F. (2025). Aluminum Fuel for Ocean Applications. MIT case: 26944.
Opened in 10/28/25

Status: Active

9.11 Participation in Conferences, Seminars, Courses, and Workshops

MPP Projects

Seed: Additive Manufacturing of Semicrystalline Polymers: Flow and Morphology

M. Andreev, C. Gangal, D. Nicholson, P. Yi, N. Kolezakis, G.C. Rutledge, "A Multiscale Model of Flow-Induced Crystallization in Polymer Processing", Center for Rapid and Sustainable Product Development, Polytechnic Institute of Leiria, Martinha Grande, Portugal, Nov. 27, 2025.

N. Kolezakis, G, D'Avino, P.L. Maffetone, V. Guida "Charged vesicle gels in consumer goods: A numerical and experimental study of structure, dynamics, and rheology", Department of Mechanical Engineering, Polytechnic Institute of Leiria, Leiria, Portugal, Nov. 25, 2025.

MPP Students

Adriano dos Santos Silva

Machine Learning & Artificial Intelligence for Chemical Engineering: Advanced (Course)
Venue: Técnico+, Instituto Superior Técnico, Lisbon, Portugal
September 10–12, 2025

Electron Microscopy Course
Venue: International Iberian Nanotechnology Laboratory (INL), Braga, Portugal
June 30–July 4, 2025

Ana Carrelhas

EWTEC 2025 (Conference)
Venue: Funchal, Madeira, Portugal
Organizers: IDMEC
September 2025

André Claro

Forecasting severe convective weather (Seminar)
Venue: Online
Organizers: Portuguese Weather Service (IPMA); Portuguese Meteorology and Geophysics Association (APMG)
Speaker: Dr. Margarida Belo-Pereira
June 3, 2025

13th Portuguese Meteorology and Geophysics Association Symposium & 23rd Luso-Spanish Meteorology Meeting (Conference)
Venue: UTAD, Vila Real, Portugal
Organizers: Portuguese Meteorology and Geophysics Association (APMG)
March 24–26, 2025

3rd Inov4Agro Scholarship Researchers Day
Venue: UTAD, Vila Real, Portugal
Organizers: Inov4Agro Associated Laboratory
November 24, 2025

Inov4Agro Open Day 2025
Venue: GreenUPorto, Vila do Conde, Portugal
December 10, 2025

Andreína Zerega

Thinking Like Nature – Integrating Biomimicry into Research (Workshop)
Event: MARE Meeting
Venue: Faculty of Sciences, University of Lisbon, Lisbon, Portugal
Speaker: Romana Santos
September 12, 2025

Camila Penso

Exploração e Análise de Dados (Microcredential)
Venue: Universidade Aberta, Portugal

Excel e Power BI (Microcredential)
Venue: Universidade Aberta, Portugal

Ferramentas Digitais (Microcredential)
Venue: Universidade Aberta, Portugal

Fundamentos de Cibersegurança (Microcredential)
Venue: Universidade Aberta, Portugal

Carlos Hernandez

Absolute Environmental Sustainability Assessment of Production and Consumption in a Systems Perspective (Course)
Venue: Technical University of Denmark, Denmark
August 25–29, 2025

Eva Iñiguez

Generalised Linear Models in R (Course)
Venue: Physalia Courses (Online)
February 24–28, 2025

EU TWILIGHTED Summer Training Workshop
Venue: GEOMAR Helmholtz-Zentrum für Ozeanforschung Kiel, Kiel, Germany
June 14–20, 2025

One Ocean Expedition Course on Climate Science, Policy, and Human-Nature Connections (Course)
Venue: Tallship Statsraad Lehmkuhl
Organizers: Dr Patrick Heimbach, Dr Kerim

H. Nisancioglu
July 5–31, 2025

Gil Serrano

IEEE RAS Summer School on Multi-Robot Systems
Venue: Czech Technical University, Czech Republic
Organizers: MRS Group
July 30–August 5, 2025

Giulia Sent

Ciência Clara – Career Strategy Programme (Course)
Venue: Teclab, Universidade de Lisboa & Online
Organizers: Filipa P. Moraes
June–September 2025

Marine Data for Sustainable Development: FAIR, CARE, TRUST (Training)
Venue: Online
October 22–24, 2025

Multi-Sensor Ocean Colour Course
Venue: EUMETSAT, Darmstadt, Germany
Organizers: EUMETSAT
December 7–11, 2025

Gonçalo Carvalho

Systematic Review of Scientific Literature (Course)
Venue: Faculty of Engineering, University of Porto (FEUP), Portugal
Instructor: Joana Alexandra Silva Duarte
September 2025 – February 2026

Heloisa Amaral Antunes

Paisagens em Transformação: Ecologia e Ferramentas Avançadas para o Planeamento Sustentável (Course)
Venue: Faculty of Sciences, University of Porto, Portugal
September 12, 13, 19, and 20, 2025

José Carlos Ferraz Caetano

O Longo Caminho da Verdade: Quando os Cientistas Persistem no Erro (Keynote Lecture)
Event: "Filosofia e História das Ciências" Seminar
Venue: Porto, Portugal
Organizer: Casa das Ciências – Fundação Belmiro de Azevedo
March 2025

Maria José Morais

Alliance4XR – Empowering Students & Educators: XR Training (Workshop)
Venue: University of Minho, Guimarães, Portugal
Organizers: Alliance4XR Project; ISISE – Institute for Sustainability and Innovation in Structural Engineering
May 30, 2025

Digital Transformation in Building Permits: Advanced Practices and the CHEK Framework (Summer course)
Venue: University of Minho, Guimarães & Gaiurb, Vila Nova de Gaia, Portugal
Organizers: CHEK – Change Toolkit for Digital Building Permits (Horizon Europe Project 101058559)
July 7–11, 2025

ISISE Day-Out & Workshop 2025
Venue: Tomar, Portugal
Organizers: ISISE – Institute for Sustainability and Innovation in Structural Engineering
October 20–21, 2025

8th PDEC Workshop
Venue: University of Minho, Guimarães, Portugal
Organizers: ISISE – Institute for Sustainability and Innovation in Structural Engineering
November 21, 2025

Maryam Salati

IEA EBC Annex 89 – Ways to Implement Net-zero Whole Life Carbon Buildings (Workshop)

Venue: ETH Zürich, Campus Hönggerberg, Zurich, Switzerland
June 25–27, 202

Matilde Marques

Climate change impacts on octocorals: Emergent pathogens, symbiont preservation and probiotic solutions (Oral presentation)
Event: 4th iBB Workshop
Venue: Instituto Superior Técnico, University of Lisbon, Portugal
July 28, 2025

Miguel Fernandes

Economics of Energy – Bridging Research and Policy (Workshop)
Venue: Nova School of Business and Economics (Nova SBE), Carcavelos, Portugal
October 23, 2025

Rafael Anjos

Rankine Lecture
Venue: Imperial College London, United Kingdom
Organizers: British Geotechnical Association
March 19, 2025

Géotechnique Lecture
Venue: Institution of Civil Engineers, United Kingdom
Organizers: British Geotechnical Association
November 4, 2025

Rita Pereira

Innovation, Entrepreneurship and Leadership (Course)
Event: IMFAHE Online Quarter Course (30 hours)
Venue: Online
January 17–April 8, 2025

Saeid Lotfi

Management in Façade Design (Course)
Institution: IAST – Institute for Architectural Science and Technology, United Kingdom
December 2025

XV Conference on Steel and Composite Construction & I Conference on Façade Engineering
Venue: Super Bock Arena, Porto, Portugal
Organizers: CMM – Associação Portuguesa de Construção Metálica e Mista
November 20–21, 2025

Hurricane Glazing: Designing Glazing for Wind-Borne Debris Protection (Webinar)
Organizers: Trosifol® (Kuraray Group)
August 2025

Enhancing Security with Laminated Glass (Webinar)
Organizers: Trosifol® (Kuraray Group)
September 2025

Designing with Laminated Glass Interlayers (Webinar)
Organizers: Trosifol® (Kuraray Group)
March 2025

An Overview of Composite Tooling Construction (Seminar)
Organizers: University of British Columbia, Canada
November 26, 2025

Advancing Hybrid Design for Composite Structures (Seminar)
Venue: Online
Organizers: The Institution of Structural Engineers (IStructE), United Kingdom
November 2025

Sara Parece

TechLaunch Program (Course)
Organizers: UT Austin Portugal Program
September 19–November 14, 2025

Simone Fernandes

ETE2025 – 2nd Workshop on Emerging Technologies for Energy (Workshop – Poster and Pitch presentation)
December 15–16, 2025

Tran Quang Minh
NORISK Master (Course)

9.12 Other Outputs

MPP Projects

Exploratory: ALAMO: Accurate federated Learning with uncertainty quantification for DER forecasting Applied to sMart Grids planning and Operation

Monteiro, D. (2025, July). Federated learning forecasting for household demand and PV production: New perspectives of fairness and personalization through regularization (Master's thesis, Instituto Superior Técnico, Universidade de Lisboa).

Pereira, L. (2025, September). *A real-world deployment of federated learning for residential solar PV power forecasting* [Poster presentation]. Machine Learning for Sustainable Power Systems, ECML-PKDD 2025 Workshop.

Silva, P. (2025, November). Uncertainty estimation metrics for federated learning forecasting algorithms applied to distributed energy resources (Master's thesis, Instituto Superior Técnico, Universidade de Lisboa).

Exploratory: GNSS Atmospheric TOmography: probing storms in a warming climate (GATO)

Mateus, P., Miranda, P. M. A., & Catalão, J. (2025). *GNSS tomography as a cost-effective tool for atmospheric water vapor monitoring* [Poster presentation]. ESA-LPS25 Symposium.

Exploratory: PEATMAP - A prototype model for studying the distribution, ecological dynamics, and carbon of peatlands in the landscape mosaics of the Iberian Peninsula

Geraldes, M., Fernandes, R., Santos, M., & Capinha, C. (2025). *Bioindicator-based mapping of peatland potential in the Western Mediterranean-Atlantic Realm*. BioRxiv, 2025.03.21.644445
https://doi.org/10.1101/2025.03.21.644445

Miguel Geraldes was an invited speaker at the webinar series "Alentejo às Quartas – à volta da Conservação da Natureza" - presentation of the project's main activities and preliminary results to a broad, predominantly non-academic audience (February 2025).

Exploratory: Sentinel-Orb - SpacE operatioNs, moniToring, and mappINg ExpLorer: a smart Orb-system

Coutinho, J. (2025). Propulsion control system in microgravity [Bachelor's report]. Department of Electrical Engineering, Instituto Superior de Engenharia do Porto (ISEP). Supervisors: A. Dias & A. Pires.

Pires, A., Coutinho, J., Santos, A., Persad, A., Dias, A., Moura, R., & Almeida, J. (2025, May 19–21). *SENTINEL smart orb-system: A scout robot for space operations and monitoring* [Poster presentation]. Luxembourg Space Resources Week 2025 (LSRW), Luxembourg.

Pires, A., Coutinho, J., Santos, A., Persad, A., Dias, A., Moura, R., & Almeida, J. (2025, September 29–October 3). *SENTINEL smart orb-system: A scout robot for space operations and monitoring* [Poster presentation]. International Astronautical Congress (IAC 2025), Sydney, Australia.
https://iac2025-iaf.ipostersessions.com/

Default.aspx?s=BC-6B-9D-AB-86-09-51-D8-AD-8C-43-94-57-B5-DA-4E

Pires, A., Coutinho, J., Santos, A., Persad, A., Dias, A., Moura, R., & Almeida, J. (2025, December 4). *SENTINEL smart orb-system: Robot for space operations and monitoring* [Poster presentation]. UMES Student-led Undergraduate Research Symposium, University of Maryland Eastern Shore. https://wwwcp.umes.edu/sans/calendar_event/umes-student-led-undergraduate-research-symposium/

Santos, A., Coutinho, J., Persad, A., Karnik, R., Dias, A., & Pires, A. (2025). SENTINEL-Orb: SpacE operatioNs, moniToring, and mappINg ExpLorer – a smart Orb-system. MIT Portugal Program – Earth Systems: Oceans to Near Space (Final Report). INESC TEC – CRAS. https://doi.org/10.54499/2022.15481.MIT (Final report submitted to FCT)

Sentinel participated in the MICROGRAVITY CAMPAIGN 2025 (NRC - National Research Council of Canada, Parabolic Flight), carried out under the scope of AST 601 course (Microgravity Science) organized by the International Institute for Astronautical Science.

Seed: Additive Manufacturing of Semicrystalline Polymers: Flow and Morphology

N. Kolezakis, G. C. Rutledge, G. R. Mitchell, J. Matias, P. G. Martinho, P. Pascoal-Faria. (2025). *Modeling Flow and Morphology in Extruder-Based 3D Printing of Semicrystalline PolymersAmerican* [Paper Presentation]. Institute of Chemical Engineering Annual Meeting, Boston, MA, United States.

Visit by N. Kolezakis and G.C. Rutledge to Polytechnic Institute of Leiria (IPL) and Center for Rapid and Sustainable Product Development (CDRSP). Purpose: collaboration planning and discussion. Nov 24-28, 2025.

Seed: Buoyancy Engine for Extended Underwater Operation

Kombargi, A. (2025). *Optimized sustainable hydrogen generation from liquid metal activated aluminum–water reactions*. (Doctoral dissertation, Massachusetts Institute of Technology).

Seed: Continuing Continuous Commissioning for Energy Efficient Buildings

Martinez, A.I., Langham, A.W., Donnal, J.S., Leeb, S.B. (2025). The Price of Undersampling Nonintrusive Electrical Data. *IEEE Transactions*. Submitted for review.

Almquist, E.T., Langham, A.W., Martinez, A.I., Bruno, S.J., Krause, T.C., Buchanan, M.C., Leeb, S.B. (2025). Behavioral Simulation Techniques for the Next Generation of Shipboard Microgrids. *Naval Engineering Journal*. Submitted for review.

Seed: Engineering Quantum Spin Hall Effect in Graphene

Yang, J., Sedeh, O. S., Yoon, C., Ye, S., Weldeyesus, H., Cotten, A., ... & Ju, L. (2025). Magnetic field-enhanced graphene superconductivity with record pauli-limit violation. arXiv preprint arXiv:2510.10873

Seed: Extreme Lipid Biophysics for Medical and Biotechnological Innovations

Silva, J.M., Zhang,Y., Dregni,A.J., Somberg, N., Hong, M. (2025, April). *Atomic Structure and Gating Mechanism of the Pathogenic Envelope Protein from SARS-COV-2*. [Conference presentation]. Portuguese Young Chemists Meeting, Faro.

Seed: Investigating fiber-based reinforcement networks for low-carbon concrete construction

MIT student, Adam Burke, visited Lisbon to attend the ICNF 2025 - 7th International Conference on Natural Fibers hosted by

FIBRENAMICS to meet with the Portuguese collaborators and learn about their diverse work on natural fiber composites across a variety of domains ranging from building construction to packaging.

Seed: Probing extreme weather events in a warming climate with GNSS and atmospheric reanalysis in the Azores Islands

Ramrajvel, N., Mondal, D., Elosegui, P., Paine, S., Mateus, P., and Mendes, V. (2025). *Decoding the signal of extreme weather events in the Azores archipelago using GNSS and atmospheric reanalysis products.* [Conference poster]. EGU General Assembly, Vienna, Austria, EGU25-13415. https://doi.org/10.5194/egusphere-egu25-13415.

Mondal, D.R., Elosegui, P., Ramrajvel, N., and Paine, S., 2025. *Major melting event on the Ross Ice Shelf, Antarctica, connected with enhanced atmospheric turbulence*. Geophysics Research Letters (peer-review article submitted)

Seed: Projecting wildfire-related toxic air pollution impacts at multiple scales

Cicone, L., Gama, C., Miranda, A., Osswald, T., Monteiro, A., Wong, A., & Selin, N. (2025). *Emissions and chemistry of PAHs from wildland–urban interface fires: Implications for human health* [Poster presentation]. International Global Atmospheric Chemistry Early Career Researcher Conference (IGAC ECR).

Roy, E..M, Selin, N.E. (2025, September). *Spatially and temporally dense measurements reveal meteorological driver of atmospheric mercury variability.* [Conference presentation]. MIT Department of Earth, Atmospheric, and Planetary Sciences Annual Research Showcase, Cambridge MA, USA.

Roy, E.M., Gay, D.A., Selin, N.E. (2025, May). *Regional drivers of Hg loadings informed by spatially and temporally dense observations.* [Conference presentation]. European Geophysical Union General Assembly, Vienna, AT.

Roy, E.M., Selin, N.E. (2025, March). *Observationally driven constraints on exchange, transport and chemical transformation of mercury.* [Conference presentation]. Environment and Climate Change Canada Air Quality Research Division Seminar Series, Virtual.

MPP Students

Ana Carrelhas

Deputy chair of the EWTEC 2025, Madeira, Portugal, September 2025.

Andry Castro

Fernandes, R., Castro, A., Marchante, H., Marchante, E., Capinha, C. (2025). *Specific richness patterns of invasive alien plants in mainland Portugal.* NeoBiota, 104. https://doi.org/10.3897/neobiota.104.163291

Fernandes, R., Castro, A., Marchante, H., Marchante, E., Capinha, C. (2025). *Padrões de distribuição de plantas exóticas invasoras em Portugal continental*. XV Congresso da Geografia Portuguesa, Évora.

Camila Penso

Teaching the following courses:

Electronics Laboratories II to 4th year biomedical engineering students.

Electronics and Digital Systems to 2nd year biomedical engineering students.

Carlos Hernandez

Hernandez, C., Rodrigues, C., & Freire, F. (2025, October 12–17). *How energy transitions reshape ecodesign of automotive components in battery electric vehicles? Retrospective vs. prospective life cycle assessment* [Poster presentation]. Brightcon Conference 2025, Grenoble, France.

Cauê Rios

Co-chair of the session "Transitioning to Sustainable Urban Mobility – Practical Applications and Behavioral Change" at the 23rd Annual STS Conference, Graz, May 2025.

Co-organization of the 10th Annual NEST Conference 2025 "Bridging the Gap between Research and Reality: A reflection on 10 years of NEST", May 29–30, 2025. Hosted by the Science Policy and Research Unit (SPRU), Business School, University of Sussex, Brighton, United Kingdom.

Cláudia Rodrigues

Rodrigues, C. (2025, October 17). [Poster presentation]. 2nd Annual Meeting of LASI, Faculdade de Medicina da Universidade de Coimbra, Coimbra, Portugal.

Cláudio Meireis

Meireis, C. (2025). *Modular Timber Façades for Sustainable Renovation of Building Envelopes.* In Stepinac, M (ed.). Short Term Scientific Missions Report - Year 3. Cost Action CA20139 HELEN.

Eva Iñiguez

A publication under review in Marine Pollution Bulletin

Co-chair of the session "4.15: Sunscreens and Personal Care Products in the Environment: New Data and Approaches to Evaluate Environmental Risks and Possible Solutions" at the SETAC Europe Annual Meeting, held from 11-15 May 2025, in Vienna, Austria. Additionally, with a poster presentation.

Filipa Corais

Chair of the session "Boosting Future Visions for Sustainable Mobility" at the 23rd Annual STS Conference, Graz, May 2025.

Co-chair of the session "Transitioning to Sustainable Urban Mobility – Practical Applications and Behavioral Change" at the 23rd Annual STS Conference, Graz, May 2025.

Heloísa Antunes

Preparation of the opinion article "Horta de Guimarães: Veiga de Creixomil as a space for learning and urban resilience" for the MIT Portugal website. The article has been finalized and submitted and is currently pending publication by the Program.

Joana Couceiro

Couceiro, J. F., Marques, M., Silva, G., Costa, R., & Keller-Costa, T. (2025). *Aquimarina aquimarinae sp. nov. and Aquimarina spinosulus sp. nov.: New bacterial species with versatile natural product biosynthesis potential* [Poster presentation]. 12th World Sponge Conference, Vila do Conde, Portugal.

Couceiro, J. F., Nunes, M., Marques, M., Silva, M. G., Daniela, M., Costa, R., & Keller-Costa, T. (2025). *Expanding the diversity of culturable coral-associated bacteria through aerobic, microaerophilic and anaerobic conditions: A quest for novel marine drug producers* [Poster presentation].

Trends in Marine Host-Microbe Symbioses Symposium, Padova, Italy.

João Rocha

Co-authored a paper that is currently under review piezoelectric benders for ground characterization.

Writing a paper reviewing electronic amplifiers for high-power / high-frequency piezoelectric acoustic sources.

Teaching classes to 2nd year students of the Electronic Engineering program at the University of Minho.

José Ferraz-Caetano

Oral Presentation outside the scope of the PhD Project: *Chemistry, Commodification, and Governance: The Role of Scientific Institutionalization in the Legacy of the Laboratório Químico Municipal do Porto, 1884-1907* at the 14th International Conference on the History of Chemistry, organized by EuChemS at the López Piñero Interuniversity Institute (Valencia, Spain), in June 2025.

Special Issue Journal Editor for *Fulbright Chronicles, Fulbright Chronicles, Volume 4, Number 1*, on Impact of AI and Social Science. (November 2025).

Luiz Navarro

Submission of a peer-reviewed article currently under review in the Elsevier Journal Computers and Electronics in Agriculture: Navarro, L., et. al. *High-Accuracy, Non-Invasive Fish Biometrics via Above-Water Stereo Vision for Precision Fish Farming*.

Mahla Shariatzadeh

Submission of a paper titled “Bi-Objective Robust Optimization of Electric Vehicle Charging with Behavioral Uncertainty” to the IEEE Transactions on Transportation Electrification journal.

Maria Anastasiadou

Invited Assistant at Nova IMS on the following courses:

- Computers’ Architecture;
- Information’s Technologies Hardware and Software;
- Storing and Retrieving Data;
- Big Data Storage.

Maria José Morais

Three abstracts accepted for Special Session SS-38: From Monitoring to Management: Digital Twins and Predictive Modelling for the Resilient Maintenance of Transport Infrastructure, 36th European Safety and Reliability Conference (ESREL 2026), as main author; full papers are currently under development.

Co-author of one abstract accepted for Special Session SS-38: From Monitoring to Management: Digital Twins and Predictive Modelling for the Resilient Maintenance of Transport Infrastructure, 36th European Safety and Reliability Conference (ESREL 2026); full paper is currently under development.

Two manuscripts under submission process, as main author.

Co-author of three manuscripts under preparation/internal revision for journals.

Coordination and organization of group activities for the RamCI cluster, ISISE, University of Minho.

Collaboration on the organizing and scientific committees for the 36th European

Safety and Reliability Conference (ESREL 2026): participated in committee meetings, collaborated on the coordination of the social program, sponsorship, and dissemination teams; created Special Session SS-38: From Monitoring to Management: Digital Twins and Predictive Modelling for the Resilient Maintenance of Transport Infrastructure related to the PhD topics, serving as chair; revised submitted abstracts for SS-38 as well as abstracts for other special and parallel sessions.

Maryam Salati

Salati, M., Silvestre, J. D. & Costa, A. A. (2025). A Framework for Implementing Dynamic Life Cycle Assessment: Data Sources, Relevant System Boundaries, Barriers, and Potential Solution Approaches. The International Journal of Life Cycle Assessment. (paper submitted to the journal).

Salati, M., Silvestre, J. D. & Costa, A. A. (2025). Toward Harmonized Dynamic LCA: Integrating temporal parameters into LCA for building sustainability. (accepted abstract and prepared conference paper to be submitted).

Matheus Correia

Gomes Correia, M., Prata, B., & Ferreira, A. (n.d.). Physical and digital infrastructure transformation for connected and automated vehicles: Impact on transportation systems, urban design, and social dynamics [Manuscript under review]. International Journal of Intelligent Transportation Systems Research.

Gomes Correia, M., Prata, B., & Ferreira, A. (n.d.). Characterizing the urban road network for automated mobility: A scalable typology for evidence-based policy [Manuscript under review]. Transport Policy.

Gomes Correia, M., Prata, B., & Ferreira, A. (n.d.). Quantifying network cohesion: Global assessment of urban infrastructure for automated mobility [Manuscript under review]. Transportation Research Record.

Tamagusko, T., Callai, S., Gomes Correia, M., & Ferreira, A. (n.d.). Optimizing pavement maintenance with AI: A data-driven framework integrating multi-objective optimization and machine learning [Manuscript under review]. Construction and Building Materials.

Miguel Fernandes

Fernandes, M. (2025, July 9–12). *Balancing conservation and use: Insights from the Portuguese marine spatial planning process* [Poster presentation]. MPA in MSP Conference, Nord University.

Fernandes, M. (2025, June 16). *Supporting the development of climate-smart marine spatial planning in Portugal* [Poster presentation]. Dia das Ciências do Mar 2025, Faculty of Sciences of the University of Lisbon (FCUL), Lisbon, Portugal.

Fernandes, M. (2025, September 15–18). *Sustainable planning at sea: Assessing conservation and use compatibility in Portugal* [Poster presentation]. ICES Annual Science Conference 2025, International Council for the Exploration of the Sea.

Miguel Lima

Invited Assistant for Laboratory Meteorology course at host institution.

Paolo Tufoni

Co-author in an article under publication process: “A Spatial Framework for Assessing Irrigation Water Use in Overexploited Mediterranean Aquifers”

Preprint: López-Pérez, E., Manzano-Juaréz,

J., Jimenez-Bello, M., García-Prats, A., Sanchis-Ibor, C., Rubio-Martin, A., Boubekri, F. Z., Kajji, A., Tufoni, P., Nunes, L. M., & Pulido-Velazquez, M. (2025). A Spatial Framework for Assessing Irrigation Water Use in Overexploited Mediterranean Aquifers. Preprints. https://doi.org/10.20944/preprints202510.1891.v1

Pedro Oliveira

Reviewer for several peer-reviewed journals: Expert Systems, Discover Computing, Neural Computing and Application, Journal of Water Process Engineering, npj Clean Water, Scientific Reports and Signal, Image and Video Processing.

Research Stay at the University of Salamanca (Spain), between the 14th and 25th of July.

Raquel Fernandes

Preprint - Geraldes, M., Fernandes, R., Santos, M., Capinha, C. (2025). Bioindicator-based mapping of peatland potential in the Western Mediterranean-Atlantic Realm. bioRxiv. https://doi.org/10.1101/2025.03.21.644445

Invited speaker for the Physical Geography Seminar, Geography Bachelor's Degree at the Institute of Geography and Spatial Planning – University of Lisbon (24/03/2025), presenting on the topic "An overview of the mapping, ecological status, and threats of Iberian peatlands.

Ricardo Magalhães

Food Quality Lab Scheduling Project for a French Multinational company,

Gas Grid Maintenance Scheduling Project for a New Zealand company,

Novel Schedule Encoding Method (paper to be published next year).

Rita Dantas

Invited assistant (professor) at FEUP on the following courses:

-Industrial Drawing, 3 hours, L.EGI;

-Project FEUP, 1.5 hours, L.EM;

-Mechanical Engineering Drawing, 3 hours, L.EM.

Rita Pereira

Project proposal submitted: Pereira, R., Norton, A., Nóbrega, J. M., & Santos, C. P. (2025, October 25). InnoAdapt—An innovative adaptive pacifier capable of malocclusion monitorization Concurso para Financiamento de Provas de Conceito 2025, TecMinho, University of Minho.

Saeid Lotfi

Technical Research Report:

-Numerical Modelling and Comprehensive Parametric Analysis of Structural Glass Elements under Wind Loading.

-Independent numerical research output documenting advanced finite element modelling and parametric analysis conducted using ABAQUS/Standard, focusing on stress distribution, deformation behavior, and sensitivity to key design parameters in laminated glass systems.

-The report consolidates numerical methodologies and results developed during PhD research and serves as a valuable foundation for near future peer-reviewed publications.

Sara Parece

Customer discovery and market study for emerging start-ups (Carbon Layers).

Conducted extensive customer-discovery research under UT Austin Portugal's TechLaunch 2025, interviewing sustainability consultants, engineers, architects, municipal officers and industry stakeholders (70+ interviews planned).

Identified market needs related to:

1. Automation of BIM-LCA workflows,

2. Integrated energy-LCA-cost analysis,

3. Standardisation via SECClasS and Uniclass,

4. Early-design decision support tools for renovation.

Completed approximately 19 peer-reviews for Q1 and Q2 journals in AEC, BIM, LCA, construction informatics, and architectural engineering.

- Journals included (indicative):

- Building and Environment,

- Journal of Building Engineering,

- Sustainable Cities and Society,

- Energy and Buildings,

6. Developments in the Built Environment,

7. and other reputable venues in the field.

Simone Fernandes

Tutoring of bachelor students from "Ciências e Tecnologias do Ambiente" and Chemistry during their final project. The internship involved the teaching of synthesis methods of MOF-based catalysts and of catalytic studies of the cycloaddition of epichlorohydrin with CO2 to produce cyclic carbonates in Shclenk tubes under moderate conditions (1 atm and temperatures under 100 °C).

Tran Quang Minh

Featured Article for Volume 340, the October 1st issue of Engineering Structures: *Enhancing the Structural Health Monitoring (SHM) through data reconstruction: Integrating 1D convolutional neural networks (1DCNN) with bidirectional long short-term memory networks (Bi-LSTM).*

Vítor Sousa

January - December 2025: Lectured classes on machining processes, including drilling, turning, and milling, integrating PhD research to provide an updated perspective on machining technologies (bachelor's level).

CLOSING REMARKS

"The year 2025 marked an important transition for the MIT Portugal Program with the launch of the fourth phase of the program, extending the collaboration through 2030. This new phase broadens the program's scope by introducing four strategic research areas, namely Energy; Chips and Nanotechnology; Space and Artificial Intelligence, while continuing work in Climate Science & Climate Change; Earth Systems; Digital Transformation in Manufacturing and Sustainable Cities.

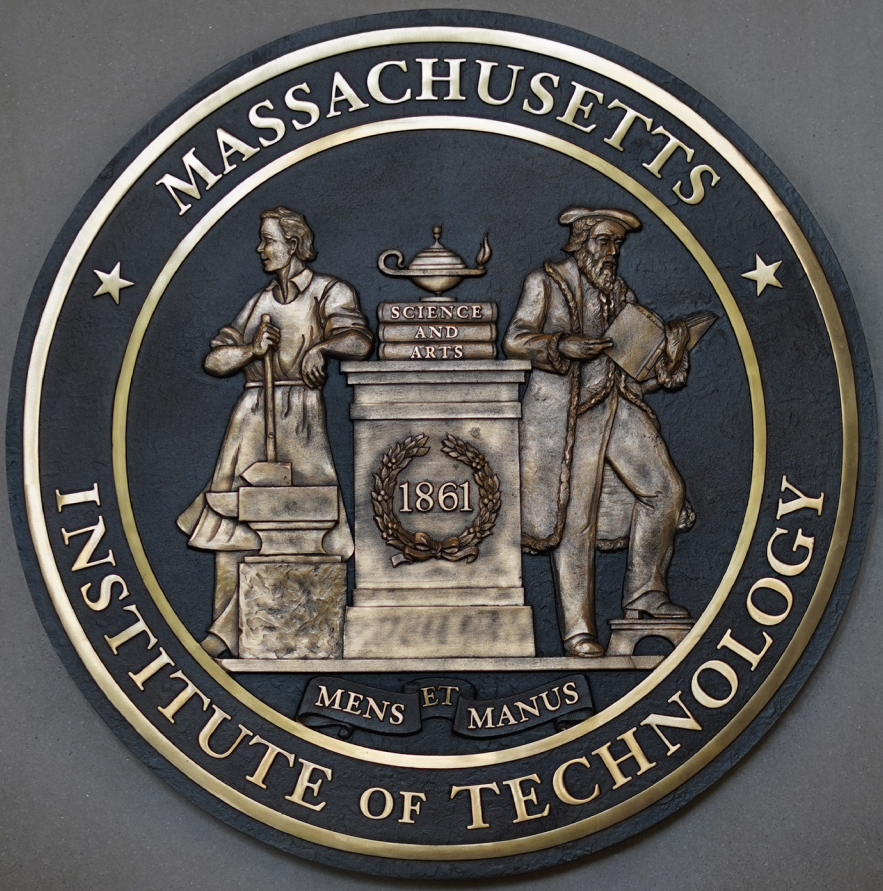
Together, these areas reflect Portugal's and Europe's strategic priorities and reinforce the program's commitment to addressing key technological and societal challenges through international collaboration.

In parallel, 2025 also marked the consolidation of a renewed institutional framework for Portugal's partnerships with U.S. universities, including establishing a new governance model and creating the Mission Structure for International Partnerships.

These developments are expected to provide greater strategic alignment, stability, and long-term vision for the partnerships as they evolve toward 2030. While 2025 was a year of the Program's transition, several important initiatives took place, which continue to strengthen the community and foster collaboration between Portuguese and MIT participants. Most importantly, the research pillar of the program was reinforced through the launch of new exploratory projects in Portugal and collaborative seed grants at MIT, supporting the development of new ideas and strengthening scientific collaboration between Portuguese institutions and MIT.

The year concluded with a transition in the program's national leadership through the appointment of new co-directors in Portugal. Looking ahead, the MIT Portugal Program is positioned to advance this new phase of the collaboration by reactivating and strengthening key initiatives, particularly those related to mobility and collaborative research with new activities expected to gain momentum in 2026."

– Message from Alexandre Ferreira da Silva and João Barreto as the new co-directors



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