MIT PORTUGAL
2024 Annual Report

MIT Portugal

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Executive Summary

MIT Portugal Program

The MIT Portugal Program presents its Annual Report for calendar year 2024.

The MIT Portugal Program (MPP) is a multi-phase strategic international collaboration between the Massachusetts Institute of Technology (MIT) and Portuguese universities, research institutions, and industry, promoted by the Portuguese Foundation for Science and Technology (Fundação para a Ciência e Tecnologia — FCT), and the Portuguese Ministry of Science, Technology, and Higher Education. Launched by the Portuguese government in 2006, renewed in 2013, and again in 2018, MPP aims to strengthen Portugal's knowledge base and international competitiveness through strategic investments in research, education, innovative ideas, and entrepreneurial training. .

The third phase, the MIT Portugal Partnership 2030 (MPP2030), launched in June 2018 and extended through 2024, focused on high-quality research collaborations in the following research areas:

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

In 2024, two calls for research proposals were issued, one at MIT and one in Portugal. The call for seed grants at MIT resulted into 30 proposals from MIT researchers from across the Institute. Sixteen projects were funded, including nine new projects, and seven were renewed with additional funding to help finish the research. The call for Portuguese exploratory grants was opened in December. The call resulted into 22 proposals, with final selection expected in 2025.

Some of the large-scale collaborative flagship research projects, between Portuguese industry, MIT researchers, and Portuguese researchers, which ended in 2023, continued to have impact in 2024. One example is the flagship project AEROS, which launched its nanosatellite (HM-1) into space in March 2024. The project won the International Small Satellites Mission of the Year Award in August.

Other highlighted events in 2024 included the Innovation Workshop at MIT; the fourth edition of the Marine Robotics Summer School, held in the Azores; and the Annual Conference, held in Coimbra.





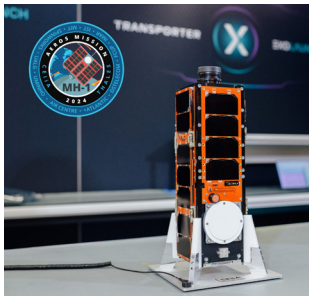

Figure 1. Photos of the the MH-1 nanosatellite and its launch.

"The flagship AEROS launched its nanosatellite (MH-1) into space in March and won the International Small Satellites Mission of the Year Award in August."

Figure 2. Photos of the 2024 Annual Conference, held in Coimbra; Next page: activities during the Marine Robotics Summer School, in the Azores.

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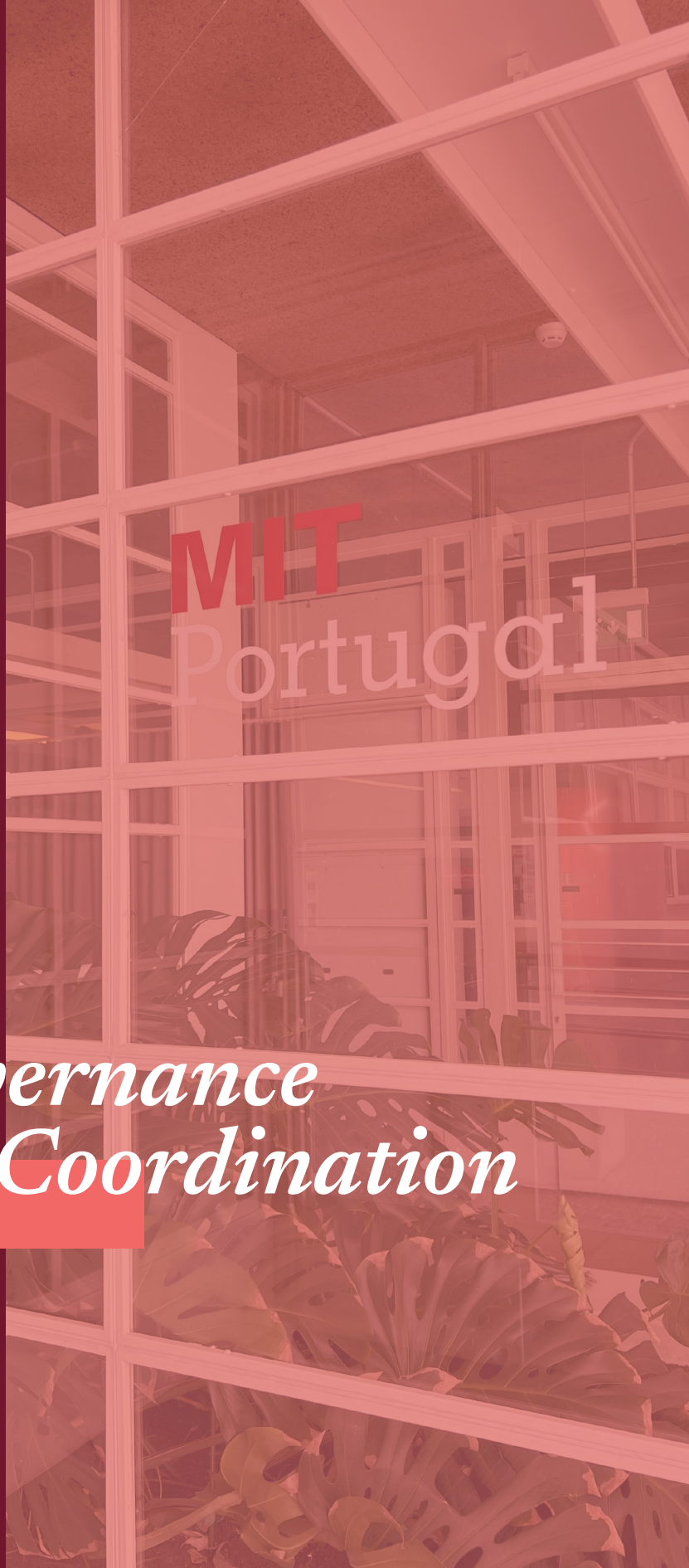


Governance & Coordination

"2024 was a pivotal year for negotiations regarding the continuation of the program into a new phase."

– Pedro Arezes, Director of the MIT Portugal Program

The MPP collaboration is a contractual agreement between MIT and FCT. These institutions, in their respective countries, have the responsibility of 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 Governing Committee (PGC)**, 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.

An independent **External Review Committee (ERC)**, formed by members from the international scientific community, reviews the research program and makes recommendations to the Program Directors and the PGC.

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 reports on all collaboration activities of the Program to ensure its effective development.

The Program is assisted by **Area Leaders**. Their role is critical in serving as review panel coordinators for calls for PhD grants and calls for research proposals, advising on the scope of their respective research areas, and promoting MPP2030 in their home institutions. The Area Leaders have been chosen based on their recognized expertise in their area of research.

2.1 2024 updates

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

Program Governing Committee

Madalena Alves

President of Fundação para a Ciência e a Tecnologia
Representative of Fundação para a Ciência e Tecnologia

Richard K. Lester

MIT Vice Provost for International Activities
MIT Senior Administration Representative

Maria Zuber

Vice President for Research at MIT
MIT Senior Administration Representative

António M. Cunha

President of North Portugal Regional Coordination and Development Commission
Representative of the Portuguese participating entities

Dava Newman

Director of MIT Media Lab
Apollo Program Professor of Astronautics at MIT and Harvard–MIT Health, Sciences, and Technology faculty member. MIT senior administration representative

Paulo Ferrão

Professor at Instituto Superior Técnico (IST)
Representative of the Portuguese participating entities

Isabel Furtado

CEO of TMG Automotive
Portuguese Industry Representative

External Review Committee

John Beddington

Former U.K. Government Chief Scientific Adviser

Melany Hunt

Dotty and Dick Hayman Professor of Mechanical Engineering, Caltech

Mohan Munasinghe

2007 Joint Nobel Peace Prize Winner, Vice Chairman of the Intergovernmental Panel on Climate Change (IPCC)

Pascale Ehrenfreund

President of the International Space University, Research Professor of Space Policy and International Affairs at the Space Policy Institute/George Washington University

Program Directors

Pedro Arezes

Full Professor in Human Factors Engineering at UMinho
National Director of MIT Portugal Program

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

Ana Mena

Innovation & Education Coordinator – Portugal (until August 2024)

Beatriz Silva

Communications Officer – Portugal (since October 2024)

Chrissy Mullin

Financial Administrator II – MIT

Deliana Ernst

Administrative Lead – MIT

Joana Soares

Communications & Events Coordinator – Portugal (until February 2024)

Lília Rocha

Project Officer – Portugal

Natalie Billings

Program Coordinator – MIT

Susana Costa

Industrial Liaison & Research Coordinator – Portugal (until February 2024)

Area Leaders

Júlia Seixas

Associate Professor with Habilitation at NOVA University
Lead Faculty of Climate Science & Climate Change

Alexandra Moutinho

Assistant Professor at Técnico Lisbon
Lead Faculty of Earth Systems: Oceans to Near Space

Miguel Nóbrega

Associate Professor at University of Minho
Lead Faculty of Digital Transformation in Manufacturing

Manuel Gameiro da Silva

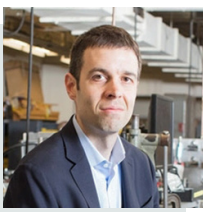
Full Professor at University of Coimbra
Lead Faculty of Sustainable Cities

Ana Camanho

Associate Professor at University of Porto
Lead Faculty of Data Science

John J. Leonard

Samuel C. Collins Professor of Mechanical and Ocean Engineering at MIT
Lead Faculty of Earth Systems: Oceans to Near Space



John Hart

Professor of Mechanical Engineering at MIT
Lead Faculty of Digital Transformation in Manufacturing

Christoph Reinhart

Professor in Building Technology at MIT
Lead Faculty of Sustainable Cities

2.2
Governance meetings

The PGC met on **Sept. 9, 2024**, to review the Program progress in **2023**, discuss the planned activities for **2024** (figure 3), and strategize on the direction of the collaboration for the next phase. The Directors of the Program were invited to attend the meeting. The MPP Directors reported the activities carried out in **2023**, detailed their financial execution, and presented the activities and remaining plans for **2024**. The PGC approved the **2024** work plan and budget provided by FCT.

No ERC meeting took place in 2024.

Figure 3. Dinner ahead of PGC meeting in September 2024 with Pedro Arezes, Doug Hart, Dava Newman, Zita Martins, Isabel Furtado, John Hansman, Richard Lester, António Cunha, Madalena Alves and Paulo Ferrão.

2.3
Meetings with external entities

In April, Pedro Arezes, the National Program Director, joined a meeting in Porto on research security guidelines at universities organized by the UT Austin Portugal Program.

In May, a meeting was held between the University of Texas Austin at Portugal Program, the MIT Portugal Program, and U.S. Ambassador Randi Levine to discuss the objectives and the plans of the U.S. programs in engaging with the new government and Minister of Education, Science and Innovation Fernando Alexandre.

In December, MPP National Director Pedro Arezes took part in several meetings with members of the government to discuss the outlines of a new phase.

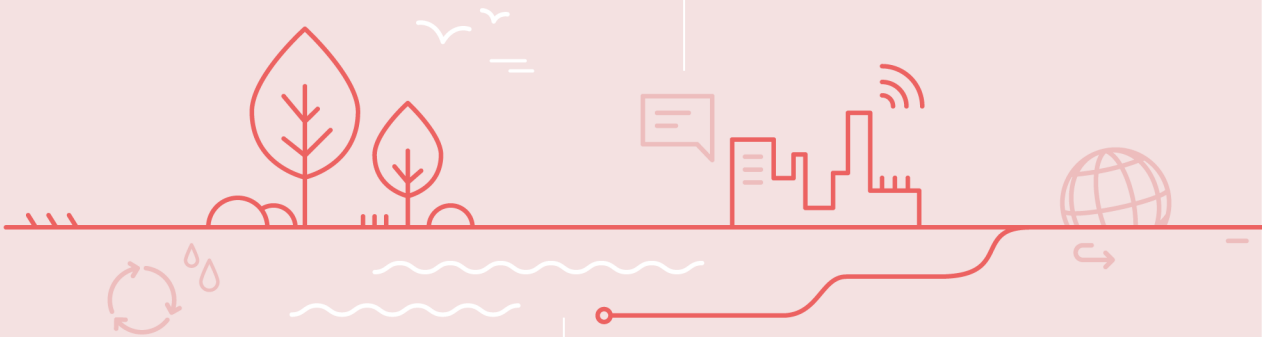

MIT Portugal
Coordination Office
info@mitportugal.org
www.mitportugal.org

03

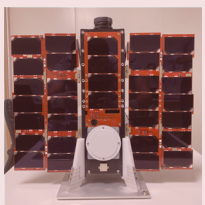
Walk through the year 2024

APR_

Open call for Seed Grants Proposals



MAR_



Launch of the MH-1 Satellite (AEROS project)

MPP hosted a group of 40 Portuguese high school students from Porto at MIT

JUNE_

Innovation Workshop at MIT

Participation of the Portuguese Minister of Education, Science, and Innovation in MIT Portugal Innovation Workshop

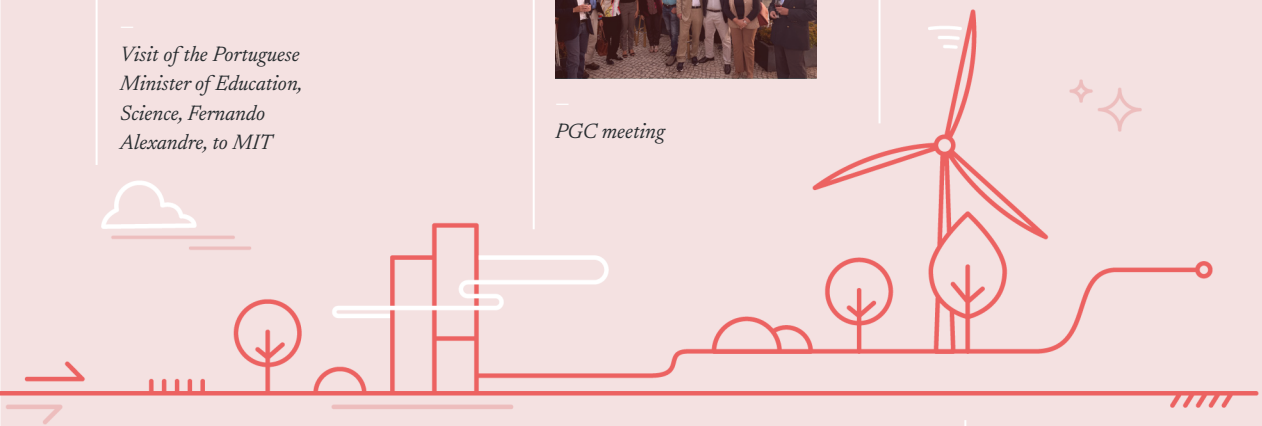
Visit of the Portuguese Minister of Education, Science, Fernando Alexandre, to MIT

SEPT_

PGC meeting

NOV_

MIT Portugal Annual Conference



JULY_

Awarded projects to collaborative joint research team (Seed Projects)

Participation in "Encontro Ciência 2024"

Marine Robotics Summer School

DEC_

Open call for Exploratory Projects by FCT

04

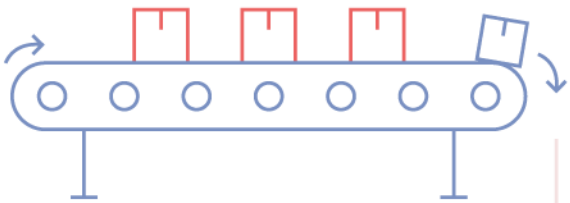
Facts & Figures 2024

104
Peer-reviewed articles

14
Books and book chapters

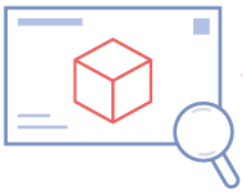
57
Proceedings/ conference papers

24 **Ongoing projects**



16
Seed projects
(from 2024 call, including 9 new projects and 7 renewed projects)

8
Exploratory projects
(from 2023 call)



6

PhD Students' in news articles in the press

Social media followers

24,128

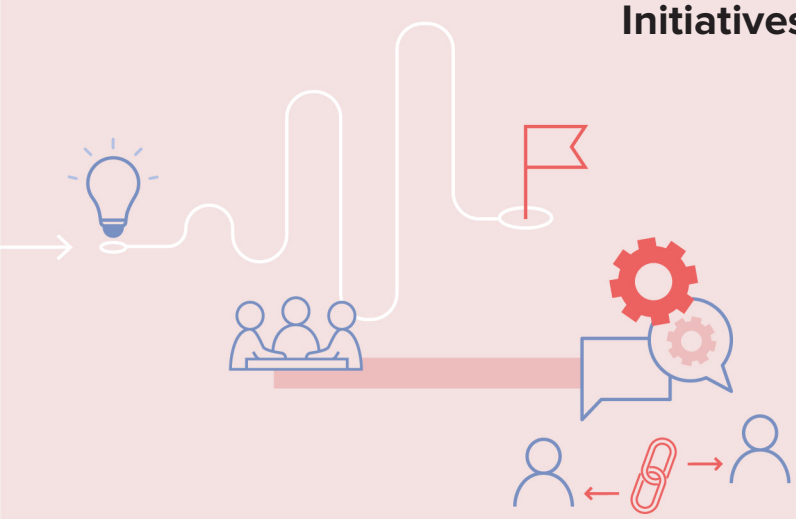
3
Newsletters

4
Website news

153
Social media posts

8

Initiatives



- **1** *Annual conference*
- **1** *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. Under MPP2030, the Program has sharpened its focus on five critical areas: Climate Science & Climate Change, Earth Systems: Ocean to Near Space, Digital Transformation in Manufacturing, Sustainable Cities, and Data Science. Strengthening research initiatives is emphasized, with a strong focus to advancing Climate Science & Climate Change.

For a more in-depth look at the projects supported by MPP in 2024, please see the following sections.

Climate Science & Climate Change

Earth Systems: Ocean to Near Space

Digital Transformation in Manufacturing

Sustainable Cities

Data Science

5.1
Overview of the Exploratory Projects

The third call from 2023 for exploratory projects as part of MPP2030 resulted in funding eight projects, whose leading Portuguese entities' locations are shown in Figure 4, identified by color of the primary scientific area.

The exploratory projects from 2023 call ran until December 31, 2024, and have already been renewed until March 31, 2025.

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

Figure 4. Location of the Portuguese leading entities of the exploratory projects. The primary scientific area of these projects is coded by the color of the location pins:
Climate Science & Climate Change – orange;
Digital Transformation in Manufacturing – yellow;
Earth Systems: Oceans to Near Space – blue;
Sustainable Cities – green; and
Data Science - gray.
The autonomous regions are not presented on the map due to simplification, as no exploratory projects have been assigned to these regions. This decision was made to streamline the visual representation and does not reflect a lack of importance or consideration for the Azores and Madeira.

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

(renewed 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

(renewed 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

(renewed 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

(renewed 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

(renewed 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 Silva
Universidade do Minho

Machine learning-aided polymer metallization for the automotive industry

(renewed 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

(renewed 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

Principal Investigator

Ana Cristina Pires de Oliveira
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)

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

(renewed 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

5.2

Overview of the Seed Projects

The MIT Portugal Program has awarded 2024 seed grants to 16 collaborative projects between MIT and Portuguese researchers, for one to two years. These grants support nine new proposals and seven projects that are continuing from previous years. The grants are awarded to researchers from eight MIT departments and centers, representing three MIT schools and its college, as well as nine Portuguese institutions. The 2024 call for proposals by the MIT Portugal Program welcomed submissions for innovative projects that have the potential to benefit Portugal in our core research areas: Climate Science & Climate Change (three projects); Sustainable Cities (three projects); Digital Transformation (two projects) and Earth Systems (five projects), as well as three projects in other research areas that aim to benefit the Portuguese people.

The following nine new awards were granted in 2024:

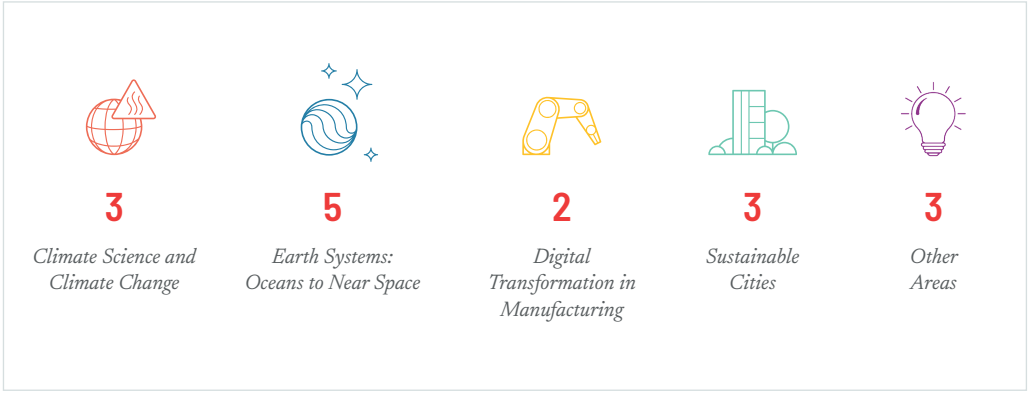


Figure 5. Number of projects awarded 2024 seed grants, by research area.

Landcover Stability: Heating and Drying of Plants and Soils

This research aims to address uncertainties surrounding the carbon sequestration potential of abandoned croplands, a strategic focus for climate change mitigation that avoids conflicts with food security and offers co-benefits such as enhanced biodiversity and climate preparedness. We propose to map cropland abandonment globally and quantify aboveground biomass and soil carbon accumulation under different restoration scenarios (active versus passive restoration). Using a combination of remote sensing, Geographic Information System (GIS) mapping, and meta-analysis techniques, we will identify regions with the highest carbon sequestration potential and assess the impacts of various factors on carbon accumulation rates. The outcomes of this research will contribute to the development of evidence-based policies and strategies for climate change mitigation and land management, highlighting the most effective restoration approaches to maximize carbon sequestration, biodiversity enhancement, and climate preparedness.

Climate Science and Climate Change

MIT Principal Investigator

Dara Enkekhabi
Professor, Department of Civil and Environmental Engineering

Portuguese Collaborator

Isabel Franco Trigo
Instituto Português do Mar e da Atmosfera (IPMA)

MIT Co-Principal Investigator

Dr. Daniel Short Gianotti
Research Scientists, Department of Civil and Environmental Engineering

Additive Manufacturing of Semicrystalline Polymers: Flow and Morphology

Additive manufacturing is a process for fabricating 3D parts from a digital model (commonly known as 3D printing). For polymers, complex parts are fabricated by Fused Deposition Modeling based on a digital specification of the desired form. However, the material properties are not well-controlled. Semicrystalline polymers are thus particularly difficult to process. To fabricate useful products, it is necessary to understand how the rheology and crystallization kinetics depend on molecular structure and are coupled during processing. In collaboration with experimental efforts of the INOV.AM and Bioshoes4ALL programs to characterize the evolution of semicrystalline morphology in situ, we will develop a state-of-the-art multiscale model that describes the coupling of the polymer rheology to flow-induced crystallization along the print road and predicts the development of semicrystalline morphology as a function of material and process parameters. Use of the model will enable better control of material properties and facilitate the development of new feedstocks and model-based control systems.

Digital Transformation in Manufacturing

MIT Principal Investigator

Gregory C Rutledge
Professor, Department of Chemical Engineering

Portuguese Collaborator

Pedro Martinho
Professor of Engineering, School of Technology and Management, member of the Center for Rapid and Sustainable Product Development (Centro para o Desenvolvimento Rápido e Sustentado de Produto, or CDRSP) Polytechnic Institute of Leiria

Bioshoes4All

Prof. Joao Matias
Adjunct Professor of Engineering, School of Technology and Management, member of CDRSP, Polytechnic Institute of Leiria

Geoffrey R. Mitchell
Researcher, CDRSP, Polytechnic Institute of Leiria

Paula Pascoal-Faria
Professor of Mathematics, School of Technology and Management, member of CDRSP, Polytechnic Institute of Leiria

Desalination, resource recovery and power generation with ionically conductive membranes

There are a variety of high-impact opportunities in Portugal to leverage advanced membrane technologies for desalination, ion recovery, and power generation. Unfortunately, current membrane materials lack the structural and functional-group characteristics needed to enable these technologies, so this proposal aims to infuse new materials concepts into membrane technology to address the water–mineral–energy nexus. The two research teams are uniquely positioned for this work. The Smith lab is a world leader in membrane materials, but has not focused significant prior effort on aqueous separations. In contrast, the Crespo group has a long-standing effort in aqueous separations for desalination, lithium recovery, and energy generation. Taken together, this proposal will leverage a unique series of membrane materials developed by the Smith lab to address major application challenges in water, minerals, and energy through a robust collaboration and exchange with the Crespo group.

Earth Systems: Oceans to Near Space

MIT Principal Investigator

Zachary P. Smith
Associate Professor, Department of Chemical Engineering

Portuguese Collaborator

João Crespo
Full Professor of Chemical and Biological Engineering, NOVA University Lisbon

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

Building on their complementary expertise and capabilities, the MIT META Lab and the Portuguese Fibrenamics team will develop degradation-resistant polyolefin-algae composite fibers and fabrics. These composite textiles will be fabricated via a combination of melt-, wet-, and electrospinning as well as knitting, and will provide passive cooling, antibacterial, anti-inflammatory, radiation shielding, and carbon dioxide sequestering properties. The experimental development process will be guided and aided by the ab-initio and thermo-mechanical modeling, as well as AI-enabled optimization algorithms. The new technology will help to address microplastic pollution at its source and will open many applications in health care, aerospace, high-performance athletics, and consumer textiles. The project will complement and support the ongoing "Pacto Bioeconomia Azul" Project led by the Fibrenamics team and funded via the EU Plan for Recovery and Resilience (PRR) program, which aims to develop new products, processes, and services resulting from incorporation of blue bioeconomy products into value chains.

Earth Systems: Oceans to Near Space

MIT Principal Investigator

Svetlana Boriskina
Principal Research Scientist, Department of Mechanical Engineering

Portuguese Collaborator

Raul Fangueiro
Professor, University of Minho and President of the Board, FIBRENAMICS – Institute for Innovation in Fibre and Composite Materials

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

The embodied carbon in concrete building construction is a major contributor to global greenhouse gas emissions; its primary ingredients of cement and steel produce 2.7 gigatons (GT) of carbon dioxide equivalent emissions annually (7% of total global emissions) and are challenging to decarbonize on the supply side. In response, a major pathway to carbon mitigation in buildings is demand-side reduction: by building more efficiently and intelligently, it is possible to provide new construction for substantially less emissions than business-as-usual approaches. In previous work by the PI and others, techniques to minimize emissions through optimization of reinforced concrete structures are shown to save up to 80% of carbon compared to typical construction methods [2]. Existing work has mainly focused on reducing the volume of concrete (and thereby cement) through surface articulation and shaping of structural elements to remove unnecessary material, and on cost-effective means of creating formwork for complex, shape-optimized building components through techniques such as additive manufacturing [3]. A remaining key challenge lies in the reinforcement used to give tensile resistance to concrete structures, almost always achieved through cold-bent steel reinforcing bars (rebars).

While rebar is small by volume compared to concrete, its emissions footprint is substantial, often contributing half or more of the embodied carbon of typical reinforced concrete construction. Furthermore, steel rebar requires excess concrete to protect it against corrosion (e.g., 5cm or more of required concrete “clear cover”), which is nonstructural but contributes substantial emissions. Finally, the construction of rebar cages (or networks) for minimal and complex concrete forms is cumbersome, time-consuming, and suffers from low precision. This project seeks to investigate an alternative approach to low-carbon reinforcement for structural concrete, based on flexible fiber tensile systems that can be precisely manufactured, prestressed, and incorporated into shape-optimized precast concrete structural components. Using existing expertise from MIT in reinforced concrete optimization and tensile network simulation, and from the University of Minho’s Fibrenamics group in fiber science and materials engineering, the interdisciplinary team will collaborate to develop and test this alternative construction approach, and to benchmark its environmental performance and cost compared to typical steel-reinforced concrete.

Sustainable Cities

MIT Principal Investigator

Caitlin Mueller
Associate Professor, Departments of Architecture and Civil and Environmental Engineering

Portuguese Collaborator

Raul Fangueiro
Professor, University of Minho and President of the Board, FIBRENAMICS – Institute for Innovation in Fibre and Composite Materials

Engineering Quantum Spin Hall Effect in Graphene

Quantum spin Hall effect (QSHE) is a fascinating topological phenomenon that could happen when electrons are confined in two dimensions (2D). It plays an important role in understanding fundamental topological physics principle in materials, as well as in engineering low-power electronic and quantum computation device applications.

In this project, we will attempt to realize QSHE in heterostructures formed by atomically thin 2D materials. We will employ electron transport measurements at cryogenic temperatures and search for the quantized conductance as evidence of QSHE. We will get theory support from Joaquín Fernández-Rossier at the International Iberian Nanotechnology Laboratory, Portugal, to design experiments and understand the data obtained. In addition, the experimental group of Sascha Sadewasser will contribute with the growth of as a substrate materials using molecular beam epitax. We will arrange exchanges of staff and students to facilitate realizing the goal of this project.

Beginning with this seed project, we expect to establish a long-term collaboration to generate impacts in higher education, fundamental physics research, and industrial application in MIT and in Portugal.

Quantum and Nano Sciences

MIT Principal Investigator

Long Ju
Assistant Professor, Department of Physics

Portuguese Collaborator

Joaquín Fernández-Rossier
International Iberian Nanotechnology Laboratory, Group Leader of Theory of Quantum Nanostructures and tenured Staff Researcher, Portugal

Sascha Sadewasser
International Iberian Nanotechnology Laboratory, Leader of the Laboratory for Nanostructured Solar Cells

Energy-efficient Brain-inspired Computing with Ionic Devices

The goal of this project is to leverage ionic computing as a highly promising and novel opportunity to enable the needed, revolutionary improvements in computing energy efficiency. If current trends continue, the global power requirements for computing will reach global primary power production capacity by 2040. The goal for the field at present is to improve the energy efficiency of computing by more than a million-fold. This project will advance a novel ionic computing device (sketched below) that we call Electrochemical Ionic Synapse (EIS), which is inspired by how our biological synapses function. To reduce the operating voltage while operating at nanosecond speeds, we will explore promising materials based on cerium(IV) oxide (cerium dioxide, CeO_2).

Use of a good proton conductor (nano-porous CeO_2 electrolyte), together with a doped CeO_2 channel (Pr-doped CeO_2 in particular) 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. Ultimately, this project will advance a novel device technology, to reduce the energy consumption and carbon dioxide emissions of computing, while advancing the abilities of artificial intelligence hardware.

Artificial Intelligence, Energy-efficient computing

MIT Principal Investigator

Bilge Yildiz

Professor, Department of Nuclear Science and Engineering

Portuguese Collaborator

José P. B. Silva

Assistant Researcher at the Centre of Physics of Minho and Porto Universities (Centro de Física das Universidades do Minho e do Porto), Portugal

Extreme Lipid Biophysics for Medical and Biotechnological Innovations

Understanding the biophysical properties of lipids is vital for advancing molecular medicine. Lipid-based nanoparticles (LNPs), used in Covid-19 vaccines, exemplify this potential. However, broader use of LNPs for gene therapy and drug delivery is hindered by chemical stability and inefficient drug release. This research addresses these challenges through two objectives. AIM-1 characterizes the supramolecular organization of phosphatidylinositol (PI) in lipid membranes. Using solid-state nuclear magnetic resonance (ssNMR), we will elucidate PI's effects in membrane destabilization to enhance drug-delivery efficiency. AIM-2 explores the unique properties of extremophile Archaea lipids for future medical and biotechnological innovations. Lipids from Sulfolobus species, stable under extreme conditions from the volcanic Azores terrain, will be analyzed using ssNMR to investigate their intriguing membrane properties. Our integrated approach will uncover novel lipid biophysics for next-generation LNPs. Additionally, exploring new extremophile organisms creates opportunities for biotechnology and bioremediation applications, and provides clues into how life may exist on other planets.

Biotechnology and Health Applications

MIT Principal Investigator

Joao Medeiros Silva
Postdoctoral Associate, Department of Chemistry

MIT Co-Principal Investigators

Mei Hong
Full Professor, Department of Chemistry

Portuguese Collaborator

Nelson Jose Simoes
Full Professor, Faculty of Sciences and Technology, University of the Azores

Duarte Nuno Toubarro
Assistant Professor, Biotechnology Center of Azores, University of the Azores

Buoyancy Engine for Extended Underwater Operation

Long-endurance autonomous ocean monitoring systems such as profiling floats and ocean gliders, which can measure at multiple depths, use buoyancy engines to drive them. These engines are typically based on changes in flotation volume driven by hydraulic pumps that are, in turn, powered by lithium batteries. These systems are highly efficient, but are severely limited by the storage capacity of their batteries. Because of this, ocean monitoring systems often require surface support ships costing upwards of $75,000 per day. The costs of these ships are so prohibitive that many ocean monitoring systems, although very expensive themselves, are often designed to be disposable, as it is cheaper to send them on one-way missions than try to recover them. Thus, even small improvements in operational life of these systems have an enormous impact on our ability to monitor the ocean.

The current proposal aims to extend typical operational life by a factor of three by developing a new type of buoyancy engine that relies on an extremely dense aluminum-based energy storage method developed here at MIT.

Earth Systems: Oceans to Near Space

MIT Principal Investigator

Douglas P. Hart
Professor, Department of Mechanical Engineering

Portuguese Collaborator

João Sousa Tasso
Faculty of Engineering – University of Porto, EU Horizon program funded research, DiverSea project and Center for Atlantic Operations, Portuguese Recovery and Resilience Funds

Unlocking carbon sequestration in abandoned croplands with satellites and AI

(renewed until August 31, 2025)

This research proposal aims to address uncertainties surrounding the carbon sequestration potential of abandoned croplands, a strategic focus for climate change mitigation that avoids conflicts with food security and offers co-benefits such as enhanced biodiversity and climate preparedness. We propose to map cropland abandonment globally and quantify aboveground biomass and soil carbon accumulation under different restoration scenarios (active versus passive restoration). Using a combination of remote sensing, GIS mapping, and meta-analysis techniques, we will identify regions with the highest carbon sequestration potential and assess the impacts of various factors on carbon accumulation rates. The outcomes of this research will contribute to the development of evidence-based policies and strategies for climate change mitigation and land management, highlighting the most effective restoration approaches to maximize carbon sequestration, biodiversity enhancement, and climate preparedness.

Climate Science and Climate Change

MIT Principal Investigator

Cesar Terrer
Assistant Professor, Department of Civil and Environmental Engineering

Portuguese Collaborator

Cristina Cruz
Assistant Professor, Universidade de Lisboa & cE3c - Center for Ecology, Evolution, and Environmental Change

Quantifying toxic air pollution and exposure from wildfires

(renewed until August 31, 2026)

Wildfires that degrade air quality are increasing in intensity worldwide, and in Portugal in particular. However, the human exposure implications of the specific toxic pollutants that can be produced or mobilized by wildfire smoke are uncertain. The objective of this work is to estimate the relative impact of large wildfire emissions to overall exposure-related metrics for two toxic substances emitted by wildfires: polycyclic aromatic hydrocarbons (PAHs) and mercury. To do so, we will use global-to-regional atmospheric modeling and data analysis to simulate the emission and dispersion of these two pollutants from large wildfires, focusing on southwestern Europe. We will use improved emission inventories and model-measurement comparisons to improve the ability of models to accurately represent these substances and their impact from wildfires. We will then calculate wildfire contributions to exposure-relevant metrics, and explore modeling of future climate impacts.

Climate Science and Climate Change

MIT Principal Investigator

Noelle Selin
Professor, Institute for Data, Systems, and Society and Department of Earth, Atmospheric & Planetary Sciences

Portuguese Collaborator

Alexandra Monteiro
Principal Researcher, University of Aveiro

Analytics for climate-resilient multi-energy systems via DER integration and demand response

(renewed until until August 31, 2025)

This collaborative project develops a new predictive and prescriptive analytics framework for building climate-resilient multi-energy systems. Our work integrates the planning of distributed energy resources (DERs) and demand response (DR) programs for improving the resiliency of renewables-dominant power systems in the face of extreme events. First, we develop a two-stage stochastic optimization approach to allocate DERs and grid hardening resources in the pre-disaster phase, and trigger DR and restoration operations in the post-disaster phase. Second, we consider resiliency and low-carbon operations as design requirements for DR programs and comparatively evaluate aggregator-coordinated and automatic response mechanisms for various disruption scenarios. Third, we refine our allocation and response strategies to include endogenous uncertainty representation, which captures the impact of planning decisions on the key parameters governing energy demand and renewable supply. Our research will contribute to a decision-support system and practical strategies for climate-resilient energy systems in Portugal and New England.

Climate Science and Climate Change

MIT Principal Investigator

Saurabh Amin
Professor, MIT Department of Civil and Environmental Engineering (CEE)

Portuguese Collaborator

Filipe Joel Soares
Centre for Power and Energy Systems (CPES) of INESC-TEC (University of Porto), Senior Researcher, Doctor

Continuous commissioning for energy-efficient buildings

(renewed until August 31, 2026)

A key component for tackling climate change is ensuring that buildings are energy efficient and sustainable. A significant portion of building energy consumption is wasted due to improper operation and control. For instance, in commercial buildings and university campuses, energy is often wasted in heating or cooling unoccupied spaces. Furthermore, even an initially "optimal" system will not operate according to design specifications indefinitely as equipment degrades and building usage evolves over time. This project will develop a new approach for "continuous commissioning" of building facilities to ensure that buildings operate at peak efficiency with a minimum expense in sensors and computation. This project will develop a real-time building monitoring and control framework that provides actionable information to operators. The solution aims to be low-cost and scalable, while helping operators better maintain existing equipment and make well-informed decisions for building equipment and control retrofits.

Sustainable Cities

MIT Principal Investigator

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MIT Co-Principal Investigators

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Professor, MIT Department of Architecture

Daisy H. Green
Post-Doctoral Associate, MIT Department of Architecture

Portuguese Collaborator

Ricardo Gomes
IST RC, Instituto Superior Tecnico, Lisboa

Semantic simultaneous localization and mapping for underwater vehicles

(renewed until August 31, 2026)

Semantic simultaneous localization and mapping (SLAM) refers to the ability of a robot to build object-based models of the environment, accounting for uncertainty. To do so, a robot must combine continuous geometric information about its trajectory and object locations with discrete semantic information about object classes. We are investigating several gaps in existing capabilities, including: (1) the ability to robustly estimate both the shape and the pose of objects, (2) the ability to transfer vision techniques from terrestrial scenes to underwater scenes, and (3) the ability to create self-improving perception system for robots using semi-supervised machine learning, with location information from SLAM as a supervisory signal.

Earth Systems: Oceans to Near Space

MIT Principal Investigator

John Leonard
Professor, MIT Department of Mechanical Engineering (MechE)

Portuguese Collaborator

Nuno Alexandre Cruz
Senior researcher at the Ocean Systems Group, Lecturer at the Dept. of Electrical and Computer Engineering, FEUP, Porto

Generative factory modeling for improved productivity, quality, and sustainability

(renewed until August 31, 2026)

Designing factories that efficiently deploy digitally controlled equipment, such as robotics and 3D printing, is essential to making manufacturing more efficient, sustainable, and locally-oriented. However, current design tools are not accessible to small and medium-sized manufacturers – which comprise over 95% of the supply chain in most developed nations, including the United States and Portugal – and therefore many manufacturers lack the ability to make data-driven decisions to invest in automation. The goal of this project is to create a more capable and affordable factory simulation approach, integrating automated generation of simulation models with machine learning methods for generative design of factories, and so enable more resilient, distributed production networks. To properly incorporate principles of quality management, both at the factory and supply chain levels, we will collaborate with colleagues from U. Minho. We plan to apply this tool with companies in Portugal, as well as in

Massachusetts, and share the outcomes across the collaboration. The results will help guide manufacturers to make investments in advanced equipment that improves productivity and reduces their carbon footprint, and the tool will be further extensible to simulate highly distributed production systems within future cities, or even in space.

Digital Transformation in Manufacturing

MIT Principal Investigator

John Hart
Professor, Department of Mechanical Engineering

Portuguese Collaborators

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Assistant Professor of Quality and Organizational Excellence, University of Minho

Bárbara Rangel Carvalho
Assistant Professor, University of Porto

Improving voxel-based 3D printing for robotic applications

(renewed until 31 August 2024)

We will investigate how we can manipulate 3D printed objects at the voxel level to produce 3D prints with accuracies unachievable in any other way. Our focus will be on the creation of novel 3D printable robotic actuators, such as the fingers of a robotic hand, and showing increased grasping precision, but our technique can also be used in a wide range of other applications. In the traditional workflow, when 3D printing a model, the model geometry is first translated into layers and voxels using software called a slicer, and then 3D printed. Inaccuracies occur as the slicer software tries to match the 3D geometry to a grid-like voxel pattern (for Polyjet 3D Printing), which leads to wrong material properties in the 3D print. We address this issue by instead assigning materials to the 3D printed voxels during the modeling stage.

Digital Transformation in Manufacturing

MIT Principal Investigator

Stefanie Mueller

Associate Professor, MIT Department of Computer Science and Artificial Intelligence Laboratory (CSAIL) and MIT Department of Engineering and Computer Science & Mechanical Engineering

Portuguese Collaborator

Pedro Neto

Assistant Professor, Department of Mechanical Engineering, University of Coimbra

Geometric deep learning-enhanced multi-physics digital twins for complex product design

(renewed until 31 August 2024)

Designing better wind turbines is critical to improving sustainable renewable energy generation. A key challenge is the time-consuming multi-physics simulations of the turbine that limit exploration of many design options. We propose a geometric deep learning approach to generate surface and volumetric meshes for fluid and structural simulations. By accelerating computational fluid dynamics and finite element analysis simulations, our proposed methods will improve the accuracy and time taken to complete wind turbine design analysis by orders of magnitude. The methods developed will be broadly applicable to applications with solid mechanics and fluid dynamics problems. These fundamental contributions to machine learning-driven meshing will also help accelerate innovation for our multiple industry partners in Portugal.

Digital Transformation in Manufacturing

MIT Principal Investigator

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Portuguese Collaborators

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Polytechnic of Porto

Sérgio Tavares
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Intelligent Seaweed Farming Management System based on Microbiome Data

(renewed until August 31, 2026)

Seaweed aquaculture has the potential to feed the world, fight climate change, and restore our ocean. However, the rapid growth of seaweed production is accelerating the spread of infectious diseases that harm the seaweed and lead to socioeconomic instability due to the loss of farming income. With the funding from this proposal, we will develop a machine learning-based aquaculture monitoring and response system that uses microbiome data to predict and prevent disease. Our system will reduce livestock losses, lead to cost savings, and promote sustainable food production. We will build our system based on microbiome data. Microbiome population and diversity are indicators of the health and resilience of the seaweed ecosystem because the microbiome changes and adapts swiftly to the earliest indication of harmful pathogens. This enables our sensor system to predict disease outbreaks before they occur and warn seaweed farmers to take timely preventative actions.

Climate Science and Climate Change

MIT Principal Investigator

Stefanie Mueller
Assistant Professor, Computer Science and Artificial Intelligence Laboratory

MIT Co-Principal Investigator

David Wallace
Professor, Department of Mechanical Engineering

Portuguese Collaborator

Rodrigo Costa
Assistant Professor, Department of Bioengineering, Técnico

Industry Collaborators

GreenWave *(U.S.)*
Aqualvor *(Portugal)*
AlgaPlus *(Portugal)*

06

Education

6.1
MPP PhD Students

Since its launch, MPP has prioritized advanced training by offering transdisciplinary 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 domains of MPP2030. Unlike previous programs, MPP2030-FCT fellows can pursue their doctoral degrees at any Portuguese university that aligns with their research interests.

In 2024, an extension year, even though no new calls for scholarships were issued, 114 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 9.

Figure 6. Research areas of the program.

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Development of optimized compressed earth blocks

Currently, with growing concern for adopting more sustainable technical solutions, interest in earth as a building material has been renewed. The main objective of this project is to develop compressed earth blocks (CEBs) capable of meeting the safety and durability requirements in line 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 through the incorporation of industrial waste and by-products, especially construction and demolition waste. Preliminary results have demonstrated the potential of replacing soil with railway concrete waste, as well as ceramic tile waste, in improving the mechanical strength of CEBs, without neglecting their thermal performance. During 2024, studies were developed regarding the optimization of soil grading in CEBs, culminating in a published article. In addition, the state of the art involving the incorporation of industrial waste and by-products in CEBs was addressed. Complementary conference papers were developed regarding the research methods adopted in the methodology. The entire experimental campaign has been completed, including the study on the incorporation of other industrial waste: granulated cork and Waste Tire Textile Fiber (WTTF). The assessment of the life cycle of the developed products and their overall sustainability is in its final stage.

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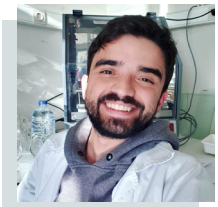
Energy, materials and health in regenerative processes of common architecture for sustainable cities

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.

Optimization of municipal solid waste management systems towards sustainability

The project focuses on (i) waste collection route optimization and (ii) valorization of plastic solid waste into carbon nanotubes (CNTs) for wastewater treatment. Both strategies contribute to optimizing municipal solid waste management systems (MSWMS). So far, the project has led to 1 journal paper and 13 conference papers/book chapters on route optimization, and 3 journal papers on waste valorization. Additionally, two projects funded by Sociedade Ponto Verde explore were approved. The first is related to using wireless sensor networks for waste monitoring and the second is related to the economic feasibility of CNT synthesis from plastic waste. The PhD project advanced both areas, with most results published and accessible. The findings align with Research Area 4 of the MIT Portugal Program (Sustainable Cities), offering solutions for MSWMS, a key aspect of urban sustainability.



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

Urban public spaces like squares, streets, and parks are essential for urban life, promoting social interaction and various activities. Rapid urbanisation, climate change, and sustainability concerns necessitate rethinking traditional and modern construction approaches. The study presents a model for assessing construction solutions by combining modern technology with vernacular knowledge. Key challenges include material adaptability to climates, sustainability, and culturally relevant design. Case studies demonstrate the successful integration of local materials and bioclimatic design with modern innovations, such as advanced materials and technologies. This collaboration enhances urban comfort, durability, and environmental performance while balancing traditional values with modern innovations. Findings highlight the importance of vernacular practices in addressing microclimatic issues, reducing urban heat islands, and preserving heritage, while modern techniques ensure adaptability and durability. This research offers valuable insights and practical guidelines for urban designers, architects, planners, and policymakers.

Sludge treatment by earthworm-enhanced reed beds towards smart-cities

This study innovated a sustainable sewage sludge management system using a sludge treatment reed bed incorporating Eisenia fetida (W-STRB) and Arundo donax in smart city planning. Research spanned two sites: Beirolas WWTP and Horto greenhouse. Over a year, Beirolas underwent 24 sludge cycles at a consistent rate of 43 kg dry solid/m^2/year. Horto pilot compared Phragmites australis and Arundo donax across three sludge loading rates. Findings, published in peer-reviewed papers, encompassed meta-analysis reviews, water balance, drained water quality, and residual sludge assessments. Notably, W-STRB excelled in dewatering and enhancing drained water quality. The residual sludge, enriched in nutrients from the worm-plant synergy, holds promise for agricultural applications. This study marks a pivotal shift towards sustainable solutions with far-reaching environmental implications.

** Thesis defended in 2024.*

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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, and 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. Two articles have been published (10.1016/j.rser.2022.113140 and 10.1061/JWRMD5.WRENG-6215) and another was approved for submission. I'm currently in the final submission phase of my PhD thesis.

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

Additive manufacturing (AM) by Fused Filament Fabrication (FFF) is an emergent technology for the production of components and structures, and whose advantages have been extensively explored in the fields of mechanical engineering[1–3]. Some shapes, such as the Gyroid [4] foam, present a complex geometry which can only be obtained with AM. 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 [5] and will permit to propose optimized bone scaffold[6-8] foams, aiming to design lighter and structurally optimized prosthesis, which will be produced by AM. Printed specimens will be submitted to experimental tests aiming to calibrate and validate the developed computational framework.

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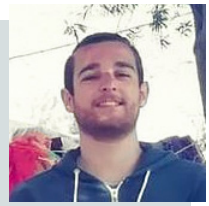
Framework for ergonomic assessment in collaborative robotic systems

The potential of Human-Robot Collaboration (HRC) remains largely untapped, particularly regarding its bi-directional relationship with ergonomic criteria. Existing collaborative robotics (cobots) frameworks often consider occupational health benefits as outcomes rather than integrating ergonomic principles as key design inputs. In industrial settings, a gap persists between the engineering aspects of cobot integration and Ergonomics & Human Factors (E&HF). Current ergonomic assessment methods are slow and inadequate for the flexible nature of cobot operations. This research aims to develop an ergonomic evaluation framework tailored to HRC systems. A laboratory prototype replicating an industrial workstation has been established, alongside a pilot study on the physical and cognitive workload of human workers under varying cobot behaviors. Results indicate that robots should adopt an assistive and anticipatory approach with verbal transparency. The proposed framework will map ergonomic evaluations to corrective measures and corresponding cobot actions, enhancing HRC effectiveness.

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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The sustainability of portuguese cities for tourism

Arturo Sousa
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This work has as a main objective to identify the role that information and communication technologies can play in promoting sociocultural sustainability in creative tourism destinations. The main research topics are creative tourism and sociocultural sustainability, with ICT as a key promoter. Creative tourism as niche tourism offers a set of benefits in the territories where it is felt and this study highlights the sociocultural benefits that define sociocultural sustainability. ICT, fashion technologies, play a significant role in promoting various types of sustainability and this study highlights the social and cultural benefits. This investigation developed a mixed methodology with a study based on interviews with artisans and creative companies in Barcelos and Óbidos, just as this study implemented questionnaire surveys with visitors and residents of these two portuguese locations.

** Thesis defended in 2024.*

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

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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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Load-Frequency Control considering Hydrogen Electrolysers' response

The first objective of this thesis was to analyze whether a large installed capacity of Hydrogen Electrolysers providing primary and fast reserves allows for the power system to be operated securely at lower synchronous inertia levels. Secondly, a novel philosophy and control scheme using Model Predictive Control for the secondary reserve were proposed, which allow for the fast ramping capabilities of HEs to be fully exploited during post-fault recovery.Thirdly, the costs for Portuguese and Spanish TSOs to join the FCR Cooperation were assessed; a tool was created to compute the revenues of a Virtual Power Plant including HEs in this market. Economic analysis was performed using opportunity costs. Fourthly, a novel regulatory scheme is proposed, which allows for calculating the costs that TSOs pay to balancing service providers such as HEs in the market, and the proposed scheme is compared against the existing one. Overall, HEs appear a promising technology when participating in LFC, with benefits for both HE owners and TSOs.

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

As a stimulus to achieving the objectives for Climate Action 2050, with regard to promoting sustainable urban mobility (SUM), the thesis focuses on the assumptions of the New Bauhaus and the role of the Architect in this process of co-creation which, in an interdisciplinary way, promotes the physical and cultural changes necessary for the paradigm shift. Thus, the thesis aims to define and evaluate an action-research methodology that aims to Accelerate the Change of Behavior, Attitudes and Mindset of society (MACBAM). The thesis is based on three pillars: Transition Management, the Design of Public Space and the change society's behavior, attitudes and mindset.

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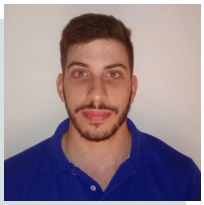
Promoting circular economy in buildings refurbishment – a methodological framework for design sustainability assessment

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.

AI based market model for renewable energy communities with storage sharing

This work plan 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.



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The role of synthetic data in improving supervised learning methods: the case of land use/land cover classification

In remote sensing, producing accurate Land Use/Land Cover (LULC) maps is challenging due to factors like data preprocessing complexities and limited labeled training data. This thesis addresses these challenges, focusing on automatic LULC classification tasks, particularly in data preprocessing. Novel techniques, including Active Learning (AL) and imbalanced learning, are developed to enhance machine learning (ML) performance in scenarios with sparse training data or rare classes. The contributions extend beyond remote sensing, proving effective in multidisciplinary classification problems. Open access datasets were utilized for testing, and all data pulling, preprocessing, and experiments are open sourced, emphasizing transparency and accessibility.

Neurostruct: machine learning in structural design

Structural analysis relies on computational methods like the finite element method (FEM), but these face efficiency and scalability challenges. This project integrates machine learning (ML), including graph neural networks (GNNs) and generative AI, to accelerate FEM simulations. We developed surrogate models to predict stress-strain behavior, plasticity, and fracture, reducing computational costs while maintaining accuracy. These models were implemented for offshore wind turbine towers, aircraft components, and complex mechanical structures. Additionally, ML-powered digital twins enable real-time monitoring and adaptive design. To streamline workflows, we applied large language models (LLMs) to convert problem descriptions into executable solutions and optimize design processes. This work demonstrates how AI enhances structural engineering, making it faster, scalable, and efficient.

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InverseESA: inverse catalytic optimization for sustainable epoxide manufacture

During the third year of my PhD under the MIT Portugal Program 2030 scholarship, I advanced my project which focuses on developing an inverse design model for optimizing industrial catalytic epoxidation of small alcohols and alkenes, to enable sustainable epoxide manufacturing. I completed Task 3, refining compound-to-descriptor translations, and initiated Tasks 4 and 5, involving new ESA catalyst generation via Inverse Design. Key achievements include publishing articles and databases, improving machine learning models for catalyst prediction, and presenting findings at international events. This model aims to lower environmental impact and industrial waste while enhancing yield and avoiding costly quantum mechanics calculations or trial-and-error methods. My visiting scholar appointments at MIT (USA) and NAIST (Japan) enriched my expertise in cheminformatics and structure optimization.

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: a carbon-neutral approach

This project aims at evaluating the ability of microalgae to fixate CH_4 (and the resulting CO_2), in order to convert it into biomass and high-value biocompounds. We evaluate the impact of two microalgae-based approaches for CH_4 metabolization: 1) Screening of 15 microalgae species using CO_2, CH_4, and O_2 and different nitrogen sources (NO_3- or NH_4+). The results indicated that 8 species seem to be able to fix 8-23 % of CH_4 during CO_2 fixation, while 5 species produced 16-43 % of CH_4 at the same growth stage. 2) An experimental design (central composite design methodology) was performed to evaluate the effect of different concentrations of O_2, CH_4, and CO_2, as well as the ratio of microalgae to methanotrophs, on CH_4 and CO_2 removal. The results showed that Synechocystis-Methylococcus co-culture offers a highly promising platform to efficiently remove CH_4 and CO_2.

Optimization of electric vehicles charging for sustainable energy systems

Decarbonization of the transportation sector relies on the widespread adoption of Electric Vehicles and appropriate charging strategies. This study aims to develop two bi-objective optimization models for EV charging scheduling at a workplace charging station, addressing the EV users' preferences in terms of economic and Quality-of-Service dimensions, by minimizing the charging cost considering the participation in Vehicle-to-Grid (V2G) modes and minimizing the deviation from the desired State-of-Charge (SoC). Also, stochastic EV users' charging behavior and its associated uncertainty are integrated into the optimization models. Key outcomes with DOI include: Bi-Objective Optimization of EV Charging in a Workplace Parking Lot, and Charging scheduling in a workplace parking lot: Bi-objective optimization approaches through predictive analytics of electric vehicle users' charging behavior.

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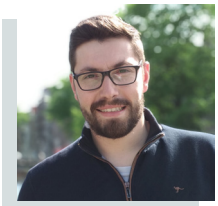
Mobility mining – from individual to group urban mobility patterns

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

According to the European Commission, 75% of EU buildings are energy inefficient by current standards, and over 85% will still be in use by 2050. Improving energy efficiency (EE) in buildings is thus a priority in EU energy and climate policy. Several programs promote EE, yet their evaluation mainly relies on cost-benefit analysis during operation, focusing on energy and emissions savings while overlooking broader lifecycle impacts. Our work proposes a holistic approach, integrating mathematical programming models with Hybrid Input-Output – Lifecycle Analysis (HIO-LCA), to support policymakers in designing EE initiatives. By accounting for multiple economic, environmental, energy, and social effects across the lifecycle of EE measures, this framework improves policy effectiveness, enhances program appeal, and fosters widespread adoption.



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RNNs for operator occupational risk analysis based on multimodal biosignal

Biosignal processing requires a series of steps to prepare data for analysis, including integrity assessment, cleansing, standardization, and feature extraction. These procedures must be tailored to each dataset and analysis goal, relying on the practitioner's expertise to transform raw biosignals into meaningful insights. Meanwhile, Deep Learning (DL) frameworks for time series have shown promise in automating such tasks. Since robust DL models learn multiple signal features, transferring this knowledge across tasks could enhance biosignal analysis. This project introduces a biosignals Neural Library with networks for processing functions like denoising and disease classification. By fine-tuning pre-trained networks, prior knowledge can be leveraged, enabling faster convergence and reducing data requirements.

Microbiome therapy for improved coral health and reef resilience

Coral reefs are key ecosystems threatened by climate change, with octocorals vulnerable to rising temperatures, pathogens and human disturbances. Interactions between octocorals and their microbiomes are crucial for coral health but their response to these stressors is unclear. This project examines octocoral responses to environmental and pathogenic stressors, the role of aquaria in preserving octocoral microbiomes, and the development of a bacterial probiotic consortium to mitigate climate change-induced stress in octocorals. We have identified 152 octocoral-associated bacteria, screened 25 isolates for beneficial traits, and demonstrated the stability of aquarium-maintained microbiomes. This project highlights the impact of environmental changes on coral health and pioneers the first application of probiotics in octocoral conservation, offering a novel strategy for reef restoration.

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

Middle East countries lag behind in renovating their built-environment to counteract the impact of climate change. The main reason for this is low tax policy on fossil fuel, which contributes to global warming and extreme weather events. This project aims to identify clean energy technologies and construction solutions that reduce the fossil fuel dependence of buildings, and analyze their energy, economic and environmental impacts, which have not yet been assessed together in that region. As coastal cities are more susceptible to global warming impacts, Bandar Abbas, a coastal city in Iran, is considered for case study. Energy simulation s 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. The outcomes are expected to be a new decision-making tool, which ultimately may influence the policy making in such cities.

The indoor environment of heritage buildings: monitoring and simulation

This doctoral research explores methods to characterize indoor environmental conditions in heritage buildings, identify tourism impacts, and define preservation strategies. It focuses on monitoring and simulation procedures to pinpoint causes of inappropriate conditions and degradation risks. The study reviews guidelines for collections and assessing conservation requirements. It involves continuous monitoring and assessment in three case studies. It also includes hygrothermal and lighting simulations with respective validation. The methodology aims to evaluate passive and management strategies in heritage buildings, addressing whether active systems are necessary for indoor environment control in today's context. The project seeks to demonstrate how monitoring and simulation can characterize indoor environments and assess control strategy quality in heritage spaces.

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Digitalization of the footwear industry using artificial intelligence

This study evaluates footwear comfort by analyzing the force-displacement non-linearity in sole damping cells. A damper object was digitally modeled in 3D software and simulated using computational fluid dynamics (CFD). Multiple simulations were conducted for different displacements and damper geometry to generate a representative dataset. Artificial neural networks (ANNs) were trained on this data, culminating in a global ANN surrogate model to accelerate CFD evaluations computing time. An optimization process, using multi-objective evolutionary algorithms was implemented to refine damper design and improve performance. A data mining technique was used to identify decision variables and objectives. Finally, an automated process for reading a digital pressure footprint and output a sole shoe damper configuration optimized to comfort feeling was developed and tested.

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

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Despite the increasing adoption of Additive Manufacturing (AM), significant challenges remain from an Operations Management perspective. Particularly, AM introduces unique complexities in production scheduling due to the need to simultaneously address scheduling and nesting decisions. However, existing scheduling models often overlook nesting. This thesis tackles the production scheduling problem in AM, hereafter referred to as AM scheduling problem (AMSP), by developing novel solution approaches that integrate nesting and scheduling decisions. Given the computational complexity, logic-based Benders decomposition (LBBD) approaches are introduced to decouple nesting and scheduling. Several methods are developed to further improve the efficiency of these LBBD approaches. Additionally, a nesting framework is proposed to provide more scalable and efficient nesting solutions for the AMSP."

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An integrated multiscale fatigue methodology applied to ocean structural systems

In Portugal, the first offshore renewable wind farm with a capacity of 25MW was inaugurated in 2020. Moreover, 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. Thus, this work intends to develop a fatigue methodology to assess support structures for wind towers in an offshore environment. Therefore, the current work investigates the fatigue behaviour of a structural steel for longer lives (high and very high cycle fatigue regimes). The notch effect and the biaxial stress states in fatigue behaviour are also addressed. The frequency effect in ultrasonic fatigue data is carefully analysed and included in material characterization throughout a probabilistic regression model. Last but not least, the corrosion due to marine environments is simulated and evaluate.

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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Feasibility study for the deepwater development of the Port of Leixões

Disruptive events sourced from several domains impact container ports' operations. To characterize the macro-environmental business conditions in which container ports operate, and find solutions to help them reshape in a sustainable way, it was developed an integrative investigation of the factors involved. This includes the assessment of political, economic, social, technological, legal, environmental and geographical drivers. It also comprises the development of a strategic framework that aims to culminate in a white book based on a well-rounded package of measures aimed at tackling current challenges arising in the seven domains. For this, the Port of Leixões is considered as a case study. The work plan is being carried out as planned and several oral communications were done. Also, a 1-month research stay in Normandy has taken place.

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

This research examines factors influencing the mobilization of demand-side flexibility and the profitability of aggregators, including aggregation strategy, rewarding strategy, energy price schemes, and market timeframe. Aggregation strategy matters, with the choice to target specific consumers or involve all in demand response programs. Aggregators may reward only consumers maximizing their profit or all consumers to ensure future engagement. Shorter market timeframes yield higher profits, but increased rewards do not always boost flexibility due to consumer limits and their comfort preferences, leading to saturation in flexibility provision. Energy pricing schemes shape flexibility along with the reward value. A consumer under two different energy prices will respond differently to the same aggregator's incentive providing different flexibilities.

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Operational forecasting platforms based on morpho-hydrodynamic emulation methods

Extreme weather events, like floods and droughts, are becoming more frequent and severe due to climate change, causing catastrophic consequences. Therefore, developing methodologies to anticipate losses and identify vulnerable areas is crucial. Numerical models provide reliable solutions for forecasting future event effects; however, they require considerable computational resources. The PhD project “Operational forecasting platforms based on morpho-hydrodynamic emulation methods” developed artificial intelligence (AI) models to reduce numerical simulation computational costs. The methodology was applied to two software packages (Delft3D and XBeach), reducing simulation time by 86% while preserving accuracy. Additionally, the modelling component of a Flood Early Warning System was implemented in the Douro Estuary by combining an estuarine process-based model with AI models.

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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

Large cities face critical challenges in managing municipal solid waste (MSW) and ensuring clean water. An innovative solution transforms MSWs into geopolymers (GPs), sustainable materials with great potential for wastewater treatment (WWT). GPs, made of aluminosilicates, offer a promising alternative to conventional concrete and can be molded into shapes like cylindrical membranes. This study develops GPs from MSWs, creating sustainable urban waste management technologies. Various additives, precursor ratios, and curing conditions were optimized to improve GP properties for WWT. GPs demonstrated high adsorption capacities for pollutants like phenol and emerging contaminants (e.g., paracetamol), along with excellent compatibility with activated carbon and carbon nanotubes. With a compressive strength of 50 MPa, GPs offer a sustainable and efficient alternative to conventional concrete.

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Digital twin implementation for heritage buildings subjected to natural hazards

Heritage Buildings (HB) populate European historic centres as both secular and sacredmonumental buildings. When a disaster involves HB, artworks are likely damaged, producing aloss of artistic and historical materials and, at the same time, an immaterial loss of memory andpeople's identity. State of the art recommendation suggests the preservation of the structuralintegrity of HB by monitoring in real-time their progressive damage, avoiding massiveinterventions and providing immediate action in case of a disaster. This PhD thesis aims todevelop and apply the Digital Twin (DT) concept to HBs threatened by natural hazards, namely-earthquakes, tsunami and floods. The main aspects of a DT model will be computationallydeveloped and investigated (data collection, geometrical modelling, software interoperability,blending of advanced methods for structural analysis, sensors and structural model real-timeupdating) and finally validated on real case studies.

The implications of additive manufacturing technology adoption for supply chain resilience

Additive manufacturing (AM) is changing the state of the supply chain (SCs), and their ability to cope with SC vulnerabilities and disruptions, i.e., supply chain resilience (SCR). SCR is vital for business continuity when facing unforeseen disruptions. However, to date, no research has investigated the implications of AM adoption for SCR, and therefore, this PhD project aims to fill this knowledge gap. Drawing on a mixed-method research approach, this PhD project will investigate how AM adoption impacts the state of the SC consequently influencing certain SC capabilities and vulnerabilities, and therefore SCR. Subsequently, an AM-SCR framework will be developed to aid decision-makers in the optimal (re)design of SCs by determining which resilience practices to capitalize on when using AM so as to develop the necessary SC capabilities to deal with SC vulnerabilities more effectively.

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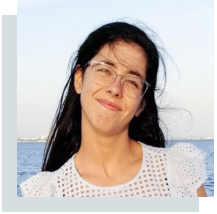

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Climate Change in the Western Iberian Coast: from the sea to estuaries

The main aim of this project is to assess long-term physico-chemical changes along the Western Iberian Coast (WIC) and study their relation to climate change, focusing on the coastal ocean and estuaries. I have focused on looking for evidence of the possible effects of climate change along the coast and have managed to cover changes in sea surface temperature and sea level along the WIC. Also, specific estuarine systems, such as the Sado Estuary, have been studied regarding historical trends and their drivers and it was possible to discuss the sensitivity of the estuary to changes in its abiotic factors. I have also started to study Marine Heat Waves and Marine Cold Spells and their features along the WIC and its estuaries. Currently, I am working with future scenarios for the Sado Estuary considering worldwide climate change evidence, through the application of a numerical model.

ALG-TERNATIVE - ALGae Towards Energy and Recycling Nutrients in wAsTewater and CO2-rich gases for 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 ALG-TERNATIVE 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 static and dynamic evaluation of the out-of-plane response in block-type masonry structures

My PhD thesis explores the out-of-plane behaviour of masonry structures under earthquake excitations. Unreinforced masonry is highly vulnerable, often leading to severe human, economic, and artistic losses. The study investigates unreinforced block-based masonry through static excitation (tilting table tests) and seismic reproduction (shaking table tests). Preliminary work characterized the properties of masonry units and their interfaces, as dry-joint contacts govern the response. Tilting table tests analysed corner specimens, assessing the effects of geometry and loading direction on structural capacity. Finally, shaking table tests progressed from single-block specimens to half-scale vertical spanning strip walls, aiming towards the construction of experimentally-informed fragility curves.

A platform strategy for cycling analytics in urban environements

In recent years, there has 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 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. Over the last years, my work has focused on the role OpenStreetMap (OSM) can play in aggregating data from different sources. Specifically, we developed a method for detecting map-matching anomalies, caused by OSM errors or travels in unofficial paths. Detecting these anomalies can help OSM collaborators improve OSM, help urban planners improve the road network infrastructure and help cyclist get better route suggestions.

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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 has an electrification rate of 43% corresponding to 18 million people without electricity access. To improve it, the Minister of Energy and Water of Angola (MINEA) defined the expansion of the power system mainly with hydropower plants. This initiative is justified by the large hydropower potential over the country, estimated at 18 GW and it represented more than 63% of the installed total capacity. It is crucial the introduction of Renewable Energy Sources (RES) that present high potential in the country, namely: solar photovoltaics, wind, and biomass. Also, the complementarity between RES in the different regions of the country, as well as decentralized solutions using RES are becoming the feasible way to manage electricity supply in rural communities instead of centralized systems. Combining these resources is a great strategy to meet the growing demand over the country.

Improving the service life of Engineered Wood Products

This research addresses the durability of engineered wood products (EWP) like Cross-Laminated Timber (CLT), which are increasingly used in sustainable construction. Despite their popularity, the long-term resilience of these products in varied climatic conditions, particularly regarding biological deterioration, is still uncertain. Focusing on Use Class 2 conditions across diverse climates in Portugal, this study aims to quantify the reduction in CLT's service life. To achieve this, we are implementing monitoring systems, conducting wetting/drying and accelerated deterioration tests, and developing numerical decay and finite element models. Additionally, we are examining how projected climate changes may impact these results. Ultimately, this research will produce guidelines for preventive measures and maintenance strategies to extend the durability of EWP.

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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.

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

Coastal and transitional ecosystems face increasing anthropogenic pressures, making continuous water quality monitoring crucial. Remote Sensing (RS) offers large-scale, high-frequency data, but its application in transitional waters is challenging due to optical complexity and land proximity. Optical Water Type (OWT) classification, which groups water pixels by RS reflectance, is emerging as a solution. This project develops an OWT-based monitoring framework to: i) link OWTs to environmental conditions, ii) analyze OWT spatio-temporal patterns, and iii) support WFD/MSFD monitoring. The first phase focused on intensive field campaigns, enabled by securing a loaned instrument through a competitive call. Methodological advancements led to two peer-reviewed publications and collaboration with the Portuguese Space Agency to assess RS applications for EU marine directives in Portugal.

Seaweed nanofluids for cooling photovoltaic solar panels used in space missions

In this work, we develop nanofluids with metallic nanoparticles using a green synthesis process mediated by algae for applications in microgravity. These advanced heat transfer fluids enhance thermal properties compared to conventional liquids. Our research was among the first to show that algae-mediated synthesis can produce nanofluids with superior heat transfer capabilities. We have already demonstrated improved thermal conductivity and efficiency in single-phase cooling systems. As a next step, we will reproduce and test passive two-phase heat exchangers, assessing the feasibility of using green nanofluids. Additionally, we will simulate their performance in microgravity to evaluate their potential for space applications.

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

The scope of my Ph.D. research is to establish criteria based on ergonomic methodologies for integration into innovative car interiors, specifically designed to accommodate emerging mobility paradigms, with a focus on Level 4 and Level 5 autonomous cars. These criteria will be developed in accordance with ergonomic principles and evaluations. To achieve this objective, a survey was conducted with a sample of 300 Portuguese participants from various regions of Portugal to assess user preferences and requirements for autonomous vehicle interiors. Additionally, a usability evaluation of an autonomous car console was carried out with 32 participants. Currently, anthropometric data of prospective users are being collected to determine the ergonomic requirements for existing and newly designed interior components. The next phase of the research will involve the validation of additional components and the establishment of ergonomic criteria for the human-machine interface within innovative car interiors.

Ecodesign of Novel Technologies in the Bioeconomy

During technology development, life cycle assessment (LCA) can guide sustainability-oriented decisions, though its application is often limited by a lack of critical data and knowledge. This PhD research advances the ecodesign of emerging technologies through prospective LCA modeling (scale-up calculations and scenario analysis) and multi-criteria decision analysis (MCDA), which integrates environmental, technical, and (socio)economic dimensions using stakeholder input. Key applications include bio-based products and technologies for waste valorization. Published work features an LCA framework for novel biopolymers and an LCA-MCDA approach for biomaterials considering future application and functionality. Current efforts focus on the socioeconomic and environmental assessment of pilot-scale wastewater nutrient recovery technologies in collaboration with industry partners.

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Sustainable production of bioactive metabolites from octocoral symbionts

This project investigates the microbiomes of marine invertebrates, such as sponges and corals, which are prolific sources of natural products. Two novel bacterial species from sponges have been described: Aquimarina spinulae and Aquimarina aquimarini, the latter producing potent antimicrobial compounds known as aquimarins. Co-culture protocols were developed to enhance secondary metabolite production, with A. aquimarini used as a model for metabolome and transcriptome analysis. Coral symbionts, unlike sponge-derived microorganisms, remain underexplored for their biosynthetic potential. A bacterial collection from a temperate coral was established under alternative cultivation conditions (e.g., anaerobic and microaerophilic incubation). Isolates from this collection have shown promising secondary metabolite production potential through PKS-gene screening and antimicrobial assays.

Testing the performance of 6 Parameterizations schemes under 6 different Weather Types

My PhD research focuses on improving the accuracy of meteorological simulations using the WRF model, a widely used weather forecasting tool. By testing different parameterization schemes, particularly for the planetary boundary layer (PBL), I assess their performance across various weather types and regions in Portugal. My findings highlight that a one-size-fits-all approach is suboptimal; instead, the choice of parameterization should adapt to the specific city, terrain complexity, and meteorological variables being simulated, such as temperature, wind, or precipitation. This tailored approach significantly enhances the precision of weather models, paving the way for more reliable forecasts.

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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. Despite efficiencies surpassing other technologies, they remain insufficient to justify the move to industrial-scale. PSCs can present several architectures, being one of them the inverted. Inverted PSCs stand out for their long lifetimes, easy fabrication, negligible hysteresis and excellent stability. Though their efficiency remains low due to non-radiative recombination of photogenerated charge-carriers. This project focuses on advancing inverted PSCs through 4 objectives: 1)preparing and characterizing complete devices, 2)phenomenological modelling, 3) developing carbon-based back-contacts on flexible substrates, and 4)scaling up and assessing stability. The final goal is to demonstrate PSC innovative potential for street furniture by proposing a device-prototype. So far, tasks 1, 2 and 3 were completed.

Development of an ecological thermal insulation product to a regenerative design

The research focuses on developing practical solutions for sustainable construction, namely insulation material, addressing the significant environmental impact of the industry. The study focuses on Cortaderia selloana, an invasive plant in Europe, exploring its potential as a thermal insulation material. By utilizing this underestimated biomass, the research not only addresses ecological challenges but also creates opportunities for new value chains, promoting local economies and reducing environmental impacts. Insulation panel samples have been manufactured, showing promising initial results. The ongoing goal is to develop a stable material that meets the requirements for building insulation. This work supports the integration of natural fibers into sustainable construction, offering innovative solutions to environmental challenges and resource efficiency.

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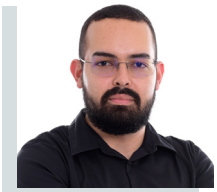

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Geosynthetics for sustainable cities: 3D numerical models and mechanical damage

Perfume design is a complex task that currently 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. It will be a disruptive CPS with self-managing and cognitive abilities. Its components will be concisely interconnected through the Internet of Things (IoT) and will use Cloud Computing as engine. Achievements thus far include the development of neural network prediction tools for key perfume properties and data analysis for identification of key properties in perfume design.

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

Perfume design is a complex task that currently 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. It will be a disruptive CPS with self-managing and cognitive abilities. Its components will be concisely interconnected through the Internet of Things (IoT) and will use Cloud Computing as engine. Achievements thus far include the development of neural network prediction tools for key perfume properties and data analysis for identification of key properties in perfume design.

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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 on a digital environment for railway track

The project aims at a framework for the integration of Performance Indicators, based on inspections, testing and monitoring data, on a holistic and sustainable management of the railway system supported by life-cycle analysis. The decision process will be supported by the use of digitalization of the system that will allow to assess different parametric analysis regarding the medium- and long-term use of the different assets exposed to different load and degradation scenarios. To gather information for the digital twin development, a framework for performing the inspection of infrastructures was developed tested and validated and a framework for the monitoring of the railway track is under development. An inspection team was organized and led to inspect 71 transport infrastructures. Collaboration in mentoring master's students and partnering with universities abroad on papers related to transport infrastructure inspection. Collaboration in preparing a successful application and organizing the ESREL 2026 Congress.

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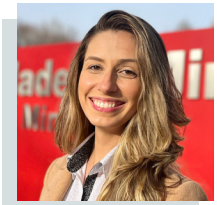

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Wooden buildings as a strategy for carbon neutrality in Portugal

To foster a competitive and resource-efficient economy aligned with sustainable development, the EU prioritizes carbon neutrality by 2050. Accordingly, Portugal aims to reduce GHG emissions by 85%-90%, necessitating a reassessment of conventional construction due to its environmental impact. In this context, timber emerges as a viable alternative to concrete and steel. Despite advancements in timber buildings in regions with severe climates, their adaptation to Portugal remains limited. This research proposes a prefabricated timber panel system for multi-story buildings, designed to address national requirements and support carbon neutrality targets. By integrating wood—a renewable, carbon-storing material—with the efficiency of prefabrication, the study aims to provide a replicable and sustainable solution for urban development, optimizing material use and enhancing energy efficiency.

Road asset management considering connected and automated vehicles

The primary objective of this doctoral research is to develop a comprehensive methodology for managing road assets within the context of connected and automated vehicles (CAVs). The study explores how transportation design will evolve with the widespread adoption of CAVs, highlighting potential improvements that could lead to more efficient resource allocation and reduced costs in road construction. The research is structured in four phases. First, we analyzed the impact of CAVs on road asset management. Next, we investigated their broader implications for transportation systems, urban design, and social dynamics. Building on these insights, we created a methodology to automatically assess the readiness of any city's infrastructure to support CAVs. Finally, we are developing a framework to help cities address identified gaps and transition toward becoming CAV-friendly environments.

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Uncertainty analysis of conceptual groundwater models

The work programme focus on determining state, pressures, and driving forces that induce water quality issues between Campina de Faro aquifer system (Faro, Algarve, Portugal) and connected water bodies, when forecasting the long-term effects of climate change. The methodology began by redefining the conceptual model related to the groundwater flow. Thus, different conceptual models were developed, hand-calibrated, and evaluated by their performance based on available information and on newly collected data. It permitted to identify the most robust model for the study area; enabling a detailed assessment of parameter uncertainty. It established a robust framework to enhance the accuracy and reliability of groundwater conceptual models, providing valuable support for decision-makers in water resource management.

Human Acceptable Ergonomics Recommendations

Work-related disorders (WRDs) affect worker well-being, productivity, and increase costs for society and organizations. Traditional occupational health assessments often overlook key physiological and motor adaptations during work. This research addresses these gaps by creating a multimodal system integrating data collection, visualization, and advanced recommendation models to improve workplace health. A custom mobile app collects subjective data through questionnaires and objective data using smart devices and research-grade tools. The app has been used to collect data from 40 office workers. Currently, work activities are being characterized by extracting features from the various data sources to create detailed worker profiles. These profiles will allow for finding similarities between workers and will be used as an input source for the recommendation system.

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Harnessing technology to peatland landscapes & GHG in the Iberian Peninsula

Peatlands are unique ecosystems providing key contributions to carbon storage and climate regulation. However, human impacts are increasingly degrading these ecosystems, converting them from sinks to sources of atmospheric carbon. To mitigate and prevent further degradation and help accomplish the Paris Agreement, it is needed to assess the current status of these ecosystems and anticipate the impacts caused by the distinct drivers of degradation. This project focuses on assessing the drivers that have accelerated peatland degradation in the Iberia Peninsula, including climate changes, colonization by invasive plant species, and human-driven changes in land-use and land-cover.

Which Type of Resilience? Crop Insurance Effects Under a Changing Climate

As climate change accelerates, viticulture faces increasing threats from rising temperatures, unpredictable rainfall, and extreme weather that jeopardize grapevine stability. Simultaneously, crop insurance providers grapple with the evolving risks posed by these transformative changes. While viticulture adaptive strategies and insurance mechanisms can play a crucial role in fostering resilience, gaps in understanding between viticulture producers and insurers may undermine their effectiveness in addressing climate risks, as each sector may view resilience differently. This thesis investigates how perceptions of climate resilience can differ between viticulture producers and crop insurance providers in Portugal's key and emerging viticultural regions of Douro, Algarve, and Alentejo using surveys and questionnaires to explore how each sector prioritizes resilience strategies. The study contributes to existing knowledge by offering insights into how differing resilience perceptions can influence both sectors, ultimately enhancing climate resilience strategies and policy recommendations for better collaboration.

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The behaviour of laminated glass panels under tensile loading and wind pressure

Glass is a key material in modern architecture, but its vulnerability to extreme loads requires innovative strengthening methods. This research explores embedded connections within laminated glass systems to enhance ductility, redistribute forces, and improve resilience. The study uses experimental and numerical tools to evaluate glass behavior under tensile loading and wind pressure. The performance of the proposed embedded connection within the laminated glass system will be compared with the traditional methods. The findings will contribute to new design guidelines for safer glass facades while maintaining aesthetic and functional benefits. This research supports advancements in Eurocodes and global standards, promoting more resilient urban infrastructure.

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

In the current context of water scarcity and climate change, urban water management faces significant challenges. This research project aims to develop an innovative model for Urban Water Communities, integrating water efficiency, nature-based solutions, and the circular economy. The model is being tested in urban areas in Portugal, assessing its implementation, management, and impact on public water supply and drainage systems. To date, 2 articles have been published, and 1 is under review in scientific journals. Additionally, 4 papers have been developed for international conferences, along with numerous contributions to other scientific events. This study is expected to contribute to sustainable and resilient public policies in the water sector, aligning with national objectives and SDGs 6, 11, 12, and 13.

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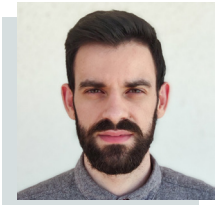
Risk-informed transport infrastructure network management

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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Cyber-physical oriented chemical process for green and sustainable production

This project has examined the integration of mechanistic and data-driven models in chemical engineering, focusing on process systems engineering. The primary objectives were to enhance analytical tools for systems described by differential equations and explore how abundant data integration can refine mechanistic models.

** Thesis defended in 2024.*

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Energy transition: future land use scenarios and planning for sustainability

Energy and climate policies in the EU, particularly in Portugal, have grown more ambitious. Portugal targets over 20 GW of photovoltaic capacity by 2030, aided by regulatory reforms waiving environmental impact assessments. However, solar expansion raises concerns about agriculture, forests, and nature conservation. This PhD research examines the territorial dynamics of utility-scale solar energy in Portugal, focusing on key drivers, future distribution, and conflicts. Using mixed methods—qualitative analysis, stakeholder workshops, spatial modelling, and machine learning—it seeks to map the geography of solar power plants, assess its location factors, develop a land conflict map, and simulate land-use change by 2040 driven by solar expansion. Findings will support policies that balance renewable energy growth with sustainability while addressing competing land uses.

A systematic risk-based decision framework to support bridge managment systems using logic tree analysis and machine learning implementations

Bridges are essential components of transportation infrastructure, yet managing them is challenging due to aging structures, rising demand, and resource limits. This research aims to develop a systematic, risk-based decision-making tool that enhances bridge management by integrating logic tree analysis with machine learning techniques. To achieve this, a hybrid approach will be used, combining data-driven predictive modeling with structured risk assessment frameworks. This study will contribute to the field by providing a reliable, data-driven framework for improving bridge maintenance strategies, enhancing safety, and extending infrastructure lifespan. The proposed tool is expected to support engineers and policymakers in making more efficient and cost-effective decisions for bridge asset management.

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Urban stream rehabilitation for sustainable cities

Urban streams are important for sustainable cities because of their ecosystem services. Yet, a majority of these remain degraded due to urbanisation. Despite existing efforts in stream restoration, many projects fail to improve ecological integrity. Ecohydrological models can be used to predict the outcomes of stream rehabilitation, however, none yet have integrated all subdisciplines of ecohydrology (hydrology, hydraulics, and ecology) and accounted for the cumulative catchment effects of land cover and climate change. Therefore, I propose to develop an ecohydrological model that predicts the ecosystem's response to in-stream rehabilitation, as well as the effects of land-cover and climate change. To do so, I will combine a hydrologic/hydraulic model and an ecological model, using data collected in the field for calibration and validation. I aim to devise a tool that facilitates effective stream rehabilitation planning, thus contributing to urban sustainability.

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

This research aims to develop an integrated management system framework by conceptualizing and implementing an open-source FM multipurpose web platform based on linked data principles and the openBIM approach. It integrates IFC models for visualization and formalizes BIM-FM information requirements (AIR and EIR) according to ISO 19650 and EN 17412-1:2020 standards. The system will be validated in the structural laboratory of the University of Minho. Key achievements so far include identifying essential operational activities through interviews and surveys, defining database models aligned with the linked open data approach, developing ontologies to describe the necessary data, and creating the platform's main interface.

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Data-driven sustainability assessment for affordable housing in Portugal - Multi-level energy optimization for early design stage

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My PhD investigates digital technologies for the optimization of affordable housing design, reconciling cost, sustainability, and livability. Through the synergistic use of computational design and Artificial Intelligence, I aim to create multi-objective optimization strategies that facilitate better decision-making by architects at the early stages of design. The major accomplishment is that my research has proven the potential to enhance the quality of housing using automation and data-based approaches while being affordable. I have established the relationship between cost and Life Cycle Assessment (LCA) from my Erasmus at LINK IO in Copenhagen which can be utilized during the practical phases of my dissertation. My research contributes towards improved, sustainable, and adaptive housing solutions for multi-family housing.

Microplastic Identification and Quantification through Optical Methods

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The increasing dispersion of microplastics in the aquatic environment has been the subject of concern for the consequences of their inclusion in ecosystems and public health. Currently, the main alternatives for identifying microplastics, are the Raman and FTIR. These are very reliable methods for laboratory analysis of microplastics, however, they involve expensive and massive equipment that requires sample collection and pre-processing. This work proposes a low cost Raman micro sensor based on NIR radiation, to achieve an accurate, autonomous, low-cost, and easy to operate microplastics sensor. This will allow the construction of a multisensor platform for massive placement in an underwater environment. Massive monitoring for big data analysis will allow a significant advance in the control of pollution of marine ecosystems.

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Sustainable Energy Systems

This thesis aims to develop an ecodesign approach that combines Life cycle assessment (LCA) and Multi Criteria Decision Analysis (MCDA) models to compare and evaluate competing ecodesign strategies. First, LCA is used to analyse environmental impacts and to support the selection of ecodesign strategies. Case studies from plastic applications are used to support the development of the ecodesign approach. Second, LCA and MCDA models are combined to compare and evaluate competing ecodesign alternatives, considering uncertain information from environmental indicators and cost. The main outcome of this phase is an MCDA-LCA ecodesign approach that provides a novel way to aggregate uncertain environmental indicators and cost to determine how much preference to the environmental criteria an ecodesign alternative requires to be preferred over a business-as-usual situation to be improved.

Nature-based Solutions for coastal defence

Eroding coastlines are mostly protected by hard engineering, which disrupts sediment balance. This has increased interest in combining them with Nature-based Solutions (NBS), i.e. coastal ecosystems that enhance ecosystem services. This study examines NBS in two vulnerable Portuguese coastal areas: Costa da Caparica and Ria Formosa. The research is structured in three phases: (1) analyzed 200+ papers, highlighting NBS benefits (e.g., carbon sequestration) and challenges (e.g., lack of political and local support). Based on these results, Phases 2 and 3 were further developed; (2) engages local communities to assess their perceptions of protection strategies. The Caparica workshop is on 13 February. (3) will conduct a cost-benefit analysis of these strategies. If results are positive, and combined with Phase 2 results, they will support NBS maintenance and expansion in similar coastal systems.

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Sustainability transitions in practice: the role of social movements in shaping sustainable mobility councils' policies in Brazil and Portugal

This research explores the role of pro-bicycle activist associations in transitioning towards sustainable urban transport. Grounded in Brazil, a Global South nation with starter cycling contexts, it examines how these associations evolve from niche social innovators to influential actors in urban mobility governance. Drawing on the Multilevel Perspective, Social Practice Theory, and institutional change, the study investigates their strategies, actions, and interactions with institutional actors. Using qualitative methods, including interviews and document analyses, the research identifies barriers and enablers of their integration into mobility regimes. Findings contribute to sustainability transitions by highlighting civil society's role in reshaping transport systems and informing policies for inclusive, sustainable urban transport in starter cycling contexts.

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

Urbanization shapes modern society, but rapid city growth challenges planners. This project explores urban dynamics - functional zoning, socioeconomic divisions, and mobility patterns - to enhance inclusiveness and safety in Lisbon. Using mobile phone data integrated with socioeconomic indicators and Points of Interest data, we analyzed human mobility and characterized zones based on functions and demographics, identifying four distinct socioeconomic areas and functionalities varying by time/day. Additionally, four population groups with unique profiles were identified based on home/work location and activity patterns. Future steps include analyzing homophily patterns and crime data to identify vulnerable un-inclusive zones that may lack safety. These insights support urban planning to foster safety, inclusiveness, and optimized services, reducing isolation and environmental impact.

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The Habitable Envelope: Prefabricated wood system for sustainable renovation of RC building envelopes

Most of Portugal's building stock was built between 1961 and 2000, with structures from the 1960s to 1980s being particularly relevant due to their age and characteristics. Typically made of reinforced concrete with masonry infill walls and often in degraded urban areas, these buildings show more anomalies and lower quality due to outdated standards and limited technical expertise. To address the climate emergency and Sustainable Development Goals 2030, we propose a modular prefabricated wood-based system to rehabilitate these structures. The 'Habitable Envelope' is a wooden exoskeleton attached to the building's exterior, improving energy efficiency, structural safety, and providing new interior spaces. This low-disruption solution also modernizes the architectural image. Focused on post-1960s social housing, this research aims to foster a sustainable, resilient built environment while preserving Portugal's building stock.

Technological contributions to patellofemoral instability management

This Ph.D. aims to develop a set of clinical decision support tools for patellofemoral instability (PI) including:(i) a diagnostic system for fully automated PI indexes estimation;(ii) a computer-assisted orthopaedic surgery system for PI-related surgical interventions;(iii) a mixed reality(M-R)-based module for surgical navigation and non-invasive techniques for the registration procedure. So far, the Thesis Project in Biomedical Engineering was presented as part of the Doctoral Programme, achieving a grade of 19.Two revisions were also accomplished, one recently submitted to a journal. Regarding diagnosis, a dataset of knee medical images was gathered and labelled for use in deep learning-based PI diagnosis, with preliminary algorithm results obtained. Additionally, the first versions of two surgical plans were developed, and a MR module for validating surgical planning was implemented.

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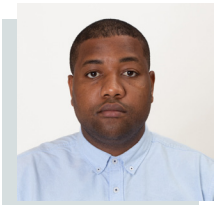

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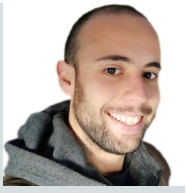
Heat transfer enhancement of thermal solar systems

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

Following UN2030 goals, this study develops sustainable liners for energy-absorbing helmet systems, focusing on urban commuters using micro-mobility solutions, and advances biomechanical injury assessment to validate the design. A state-of-the-art review identified challenges in micromobility, regulations, padding materials, helmet energy absorption standards, injury criteria, biomechanical head models, and numerical simulations. Research also explored shear-thickening fluids (STFs) and their engineering applications. Hybrid composites of cork, STF, and polymers were tested experimentally, materials were characterized in Abaqus, and a numerical helmet model was developed to simulate real impact conditions in a virtual environment. A physical prototype, taken to be tested in a certified laboratory for helmet testing, confirmed numerical results with highly satisfactory performance.



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

The number of satellites being deployed each year is rapidly increasing, leading to a rise in space debris and collisions, which shorten satellites' operational lifetime, render systems inoperative, and worsen the problem. On-Orbit Servicing (OOS) is the key to solving this issue and enabling sustainable growth in satellite deployment. My PhD research focuses on developing innovative approaches to satellite guidance, navigation, and control for cooperative OOS missions. Currently, I am working on advanced filtering techniques to estimate the motion of target satellites, enabling successful rendezvous and capture for servicing.

Causal neural networks prediction for automated driving systems

The main objective of this work plan is to provide a vital function of the Autonomous Driving pipeline, the Prediction, with tools that allow analyzing its inference process in a causal way, in what is commonly called explainability in the literature. At the time of writing, Task 2: Autonomous Driving Simulation and Scenario Generation (included in the workplan) has been fulfilled. Task 1: Reinforcement Learning in architectures with explainability is being concluded, concurrently with Task 3: Integration of Planning and Prediction of Safe Movement into Autonomous Driving. Scientific Publication will be concluded with the conclusion of Task 1 & 3.

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Increasing urban resilience through a Food-productive Green Infrastructure

The Anthropocene's challenges have sparked intense debate on strategies to increase urban resilience. Despite its importance, food production remains overlooked by planning professionals. The integration of urban agriculture (UA) into green infrastructure (GI) planning process is a promising strategy. This study develops a framework for food-productive GI, a network of multifunctional green spaces, using Matosinhos, Portugal, as a case study. The research analyses concepts, policies, and case studies, maps the municipal productive landscape, and engages stakeholders in discussions on UA implementation (all under development). The findings will support the creation of a land use methodology (UA index) and criteria for integrating UA into GI plans. The outcome will be a strategic planning methodology and design guidelines to inform planners and promote food production in urban green spaces.

Strategies for smart ecosystems restoration and oceans sustainability

This project focuses on the development of bioactive and multifunctional concrete for marine applications that could facilitate marine ecosystem restoration, coastal protection, renewable energy production, and monitoring of dynamic oceanic and geological systems. The methodology is based on the use of a highly electrically conductive cementitious composite (E3C) specifically designed for marine environments. The study includes the investigation of three smart properties of E3C such as self-monitoring, self-healing, and bio-receptivity under marine conditions. In addition, the project includes the testing of an E3C artificial reef prototype to evaluate its performance under in situ conditions. Significant results have been achieved, including the submission of two patents related to self-healing and bioactive properties, and a published article related to the self-sensing.

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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 acoustic transducers development

During the second year of his PhD, João Rocha completed key milestones in his research on underwater acoustic communication. He designed and simulated power amplifiers for piezoelectric transducers, selecting prototypes for efficient signal transmission while balancing power, cost, and signal quality. He also explored frequency modulation techniques to optimize energy efficiency and adaptability to different distances. Additionally, he developed hydrophone instrumentation using PVDF for improved broadband signal acquisition. His work contributed to the SONDA project, enhancing underwater monitoring technologies. Next, he will focus on prototyping, laboratory testing of amplification electronics, and refining transducer instrumentation for real-world applications.

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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 mixed. This work aims to study the impacts of telework on travel behavior. A systematic literature review and meta-analysis were conducted, submitted to Urban Science. A Structural Equation Model (SEM) was estimated using data collected in 2021 from 3 metropolitan areas, Lisbon (LMA, Istanbul, and Porto Alegre, aimed at studying telework effects on weekly trips by transport mode, resulting in a paper published by the Journal of Transport geography. Previously, a qualitative analysis based on interviews conducted at the LMA was published by the Journal of Transport Geography. We are working on another SEM to evaluate telework effects on travel patterns using data collected in the LMA during 2023.

I4F Intelligent Fish Farming for Future

Aquaculture is vital to meet global food demand. European seabass (Dicentrarchus labrax), a key Mediterranean species, faces challenges in weight uniformity during rearing. Uniformity reduces aggression, improves feed efficiency, ensures predictable harvests, and enhances sustainability. Current grading methods are labor-intensive and costly, limiting economic efficiency. The I4F project aims to develop tools and models to monitor and predict weight dispersion based on rearing conditions. These innovations aim to optimize grading, lower costs, improve welfare, and support sustainability. Launched in Sept/2022 (completion in Sept/2026), I4F has already developed imaging-based fish weighing framework and published a growth prediction methodology. Data from trials in 2024 will refine tools and train models for grading optimization, ensuring a significant impact on European seabass farming.

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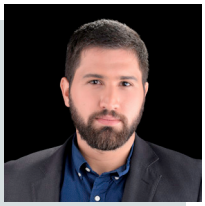

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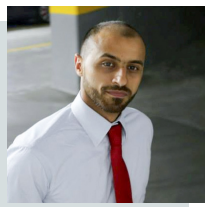
Risk assessment of Masonry Bridges and Resilience enhancement to Flood events

Masonry arch bridges (MABs) are a vital part of Europe's infrastructure, yet they face increasing risks from climate change, particularly flooding. This project develops a risk-informed, resilience-based framework to assess and enhance the performance of MABs under extreme weather events. By integrating numerical modelling, field data, and advanced analytical techniques, we improve structural assessment accuracy and inform effective mitigation strategies. Key achievements include the validation of a novel Discrete Macro-Element Method (DMEM). These advancements help preserve cultural heritage while ensuring infrastructure resilience in a changing climate.

Towards country-wide implementation of BIM object rules and automation of BIM object 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 science-based approach for clarifying the data needs of BIM objects for stakeholders using the concept of Product Data Templates (PDTs), (ii) Implementing a standard compliant platform for a national data dictionary, and open PDTs for the industry, and (iii) creating a tool for the automation of BIM object compliance checking.



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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.

Anomaly detection models to improve the sustainability of water companies

Sustainability and energy efficiency are central challenges in managing essential infrastructures, such as Wastewater Treatment Plants (WWTPs). With the increasing availability of data, it has become possible to apply advanced analysis techniques to optimise these systems. Throughout this year, my work has focused on applying Machine and Deep Learning models for anomaly detection and prediction of critical variables to optimise the operation of these facilities. After data processing and analysis were completed, anomaly detection models, including Isolation Forest and Autoencoders, were implemented, along with predictive models. The main focus was the anaerobic reactor of the WWTPs, analysing energy production. Improving these processes' efficiency optimises resources, strengthening the sustainability of these infrastructures and contributing to a more efficient energy model.

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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, 2nd year of 4, packing tests and triaxial monotonic tests were carried out to validate the effectiveness of commercially available reinforcement shapes. 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

Optimizing the performance of industrial systems and services is crucial for enhancing value in companies and society. However, the complexity of production scheduling makes it impractical for exact algorithms to find optimal solutions. As a result, many companies rely on simulation-based software or human decision-making, which often yield suboptimal outcomes. This PhD project focuses on designing novel high-performing scheduling algorithms to tackle complex problems, such as the Dual Resource Constrained Flexible Job Shop Scheduling Problem (DRC-FJSSP). So far, this research has generated groundbreaking results, improving scheduling efficiency by 17% through the development of top-performing heuristics like BTF and xBTF, representing hundreds of millions of dollars in potential savings annually by industrial standards. Current efforts explore new methods for encoding scheduling solutions, a critical yet under-researched area with significant potential to enhance algorithm performance. These advancements aim to deliver practical, implementable solutions, boosting industrial productivity and driving economic growth.

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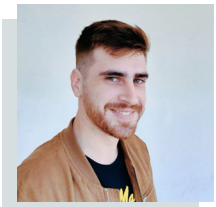

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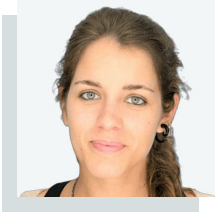
An Advanced Framework for Distributed Plantwide Process Monitoring

Current plantwide statistical process monitoring (SPM) methods struggle to detect and diagnose localized faults in high-dimensional processes, affecting safety, efficiency, and sustainability. They also fail to account for different time scales relevant to fault detection and degradation prognosis. This project introduces MAG-NET (Multilevel and Multiscale Aggregation of Causal Networks), a novel framework that integrates causality into distributed SPM, enhancing fault diagnosis. A key contribution is the study of how partitioning causal networks into communities improves fault detection sensitivity. Additionally, models were developed to predict a variable's fault detection sensitivity in scale-free networks for different fault types, based on network characteristics and partitioning methods, optimizing aggregation for better performance. A large-scale causal-network-based data simulator was also created, enabling the generation of highly realistic process data under normal and faulty conditions to validate and test new monitoring approaches.

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.



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

Construction faces increasing sustainability performance, material and manpower scarcity and a growing shift into urban renovation processes, demanding time, cost and material efficiency. High-performing renovations can significantly reduce the building life cycle impact, but as Architects and Engineers transition to the BIM methodology, they find that computational tools and data to support sustainability and circular economy goals are primarily non-existing. This research aims to support informed decision-making on building renovation scenarios at early design phases from a circular material management perspective. The specific goals are: i) collect and define design criteria that guide construction designers to informed decisions, ii) develop BIM-based tools that identify the optimal design scenarios, and then iii) optimise the proposed tools with machine learning techniques. The expected results are a bim-based methodology that, through computational techniques, becomes more accurate over time and a database with the characterisation and environmental assessment of several renovation projects.

Influence of the masonry pattern in the safety assessment of historic 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 behaviour is difficult to predict. Such geometrical uncertainties suggest investigations based on probabilistic approaches where masonry patterns are characterised by certain statistical variations. This PhD thesis aims to investigate the influence of masonry arrangements on the structural behaviour of HMS. At first, a masonry pattern generator was developed to create random patterns that are categorised and investigated. Then, advanced numerical models based on the discrete element method (DEM) are be adopted to perform parametric and sensitivity analyses aiming to develop easy-to-use analytical tools and provide useful guidelines for researchers and practitioners.

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

The PhD project focuses on developing porous Metal-Organic Frameworks (MOF)-based platforms to dual CO2 capture and conversion into added-value chemical products, such as cyclic carbonates, with industrial applicability, under mild conditions. So far, a series of defect-engineered MOFs (UiO-66, MOF-808, MOF-818, MOF-74, ZIF-8, ZIF-67, UTSA-16, MIP-202) and MOF-based materials have been synthetized under convectional heating, microwave radiation and ambient conditions, with deliberate defects introduced by strategies such as mixing ligands. A three-month research stay at ESCET – URJC (Madrid) with Dr. Pedro Leo, enabled the characterization of prepared materials, innovative MOF@silica hybrid synthesis and CO2 sorption studies. At FCUP, catalytic studies to convert CO2, using epichlorohydrin as the epoxide, are underway, with optimized quantification methods via gas chromatography and NMR.

Post-fire vegetation recovery under present and future climate change conditions

The current PhD proposal aims to analyse the post-fire vegetation recovery globally, focusing on fire-prone regions but also on areas which are observing an increment in fire weather conditions and fire occurrence. By combining long-term remote-sensing datasets with dynamical vegetation and land surface models' outputs, this project aims to identify patterns and quantify trends in post-fire recovery data to assess changes in fire disturbance regimes, both under present and future climate conditions.

** Tiago Silva quits PhD in 2024.*

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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.

Modelling and optimization for sustainable INCONEL machining processes

Inconel 718 has very low machinability, causing high amounts tool wear and requiring large amounts of cutting fluid during machining. However, this excessive tool wear and use of fluid are hazardous to the environment, worker safety, and significantly increase costs. To mitigate these issues, various solutions can be adopted, such as novel cutting tools, coatings, lubrication techniques, or process parameter optimization. This work aims to develop optimization models for Inconel 718 machining, improving efficiency, quality, sustainability, and tool life. A viable tool material, SiAlON (ceramic), has been the focus of recent PhD research. These tools have shown excellent performance in milling operations, enhancing productivity and reducing wear. Additionally, SiAlON tools enable dry machining, eliminating lubricants and offering a more sustainable alternative to coated WC-Co tools.

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Quantitative modelling of the ocean with acoustic waves

I am currently pursuing a PhD in Earth Resources at Instituto Superior Técnico, where my research focuses on modeling the ocean using acoustic waves. My work involves identifying ocean processes and developing computational tools to predict the spatial distribution of ocean temperature and salinity using multichannel reflection seismic data. Seismic oceanography has proven its value in 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 studying fine-scale processes spatially. However, their interpretation has been focused on qualitative methods, and integration with dynamic ocean models is still unexplored. I am developing and implementing 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. The goal is to provide high-resolution images of the ocean to study fine-scale processes and contribute to understanding global ocean circulation. Additionally, I have been involved in the FRESNEL project, which integrates geostatistical forecasting with autonomous underwater vehicle (AUV) path planning. I have a strong background in geology, geophysics, and geosciences, I am dedicated to advancing my knowledge and skills in oceanography.

Crop-watershed modelling of future agricultural water availability in Portugal

My PhD work aims to project future agricultural water availability and crop water demands in Portugal, using integrated crop-watershed modelling. Through a systematic literature review, I concluded that future Mediterranean water reserves may not meet agricultural demands under climate change, due to increased irrigation and reduced reservoir inflows caused by increasing temperatures and less-frequent precipitation, particularly in the Iberian Peninsula (IP). These conclusions were validated by ERA5-IBERIA01 data, which revealed a drying trend over southwestern IP throughout the last century. As an adaptation measure, the reviewed studies suggest the use of integrated modelling and decision-support systems to improve water management. Thus, I am currently performing hydrological modelling of the Sado River basin (southwestern Portugal), that will be followed by crop modelling.

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

Recently, wood has become a popular sustainable alternative material, but most Life cycle assessment (LCA) studies rely on old studies, not accounting for the dynamic of forests and the effects of climate change on the carbon cycle. Wildfires constitute a significant source of carbon emissions in the Mediterranean, and climate change exacerbates it. Therefore, my project aims to analyze the effects of wildfires on the carbon cycle of forests in Southern Europe, using Portugal as a case study for the current and future climate change scenarios and to assess its impact on the built environment. Thus, the project's first year (2024) was devoted to calculating the carbon budget of Portuguese forests and exploring the singularities of Portugal's climate and vegetation. The following steps are developing the climate change scenarios and estimating the impact of the Portuguese forestry sector.

Methodologies and tools for BIM based calculation of Dynamic Life Cycle Assessment

The European Parliament has voted to regulate life-cycle carbon in the Energy Performance of Buildings Directive (EPBD), and national laws are following suit by introducing the Nearly Zero Energy/Emission Building as the minimum standard for new constructions in the near future. To that regard, Life Cycle Assessment (LCA) as a method for buildings' environmental impact assessment, integrated with BIM can facilitate integration of environmental aspects in the planning process, limit productivity shortcomings and reduce environmental impacts, resulting from an unaware decision making. This proposal aims to develop an innovative BIM-based LCA method that can facilitate low-carbon design under the transition for smartening the construction sector in Portugal. The research findings contribute to achieving UN Sustainable Development Goals for sustainable cities and communities and climate action, reducing carbon emissions in the AEC sector, and align with Industry 4.0 trend of using digital tech for efficient and interconnected systems in smart cities.

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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 better ocean management. Among the many threats faced in MSP development, climate change (CC) is considered to be a major one. Developing climate-smart MSP that properly integrate knowledge on climate risks and opportunities is fundamental. Hence, the main objective is to support such integration of knowledge by exploring the Portuguese case study to assess the vulnerability of national MSP initiatives to CC. Currently, a characterization of existing and future activities was performed, together with the assessment of areas of interest for seaforests habitats, responsible for numerous important services. This will support an analysis of potential conflicts and synergies between the activities, as well as their dependency on services provided in the area.

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

My work, “The role of large-scale patterns in climate extremes on a changing climate”, focuses on the study of large atmospheric structures, atmospheric blockings, and their surface impacts on atmospheric extremes such as heatwaves or droughts, and how it has and will change with a warming climate. Currently, I have finished an algorithm for the identification of the structures themselves and the cataloguing of events in climate datasets, which is available through GitHub and will be published as an article in 2025. Following, I have the aim to study extreme hydrological events in the same context. I have also collaborated with a major European project studying precipitation variability in the Mediterranean, which has been approved for publication in Nature. Furthermore, I have participated and contributed to several studies which are currently in review and preparation for publication.

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Towards climate change mitigation by sustainable wire-arc additive manufacturing

Wire-Arc Additive Manufacturing (WAAM) is an emerging AM process that uses wire as the feedstock and electric arc to melt the wire. 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 in infancy. This PhD plan proposes to evaluate the WAAM´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, a web platform is being developed created that quickly calculates and compares environmental, economic, and social impacts of WAAM and other manufacturing processes to select the most sustainable approach.

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

To better understand the patterns of climate change, in situ ocean observing systems need to be improved. The major limitation of current ocean technology is the sensors, which are too large (and expensive), and require expensive, nonrechargeable (or low capacity) batteries. Recent advances in self-powered buoy suggest that they could be used for real-time ocean monitoring, either by integrating sensors into the buoy or by powering other autonomous underwater vehicles. It is a crucial step to have continuous power generation and storage to enable continuous data collection during large periods of operation. The aim of this work is to design oscillating water column wave energy converters with novel control strategies, develop a new turbine concept and explore operational configurations to increase efficiency and integration into self-powered buoys. The main contribution is a technological solution for a self-powered buoy to be used as an electrical socket in the middle of the ocean.

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6.2
Networking and training

During 2024, MPP continued to integrate PhD candidates into the MPP community, providing networking opportunities and training to develop transversal skills.

The 2024 MPP Annual Conference in November provided the opportunity for students in Portugal and at MIT to participate in the conference and to present their research during its poster session. The event included 42 posters, 33 from MPP PhD candidates and other students in Portugal, and nine from MIT students.

As part of the MPP training program, in 2024 the MPP coordination office organized a new edition of Innovation Workshop. This workshop was a hands-on program designed to expose participants to critical elements of venture creation and the potential commercialization of high-impact research and technologies. It was primarily intended for aspiring and early-stage entrepreneurs, as well as students and researchers who seek to explore the application and business prospects of their ideas and research.

The Innovation Workshop, held in June at MIT, hosted 32 participants and featured seminars by MIT and Portuguese innovators, entrepreneurs, and visionaries, with hands-on experience in commercialization.

Following the success of the previous editions, MPP co-organized a fourth edition of the Marine Robotics Summer School. This initiative, open to all master's and PhD students working in Portuguese universities and at MIT, provides an exceptional learning experience by combining advanced theory and practice in marine robotics. For two weeks, students had the opportunity to interact with experts from MIT, the University of Porto, and the University of Azores.

Students also engaged in several practical group activities, including building "drifters" with recyclable materials equipped with GPS and temperature sensors and practicing and operating at sea with the autonomous underwater vehicles, small remote-operated vehicles, and unmanned aerial vehicles. The summer school, held in Horta, Azores, hosted 12 students from MIT, 11 students from Portuguese universities, and three Portuguese Navy students with a strong interest in marine robotics, oceanography, ocean observation, marine biology, marine archaeology, or ecosystem mapping.

07

Events, Networking Activities & Outreach

During 2024, an extension year, MPP continued to foster meaningful opportunities, each designed to create a positive impact on our community. These included an Innovation Workshop at MIT; the Marine Robotics Summer School at Azores; a Program Governance Committee meeting; and other network and outreach activities, including "Encontro Ciência 2024." Another important event was the MPP Annual Conference, with more than 130 in-person participants.

A few highlights from 2024 can be found below:

MARCH_

MIT Portugal Program hosted a group of 40 Portuguese high school students from Porto at MIT

March 21, MIT

In March, a group of 40 Portuguese students from Porto interested in applying to U.S. universities visited Massachusetts, where the MPP hosted the group at MIT. On a tour led by the MIT students affiliated with the MIT Portugal Program, students had a chance to see the Product Design Laboratory, Material Science and Engineering Metallurgical Lab, Glass Lab, and the MIT.nano building. They also visited the Innovation Center and Hayden Library. All students left with the souvenir keychains cut for them during the laser cutter demo at the MIT MakerWorkshop.

Figure 7. Students from "Colégio Ribadouro" visiting MIT

JUNE_

Innovation Workshop

June 3- 7, MIT

Figure 8. 2024 Innovation Workshop Students

The workshop was hosted by Christina Chase (co-founder and managing director of the MIT Sports Lab), 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). It included talks by renowned guests such as Isabel Furtado (CEO of TMG Automotive), Marina Hatsopoulos (entrepreneur and writer), Reed Sturtevant (general partner at Engine Ventures), 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), Sridhar Lyengar (founder and chair of Elemental Machines), Dulcie Madden (experienced startup founder and operator), Pedro Rocha Vieira (co-founder and global CEO of Beta-i), and a special contribution by Portugal's Minister of Education, Science, and Innovation Fernando Alexandre.

51
Student applications

35
Selected applicants

6 *Nationalities*

(Portuguese, Brazilian, Colombian, German, Ecuadorian, Azerbaijani)

The call for MIT Portugal Innovation Workshop 2024 resulted in 51 applications, and 32 students and researchers from Portuguese institutions were selected to attend. Participants came from various Portuguese universities, including the University of Lisbon, University of Coimbra, University of Porto, University of Aveiro, University of Minho, Polytechnic Institute of Bragança, NOVA University Lisbon, Isctec - University Institute of Lisbon, and Nova School of Business and Economics.

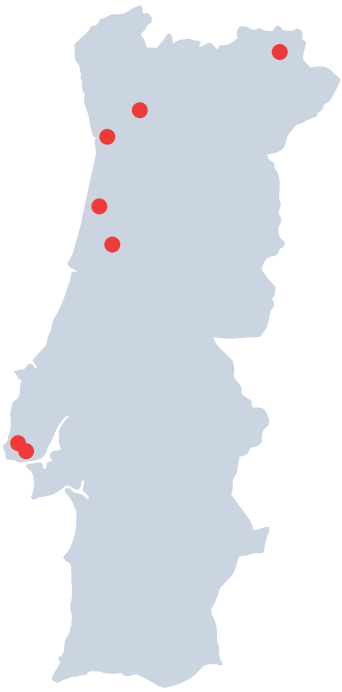


Figure 9. Facts and figures of the 2024 Innovation Workshop, illustraded above.

"The workshop was the start of everything. It gave me the confidence to bring the concept to life and start building a team. Today, we're a team of five, working on securing a provisional patent and turning our vision into reality."

– Luca Gusella, Instituto Superior Técnico (University of Lisbon)

Figure 10. Luca Gusella, 2024 Innovation Workshop Student

JUNE_

Participation of the Portuguese Minister of Education, Science, and Innovation in MIT Portugal Innovation Workshop and Visit to MIT

June 3-4, MIT

Portugal's Minister of Education, Science, and Innovation Fernando Alexandre, visited MIT on June 3-4, 2024, meeting with MIT senior leadership and faculty to learn more about the partnership and MIT's innovation ecosystem.

> ***"An incredible, unforgettable, and truly unique experience—probably one of the best of my life."***
>
> *– Mariana Maia, University of Minho*

During his visit, he also participated in the Innovation Workshop, engaging with 32 Portuguese aspiring student entrepreneurs.

Minister Alexandre traveled to MIT with Pedro Arezes, national director of the MIT Portugal Program, and with Antonio Cunha, resident of the Norte Regional Coordination and Development Commission from Portugal.

Figure 11. Tiago Araújo, Consulate General of Portugal in Boston; António M. Cunha, President of the Norte Regional Coordination and Development Commission, Portugal; Fernando Alexandre, Portuguese Minister for Education, Science, and Innovation; Pedro Arezes, National Director of MIT Portugal Program

JULY_

Encontro Ciência 2024

July 3, Alfândega do Porto

MIT Portugal, along with the CMU Portugal Program and UT Austin Portugal, hosted the "Collaborative Projects under FCT's International Partnerships with Carnegie Mellon University, Massachusetts Institute of Technology and University of Texas at Austin" session at the 2024 Encontro Ciência Summit, to present and discuss the impact of their partnership.

An overview video was produced to present the key outcomes of these partnerships.

The session began with an open discussion involving stakeholders from the three programs.

Pedro Arezes, MIT Portugal Director, Simão Soares, Chief Executive Officer of SilicoLife, a spin-off of the MIT Portugal program in Bioengineering in phase 1, and Nélson Costa was a Visiting Scholar at MIT AGELAB, under the MPP.

Figure 12. Speakers of the International Partnerships Session at Ciência 2024

JULY_

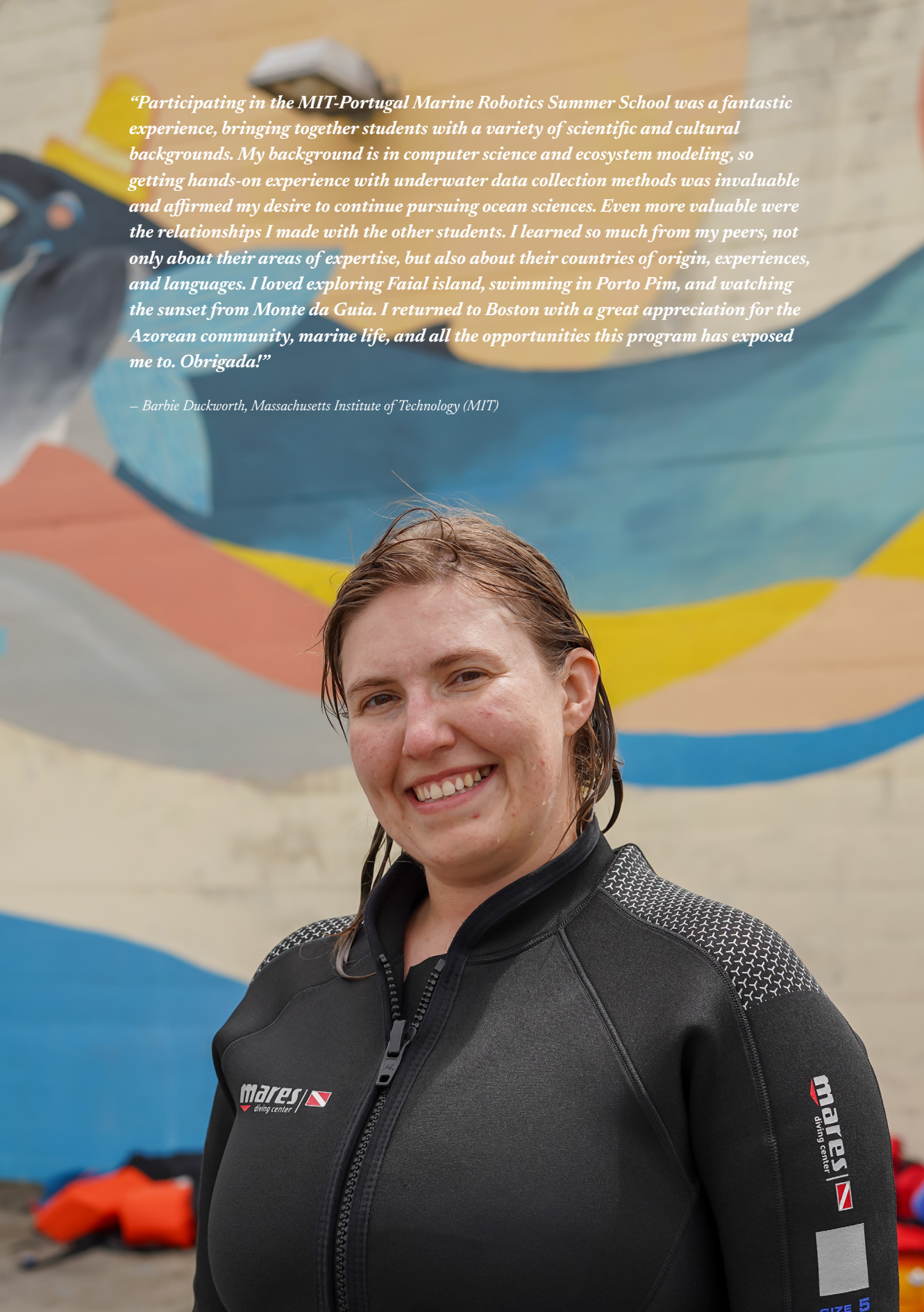
4th Marine Robotics Summer School

July 8 to 19, Faial, the Azores

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

Figure 13. Students and some instructors of the Marine Robotics Summer School, in the Azores, in July 2024.

This summer school was jointly organized by the MPP, FCT, LSTS – Underwater Systems and Technology Laboratory (FEUP), and Instituto de Investigação em Ciências do Mar – OKEANOS (University of Azores). The partner entities for this edition were CoLab +ATLANTIC, School of the Sea of the Azores (EMA), Instituto do Mar (IMAR), Fundação Luso-Americana para o Desenvolvimento (FLAD), and the Portuguese Navy. The summer course had the high patronage of the Regional Government of Azores.



"Participating in the MIT-Portugal Marine Robotics Summer School was a fantastic experience, bringing together students with a variety of scientific and cultural backgrounds. My background is in computer science and ecosystem modeling, so getting hands-on experience with underwater data collection methods was invaluable and affirmed my desire to continue pursuing ocean sciences. Even more valuable were the relationships I made with the other students. I learned so much from my peers, not only about their areas of expertise, but also about their countries of origin, experiences, and languages. I loved exploring Faial island, swimming in Porto Pim, and watching the sunset from Monte da Guia. I returned to Boston with a great appreciation for the Azorean community, marine life, and all the opportunities this program has exposed me to. Obrigada!"

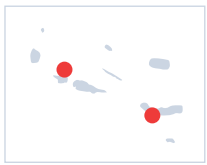
– Barbie Duckworth, Massachusetts Institute of Technology (MIT)

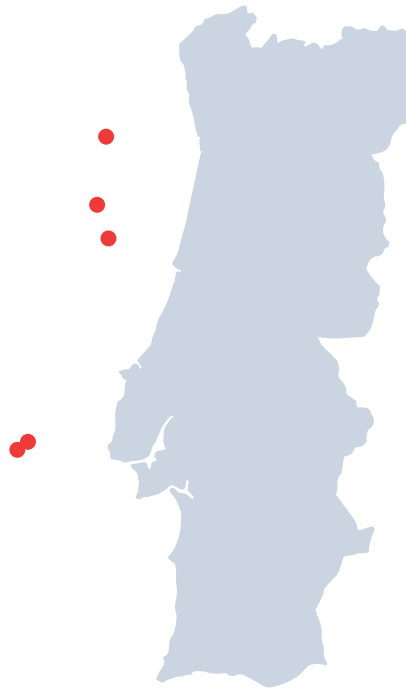
"The Marine Robotics Summer School 2024 was a fun blend of hands-on research projects and cultural exchange between Portuguese universities and MIT. Together, we deployed multiple camera systems to capture marine life up close and learned about the design of autonomous underwater systems. Outside the lab, we went whale watching, sailed around the island, and even dissected fish. I am happy to have gotten to know other students working on important projects and have luckily been able to keep contact with some of them. It was a memorable program that highlighted how important cooperation between marine science and engineering is for protecting our oceans."

– Maximilian Vieweg, Instituto Superior Técnico (University of Lisbon)

104
Student applications

26
Selected Grad students in Engineering and Science fields





8 *Nationalities*

(Portuguese; American; Austrian; German; Indian; Spanish; Colombian; Filipino; Jamaican; and New Zealender)

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

14 *Students from Portuguese universities, of which 4 female and 10 male:*

University of the Azores; University of Coimbra; University of Aveiro; Faculty of Engineering University of Porto; Instituto Superior Técnico; University of Madeira and Portuguese Navy (represented as red dots in the map)

3 *Students from Portuguese Navy*

Figure 14. Facts, photos and figures of the 2024 Marine Robotics Summer School, illustraded above.

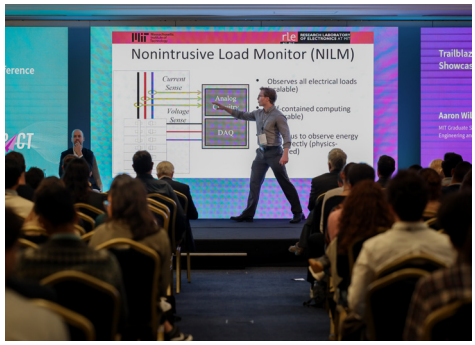
NOVEMBER_

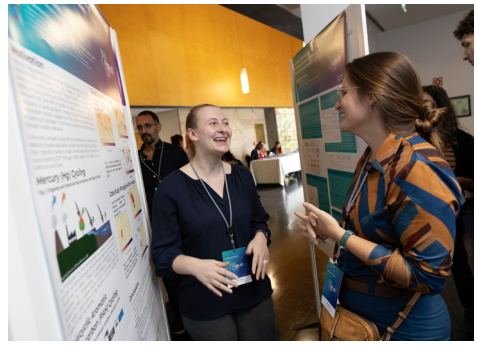
2024 MIT Portugal Annual Conference

November 8, Quinta das Lágrimas, Coimbra

On Friday, Nov. 8, MPP hosted its annual conference at Quinta das Lágrimas, in Coimbra. This year's event, titled "Ideas to Impact," aimed to reflect on past achievements, celebrate ongoing successes, and envision the future. For nearly two decades, MPP has supported innovative projects, advanced high-level training, and fostered high-profile collaborations, all of which showcase the transformative power of science and innovation. The conference showed how the ideas from the MPP community have evolved into impactful projects and solutions that benefit society.

Figure 15. MPP Annual Conference: attendees; posters presentation; and sessions.





The conference included more than 130 participants, including 25 speakers from diverse fields who shared valuable insights and fostered connections. A student poster session featured more than 42 posters showcasing cutting-edge research from Portuguese and MIT students and researchers. The best five posters were recognized with awards for their excellence.

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 2024, we received 25,542 visits, and four new articles were published. As in 2023, the most visited pages, according to Google Analytics, were related to student training and education initiatives, namely the 2024 Marine Robotics Summer School and the MIT Portugal Innovation Workshop.

25,542
Visitors

Among the 26,000 active users, we observed that 9,700 are in Portugal, 5,400 in the United States, 1,200 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: Twitter (now called X), LinkedIn, Facebook, and YouTube.

› **Facebook**

https://www.facebook.com/MIT.Portugal.Program

› **LinkedIn**

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

› **X (formerly Twitter)**

MIT Portugal Program (@MITPortugal)/ X (twitter.com)

› **YouTube**

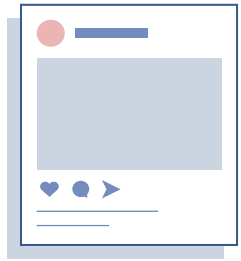
https://www.youtube.com/@mitportugalvideo

The number of publications (through the four channels) exceed 150 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 2024. As of this report, we are connecting with over 24,000 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. In 2025 the Program will extend its presence to Instagram.



153

Social media publications

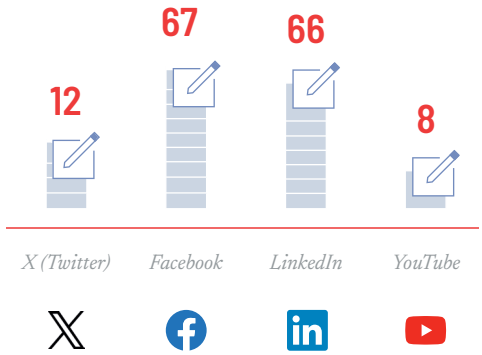
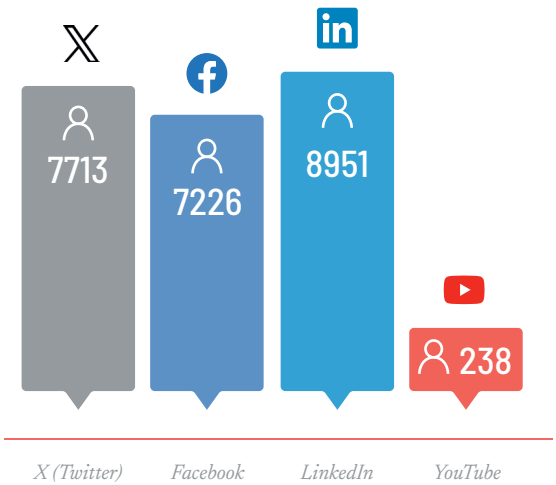


Figure 16. Number of social media publications through the four channels (total 153).



24,128

Social media followers

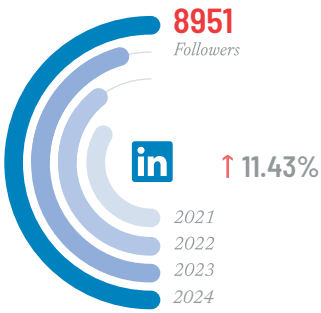
Figure 17. Number of social media followers (Total 23 240).

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.

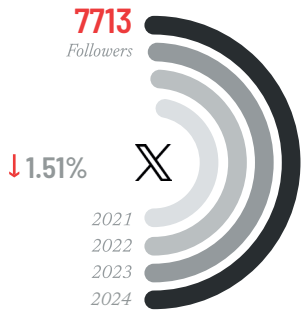
LinkedIn is the social network that generates the most interaction with our community, reaching 8,951 followers in 2024.

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



Twitter (X)

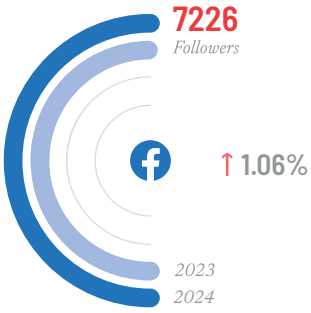
Unlike other social networks, we observed a decline in MIT Portugal's followers, dropping to 7,713 in 2024.



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 2024, it gained only 76 new followers, reaching a total of 7,226 people. Of these, 53.30% are men and 46.70% are women.



YouTube

In 2024, the MIT Portugal YouTube channel reached 238 subscribers (growth rate of 5.31%). Throughout the year, eight new videos were published — one covering the 2024 Marine Robotics Summer School and the remaining ones featuring the 2024 MPP Annual Conference.

In total, the channel had about 1,600 views.

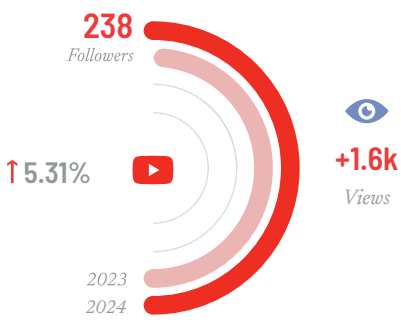


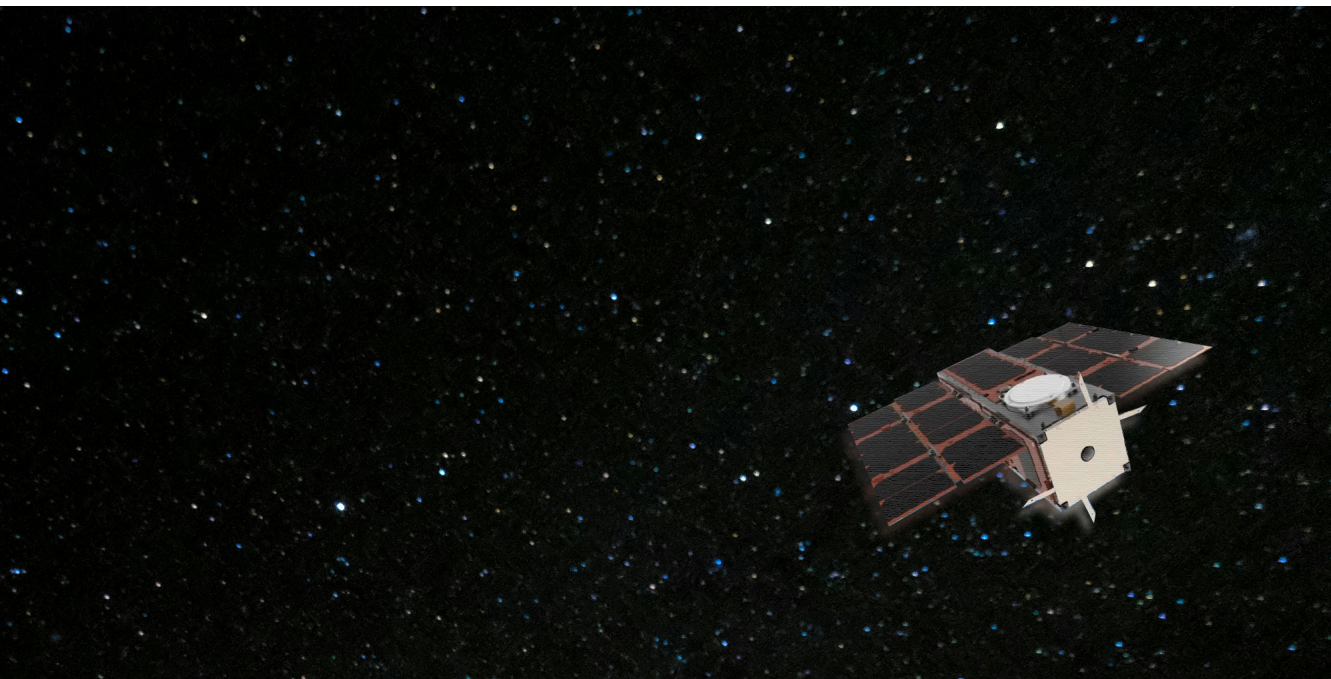
Figure 18. Number of followers by year, and growth rate of each social media channel.

Press and Media Communication

Establishing press and media communication to highlight Program initiatives and achievements to stakeholders and the public is another goal of the Program's communication strategy.

In 2024, the highlight of MIT Portugal Program's presence in the media was the launch of Aeros MH-1, the second Portuguese satellite to be placed in orbit. This event indeed represents a highly significant scientific milestone for Portugal and was widely reported by the Portuguese media.

As in 2023, we also highlight our participation in the podcast "90 Segundos de Ciência" ("90 Seconds of Science"), which allowed us to share more about our flagship projects (NEWSAT and K2D).



09

Outputs of the Program

9.1 Peer-reviewed Publications

MPP Projects

Peer-reviewed publications

Amezquita, H., Guzman, C. P., & Morais, H. (2024). Forecasting Electric Vehicles' Charging Behavior at Charging Stations: A Data Science-Based Approach. *Energies*, 17(14), Article 14.

https://doi.org/10.3390/en17143396

Exploratory: Accurate Federated Learning with Uncertainty Quantification for DER Forecasting Applied to Power Grids Planning and Operation

Kombargi, A., Ellis, E., Godart, P., & Hart, D. P. (2024). Enhanced recovery of activation metals for accelerated hydrogen generation from aluminum and seawater. *Cell Reports Physical Science*, vol. 5 issue 8, 102-121.

https://doi.org/10.1016/j.xcrp.2024.102121

Flagship: K2D

Mateus, P., Catalão, J., & Nico, G. (2024). Improving the Accuracy and Spatial Resolution of ERA5 Precipitable Water Vapor Using InSAR Data. *IEEE Geoscience and Remote Sensing Letters*, vol. 21, (pp. 1-5), 2024.

https://doi.org/10.1109/LGRS.2024.3379249

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

Mateus, P., Catalão, J., Fernandes, R., & Miranda, P. M. A. (2024). Atmospheric Water Vapor Variability over Houston: Continuous GNSS Tomography in the Year of Hurricane Harvey (2017). *Remote Sensing*, 16(17), 3205.

https://doi.org/10.3390/rs16173205

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

Mateus, P., Nico, G., Catalão, J., & Miranda, P.M.A. (2024) Precipitable water vapor from Sentinel-1 improves the forecast of extratropical storm Barbara. *Quarterly Journal of the Royal Meteorological Society*, 150(761), 1988–2004.

https://doi.org/10.1002/qj.4686

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

Articles

Green, D. H., Lin, Y., Botterud, A., Gregory, J., Leeb, S. B., & Norford, L. K. (2024). Pareto-optimized thermal control of multi-zone buildings using limited sensor measurements. *IEEE Transactions on Smart Grid*, 15(5), 4674–4689.

Seed: Continuous Commissioning for Energy Efficient Buildings

Kim, H., & Velásquez-García, L. F. (2024). High-impulse, modular, 3D-printed CubeSat electrospray thrusters throttleable via pressure and voltage control. Advanced Science. Advance online publication.

https://doi.org/10.1002/advs.202413706

Flagship: NEWSAT

MPP PhD Candidates

(Authorship by MPP2030 students is underlined)

Articles

Afonso, I. S., Cardoso, B., Nobrega, G., Minas, G., Ribeiro, J. E., & Lima, R. A. (2024). Green synthesis of nanoparticles from olive oil waste for environmental and health applications: A review. *Journal of Environmental Chemical Engineering*, 12, 114022.

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Alves, D. I., Carvalho, Ó., Fernandes, N. A., Cosentino, L. T., Paula Junior, A. C., Fangueiro, R., & Ferreira, D. P. (2024). Upcycling of industrial footwear waste into nonwoven fibrous structures with thermal and acoustic insulation properties. *Journal of Environmental Management*, 363, 121363.

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9.2 Books or Book Chapters

MPP PhD Candidates

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9.3 Proceedings or Conference Papers

MPP Projects

Amezquita, H., Guzman, C. P., & Morais, H. (2024). A Computational Implementation to Forecast Electric Vehicles Usage in the Power System. *2024 IEEE 22nd Mediterranean Electrotechnical Conference (MELECON)*, 1374–1379.

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Exploratory: Accurate Federated Learning with Uncertainty Quantification for DER Forecasting Applied to Power Grids Planning and Operation

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Matos, A. M., Fonseca, M., Milheiro, P., & Pimentel, M. (2024). Formulações ternárias para impressão 3D utilizando materiais nacionais. *Encontro Nacional do Betão Estrutural 2024*. Porto, Portugal.

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

Pereira, L., Nair, V., Annaswamy, A., Dias, B., & Morais, H. (2024). Accurate federated learning with uncertainty quantification for distributed energy resource forecasting applied to smart grids planning and operation: The ALAMO vision. *IET Conference Proceedings*, 1123–1126.

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Exploratory: Accurate Federated Learning with Uncertainty Quantification for DER Forecasting Applied to Power Grids Planning and Operation

MPP PhD Candidates

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Pereira, R., Romero, J., Norton, A., & Nóbrega, J. M. (2024). Multiscale model to assess complex tongue muscles behavior. Apresentado no *6th FOAM@IBERIA Meeting*, Campus Industrial de Ferrol, Galicia, Espanha, 3–4 outubro 2024.

Pinheiro, C., Margalho, É. M., Alcantara, A., Lima Junior, O., Segundo, I. R., Branco, V. C., Bertoncini, B., Costa, M. F. P. C. M., Simões, R., Freitas, E., & Carneiro, J. A. S. A. O. (2024). Monitorização atmosférica dos níveis de NO_2 usando a técnica de amostragem passiva. In *Sustentabilidade, Meio Ambiente e Responsabilidade Social: Artigos Selecionados* (Vol. 3). Editora Poisson.

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Serrano, G., Jacinto, M., Ribeiro-Gomes, J., Pinto, J., Guerreiro, B. J., Bernardino, A., & Cunha, R. (2024). Physics-informed neural network for multirotor slung load systems modeling. In *2024 IEEE International Conference on Robotics and Automation (ICRA)* (pp. 12592–12598).

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Silva, A. S., Lima, J., Silva, A. M. T., Gomes, H. T., & Pereira, A. I. (2024). Time-dependency of guided local search to solve the capacitated vehicle routing problem with time windows. In *Proceedings of the International Conference on the Applications of Evolutionary Computation* (pp. xx–xx). Springer.

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Szabó, S., Funari, M. F., & Lourenço, P. B. (2024). Influence of uncertainties on the compound rocking failure mechanism of single-nave masonry churches. In *Proceedings of the 18th International Probabilistic Workshop* (pp. 177–186). Springer.

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Szabó, S., Funari, M. F., D'Altri, A. M., de Miranda, S., & Lourenço, P. B. (2024). A two-step approach for the seismic assessment of masonry structures accounting for the actual masonry pattern. In *Proceedings of COMPDYN 2024*.

Szabó, S., Pulatsu, B., & Funari, M. F. (2024). Cross-section influence on the out-of-plane behavior of historic masonry walls. In *Proceedings of the Canadian Society for Civil Engineering Annual Conference 2023*.

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Tesch, L., Gervásio, H., & Craveiro, H. D. (2024). Life cycle assessment of low carbon sandwich panels with wood fibre core. *ce/papers*, 7(2), 85–91.

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Vecchio, D., Colombo, C., Vlachakis, G., Mendes, N., & Lourenço, P. B. (2024). The design of a shaking table campaign on the out-of-plane response of masonry structures. *MATEC Web of Conferences, 403*, 04004.

Vuoto, A., Funari, M. F., Szabó, S., Pulatsu, B., & Lourenço, P. B. (2024). Competitiveness of computational modelling strategies: A framework to implement efficient digital twins of historical masonry structures. In *ECCOMAS Congress 2024 Proceedings*.
https://doi.org/10.23967/eccomas.2024.092

9.4 PhD Thesis

Amir Gholipour
University of Lisbon
Sludge treatment by earthworm-enhanced reed beds towards smart-cities
December 2024

Arturo Sousa
University of Madeira
As Tecnologias de Informação e Comunicação para a sustentabilidade sociocultural do turismo criativo
June 2024

Diogo Neves Ferreira
Instituto Superior Técnico of the University of Lisbon
Biradial turbine generator-set for off-grid OWC wave energy converters
January 2024

Michael Parkes
Instituto Superior Técnico of the University of Lisbon
The Rise and Fall of an Experiment in Sustainable Building – Integrated Indoor Vertical Farming
May 2024

Vinicius Santana
University of Porto
Cyber-physical oriented chemical process for green and sustainable production
March 2024

9.5 Oral Communications

MPP Projects

Antunes, A., Brudner, A., Patricio, A., Duarte Santos, G., & Ben-Akiva, M. (2024, October). How driving automation will save demand responsive transit. INFORMS Annual Meeting, Seattle, WA, United States.
Seed: Demand responsive transit - why do they fail, and how (and if) can they succeed?

Brudner, A., Patricio, A., Duarte Santos, G., Antunes, A., & Ben-Akiva, M. (2025, January). How driving automation will save demand responsive transit. Transportation Research Board (TRB) Annual Meeting, Washington, D.C., United States.
Seed: Demand responsive transit - why do they fail, and how (and if) can they succeed?

Cicone, L., Gama, C., Miranda, A., Osswald, T., Monteiro, A., Wong, A., & Selin, N. (2024). Quantifying the wildfire

contribution to polycyclic aromatic hydrocarbon exposure and health effects. International Global Atmospheric Chemistry Conference (IGAC).
Seed: Quantifying toxic air pollution and exposure from wildfires

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

Cicone, L., Roy, E., Monteiro, A., Miranda, A., Gama, C., Osswald, T., & Selin, N. (2024). Global and regional wildfire emissions of toxic pollutants contribute to health risks. MIT Portugal 2024 Annual Conference. Coimbra, Portugal.
Seed: Quantifying toxic air pollution and exposure from wildfires

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

Kombargi, A. (2024, June). Efficient and green hydrogen production from aluminum-water reaction. World Hydrogen Energy Conference. Tulum, Mexico.
Flagship: K2D

Kombargi, A. (2024, March). Inexpensive green hydrogen production from aluminum-water reaction. American Physical Society March Meeting. Minneapolis, MN, USA.
Flagship: K2D

Kombargi, A. (2024, October). Efficient hydrogen production from recycled aluminum and seawater. Materials Science & Technology technical meeting. Pittsburgh, PA, USA.
Flagship: K2D

Mateus, P., Mendes, V. B., Miranda, P. M., Mondal, D. R., & Elosegui, P. (2024, December). Monitoring atmospheric water vapor cost-effectively using GNSS tomographic methods [Apresentação oral]. AGU Fall Meeting 2024, San Francisco, CA, United States.
https://agu.confex.com/agu/agu24/meetingapp.cgi/Paper/1535641
Seed: Probing extreme weather events in a warming climate with GNSS and atmospheric reanalysis in the Azores Islands

Matos, A. M. (2024, May). Cement-based materials stand for digital and industrial construction [Keynote presentation]. CINPAR 2024 – XX International Conference on Building Pathology and Constructions Repair, Fortaleza, Brazil.
Exploratory: Next Generation of Digital "Concrete": performance mix design and assessment of sustainable and circular cementitious composites

Monagle, D., Ponce, E., Leeb, S. B., Saathoff, E., Brooks, D., Krause, T., & Green, D. (2024, March). Build to win: Electrical hardware opportunities for STEM education. In 2024 IEEE Integrated STEM Education Conference (ISEC). IEEE. Princeton, NJ, United States.
Seed: Continuous Commissioning for Energy Efficient Buildings

Mondal, D. R., Elosegui, P., Brock, L., & Paine, S. (2024, December). Atmospheric turbulence on the Ross Ice Shelf, Antarctica, during the January 2016 melting event [Apresentação oral]. AGU Fall Meeting 2024, San Francisco, CA, United States.
https://agu.confex.com/agu/agu24/meetingapp.cgi/Paper/1675812

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

Mondal, D. R., Elosegui, P., Brock, L., Paine, S., Mateus, P., & Mendes, V. (2024, April). Probing the dynamics of extreme weather events in the Azores, Portugal [Resumo de conferência]. European Geophysical Union General Assembly (EGU2024), Vienna, Austria.

https://meetingorganizer.copernicus.org/EGU24/EGU24-5929.html

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

Nico, G., Mateus, P., and Catalao, J. (2024, April 14-19). On the contribution of InSAR Meteorology to a Digital Twin Of The Atmosphere. EGU General Assembly 2024. Vienna, Austria.

https://doi.org/10.5194/egusphere-egu24-20132

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

Pereira, L. (2024, July 11-12). Accurate federated learning with uncertainty quantification for distributed energy resource forecasting applied to smart grids planning and operation: The ALAMO vision. 2024 LARSYS Annual Meeting. Lisbon, Portugal.

Exploratory: Accurate Federated Learning with Uncertainty Quantification for DER Forecasting Applied to Power Grids Planning and Operation

Pires, A. (2024, June). Potential of the Space Sector in Portugal: Challenges and Opportunities. Space on Earth (by SANJOTEC), Parque de Ciência e Tecnologia, Porto, Portugal.

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

Pires, A. (2024, November). SENTINEL-Orb robotic system: Paving the way for future space missions. MIT Portugal 2024 Annual Conference, Coimbra, Portugal.

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

Roy, E. M., & Selin, N. E. (2024, July). Quantification of elemental mercury surface exchange using inverse methods. MIT EAPS Atrium Talk Series, Cambridge, MA, United States.

Seed: Quantifying toxic air pollution and exposure from wildfires

Roy, E. M., Feinberg, A., Fisher, J. A., Powell, J., Ward, J., Harnwell, J., Dlamini, T., & Selin, N. E. (2024, July). Using the unused data: Top-down constraints on mercury exchange from diffuse processes. International Conference on Mercury as a Global Pollutant, Cape Town, South Africa.

Seed: Quantifying toxic air pollution and exposure from wildfires

MPP PhD Candidates

(Authorship by MPP2030 students is underlined)

Aghabayli, A. (2024, September) [Workshop presentation]. PhD Workshop, eCAADe Conference.

Alves, A. (2024, June 4). *Decarbonization and land-use transformation in Portugal: Impacts of the energy-climate agenda* [Oral presentation]. Wageningen Energy Alliance Meeting 2024, Wageningen, The Netherlands.

Alves, A., Marques da Costa, E., Gomes, E., & Niza, S. (2024, December 9). *Exploring solar energy in Portugal's energy transition* [Oral presentation]. Sustainable Transitions – Balance and Future

Challenges in EU Cohesion Policy Context (RSA Research Network on EU Cohesion Policy #CPnet).

Anjos, R. (2024, November 22). *Effect of crumb rubber size on packing of 1/3 scaled ballast* [Conference presentation]. 5th International Conference on Transportation Geotechnics, Sydney Masonic Centre, Australia.

Anjos, R. P. (2024, August 26). *Reinforcement of coarse granular aggregates with microgrids: Influence on packing* [Conference presentation]. XVIII European Conference on Soil Mechanics and Geotechnical Engineering, MEO Arena, Lisbon, Portugal.

Antunes, H. A. (2024, June 18–22). *Proximity agriculture in underdeveloped urban areas: A case study in Matosinhos, Northern Portugal* [Oral presentation]. 11th AESOP Sustainable Food Planning Conference, Ghent and Brussels, Belgium.

Antunes, H. A. (2024, March 5). *Increasing urban resilience through a food-productive green infrastructure in Great Porto* [Poster presentation]. Doctoral Colloquium, AESOP4food Online Seminar 2024.

Antunes, H. A. (2024, September 7–11). *Building urban resilience: Assessment of potential food spaces in Matosinhos, Portugal* [Oral presentation]. ECLAS Conference "Regenerative Landscapes: Designing the Transition", Université libre de Bruxelles, Brussels, Belgium.

Antunes, H. A. (2024, September 7–11). *Increasing urban resilience through a food-productive green infrastructure* [Poster presentation]. Doctoral Colloquium, ECLAS Conference "Regenerative Landscapes: Designing the Transition", Université libre de Bruxelles, Brussels, Belgium.

Baldo, A. P., Ferreira, A. P., Silva, A. S., Diaz de Tuesta, J. L., Marin, P., Peres, J. A., & Gomes, H. T. (2024, November 13–15). *Breakthrough curve of activated carbon and geopolymer for the adsorption of sulfamethoxazole, acetaminophen, and gallic acid* [Oral presentation]. Galician-Portuguese International Conference on Chemistry, Vigo, Galicia, Spain.

Baldo, A. P., Ferreira, A. P., Silva, A. S., Diaz de Tuesta, J. L., Marin, P., Peres, J. A., & Gomes, H. T. (2024, November 13–15). *Synthesis and characterization of activated carbon, geopolymers and carbon nanotubes from waste-derived sources* [Oral presentation]. Galician-Portuguese International Conference on Chemistry, Vigo, Galicia, Spain.

Bona, S., Gomes, R., Silva-Afonso, A., & Rodrigues, F. (2024, July 16–19). *Sustainable transition in urban water management: The contribution of urban water communities* [Oral presentation]. Research Summit 2024 – Research Forum of the University of Aveiro, Aveiro, Portugal.

Bona, S., Silva-Afonso, A., & Gomes, R. (2024, May 16–18). *Gestão integrada da água urbana: Em direção a comunidades sustentáveis* [Oral presentation]. Conferência Água – Desafios do Futuro, Faro, Portugal.

Bona, S., Silva-Afonso, A., Gomes, R., & Rodrigues, F. (2024, November 6–8). *Gestão integrada da água urbana: Análise de parâmetros para sistemas híbridos locais* [Oral presentation]. 5º Congresso Luso-Brasileiro de Materiais de Construção Sustentáveis | Congresso Construção 2024, Lisbon, Portugal.

Caetano, J. C. F. (2024). *Decoding chemical complexity: Explainable AI toolboxes for thermodynamic property prediction* [Oral presentation]. 5th PCLab Day, Department of Chemical Engineering, Faculty

of Sciences and Technology, University of Coimbra, Portugal.

Caetano, J. C. F. (2024, June). *Making sense of data: Intelligible machine learning analytics for VOC vaporization enthalpy prediction* [Oral presentation]. 16th National Physical Chemistry Meeting & 5th Computational Chemistry Symposium, Portuguese Chemical Society, University of Lisbon, Portugal.

Cardoso, A. (2024, March 22). *Digital transformation in the promotion of occupational health* [Invited speaker presentation]. Spring School Hands-on.

Cardoso, A. (2024, May 29). *Development of a real-time assessment framework for collaborative robotic systems* [Oral presentation]. Workshop of the Doctoral Program in Industrial and Systems Engineering, School of Engineering, University of Minho, Portugal.

Cardoso, A. (2024, May 29). *Introducing assistive assembly: Reducing cognitive workload, unlocking efficiency* [Poster presentation]. Workshop of the Doctoral Program in Industrial and Systems Engineering, School of Engineering, University of Minho, Portugal.

Cardoso, A. (2024, September 26). *Enhancing worker well-being: A study on assistive assembly to mitigate work-related musculoskeletal disorders and modulate cobot assistive behavior* [Oral presentation]. 6th International Conference on Human Systems Engineering and Design: Future Trends and Applications (IHSED 2024), Split, Croatia.

Carrelhas, A. A. (2024, September 17–19). I*mpulse turbine-generator set for the Mutriku Wave Power Plant* [Oral presentation]. ICOE 2024 – International Conference on Ocean Energy, Melbourne, Australia.

Castro, A. (2024, September). *Large language models overcome the challenges of unstructured text data in ecology* [Oral presentation]. 13th International Conference on Biological Invasions, Lisbon, Portugal.

Colombo, C. (2024). *Seismic fragility curves of rocking blocks: Shaking table tests and numerical modelling* [Oral presentation]. 18th International Brick and Block Masonry Conference (IB2MAC), Birmingham, UK.

Corais, F. (2024, June 16–19). *Living Labs for Transition Experiments (TE): A new methodology to accelerate the change of behaviors, attitudes and mindsets (MACBAM) towards sustainable mobility* [Oral presentation]. 15th International Sustainability Transitions Conference, University of Oslo, Norway.

Cordeiro, A., Müller-Carneiro, J., Bexiga, J., Rubel, M., Saerens, B., Dockx, L., & Freire, F. (2024, October 8–10). *Life cycle assessment of an ammonia stripping-scrubbing pilot technology for nitrogen recovery from urban wastewater* [Poster presentation]. European Sustainable Phosphorous Conference (ESPC5), ESPP/BETA Technological Center, Lleida, Spain.

Correia, M. G. (2024, December 8). Development of a tool for automated integrati*on of Mapillary and OpenStreetMap data* [Oral presentation]. State of the Map Latam 2024.

Cosentino, L., Jacinto, C., Paula Junior, A. C., Fernandes, J., & Mateus, R. (2024, November 7). *Avaliação do ciclo de vida de produtos de base biológica na construção* [Oral presentation]. 5º Congresso Luso-Brasileiro de Materiais de Construção Sustentáveis, Lisbon, Portugal.

Cosentino, L., Mateus, R., & Fernandes, J. (2024, January 30). *Development of an*

ecological thermal insulation product for a regenerative building design [Poster and flash talk]. UMinho Research & Innovation Open Days, 1st edition.

Costa, P. (2024, November 8). *Evolutionary multi-objective optimization of shoe sole damper geometry using surrogate models and data mining* [Poster presentation]. MIT Portugal Program Annual Conference, Coimbra, Portugal.

Dâmaso Duarte, A. F. (2024, June). *Multisource modelling of the ocean* [Poster presentation]. GeoEnv 2024 Congress, Chania, Greece.

Dâmaso Duarte, A. F. (2024, May). *Contributing for the understanding of the ocean with acoustic data* [Oral presentation]. Encontro de Oceanografia APOCEAN, Peniche, Portugal.

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

Dantas, R., Fiorentin, F., Correia, J. A. F. O., Lesiuk, G., & De Jesus, A. (2024). *Biaxial stress state in very high cycle fatigue of S690 structural steel* [Oral presentation]. 9th International Conference on Very High Cycle Fatigue (VHCF9), Lisbon, Portugal.

Dantas, R., Gouveia, M., Gomes, V. M. G., Silva, F. G. A., Fiorentin, F., De Jesus, A., Correia, J., & Lesiuk, G. (2024). *An analysis of frequency effect in fatigue data of metal alloys with different crystal structures* [Oral presentation]. European Conference on Fracture (ECF24), Zagreb, Croatia.

Dias, M. (2024, April 15). *Susceptibility of the Iberian Peninsula to extreme precipitation and aridity: A high-resolution analysis for 1950–2022* [Oral presentation]. EGU General Assembly 2024, Vienna, Austria.

Dias, M. (2024, September 4). *Extreme precipitation and aridity in Iberian Peninsula: A new high-resolution susceptibility analysis over 1950–2022* [Oral presentation]. EMS Annual Meeting 2024, Barcelona, Spain.

Faria, J. P. D., Marques, C. P., Pombo, J. A. N., Mariano, S. J. P. S., & Calado, M. R. A. (2024). *A novel multi-swarm and multi-objective optimization algorithm for solving engineering problems* [Conference paper]. 2024 IEEE International Conference on Environment and Electrical Engineering & IEEE Industrial and Commercial Power Systems Europe (EEEIC/I&CPS Europe), Rome, Italy.

Faria, J. P. D., Pombo, J. A. N., Calado, M. R. A., & Mariano, S. J. P. S. (2024). *Solar grid tied inverters: Configuration, topologies, and control strategies* [Conference paper]. 2024 IEEE International Conference on Environment and Electrical Engineering & IEEE Industrial and Commercial Power Systems Europe (EEEIC/I&CPS Europe), Rome, Italy.

Fereidani, N. A. (2024, June 22–26). *Energy efficiency in coastal climates: Unravelling design sensitivities* [Conference presentation]. ASHRAE Annual Conference, Indianapolis, USA. https://doi.org/10.63044/s24fer03

Fernandes, J. I. B. (2024). *A circular refurbishment framework to facilitate buildings-oriented circular economy policies* [Oral presentation].

Fernandes, M. Â. R. M. (2024, June 10). *Climate-related vulnerability and risk assessment of main ocean uses: An overview* [Online oral presentation]. NavHub Talks – Coastal Research Collaboration Hub.

Fernandes, R. (2024, July 15). *Diversity and distribution patterns of invasive alien*

plant species in mainland Portugal [Oral presentation]. IYrCIS Conference 2024.

Fernandes, S. (2024, November 13–15). *Defect engineering of UiO-66 using a mixed-ligand strategy via microwave-assisted synthesis to enhance CO_2 capture and conversion potential* [Oral presentation]. XXVIII Encontro Galego Portugués de Química, Vigo, Galicia, Spain.

Fernandes, S. (2024, October 24–25). *Sustainable synthesis of defective UiO-66 for enhanced CO_2 capture and valorization* [Oral presentation]. Synthesis&Catalysis Workshop 2024, NOVA School of Science and Technology, Caparica, Portugal.

Fernandes, S. (2024, October 29–31). *Tri-hybrid catalyst combining polyoxometalates, MOF and silica for the desulfurization of heavy fuel oil* [Oral presentation]. 1st International Conference on Maritime Efficiency and Energy Transition, CEHIPAR/INTA, Madrid, Spain.

Hernandez, C., Manzolli, J. A., Simões, T. R., Redol, J., Rodrigues, C., & Freire, F. (2024, June 25–27). *The influence of a rooftop photovoltaic system on the electricity consumption of a plastic moulding plant: A carbon footprint assessment* [Oral presentation]. 2024 IEEE 22nd Mediterranean Electrotechnical Conference (MELECON), Porto, Portugal.

Hernandez, C., Rodrigues, C., Silva, P., Tomé, G., & Freire, F. (2024, March 5–8). *Carbon footprint assessment of electricity systems of a plastic moulding plant* [Poster presentation]. Young Energy Researchers Conference, World Sustainable Energy Days (WSED 2024), Wels, Austria.

Iñiguez Santamaria, E. (2024). *Beyond the surface: Investigating UV-filter presence and biomagnification in three NE Atlantic pelagic species* [Oral presentation]. SETAC Conference, Seville, Spain.

Kappler, L. B., & de Abreu e Silva, J. (2024, July 3–5). *Will telework reduce travel? An evaluation of empirical evidence with meta-analysis* [Oral presentation]. NECTAR Conference 2024, Brussels, Belgium.

Kappler, L. B., de Abreu e Silva, J., & Melo, P. C. (2024, August 26–30). *Will telework reduce travel? An evaluation of empirical evidence with meta-analysis* [Oral presentation]. ERSA Online Conference 2024, Terceira Island, Portugal.

Kirkici, H. (2024) [Oral presentation]. IHSED 2024 – Human Systems Engineering and Design Conference.

Kokare, S. (2024, May 29 – June 1). *Exploring the environmental and economic benefits of wire arc additive manufacturing compared to subtractive manufacturing* [Conference presentation]. 57th CIRP Conference on Manufacturing Systems, Póvoa de Varzim, Portugal.

Lima Jr., O., Margalho, É., & Freitas, E. (2024, April 18). *New abilities for smart road elements: Asphalt pavements and road markings* [Oral presentation]. BIP Thessaloniki, Thessaloniki, Greece.

Lima Jr., O., Rocha Segundo, I., Freitas, E., & Carneiro, J. (2024, May 27). *Smart road marking through self-cleaning capacity* [Online oral presentation]. 10th IMFAHE International Conference.

Lima Jr., O., Rocha Segundo, I., Mazzoni, L. N., Freitas, E., & Carneiro, J. (2024, June 14). *Improving the road safety and the service life of road markings through self-cleaning ability* [Conference presentation]. Bituminous Mixtures and Pavements VIII, 8th International Conference, Taylor & Francis, Thessaloniki, Greece.

Lima Jr., O., Rocha Segundo, I., Mazzoni, L., Costa, M. F. M., Freitas, E., & Carneiro, J. (2024, July 16). *Artificial*

intelligence-enhanced colorimetric assessment of self-cleaning road marking paints [Oral presentation]. 6th International Conference on Applications in Optics and Photonics (AOP 2024), University of Aveiro, Portugal.

Lima Jr., O., Rocha Segundo, I., Reis, E., Mazzoni, L., Costa, M. F. M., Freitas, E., & Carneiro, J. (2024, September 13). *Applied optics in the development of smart road markings* [Conference presentation]. 12th European Optical Society Annual Meeting, EPJ Web of Conferences, Naples, Italy.

Lima, M., Santos, L. C., Cardoso, R. M., Soares, P. M., & Trigo, R. M. (2024). *Lagrangian analysis of the extreme-windstorm dynamics associated to post-tropical cyclone Leslie landfall in Portugal* (No. EGU24-599) [Conference presentation]. Copernicus Meetings.

Madureira, L. (2024, June 16–21). *A cyanobacteria–methanotroph co-culture approach for simultaneous removal of methane and carbon dioxide from biogas* [Oral presentation]. 8th Congress of the International Society of Applied Phycology (ISAP), Porto, Portugal.

Margalho, É. M., Gomes, I., Lima Jr., O., Rocha Segundo, I., Nunes, C., Tavares, C., Freitas, E., & Carneiro, J. (2024, June 14). *Evaluation of air cleaning through photocatalytic asphalt mixture functionalized with TiO_2 nanoparticles* [Oral presentation]. Bituminous Mixtures and Pavements VIII – 8th International Conference, Thessaloniki, Greece.

Marques, M., da Silva, D., Santos, E., Baylina, N., Peixoto, R., Keller-Costa, T., & Costa, R. (2024, November 25–27). *Explorando a comunidade bacteriana cultivável e as suas características simbióticas em octocorais tropicais de aquário e do Mar Vermelho* [Online oral presentation]. Microbiologia 2024.

Marques, M., Militão, R., Santos, E., Baylina, N., Peixoto, R., Keller-Costa, T., & Costa, R. (2024, July 2–5). *Insights into the culturable community and symbiosis-related traits of bacteria from long-term aquarium and Red Sea tropical octocorals* [Oral presentation]. European Coral Reef Symposium (ECRS 2024), Naples, Italy.

Marques, M., Peixoto, R., Keller-Costa, T., & Costa, R. (2024, November 5). *Climate change impacts on octocorals: From emerging pathogens to probiotic solutions* [Pitch presentation]. PhD Open Days 2024 – 10th Edition, Lisbon, Portugal.

Meireis, C. (2024, July). *Characterization and diagnosis of social housing in Viana do Castelo: A representative analysis of Portugal's social housing* [Oral presentation]. Urban Futures – Cultural Pasts: Sustainable Cities, Cultures & Crafts, Barcelona, Spain.

Meireis, C. (2024, November). *The habitable envelope: A sustainable renovation process for social housing* [Poster presentation]. MIT Portugal 2024 Annual Conference – Ideas to Impact, Coimbra, Portugal.

Melo, W. W. (2024). *Previsão da evolução de perfis de praia baseada em ferramentas de inteligência artificial* [Oral presentation]. 7ª Conferência sobre Morfodinâmica Estuarina e Costeira, Aveiro, Portugal.

Mindrico, T. M. (2024, June 19). *Generative artificial intelligence (AI) potentialities in the creative field* [Oral presentation]. ICRT Video & Photo Meeting, DECO PROteste & International Consumer Research and Testing, Lisbon, Portugal.

Mindrico, T. M. (2024, March 12). *How to play: A speculative way into civic media* [Oral presentation]. Transmedia Questions (MA) and Interactive Systems (BA), Faculty of Fine Arts, University of Lisbon, Lisbon, Portugal.

Mindrico, T. M. (2024, May 17). *Como jogar: Um caminho especulativo para os média cívicos* [Oral presentation]. Seminário de Iniciação à Investigação Artística: Práticas Multimédia e Transmédia, Universidade de Évora, Évora, Portugal.

Molina, O., Soares, P. M., Lima, M. M., Lima, D. C., Gaspar, T., & Trigo, R. (2024). *Updating the assessment of climate change at decadal scale and consolidating with CMIP6 future projections (No. EGU24-435)* [Conference presentation]. Copernicus Meetings.

Müller-Carneiro, J., Dias, L. C., Rodrigues, C., & Freire, F. (2024, October 8–10). *Assessing nutrient security and replacement potential of novel technologies for wastewater nutrient recovery* [Poster presentation]. European Sustainable Phosphorous Conference (ESPC5), ESPP/BETA Technological Center, Lleida, Spain.

Nascimento, P. (2024). *Improving the efficiency of logic-based Benders decomposition for large-scale optimization* [Oral presentation]. INFORMS Annual Meeting.

Nascimento, P. (2024). *Improving the efficiency of logic-based Benders decomposition for large-scale optimization* [Oral presentation]. XXIII Congress of the Portuguese Operational Research Society.

Navarro, L. C., Nogueira, L., Matos, A., Rocha, A., & Ozório, R. (2024, August 27). *Measurement of European seabass (Dicentrarchus labrax) in the rearing environment by images taken by cameras above RAS tanks* [Oral presentation]. Aqua2024 – International Conference and Exposition, European Aquaculture Society, Copenhagen, Denmark.

Nobrega, G. (2024, August 5). *Experimental investigation of green nanofluids: Assessment of wettability, viscosity and thermal conductivity* [Oral presentation]. ASME 2024 – 7th International Conference on Micro/Nanoscale Heat and Mass Transfer.

Pais, A. (2024). *Machine learning for bone remodeling analysis* [Oral presentation]. Congress on Numerical Methods in Engineering 2024, Aveiro, Portugal.

Pais, A., Alves, J. L., & Belinha, J. (2024). *Accelerating the prediction of bone remodelling with neural networks* [Conference presentation]. ECCOMAS Congress 2024, Lisbon, Portugal.

Pais, A., Alves, J. L., & Belinha, J. (2024). *Designing unit cells with specific elastic properties with neural network* [Conference presentation]. ECCOMAS Congress 2024, Lisbon, Portugal.

Pais, A., Alves, J. L., & Belinha, J. (2024). *Unit cell design for stress shielding minimization using neural networks* [Conference presentation]. Congress on Numerical Methods in Engineering 2024, Aveiro, Portugal.

Parece, S. (2024, December 3–6). *Optimizing sustainability through digital tools: Energy and carbon comparative analysis of brick, concrete, and wood frame construction envelopes in Coimbra residences* [Oral presentation]. 7th International Symposium on Formal Methods in Architecture, Oporto, Portugal.

Parece, S. (2024, July 3–5). *Addressing material efficiency in building renovation scenarios: A BIM-based decision support tool* [Oral presentation]. Encontro Ciência 2024, Oporto, Portugal. https://app.encontrociencia.pt/exhibitor/23502

Parece, S. (2024, May 8–10). *A BIM-based tool for the rapid assessment of embodied carbon using the SECClasS classification system* [Oral presentation]. 5th

Portuguese Congress of Building Information Modelling, Lisbon, Portugal.

Parece, S. (2024, November 8). *Addressing material efficiency in building renovation scenarios: A BIM-based decision support tool* [Poster presentation]. MIT Portugal Program Annual Conference: Ideas to Impact, Coimbra, Portugal. https://mitportugal.mit.edu/poster-gallery/2024/student-posters/addressing-material-efficiency-building-renovation-scenarios-bim-based-decision-support-tool

Paula Junior, A. C., Jacinto, C., Cosentino, L., Fernandes, J., Teixeira, E., & Mateus, R. (2024, November 6). *Aplicação do método de estado estacionário (hotbox) para a caracterização das propriedades térmicas de diferentes produtos de construção* [Oral presentation]. 5º Congresso Luso-Brasileiro de Materiais de Construção Sustentáveis, Lisbon, Portugal.

Pereira, R. (2024, June 3). *Innovative adaptive pacifier manufacturing technology – Pitch* [Pitch presentation]. MIT Portugal Innovation Workshop, Massachusetts Institute of Technology (MIT), Cambridge, MA, USA.

Pereira, R. (2024, June 7). *Innovative adaptive pacifier manufacturing technology – 30|90 days* [Pitch presentation]. MIT Portugal Innovation Workshop, Massachusetts Institute of Technology (MIT), Cambridge, MA, USA.

Ribeiro, J. A. (2024, July). *Clustering and coarsening for large-scale graph prediction of shell buckling* [Oral presentation]. 6th World Congress on Computational Mechanics & 4th Pan American Congress on Computational Mechanics (WCCM 2024 & PANACM 2024).

Ribeiro, J. A. (2024, June). *Graph neural network for large-scale graph prediction of shell buckling* [Oral presentation]. 9th European Congress on Computational Methods in Applied Sciences and Engineering – ECCOMAS 2024.

Ribeiro, J. A. (2024, June). *Graph neural networks for stress prediction in structural design* [Oral presentation]. 9th European Congress on Computational Methods in Applied Sciences and Engineering – ECCOMAS 2024.

Ribeiro, J. A. (2024, November). *Structural assessment based on computational models and digital twin technologies* [Oral presentation]. International Scientific Conference – Transport Means 2024.

Rios, C. M. (2024, December 11). *Sustainability transitions in practice: The role of social movements in shaping sustainable mobility councils' policies in Brazil and Portugal* [Online oral presentation]. The Future of Urban Mobility – International PhD Colloquium, University of California Berkeley, University of Porto, Universidad Politécnica de Madrid, University of Manchester, University of Minho, McGill University, Technische Universität München.

Rios, C. M. (2024, February 12–16). *Bottom-up mobilisation: The role of social movements in sustainable mobility transitions in Global South and North* [Oral presentation]. UpGradeMobility Graduate School Winter School, Karlsruhe Institute of Technology, Karlsruhe, Germany.

Rios, C. M. (2024, July 3–6). *Sustainability transitions in practice: The role of social movements in shaping sustainable mobility councils' policies in Brazil and Portugal* [Oral presentation]. AHEAD OF THE GAME – AESOP PhD Workshop, Institut d'Urbanisme et de Géographie Alpine, Grenoble, France.

Rios, C. M. (2024, September 10). *Sustainability transitions in practice: The role of social movements in shaping sustainable*

mobility councils' policies in Brazil and Portugal [Oral presentation]. Cycling and Society Symposium 2024, Instituto Politécnico do Porto, Escola Superior de Educação, Porto, Portugal.

Rito, D. R. (2024, February 6). *How can mixed reality improve healthcare?* [Workshop presentation]. XIX Jornadas de Engenharia Biomédica, University of Minho, Portugal.

Rubel, M., Someus, E., Müller-Carneiro, J., & Freire, F. (2024, October 8–10). *Life cycle assessment of an innovative technology for dairy wastewater treatment with the production of phosphorus-rich fertilizer* [Oral presentation]. European Sustainable Phosphorus Conference (ESPC5), ESPP/BETA Technological Center, Lleida, Spain.

Santos, C. J. (2024, November 8). *Nature-based solutions for coastal protection* [Conference presentation]. MIT Portugal 2024 Annual. Coimbra, Portugal.

Santos, L., Lima, M. M., Soares, P. M., Trigo, R. M., & Cardoso, R. M. (2024). *High-resolution simulation of the extreme fire event in Central Portugal, Pedrogão Grande (2017)* [Conference presentation No. EGU24-708]. Copernicus Meetings.

Serra, G. (2024, August 2). *A cortiça no desenvolvimento de produtos em engenharia* [Oral presentation]. LusoCiência 2024, Gouveia, Portugal.

Serra, G. (2024, June 20). *Study on the impact behavior of shear thickening fluid (STF) reinforcements in cork composite structures* [Oral presentation]. AuxDefense 2024, Braga, Portugal.

Serra, G. (2024, November 8). *Designing for sustainability and safety in urban micro-mobility: A novel helmet concept* [Conference presentation]. MIT Portugal 2024 Annual Conference, Coimbra, Portugal.

Silva, A. S. (2024, November 8). *Optimization of municipal solid waste management towards sustainability* [Conference presentation]. MIT Portugal 2024 Annual Conference. Coimbra, Portugal.

Silva, A. S. (2024, June 15). *Optimizing waste collection in constrained urban spaces: A hybrid fleet approach* [Oral presentation]. OL2A 2024.

Silva, A. S. (2024, May 10). *Unveiling key parameters: Time windows and travel times in capacitated waste collection* [Virtual oral presentation]. ICCSA 2024.

Sousa, V. F. (2024, December 5). *Impact of milling mode on cutting forces and tool wear in Inconel 718 machining with SiAlON end-mills* [Poster presentation]. HiREV – Shaping the Future of Automotive Components, Terminal de Cruzeiros do Porto de Leixões, Portugal.

Szabó, S. (2024). *Influence of uncertainties on the compound rocking failure mechanism of single-nave masonry churches* [Conference presentation]. 18th International Probabilistic Workshop.

Szabó, S. (2024). *On the optimal survey of masonry texture for the seismic assessment of historic masonry structures* [Conference presentation]. ECCOMAS Congress 2024.

Tenente, M. (2024, May 8). *INESC Coimbra's current and future role in research on energy systems and policies* [Oral presentation]. Energy Forum, Department of Electrical and Computer Engineering, Faculty of Science and Technology, University of Coimbra, Portugal.

Vuoto, A. (2024, June 3–7). *Competitiveness of Computational Modelling Strategies: a Framework to Implement Efficient Digital Twins of Historical Masonry Structures.* [Oral presentation]. ECCOMAS Congress 2024 – 9th European Congress on Computational Methods in Applied Sciences and Engineering, Lisbon, Portugal.

9.6 Prizes and Honors

MPP PhD Candidates

Ana Filipa Duarte
Award for Best Scientific Paper
by APOCEAN

Ana Paula F. da Silva
1st Place at the International Meeting of Young Entrepreneurs (EIJE)

1st Place at Poliempreende

Beatriz Biguino
Best MIT Portugal Student Poster Award in Climate Science & Climate Change
by MIT Portugal Program at the 2024 MIT Portugal Conference, November 2024, Coimbra Portugal

Filipa Corais
1st Place in the Category of Conscious Citizenship
by Abayomi Academy International Award 2024

Joana Couceiro
Best MIT Portugal Student Poster Award in Earth Systems: Oceans to Near Space
by MIT Portugal Program at the 2024 MIT Portugal Conference, November 2024, Coimbra Portugal

João Alves Ribeiro
FLAD Scholarship Award
by FLAD, January 2024

Leandro Madureira
Finalist of Blue Bio Value Ideation 2024 | Project: PhotoUp_CH4: A Partnership for Sustainable Biomethane
by Blue Bio Value Ideation

Luiz Claudio Navarro
Best MIT Portugal Student Poster Award in Data Science
by MIT Portugal Program at the 2024 MIT Portugal Conference, November 2024, Coimbra Portugal

Orlando de Sousa Lima Júnior
ANPET 2024 Scientific Production Award
by National Association for Research and Education in Transportation

Young Researcher Award 2024
by International Conference on Building Pathology and Constructions Repair (CINPAR)

Pedro José Oliveira
Best Paper Award in Smart Cities: "Employing Explainable AI Techniques for Air Pollution: An ante-hoc and post-hoc approach to predicting nitrogen dioxide"
by the 25th International Conference on Intelligent Data Engineering and Automated Learning (IDEAL2024), November 2024, Valencia, Spain

Rafael Anjos
ISSMGE Foundation Award 2024
by International Society of Soil Mechanics and Geotechnical Engineering

Rita Dantas
Young Scientist Award 2024: Best Presentation: "An analysis of frequency effect in fatigue data of metal alloys with different crystal structures"

by ESIS (European Structural Integrity Society)

Sara Cerqueira
Fulbright Grant for Research
by Fulbright (with the support of FCT - Host Institution: MIT)

Sara Parece
Best MIT Portugal Student Poster Award in Sustainable Cities
by MIT Portugal Program at the 2024 MIT Portugal Conference, November 2024, Coimbra Portugal

Simone Fernandes
Best Oral Communication Award - Presentation of PhD Research Results: "Sustainable Synthesis of Defective UiO-66 for Enhanced CO_2 Capture and Valorization"

by the Synthesis & Catalysis Workshop 2024, FCT - NOVA University of Lisbon

Tiago Mindrico
2024 Pilot Project Funding: "OUTCASTS: THEORIES AND ARTISTIC PRACTICES"
by University of Lisbon Center for Research and Studies in Fine Arts, Portugal

9.7 Courses and Workshops Organized

MPP Projects

Roy, E. M., Feinberg, A., & Selin, N. E. (2024, October).
MCHgMAP Workshop
Session: Inputs to MCHgMAP atmospheric simulations: Geogenic and biomass burning emissions
Venue: Portorož, Slovenia
October, 2024
Seed: Quantifying toxic air pollution and exposure from wildfires

Silva, T., & Guerra-Garcia, C. (2024, September 30).
Gaseous Electronics Conference, American Physical Society
Session: Plasmas for sustainability [Workshop]
Venue: San Diego, CA, United States
September 30, 2024
Seed: Inverse design and Modeling of Plasma-Assisted CO2-conversion Technologies (IMPACT)

MPP PhD Candidates

André Cardoso
Spring School Hands-On
Session: Digital Transformation in the Promotion of Occupational Health
Venue: Guimarães, Portugal
Organizers: DTx Colab
March 22, 2024

André Claro
Inov4Agro Scholarship Researchers' Day
Venue: CIBIO - Research Centre in Biodiversity and Genetic Resources, Porto, Portugal
Organizers: Inov4Agro Scholarship Researchers
October 7, 2024

Andrea Tarazona
20th International Probabilistic Workshop (IPW2024)
Venue: University of Minho, Portugal
May 8-10, 2024

Camila Penso
Seminário de Tecnologias de Monitorização Oceânica
Venue: Famalicão IN HUB, Portugal
November 11, 2024

Cláudia Rodrigues
Workshop on Spatial Data Analysis
Venue: University of Coimbra, Portugal
Organizers: Carlos Bento and Cláudia Rodrigues
June 4, 2024
Workshop on Python for Data Analysis
Venue: University of Coimbra, Portugal
Organizers: Carlos Bento and Cláudia Rodrigues
October 19, 2024

Eva Iñiguez
Plásticos e contaminantes associados: perceções atuais e direções de pesquisas futuras para o MARE (Workshop)
Venue: Évora, Portugal
Organizers: Eva Iñiguez, Annalisa Sambolino, Carla Silva and Joana Antunes

November 4-5, 2024

Filipa Corais
Mobilidade Sustentável e Inclusiva - Universidade de Fim-de-Verão

Organizers: Câmara Municipal de Braga, Universidade do Minho & Universidade Católica
September 17-19, 2024

Heloisa Antunes
Lecture: Agricultura Urbana como Ferramenta de Regeneração da Paisagem (e além) – Master's Program in Soil Assessment and Remediation

Venue: University of Porto, Portugal
April 29, 2024

Lecture: Food Spaces – Integração de Áreas Produtivas em Espaços Verdes Urbanos – Master's Program in Landscape Architecture

Venue: University of Porto, Portugal
October 14, 2024

Jade Müller Carneiro
Circular Economy in Companies and Scientific Research

Venue: Department of Mechanical Engineering, University of Coimbra
Organizers: Center for Industrial Ecology, ADAI
April 24, 2024

Joana Príncipe
Seminar - Electrochemistry: from Fundamentals to Applications

Venue: FEUP, Porto, Portugal
Organizers: Joana Príncipe, Vera Duarte and Luísa Andrade
February 21, 2024

João Rocha
Missão SONDA

Venue: Ponda Delgada, São Miguel
Organizers: UMinho, INESC-TEC & IST
August 8-12, 2024

Workshop de Tecnologias de Monitorização Oceânica

Venue: Famalicão IN HUB, Portugal
November 11, 2024

José Ferraz Caetano
International Sustainable Chemistry Collaborative Centre (ISC3)

Session: Data Science Skills for Sustainable Chemistry: Leveraging Data Science to Address Climate Change, Plastic and Waste Pollution
Venue: Germany, (Online)
November 28, 2024

Luana Lübe Tesch
3rd Training School of the Cost Action MODENERLANDS

Venue: University of Belgrade, Serbia
Organizers: Member of the Organizing Committee and Speaker
June 18-21, 2024

Marcos Tenente
INESC Coimbra Master Classes: Science Mapping Tools for Effective Bibliometric Analysis and Visualization

Venue: Online
Speaker: Jônatas Augusto Manzolli
May 15, 2024

INESC Coimbra Master Classes: An Introduction to CPLEX Optimization Using Open Programming Language (OPL)

Venue: Online
Speaker: Vahid Rasouli
July 16, 2024

INESC Coimbra Master Classes: Literature Research: An Overview of Best Practices, Strategies, and Resources

Venue: Online

Speaker: Ana Luísa Reis
October 23, 2024

Orlando Lima Júnior
10th International Conference on Maintenance and Rehabilitation of Pavements (MAIREPAV 2024)

Venue: University of Minho, Portugal
Organizers: Member of the Organizing Committee
July 24, 2024

6th International Conference on Application of Optics and Photonics (AOP 2024)

Venue: University of Aveiro, Portugal
Organizers: Member of the Organizing Committee
July 16-19, 2024

Pedro Oliveira
Advanced School on Artificial Intelligence - EAIA 2024

Venue: School of Technology and Management of Viana do Castelo, Portugal
Organizers: Member of the Organizing Committee
September 2-3, 2024

Phillip Probst
Sci-Vi for Sciences: How Animated Science Visualization Can Help Promote Our Research

Venue: FCT NOVA, Departamento de Física, Sala de Seminários
Organizers: Ágota Vegsõ, Phillip Probst, Hugo Gamboa
October 16, 2024

Samruddha Kokare
Advanced Research Training Workshop

Venue: Vrije Universiteit Brussels, Belgium
September 10-12, 2024

Tiago Mindrico
XII Graduate Conference in Culture Studies: Space Oddity

Session: Cassandra 2.0 - Community Mapping through a Digital Ludic Urban Experience (Workshop)
Venue: Faculdade de Ciências Humanas, Universidade Católica Portuguesa
January 27, 2024

Outcasts: Theories and Practices Conference

Venue: Faculty of Fine Arts of University of Lisbon, Portugal
Organizers: Member of the Organizing Committee
October 14-15, 2024

9.8 Outreach Activities

MPP PhD Candidates

Adriano Silva
MIT Portugal 2024 Annual Conference – Ideas to Impact

Speaker at the session: Trailblazing Research: Showcasing Student Projects
Venue: Coimbra, Portugal
November 8, 2024

Ana Filipa Duarte
2024 Marine Robotics Summer School

Venue: Faial Island, Azores, Portugal
July 8-19, 2024

Ana Paula F. da Silva
MIT Portugal Innovation Workshop 2024

Venue: MIT, USA
June 3-7, 2024

André Cardoso
Inovar & Empreender 2024

Venue: University of Minho, Portugal
September 19, 2024

Andreína Zerega

European Researcher's Night

Venue: Coimbra, Portugal
September 7, 2024

Aydan Aghabayli
MIT Portugal Innovation Workshop 2024

Venue: MIT, USA
June 3-7, 2024

Carlos Carvalho
MIT Portugal Innovation Workshop 2024

Venue: MIT, USA
June 3-7, 2024

Carlos Hernandez
MIT Portugal Innovation Workshop 2024

Venue: MIT, USA
June 3-7, 2024

Catarina Jóia Santos
MIT Portugal 2024 Annual Conference – Ideas to Impact

Speaker at the session: Trailblazing Research: Showcasing Student Projects
Venue: Coimbra, Portugal
November 8, 2024

Cauê Martins Rios
UpGrade Mobility Winter School

Venue: Germany
February 12-16, 2024

Aesop 2024 PhD Workshop - Ahead of the game. Reversibility, frugality and care in the context of urban transitions

July 3-6, 2024

EIT Urban Mobility Bari Summer School 2024

Venue: Politecnico di Bari, Italy and Faculty of Sciences, Department of Geography, Universtiy of Ghent
August 29 – September 6, 2024

2024 STRN/NEST Method School

Venue: Rotterdam, Netherlands
July 8-12, 2024

Eva Iñiguez
Ciência Viva – "Expedição submarina: aventura e biodiversidade para jovens exploradores"

Venue: Madeira, Portugal
August 2 – September 8, 2024

Gabriel Serra
MIT Portugal Innovation Workshop 2024

Venue: MIT, USA
June 3-7, 2024

MIT Portugal 2024 Annual Conference – Ideas to Impact

Speaker at the session: Trailblazing Research: Showcasing Student Projects
Venue: Coimbra, Portugal
November 8, 2024

Heloisa Antunes
The NBS Summit Urban Edition

Venue: Porto, Portugal
May 23-24, 2024
Erasmus+ Short mobility at University of Ghent and attendance at 11th AESOP Sustainable Food Planning Conference

Venue: Brussels and Ghent, Belgium
June 18-22, 2024

Workshop PNUM 2024 - Resiliência e Forma Urbana

Venue: Universidade Portucalense, Porto, Portugal
June 26-29, 2024

Erasmus+ Blended Intensive Program (BIP) "Regenerative Landscapes. Designing the Transition (ECLAS) – Poster and oral presentation

Venue: Université libre de Bruxelles, Belgium
September 7-11, 2024
Porto Urban Greening Bienal

Venue: Fundação Eng. António de Almeida, Porto, Portugal
October 17-18, 2024

Jade Müller Carneiro
MIT Portugal Innovation Workshop 2024
Venue: MIT, USA
June 3-7, 2024

Joana Couceiro
International Microorganism Day (IMD)
Venue: Lisbon, Portugal
September 9, 2024

João Alves Ribeiro
MIT Portugal Innovation Workshop 2024
Venue: MIT, USA
June 3-7, 2024

Entrepreneurship Program – Faber

DEEPTECH VENTURE Program - Conception X

José Ferraz Caetano
Sustainable Business Model Hackathon Eco-responsible Society - Working Group of AEGEE Europe (Webinar)
Presentation: Integrative Strategies for Science Policy: Advocacy, Circular Economy, and Financial Planning for Sustainability
Venue: Germany
June, 2024

Fulbright Commission Pre-Departure Session 2024
Session: Ser Fulbrighter: o papel da diplomacia pública e a pertença à comunidade Fulbright
Venue: Lisbon, Portugal
May, 2024

International Younger Chemists Network
Presentation: Sustainable Chemistry & Youth: Unveiling the Global Framework on Chemicals
Venue: USA
April, 2024

Leandro Madureira
Pint of Science Braga (Co-organizing committee)
Venue: Braga
May 13-15, 2024

Mahla Shariatzadeh
RES4CITY Workshop - Renewable Energy Solutions for Coimbra (Speaker)
Venue: Coimbra, Portugal
October 4, 2024

Matilde Marques
International Microorganism Day
Venue: IST, Lisbon, Portugal
September 17, 2024

Miguel Fernandes
Dia Aberto em Ciências 2024
Co-organization of the activity: Qual a importância das florestas marinhas portuguesas?
Venue: University of Lisbon, Portugal
May 8, 2024

Pedro Oliveira
2nd European Summer School on Artificial Intelligence
Venue: Athens, Greece
July 15-19, 2024

Advanced School on Artificial Intelligence (EAIA 2024)
Venue: Viana do Castelo, Portugal
September 2-3, 2024

Rafael Anjos
MIT Portugal Innovation Workshop 2024
Venue: MIT, USA
June 3-7, 2024

Rita Pereira
MIT Portugal Innovation Workshop 2024
Venue: MIT, USA
June 3-7, 2024

Rodrigo Paredes
1st edition PhD International Intensive School

Presentation: Towards Zero Emission Mobility: An Hydrogen Scenario
Venue: Naples, Italy
Organizers: Department of Industrial Engineering of the University of Naples Federico II

Samruddha Kokare
European Researcher's Night 2024

Presentation: Is 3D Metal Printing Sustainable?
Venue: Lisbon, Portugal
September 27, 2024

Sara Parece
MIT Portugal Innovation Workshop 2024

Venue: MIT, USA
June 3-7, 2024

Simone Fernandes
Open Days at FCUP

Venue: FCUP, Porto, Portugal
February 9-10, 2024

9.9
News in Media

Innovation Workshop

1. Governo da República Portuguesa (XXIV Governo Constitucional) – Ministro da Educação, Ciência e Inovação em visita de trabalho ao Massachusetts Institute of Technology

2. Global MIT – Portuguese Minister of Education, Science, and Innovation participates in MIT Portugal Innovation Workshop

Flagship Project AEROS

3. MIT News – AEROS CubeSat launches to study ocean health

4. Diário de Notícias – Costa enaltece lançamento do segundo satélite da história espacial portuguesa. "Grande projeto"

5. Expresso – Segundo satélite português é lançado segunda-feira dos Estados Unidos: chama-se Aeros e sucede ao PoSat

6. Público – Agora, sim. Trinta anos depois, Portugal volta a enviar um satélite para o espaço

7. Jornal de Notícias – Satélite português vai vigiar Atlântico a 510 km da Terra

8. RTP Notícias – Satélite AEROS MH-1 oferece olhar científico português sobre a Terra

9. Compete 2030 – Nanossatélite Português Aeros MH-1 ganha prémio internacional

10. Visão – Satélite português AEROS MH-1 já enviou as primeiras imagens da Terra

11. Expresso – Observar o oceano a partir do espaço? É possível graças a um satélite completamente português

12. Renascença – Nanossatélite português Aeros MH-1 recebe Prémio Missão do Ano de conferência nos EUA

13. CNN Portugal – Pesa menos de 5 quilos: o português Aeros é lançado para o Espaço pelas 21:18

Others

14. OBSERVADOR – Governo renova parcerias com universidades norte-americanas até 2030

15. MIT News – New AI tool generates realistic satellite images of future flooding

16. APDC – Revista Comunicações – O engenheiro que coloca as pessoas no centro da inovação

17. Público – FCT delegou avaliação das parcerias com universidades norte-americanas em consultora

18. Notícias UPorto – Estudante da FEUP premiada pela Sociedade Europeia de Integridade Estrutural

19. Notícias OKEANOS – Ilha do Faial acolhe a 4º edição da Marine Robotics Summer School

20. 90 Segundos de Ciência – Miguel Ângelo Carvalho - Projeto Operator desenvolve sensores para melhorar a produtividade, a ergonomia e o bem-estar dos trabalhadores

21. 90 Segundos de Ciência - Gustavo Dias - Na Universidade do Minho, um grupo de investigadores está a desenvolver um projeto de criação de nanosatélites através de impressão 3D

22. Podcast RUM – Eduardo Borges Pereira - 'K2D – Knowledge and Data from the Deep to Space'

23. Podcast RUM – Miguel Carvalho – 'Operator 4.0". Um projeto que pretende monitorizar a postura, stress e produtividade dos funcionários'

24. Notícias Técnico Lisboa – "Electronics First: Come and build your own oscilloscope", workshop by Steven Leeb

25. Visão – Jornalista Cândida Pinto e cientista Maria Nunes Pereira vencem prémios Dona Antónia "Ferreirinha" para mulheres empreendedoras e inovadoras

26. OBSERVADOR – Portugal e EUA juntos na obtenção de fibras naturais com aplicação na construção civil e saúde

27. RUM – Cabos submarinos podem ajudar NATO na defesa e investigadores com alterações climáticas

MPP PhD Students

Ana Carrelhas

Climate Science & Climate Change

28. Cluster de Energía – ARRECIFE e IDOM entre cuatro entidades a que EVE adjudica contratos Fase II en el marco proyecto TurboWave

29. OES News – OES Annual Report 2023

Filipa Corais

Sustainable Cities

30. CrAFt – The Transition Experiments in Braga

José Ferraz Caetano

Data Science

31. Público – Quando a ciência perde a alma

Rita Dantas

Earth Systems: from Oceans to near Space

32. Notícias UPorto – Estudante da FEUP premiada pela Sociedade Europeia de Integridade Estrutural José Ferraz Caetano

Sara Cerqueira

Digital Transformation in Manufacturing

33. ENGIUM – Duas estudantes da EEUM premiadas com bolsas Fulbright para investigar nos EUA

34. Fulbright – My Fulbright Experience – Sara Cerqueira

35. UMinho – Seis estudantes da UMinho premiados com bolsas Fulbright para investigar nos EUA

Simone Fernandes

Climate Science and Climate Change

36. LAQV requimte – Synthesis&Catalysis Workshop 2024 abordou as novas tecnologias facilitadoras para a síntese química: eletroquímica e química de fluxo

9.10 Patents

MPP Projects

Wang, B., Makatura, L., Wojtan, C., Bickel, B., Chen, Y., Deng, B., Matusik, W. (2024) Procedural Generation of Metamaterials. Application No. PCT/US2024/021281. MIT case: 24891.

[Effective filling date: 25/03/2024]

MPP PhD Students

Penso, C. (2024, December 30). Device and method for identifying polymers particles in fluid flows.

[Patent pending]

Pereira, I. (2024). Bioactive marine concrete and uses thereof. International Patent Application No. PCT/IB2024/059548.

Also filed as provisional application No. 118948 in 2023

Pereira, I. (2024). Sustainable self-healing marine concrete and method therefor. European Patent Application No. 24203667.1.

Also registered as application No. 118947 in 2023

Rito, D. R. (2024). Clinical decision support system for patellofemoral instability diagnosis and treatment.

[Patent pending]

Invention Disclosure – Projects

De Weck, O. L., Haji, M. N., Norheim, J. J., Platform for Expanding AUV exploRation to Longer ranges (PEARL). MIT case: 22190.

Opened in 2020 and closed in 2024

Ellis, E., & Kombargi, A. Near Complete Recovery of Eutectic Gallium-Indium Metal in Aluminum and Salt Water Reactions with Increased Reaction Rates through Addition of Imidazole. MIT case: 25003.

Opened in 2023 and closed in 2024

9.11 Other Outputs

Posters presented at MIT Portugal 2024 Annual Conference

Quinta das Lágrimas, Coimbra, November 8

The event showcased the cutting-edge research from Portuguese and MIT Students and researchers with 42 Conference Posters and recognized the best 5 posters.

Best Poster

1. **Beatriz Biguino**. Marine Heat Waves vs Marine Cold Spells: when seasonal upwelling dictates the hotter topic.

https://mitportugal.mit.edu/poster/marine-heat-waves-vs-marine-cold-spells-when-seasonal-upwelling-dictates-hotter-topic/

Climate Science & Climate Change

2. **Joana Couceiro**. Community structure, bioactivities and secondary metabolite production of bacteria associated with a temperate octocoral.

https://mitportugal.mit.edu/poster/community-structure-bioactivities-and-secondary-metabolite-production-bacteria-associated-temperate/

Earth Systems: Oceans to Near Space

3. **Kaitlyn Gee**. Integrated Modeling of Digital Product Design and Manufacturing for Improved Productivity, Quality, and Sustainability

https://mitportugal.mit.edu/poster/

integrated-modeling-digital-product-design-and-manufacturing-improved-productivity-quality-and/

Digital Transformation in Manufacturing

4. **Luiz Claudio Navarro**. Measuring European Seabass (Dicentrarchus labrax) in the Rearing Environment using Cameras Above RAS Tanks.

https://mitportugal.mit.edu/poster/measuring-european-seabass-dicentrarchus-labrax-rearing-environment-using-cameras-above-ras-tanks/

Data Science

5. **Sara Parece**. Addressing Material Efficiency in Building Renovation Scenarios, A BIM-based decision support tool.

https://mitportugal.mit.edu/poster/addressing-material-efficiency-building-renovation-scenarios-bim-based-decision-support-tool/

Sustainable Cities

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6. **Aaron Langham**. Continuous Commissioning for Energy Efficient Buildings.

https://mitportugal.mit.edu/poster/continuous-commissioning-energy-efficient-buildings/

Sustainable Cities

7. **Albano Martins**. Sustainable construction solutions for outdoor public spaces: modernity and tradition in optimizing urban quality.

https://mitportugal.mit.edu/poster/sustainable-construction-solutions-outdoor-public-spaces-modernity-and-tradition-optimizing-urban/

Sustainable Cities

8. **Ana Filipa Dâmaso Duarte**. Multi-Source Modelling of the Ocean.

https://mitportugal.mit.edu/poster/multi-source-modelling-ocean/

Earth Systems: Oceans to Near Space

9. **Ana Silva**. A home powered by time: A decade of microgeneration and energy independency.

https://mitportugal.mit.edu/poster/home-powered-time-decade-microgeneration-and-energy-independency/

Sustainable Cities

10. **André Claro**. Extreme precipitation and aridity in the Iberian Peninsula: A new high-resolution analysis for 1950-2022.

https://mitportugal.mit.edu/poster/extreme-precipitation-and-aridity-iberian-peninsula-new-high-resolution-analysis-1950-2022/

Climate Science & Climate Change

11. **André Santos**. SENTINEL-Orb:SpacE operatioNs, moniToring, and mappINg ExpLorer: a smart Orb-system.

https://mitportugal.mit.edu/poster/sentinel-orbspace-operations-monitoring-and-mapping-explorer-smart-orb-system/

Earth Systems: Oceans to Near Space

12. **Andreina Zerega**. Sustainable Cities Start with Healthier Streams: Predicting Restoration Outcomes.

https://mitportugal.mit.edu/poster/sustainable-cities-start-healthier-streams-predicting-restoration-outcomes/

Sustainable Cities

13. **Anne Patricio**. How Driving Automation Will Save Demand Responsive Transit.

https://mitportugal.mit.edu/poster/how-driving-automation-will-save-demand-responsive-transit/

Sustainable Cities

14. **Aydan Aghabayli**. Multi-objective environmental assessment for affordable housing – predictive and generative approaches for early design optimization.

https://mitportugal.mit.edu/poster/multi-objective-environmental-as-

sessment-affordable-housing-predictive-and-generative-approaches/

Sustainable Cities

15. Carlos Carvalho. Extraction and application of map-matching anomalies to the improvement of the cycling road network infrastructure and road maps.

https://mitportugal.mit.edu/poster/extraction-and-application-map-matching-anomalies-improvement-cycling-road-network-infrastructure/

Sustainable Cities

16. Charlene Xia. Identifying Microbiome's Health in Marine Environments from Data Collected via a Real-time Opto-fluidics Monitoring system.

https://mitportugal.mit.edu/poster/identifying-microbiomes-health-marine-environments-data-collected-real-time-opto-fluidics/

Climate Science & Climate Change

17. Cláudia Rodrigues. URBAN SPATIAL DATA ANALYSIS: Towards Safe, Inclusive, and Sustainable Spaces.

https://mitportugal.mit.edu/poster/urban-spatial-data-analysis-towards-safe-inclusive-and-sustainable-spaces-2/

Sustainable Cities

18. Cláudio Meireis. The Habitable Envelope: A Sustainable Renovation Process for Social Housing.

https://mitportugal.mit.edu/poster/habitable-envelope-sustainable-renovation-process-social-housing/

Sustainable Cities

19. Fernando Ribeiro. Hydrogen Electrolyser participation in Automatic Generation Control using Model Predictive Control.

https://mitportugal.mit.edu/poster/hydrogen-electrolyser-participation-automatic-generation-control-using-model-predictive-control/ ecodesign-plastic-products-novel-approach-and-applications

Sustainable Cities

20. Filipa Corais. The Impact of a New Methodology to Accelerate the Change of Behaviors, Attitudes and Mindsets (MACBAM) towards Sustainable Urban Mobility.

https://mitportugal.mit.edu/poster/impact-new-methodology-accelerate-change-behaviors-attitudes-and-mindsets-macbam-towards-sustainable/

Sustainable Cities

21. Giulia Sent. Development of Earth Observation products for coastal waters in support of water quality monitoring.

https://mitportugal.mit.edu/poster/development-earth-observation-products-coastal-waters-support-water-quality-monitoring/

Earth Systems: Oceans to Near Space

22. Hatice Kirkici Gonçalves. Portuguese users' preferences about ergonomic requirements of autonomous vehicles.

https://mitportugal.mit.edu/poster/portuguese-users-preferences-about-ergonomic-requirements-automous-vehicles/

Sustainable Cities

23. Hyeonseok Kim. High-Impulse, 3D-Printed CubeSat Electrospray Thruster Throttleable via Pressure and Voltage Control.

https://mitportugal.mit.edu/poster/high-impulse-3d-printed-cubesat-electrospray-thruster-throttleable-pressure-and-voltage-control/

Earth Systems: Oceans to Near Space

24. João Alves Ribeiro. AI-Driven Design Optimization of Offshore Wind Turbine Towers: Unlocking the Path to Upscaling.

https://mitportugal.mit.edu/poster/ai-driven-design-optimization-offshore-wind-turbine-towers-unlocking-path-upscaling/

Digital Transformation in Manufacturing

25. Jordi Vila-Pérez. High-Fidelity Ionosphere-Thermosphere Modeling: a

Physics-Based Discontinuous Galerkin Approach.

https://mitportugal.mit.edu/poster/high-fidelity-ionosphere-thermosphere-modeling-physics-based-discontinuous-galerkin-approach/

Earth Systems: Oceans to Near Space

26. Laísa Braga Kappler. Telework frequency and travel behavior during the COVID-19 pandemic. A study across different Metropolitan Areas: Lisbon, Istanbul, and Porto Alegre.

https://mitportugal.mit.edu/poster/telework-frequency-and-travel-behavior-during-covid-19-pandemic-study-across-different-metropolitan/

Sustainable Cities

27. Lexia Cicone. Global and regional wildfire emissions of toxic pollutants contribute to health risks.

https://mitportugal.mit.edu/poster/global-and-regional-wildfire-emissions-toxic-pollutants-contribute-health-risks/

Climate Science & Climate Change

28. Livia Tavares Cosentino. Development of an ecological thermal insulation product for a regenerative design.

https://mitportugal.mit.edu/poster/development-ecological-thermal-insulation-product-regenerative-design-3/

Sustainable Cities

29. Luana Lübe Tesch. Impact of climate change-driven wildfires on the life cycle of wood materials.

https://mitportugal.mit.edu/poster/impact-climate-change-driven-wildfires-life-cycle-wood-materials/

Climate Science & Climate Change

30. **Mahla Shariatzadeh**. Workplace EV charging scheduling through bi-objective optimization and predictive EV user behavior.

https://mitportugal.mit.edu/poster/workplace-ev-charging-scheduling-through-bi-objective-optimization-and-predictive-ev-user-behavior/

Sustainable Cities

31. Maryam Salati. Methodologies and Tools for BIM-Based Calculation of Dynamic Life Cycle Assessment towards Net Zero Emission Buildings.

https://mitportugal.mit.edu/poster/methodologies-and-tools-bim-based-calculation-dynamic-life-cycle-assessment-towards-net-zero/

Sustainable Cities

32. Matilde Marques. Climate change impacts on octocoral holobionts: from emerging pathogens to probiotic solutions.

https://mitportugal.mit.edu/poster/climate-change-impacts-octocoral-holobionts-emerging-pathogens-probiotic-solutions/

Earth Systems: Oceans to Near Space

33. Mohamad El Sibaii. Towards an open, Interoperable and Standard-Compliant Query Platform for Product Data Templates

https://mitportugal.mit.edu/poster/towards-open-interoperable-and-standard-compliant-query-platform-product-data-templates/

Data Science

34. Paolo Tufoni. Bayesian model averaging for identifying the most robust conceptual model.

https://mitportugal.mit.edu/poster/bayesian-model-averaging-identifying-most-robust-conceptual-model/

Climate Science & Climate Change

35. Paulo Nascimento. Towards Additive Manufacturing industrialization: efficient nesting and scheduling of irregular parts.

https://mitportugal.mit.edu/poster/towards-additive-manufacturing-industrialization-efficient-nesting-and-scheduling-irregular-parts/

Digital Transformation in Manufacturing

36. Paulo Santos Costa. Evolutionary Multi Objective Optimization of Shoe Sole Damper Geometry Using Surrogate Models and Data Mining.

https://mitportugal.mit.edu/poster/evolutionary-multi-objective-optimization-shoe-sole-damper-geometry-using-surrogate-models-and-data/

Digital Transformation in Manufacturing

37. Saeid Lotfi. Innovative Strengthening Strategies for Glass Structures under Extreme Loads: The Constructive Role of Embedded Connections.

https://mitportugal.mit.edu/poster/innovative-strengthening-strategies-glass-structures-under-extreme-loads-constructive-role-embedded/

Sustainable Cities

38. Samruddha Kokare. Development of an online Life Cycle Sustainability Assessment tool for WAAM-built products.

https://mitportugal.mit.edu/poster/development-online-life-cycle-sustainability-assessment-tool-waam-built-products/

Climate Science & Climate Change

39. Sara Bona. Sustainable Transition in Urban Water Management: The Contribution of Urban Water Communities.

https://mitportugal.mit.edu/poster/sustainable-transition-urban-water-management-contribution-urban-water-communities/

Sustainable Cities

40. Simone C. Fernandes. Advanced MOF-based materials towards dual carbon dioxide capture and conversion.

https://mitportugal.mit.edu/poster/advanced-mof-based-materials-towards-dual-carbon-dioxide-capture-and-conversion-2/

Climate Science & Climate Change

41. Sohum Patel. Ionically Conductive Polymers of Intrinsic Microporosity for Desalination, Power Generation, and Resource Recovery.

https://mitportugal.mit.edu/poster/ionically-conductive-polymers-intrinsic-microporosity-desalination-power-generation-and-resource/

Earth Systems: Oceans to Near Space

42. Tiago Mindrico. Exploring the Future of Public Statuary: Integrating XR and Speculative Design.

https://mitportugal.mit.edu/poster/exploring-future-public-statuary-integrating-xr-and-speculative-design/

Sustainable Cities

Posters at Other Conferences

MPP Projects

Aly Kombargi

Hydrogen Fuel Production from Seawater and Recycled Aluminum

Conference: MIT Energy Night
Location: Cambridge, USA

November 2024

Flagship: K2D

Ana Cristina Pires de Oliveira

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

Conference: GLEX SUMMIT
Location: Porto, Portugal

June 2024

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

Dhiman Mondal, Pedro Elosegui, Lucy Brock, Scott Paine, Pedro Mateus & Virgílio Mendes

Probing the Dynamics of Extreme Weather Events

Conference: EGU24 General Assembly
Location: Vienna, Austria

April 2024

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

Pedro Mateus, Virgílio Mendes, Pedro M. A. Miranda, & Dhiman Mondal, Pedro Elosegui

Monitoring Atmospheric Water Vapor Cost-Effectively Using GNSS Tomographic Methods

Conference: AGU24 Annual Meeting
Location: Washington, D.C., USA

December 2024

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

MPP PhD Students

Eva Iñiguez

Assessment of contamination by organic UV Filters in Two Deep Diving Cetaceans Species in Madeira Archipelago (NE Atlantic)

Conference: European Cetacean Society (ECS)
Location: Sicily, Italy

April 10-12, 2024

Leandro Madureira

Screening of microalgae-based approaches for CH4 biofixation

Conference: International Conference on Algal Biomass, Biofuels & Bioproducts (Algal BBB)
Location: Florida, USA

June 10-12, 2024

Matilde Marques

Hydrogen Fuel Production from Seawater and Recycled Aluminum

Conference: Joint Microbiology & Infection Conference 2024
Location: Wuerzburg, Germany

June 2-5, 2024

Climate change impacts on octocoral holobionts: from emerging pathogens to probiotic solutions

Conference: JPhD Open Days 2024 – 10th edition
Location: Lisbon, Portugal

November 5, 2024

Sara Bona

From nearly zero water buildings to urban water communities: The need to define parameters to support the new paradigms

Conference: IWA World Water Congress & Exhibition
Location: Toronto, Canada

August 11-15, 2024

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

Conference: RISCOday 2024 – Risks and Sustainability in Construction, Civil Engineering
Location: University of Aveiro, Portugal

October 31, 2024

Tiago Mindrico

Reimagining Public Space: sustainability through speculative civics

Conference: LARSyS Annual Meeting
Location: Lisbon, Portugal

July 11-12, 2024

Other Publications

MPP Projects

Lemos, A. C. (2024, July). Impressão 3D de materiais cimentícios – Estudos laboratoriais. Faculty of Engineering of the University of Porto.

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

Keller, B. (2024, October). Assessment of CO_2 emissions of 3D printing concrete: Paste level study and optimization. Faculty

of Engineering of the University of Porto.

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

MPP PhD Students

Bona, S., Gomes, R., Silva-Afonso, A., & Rodrigues, F. (2024). Sustainable transition in urban water management: The contribution of urban water communities. In Book of Abstracts of the Research Summit 2024 - Research Forum of the University of Aveiro (p. 258). University of Aveiro. ISBN 978-972-789-937-1.
https://doi.org/10.48528/5rnm-k519

Bona, S., Silva-Afonso, A., & Gomes, R. (2024). Gestão integrada da água urbana: Em direção a comunidades sustentáveis. In Book of Abstracts of the Conferência Água - Desafios do Futuro (pp. 43–44). APRH - Associação Portuguesa dos Recursos Hídricos. ISBN 978-989-8509-37-6.

Fernandes, M., Sent, G., Brito, A.C. (2024). FPCUP ACTION 2021-2-33: COPERNICUS FOR MARINE SPATIAL PLANNING AND EU DIRECTIVES, Country Report for Portugal, October 2024, 61pp.

Matos, J. C., Sousa, H. S., Morais, M. J., (2024), Sistema de apoio à gestão de Obras de Arte do Concelho de Viana do Castelo (System for the Management of Works of Art in the Municipality of Viana do Castelo.

Adriano Silva
Research Project: A digitalização como ferramenta para melhorar a sustentabilidade do processo de recolha seletiva" aprovado pela Sociedade Ponto Verde.

Research Project: Estudo técnico-económico para a valorização de resíduos de embalagens plásticas em nanotubos de carbono" aprovado pela Sociedade Ponto Verde.

Ana Filipa Duarte
Participation in the FRESNEL project with LSTS (FEUP)

Ana Paula F. da Silva
Incubation of the initiative "Ecocarv" at the Entrepreneurship and Innovation Office of IPB

André Cardoso
Laboratory demonstration of the work developed within the scope of the doctoral program, at the DTx facilities, for the following entities/individuals:

- Minister of Economy and the Sea - Prof. António Costa Silva (January 19, 2024)
- Erasmus+ ReCap 4.0 project consortium – Reinforcing Non-University at the Tertiary Level in Engineering and Technology to Support Thailand Sustainable Smart Industry (March 25, 2024)
- Ikea Industry (April 5, 2024)
- Erasmus+: Staff Mobility Week on innovation and Entrepreneurial Ecosystems (June 25, 2024)
- Brazilian Industrial Research and Innovation Company (EMBRAPII) (June 28, 2024)
- United Nations University, OMAN delegation (August 1, 2024)
- President of the FCT – Prof. Doctor Madalena Alves (October 15, 2024)

Aydan Aghabayli
International Mobility at Link Arkitektur
Location: Copenhagen, Denmark
August-December 2024

Camila Penso
Defense of the PhD Thesis Plan
July 2024

Cláudia Rodrigues
Submission of two research articles in peer-reviewed journals (both under review):
-Socioeconomic and Functional Zoning Characterization in a City: A Clustering Approach. Submitted to Cities: The International Journal of Urban Policy and Planning (Elsevier)

-Profile Segmentation: Clustering Approach Based on Behavioral Patterns Extracted from Mobile Phone Data. Submitted to Journal of Ambient Intelligence and Smart Environments (IOS Press)

Eva Iñiguez
Blue Bio Techpreneurs Nordic Hackathon
Location: Odense, Denmark
September 28-30, 2024

Heloisa Antunes
International Mobility at the Centre for Studies in Food Security (CSFS)
Location: Toronto, Canada
March 10 – April 30, 2024

Research Visit at "Terra Sintrópica" Project
Location: Mértola, Portugal
May 7-9, 2024

Erasmus+ Short Mobility at University of Ghent, Belgium

Erasmus+ Blended Intensive Program (BIP) "F_Land Second Edition"
July 8-12, 2024 (Online)
July 15-19, 2024 (Centro Studi Alpino - Università degli Studi della Tuscia, Pieve Tesino, Italy)

Mariana Dias
Four-month research period at MIT (USA) under the Fulbright Program

Phillip Probst
Team member of the research project "PrevOccupAI+" (Prevention of Occupational Disorders in Public Administration based on Artificial Intelligence PLUS) - approved by FCT in December of 2024

Rita Pereira
Technological advancements in Proof of Concept - "SmartPacif - A Innovative adaptive pacifier capable of malocclusions monitorization"
R. Pereira, A. Norton, J.M. Nóbrega, C. P. Santos,
TecMinho, University of Minho

2024 Best Student Initiative of the University of Minho – "Future Pacifiers"
Health and Well-Being Category (Oral Presentation)
Department of Polymer Engineering, School of Engineering, University of Minho
December 19, 2024

Sara Cerqueira
Team member of the MIT Portugal Program Exploratory Project: "INTEGRATOR: Pain and physical limitations perception for human-sensitive Intelligent collaborative robotics" (Ref:2022.15668.MIT)

Sara Parece
LEED GA + LEED AP BD+C Course
By ADENE Academy
November 4-12, 2024

Master Dissertations

MPP Projects

Henriques, C. (2024). Use of transfer learning in forecast algorithms applied to electric vehicles charging stations consumption.
Venue: Instituto Superior Técnico – University of Lisbon

Exploratory: Accurate Federated Learning with Uncertainty Quantification for DER Forecasting Applied to Power Grids Planning and Operation

Lectures and Mentorships

Jade Müller Carneiro
Lecture "Scenario analysis for Prospective LCA", Ecodesign of bioproducts course" (MSc/PhD level)
Brazilian Agricultural Research Corporation (Embrapa) and State University of Ceará (UECE)
Venue: Online
November 4, 2024

Lecture "Prospective LCA of Emerging Technologies: Focus on Scenario Analysis"

Industrial ecology course (MSc/PhD level)
Venue: Department of Mechanical Engineering, University of Coimbra, Portugal
November 7, 2024

Lecture "Life cycle assessment: a tool for environmental sustainability"

Postgraduate degree in Food, Nutrition and Health - Federal University of Rio Grande do Sul (UFRGS)
Venue: Online
April 17, 2024

Sara Parece

Lecture "Embodied Carbon and Life Cycle Assessment in the Building Systems"

Course focused on Digital Technologies, Buildings, and Sustainable Construction
Venue: : ISCTE, Sintra, Portugal

Vítor Sousa

Co-supervision of the master's thesis "Machinability of Inconel 718 in milling operations using SiAlON tools" by the student Filipa Moreira

Contribution to the Hi-rEV Project

Moreira, F., Sousa, V. F., Silva, T. E., Matos, F., Figueiredo, D., Guimarães, B., Aires, T., de Jesus, A. M., & Reis, A. R. (2024). *Estudo de maquinabilidade da liga IN718 com recurso a ferramentas cerâmicas em operações de fresagem*. Revista Iberoamericana de Ingeniería Mecánica, 28(2), 27–30.


MIT
Portugal
Digital
Transformation
in Manufacturing

CLOSING REMARKS

"The year 2024 was marked by a lower level of activity within the MIT Portugal Program compared to previous years. This apparent reduction was not a reflection of diminished interest or commitment but rather a consequence of the uncertainty surrounding the program's continuation, as well as the need to reassess its focus and strategic objectives. This period of transition naturally led to an adjustment in the pace of activities, making 2024 somewhat atypical in terms of the program's development.

Despite this context, 2024 was also a year of important milestones. One of the key moments was the audit conducted on the international partnerships, including MIT Portugal. As expected, the results of this thorough evaluation were highly positive, providing a clear and well-supported confirmation of the value these partnerships bring. Specifically, the findings reinforced the significant impact of MIT Portugal, both in terms of scientific collaboration and its broader contributions to the national innovation ecosystem.

Additionally, 2024 was a pivotal year for negotiations regarding the continuation of the program into a new phase. This process required careful planning and discussions among all stakeholders, and we are now at a crucial juncture, looking ahead with renewed determination and shared commitment. The positive outcome of these negotiations has strengthened our collective motivation to expand the program's reach and effectiveness.

As we move forward, we have great expectations for this next stage of MIT Portugal. We firmly believe that this new phase will bring even greater tangible impact, reinforcing Portugal's role in cutting-edge research and innovation and further strengthening the country's scientific and technological landscape. With a reinforced sense of purpose, we are eager to embark on this next chapter, ensuring that the program continues to thrive and create meaningful contributions at both national and international levels."

– Pedro Arezes, Nacional Director of the MIT Portugal Program


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