# **MIT** Portugal









# **MIT** Portugal

# Training the Leaders of the Future **Doctoral Students 2014**

#### Academic Institutions Providing PhD Degrees in Association

Escola da Engenharia da Universidade do Minho Faculdade de Ciências da Universidade de Lisboa Faculdade de Ciências e Tecnologia da Universidade de Coimbra Faculdade de Ciências e Tecnologia da Universidade Nova de Lisboa Faculdade de Economia da Universidade de Coimbra Faculdade de Engenharia da Universidade do Porto Instituto Superior de Economia e Gestão da Universidade de Lisboa Instituto Superior Técnico da Universidade de Lisboa





**U.** PORTO

FEUP FACULDADE DE ENGENHARIA







# Contents

- 5 Introduction
- 11 Our Students
- 13 Bioengineering Systems
- 77 Leaders for Technical Industries
- 117 Sustainable Energy Systems
- 183 Transportation Systems



# Introduction

The MIT Portugal Program (MPP) is a strategic international partnership between Portuguese universities and research centers, Massachusetts Institute of Technology (MIT), and multiple partners from industry and government. It is funded by the Fundação para a Ciência e Tecnologia (FCT). The program's goal is to strengthen Portugal's knowledge base and international competitiveness through strategic investment in people, knowledge, and ideas in innovative technology sectors. MPP was launched in 2006. In 2013it was renewed through 2017, following a positive external review and overwhelming support from university leaders and faculty in Portugal.

The MPP focuses on developing integrated research activities in university-industry partnerships, creating value and contributing to sustainable economic growth through the development of new knowledge based products and services. The success of this strategy requires a critical mass of highly educated young professionals and researchers, motivated to engage in entrepreneurship. Program participants bring together university and industry requirements and research at national and international levels. MPP graduates can act as change agents, combining deep, innovative scientific and technical background with real-world know-how in order to take new technologies and systems to global markets.

The MPP was designed around four scientific focus areas with an engineering systems core: bioengineering systems, engineering design and advanced manufacturing, sustainable energy systems, and transportation systems. The program has established seven graduate education programs (three masters and four PhD) awarded jointly by the participating universities and involving about 270 Portuguese faculty members and 70 from MIT.



The four MPP doctoral programs are supported from the competitive funding scheme (PD-F Program) promoted by Fundação para a Ciência e Tecnologia (FCT). This FCT support for the four PhD programs secures ten PhD mixed studentships per program per year and covers the associated annual tuition fees of up to €2750 per studentship.

The four MPP doctoral programs have reviewed their curriculum, emphasizing entrepreneurship activities offered to all the students together. This promotes an interdisciplinary and interinstitutional consortium of universities and research institutes, a result of the students' experiences and the networks established during the first phase of the program. These early experiences and connections benefit the PhD candidates as they continue into the second MPP phase of building intellectual structures and research objectives.

The program has produced hundreds of scientific papers and contributions to international conferences. Students and faculty have created more than a dozen startup companies. In addition, the MPP has influenced many people and institutions outside the program, producing significant cultural change within Portugal.

To date, MPP has received 2711 PhD candidates' applications with an average acceptance rate of 23.3%. During the academic year 2014-2015, MPP received the highest number of applications thus far (473). Moreover, MPP attracts many students from outside Portugal. MPP has received PhD applications from than 25 nationalities, with the number of international applicants averaging 50.9%.





So far, 636 PhD candidates have enrolled at Portuguese universities under MPP programs across the four doctoral programs.



Of these, 111 have graduated since June 2011, setting the stage for a sizeable and strong *Alumni* network around the globe.





Of the MPP PhD *Alumni*, 53 % continued their professional path in Portugal, and 38 % opted for a career abroad (no information is available for 9% of the graduates).



After the completion of the PhD, the majority of the graduates continued within academia. About 51% of the *Alumni*, both in Portugal and abroad, are still connected with universities. Reflecting also the diversity of research institutes and Universities of their PhD Advisors, MPP PhD *Alumni* identify themselves as postdoctoral researchers, researchers, or professors at prestigious Academic centers around the world.

One of the MPP PhD program objectives is to contribute to the formation of leaders with unique knowledge and a global perspective, including a direct connection with the development of technology and its application. A growing number of the PhD research projects have been developed within an industry context. PhD candidates have conducted their research projects in a diverse array of industrial affiliates, including Adira, Ajc, Altakitin, Brisa, Caetanobus, Celgene Cellular Therapeutics, Celoplás, Câmara Municipal de Lisboa, Colep, Continental, Crioestaminal S.A, Efacec, Finertec Energia, Galp, Hovione, Iberoleff, Innocore Pharmaceuticals, Laborial, Mobiag, Petrotec, Portugal Telecom, Rave, Refer, Rolls-Royce, Sata, Simoldes Plásticos, Soprefa, Tap, Transdev, USA Rail Administration, and Zipcar. Nowadays 41% of the MPP alumni work outside academia in several fields of expertise, demonstrating the multifaceted ability of the PhD programs to prepare their graduates to succeed and excel within the work force.



For the future, MPP aims to consolidate the efforts of the first stage:

- Continuous support of a higher education ecosystem directly connected to technology development and innovation
- Promotion of a healthy relationship between graduate students and industry experts and projects
- Further development of cross-disciplinary innovation and entrepreneurship activities

These strategies aim to maximize knowledge transfer and to translate technology-based ideas into economic value. These benefits will come from a combination of individual drive, basic research, technology innovation, entrepreneurship, industry-academia collaboration, and the successful integration of highly educated innovators into the workforce.



# **MIT** Portugal

# Training the Leaders of the Future **Our Students**







# Training the Leaders of the Future **Bioengineering Systems**



# A scope of the doctoral program including a typical/ desired student profile

The main objective of the Bioengineering Systems PhD program within the MIT Portugal Program (MPP) is to ensure that a PhD holder in this field is provided with systematic understanding and skills at the intersection of life sciences and engineering. By developing a combination of unique skills in bioengineering technical innovation, entrepreneurship, leadership, and systems thinking, this PhD program aims to educate the next generation of industrial leaders in existing industries, promoters of new enterprises, and independent, interdisciplinary researchers in the field of bioengineering. The program is a consortium of MIT with four Portuguese universities and four centers of excellence/associated laboratories.

The Bioengineering Systems vision is to create educational and research programs that lay the foundation for the next generation of biotechnology industry and academic leaders in Portugal. Traditional programs in bioengineering and related disciplines provide fundamental engineering and life science building blocks as a foundation for the curriculum and associated research efforts. The Bioengineering Systems doctoral program has changed this paradigm. It combines engineering with experience in innovation, leadership, and systems thinking in order to produce a new generation of bioengineering innovators.

It focuses on cutting edge research, consolidated and updated through a doctoral program to bring forth novel scientific knowledge and new technologies in the area of bioengineering. It also considers potential applications with shorter times to market, lower initial capital investment, or higher value creation (societal and economic).

This program aims to promote a highly integrated set of advanced education and research activities that cross disciplinary boundaries and link engineering education to industry. The program does this by focusing on innovation and entrepreneurship with a hands-on approach and educational experiences, as well as interaction with industry (laboratory rotations in the industrial environment, scholarship sponsorship, and joint workshops organized with industrial affiliates).

This synergy with industry is crucial taking innovation to market to improve companies' international competitiveness, and maintaining a high level of graduates' employability.

Moreover, as the Bioengineering program is one of a highly integrated set of MPP PhD programs on Engineering Systems, the students are offered several cross-cutting education modules in the areas of innovation, entrepreneurship, and leadership. These were developed and designed



by adapting lessons from the MIT ecosystem to the specific Portuguese context. This thematic focus has been recognized as a vital enrichment and source of reform for Portuguese engineering education, where innovation skills are typically not taught.

This program is extremely suitable for high quality students who wish to pursue their PhD research studies in Bioengineering (bioprocess engineering, computational biosystems, regenerative medicine, tissue engineering, nanobiotechnology and biomaterials, biomedical devices and technologies, drug development practices, and applied neuroscience). Students should also be comfortable with group work assignments and collaborative efforts in problem-solving tasks. The program is also suitable for students who are aiming for a deeper knowledge of technological innovation and integration with entrepreneurship environments.

At the conclusion of their PhD program, the graduates will have a strong knowledge of the research areas mentioned above and will be capable of conceiving, conducting, and implementing research in scientific projects in bio-engineering laboratories/private companies around the world. Several former students and alumni have already created or are involved with start-up companies (Cell2B, Matera, SilicoLife, Inception).





Other graduates are working at or performing research in national and international companies. Bioengineering graduates also have a strong background in innovation and leadership, as well as a strong relation with entrepreneurship. They have the problem-solving and communication skills needed to succeed in one of the most important emerging areas of world technology. The program targets high-flyers: highly motivated prospective PhD students, with a passion to carry out research in biology and engineering, and who have an excellent academic record.

An academic background in biomedical engineering, or biological and/or biochemical engineering is preferred, but experience in biotechnology, molecular and cell biology, pharmaceutical sciences, biochemistry/microbiology, or chemical engineering is also suitable. Outstanding records in chemistry, physics, materials science and engineering, computer science, or electric/ mechanical engineering are also considered with a minimal background in bioengineering research areas.

Students must desire to pursue a program that is creating a new generation of leaders who have unique knowledge and a global perspective. They will require the ambition to work toward developing a bioengineering systems approach with a strong emphasis on innovation and entrepreneurship.

Students are expected to have an international outlook for their future careers and a passion to engage with world-class research labs (where mobility is necessary for the implementation of research projects). They should be motivated to connect with a large network of researchers from different areas, leading to creation and development of interdisciplinary knowledge and the establishment of international cooperation.

### Curriculum

This program is a four year degree (240 European Credit Transfer and Accumulation System credits).

In the first year, the first semester contains curricular units and educational modules, while the second semester is dedicated to introductory laboratory placements and to an innovation course. The program's first year is a comprehensive curriculum of coursework delivered in 2- or 3-week modules jointly taught by faculty from Portuguese universities and MIT. These modules are presented in different Portuguese institutions, promoting student and teacher mobility. The joint teaching by faculty across Portugal, as well as from MIT, provides the students with an international view of science, engineering, and research, and the opportunity to build strong and effective collaborations.

During the remaining three years, students develop their thesis plans, conduct research, and present their dissertations at the end of the fourth year. Over the four years, the student is invited to navigate into the MPP ecosystem, with many activities in innovation and entrepreneurship.

#### In the first semester, students attend:

- Four intensive 2- to 3-week mandatory courses: Innovation & Entrepreneurship for Technological Systems Bioprocess Engineering Cell and Tissue Engineering Computational Biosystems Science and Engineering
- B. Two optional courses selected from: Nanobiotechnology and Biomaterials Neurosciences
   Principles and Practice of Drug Development Biomedical Devices and Technologies.

Each course is coordinated by members from at least three different institutions, always including one MIT faculty member. The courses are delivered in different locations in the Portuguese universities. Students also follow short-term cross-cutting courses, such as Leadership and Systems Thinking, which give them additional skills and tools, different from their academic curriculum.

#### During the second semester the students follow:

- **C.** Two laboratory placements (nine weeks each) that improve their research skills and aid the decision-making process concerning thesis research topics. These placements are very flexible. The students choose from an extensive list of proposals, not only from the labs involved in the program but also from the industrial affiliates.
- **D.** The course named Innovation Teams with Seminar (I-Teams), in which the students work in teams with researchers from the most important Portuguese research labs. Each team works with a selected technology emerging from these labs, and focuses on building a go-to-market strategy, identifying the best path. The teams present their progress with a mid-semester meeting (with tutors, primary investigators, and external experts) in which they receive feedback and refine their assumptions. The final output consists of a written report with the main results and conclusions, and a public presentation to the community, including invited business developers and investors. Students learn about the realities of the business world and build strong connections as they network with Portuguese companies and stakeholders from throughout the globe.

During their PhD research, the students are expected to have training periods at MIT and/or other foreign institutions, depending on their specific PhD project, foreign advisor, and the collaboration established, as well as shorter training periods in the Portuguese institutions.



The distinctive structure of this doctoral program makes it significantly different from other doctoral programs in bioengineering or life sciences. The strong emphasis on technical innovation and leadership development, contact with the most significant core areas and state-of-the-art topics of bioengineering with a strong focus in engineering systems, the laboratory placements during the second semester which help the students to decide the research area for their PhD thesis, as well as the strong interaction between academia, industry and business, make the Bioengineering Systems doctoral program stand out from global peer programs.

### Main research topics

**Biomolecular, Bioprocess & Biosystems Engineering:** to foster knowledge of complex biological systems and design of novel technologies, e.g., nano-scale technologies, systems and synthetic biology, bioprocess monitoring and control using non-invasive sensing systems for the intelligent production of high value products (e.g., biopharmaceuticals, sustainable specialty or bulk chemicals and, fuels).

**Cells and Bio-inspired Materials in Regenerative Medicine:** to develop novel robust cell production systems, as well as novel materials and their interfaces to cells; to engineer innovative scaffolds and human-like substitutes for tissue engineering; and to target controlled release delivery cell systems.

**Biomedical Devices & Technologies:** to develop novel bio-imaging technologies, advanced diagnostic sensors and novel designs, e.g. orthoses and wearable sensors to aid patient mobility.

**Engineering Processes for Health Care Practice:** to design and control complex health care systems using engineering systems concepts and approaches for solutions to the challenging problems of improving quality, safety, and cost-effectiveness.

**Biosystems Innovation, Management & Policy:** to promote a strategic approach empowering bioengineers to understand innovation paths and successfully translate research into new business

### Affiliated Institutions (Universities and Companies)

The doctoral program is currently offered jointly by the following institutions

#### NOVA (Universidade Nova de Lisboa)

Faculdade de Ciências e Tecnologia - FCTUNL Instituto de Tecnologia Química Biológica - ITQB (associated laboratory with Instituto Gulbenkian de Ciência)

#### Universidade de Lisboa

Instituto Superior Técnico - IST Faculdade de Medicina - FMUL (to join soon)

**Universidade do Minho** Escola de Engenharia - EEUM

In collaboration with: Universidade de Coimbra (soon to be a joint degree institution as well) Centro de Neurociências e Biologia Celular - CNC

### Affiliations

Partnership and collaboration in the program's education and research features: Hovione S.A.

#### Industrial affiliates:

Alfama, Inc.; Altakitin Corp.; Bioalvo S.A.; Biotecnol, S.A.; Biotempo Lda.; Biotrend – Inovação e Engenharia em Biotecnologia, S.A.; CIPAN – Companhia Industrial Productora de Antibiótitcos,S.A.; Crioestaminal – Saúde e Tecnologia, S.A.; ECBio – I&D em Biotecnologia, S.A.; Grupo Bial; Grupo Frulact; Stemmatters, Biotecnologia e Medicina Regenerativa Lda.; Unicer Bebidas, S.A.







#### Thesis title:

# Development of nanomorphous silicon solar cells on ceramic substrates with biomedical application

PhD Advisors: Rodrigo Martins (FCT-UNL); Hugo Águas (FCT-UNL)

António Vicente

Nationality: Portuguese PhD in: Bioengineering (BIO-E) Starting year: 2008/2009 Institutional affiliation: Faculdade de Ciências e Tecnologia da Universidade Nova Lisboa This PhD thesis aims at the development and fabrication of high efficiency thin film silicon solar cells deposited on ceramic substrates, with a specific architectural design. The Biomedical Engineering application of these novel and innovative integrated photovoltaic ceramics will also be studied, namely for the design of a self-sufficient, by renewable energy, Field Hospital.



## Sara Matias

Nationality: Portuguese PhD in: Bioengineering (BIO-E) Sub area: Neuroscience Starting year: 2008/2009 Institutional affiliation: Faculdade de Ciências e Tecnologia da Universidade Nova Lisboa

#### Thesis title:

#### Monitoring serotonergic neuronal activity in behaving rodents

**PhD Advisors:** Zachary F. Mainen (Champalimaud Centre for the Unknown); Manuel Nunes da Ponte (REQUIMTE, Departamento de Química, FCT-UNL)

Serotonin (5-HT) is a neuromodulator involved in a wide range of brain functions and diseases. The main source of 5-HT to the forebrain is the heterogeneous Dorsal Raphe Nucleus (DRN). To monitor specifically the activity of 5-HT neurons, we use a genetically encoded calcium indicator (GCaMP6s) delivered to DRN neurons through a viral infection strategy in genetically engineered mice. To excite and collect the fluorescence emitted by GCaMP6s during 5-HT activity, we developed an optical setup based on an implanted fiberoptic. Following validation of this setup, we are now using it to monitor 5-HT activity in mice performing a pavlovian task in which 4 odors cue 4 different outcomes. 5-HT activity during the odor cue presentation seems to be related to the value of the predicted outcome, a function that might be important in the study of cognitive and mood disorders such as depression.





## Paulo Maia

Nationality: Portuguese PhD in: Bioengineering (BIO-E) Sub area: Computational Bioengineering, Genomics, Systems and Synthetic Biology Starting year: 2009/2010 Institutional affiliation: Escola de Engenharia da Universidade do Minho

#### Thesis title: Algorithms and tools for in silico design of cell factories PhD Advisors: Isabel Rocha (UMinho); Miguel Rocha (UMinho)

Shifting from chemical to biotechnological processes is one of the cornerstones of the XXIst century industry. The production of a great range of chemicals via biotechnological means is a key challenge towards a biobased economy. However, this shift is occurring at a pace slower than initially expected. The development of efficient cell-factories that allow for competitive production yields is of paramount importance for this leap to happen. Constraint-based models of metabolism, together with in silico strain design algorithms promise to reveal insights into the best genetic design strategies, a step further to achieve that goal. My research focuses in the thorough analysis of the main in silico constraint-based strain design strategies and algorithms as well as their application in real-world case studies. New algorithms and tools are also being developed in the course of my PhD.



# Pedro Evangelista

Nationality: Portuguese
PhD in: Bioengineering (BIO-E)
Sub area: Computational Bioengineering, Genomics, Systems and Synthetic Biology
Starting year: 2009/2010
Institutional affiliation: Escola de Engenharia da Universidade do Minho

#### Thesis title:

#### Novel approaches for dynamic modelling of E. coli and their applications in metabolic engineering

**PhD Advisors:** Isabel Rocha (UMinho); Miguel Rocha (UMinho); Bruce Tidor (MIT)

Until recently, in bioprocess engineering, cells were modeled as black box entities responsible for consuming substrates and producing certain compounds, ignoring the underlying biological mechanisms. Despite advances in experimental technologies, the construction of cellular mechanistic dynamic models has been hampered by the lack of specific experimental data and imprecise knowledge of the mechanistic rate laws underlying several reactions. Nonetheless, even incomplete cellular models provide valuable insights to engineering efforts in Biotechnology. The aim of this project is to develop a mechanistic Escherichia coli model, to investigate Metabolic Engineering strategies in order to improve the production of industrial relevant compounds.





#### Thesis title:

# Development of natural-based hydrogel particles using a biomimetic methodology

PhD Advisors: João F. Mano (3B's Research Group, UMinho)

## Ana Catarina Lima

Nationality: Portuguese PhD in: Bioengineering (BIO-E) Sub area: Stem Cell, Tissue Engineering and Regenerative Medicine Starting year: 2010/2011 Institutional affiliation: Escola de Engenharia da Universidade do Minho My PhD work has been focused in using superhydrophobic surfaces methodology to produce more complex polymeric systems in terms of physical structure and composition. Several natural-based polymeric systems were developed to encapsulate cells and drugs. The application of the developed systems was focused in tissue engineering and regenerative medicine. The obtained particles were characterized in vitro and the potential of some systems was evaluated in vivo.



# Ana Margarida Dias

Nationality: Portuguese PhD in: Bioengineering (BIO-E) Sub area: Bioprocess and Biomolecular Engineering Starting year: 2010/2011 Institutional affiliation: Faculdade de Ciências e Tecnologia da Universidade Nova Lisboa

#### Thesis title:

# Exploring new protein-based scaffolds for bioengineering applications

**PhD Advisors:** Cecilia Roque (FCT-UNL); Olga Iranzo (former at ITQB-UNL, Oeiras, Portugal at present in Institut des Sciences Moléculaires de Marseille, Aix Marseille Université CNRS, Marseille)

Over the past 35 years monoclonal antibodies and derived structures became the standard binding proteins representing powerful tools in biotechnology and biomedicine. Other protein binding scaffolds, with the robustness and versatility required, are recently being explored through biological and chemical combinatorial and rational strategies. The WW domain is one of such promising scaffolds. In this project, the aim is to create new scaffolds based on the WW domains, with affinity and specificity towards two important classes of proteins, namely antibody molecules and phosphoproteins, both constituting useful therapeutics and biomarkers. Despite the numerous applications of affinity reagents, the developed affinity structures will be primarily tested for protein purification by conventional chromatography and magnetic separation systems.





## **Gabriel Mendes**

Nationality: Portuguese PhD in: Bioengineering (BIO-E) Starting year: 2010/2011 Institutional affiliation: Escola de Engenharia da Universidade do Minho

#### Thesis title:

#### Magnetotransfection – Exploring new ways to improve Clostridium pasteurianum for better butanol yield

**PhD Advisors:** Manuel Mota (CEB Uminho); Leonardus Kluskens (CEB Uminho); Senentxu - Lanceros Mèndez (CF Uminho)

This project aims to develop products that simplify the laboratory methods used for the genetic improvement of microorganisms with commercial potential that can be applied in biotechnology, in areas such as food industry, environment or energy. These products will constitute a new methodological paradigm through its simplicity and will substitute classical procedures that are more time-consuming, more expensive and technically more demanding. Transformation of microorganisms is a cumbersome procedure normally needing three main steps. With our technology we envisage attaining transformation in a single step through spreading microorganisms and foreign DNA on novel transformation petri-dishes.



## Ines A Isidro

Nationality: Portuguese PhD in: Bioengineering (BIO-E) Sub area: Computational Bioengineering, Genomics, Systems and Synthetic Biology Starting year: 2010/2011 Institutional affiliation: Faculdade de Ciências e Tecnologia da Universidade Nova Lisboa Thesis title: Functional enviromics: Applications to bioprocess monitoring and control PhD Advisors: Rui Oliveira (FCT-UNL)

Functional enviromics is an emerging systems biology science that aims at discovering the function of the entirety of environmental factors – envirome – on cellular regulation. Motivated by the perception that the power of the envirome is many times underestimated in cell culture engineering in detriment to genetic optimization, we develop analytical methodologies and computational algorithms to support functional enviromics as a complementary approach. This opens new possibilities for the design of pathway-oriented bioprocess control schemes.



## Ivana Kostic

Nationality: Serbian PhD in: Bioengineering (BIO-E) Sub area: Stem Cell, Tissue Engineering and Regenerative Medicine Starting year: 2010/2011 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

### Thesis title:

# Cell and Cell-free therapeutic engineering for cardiac regeneration

**PhD Advisors:** Lino Ferreira (PhD, Center for Neurosciences and Cell Biology, UC and Biocant-Center of Innovation and Biotechnology); Jeffrey Karp (PhD, Brigham and Women's Hospital, Harvard Medical School, USA)

For clinical efficacy, it is imperative that stem cells survive and engraft into the host tissue. Unfortunately, most of the cells die a few days after delivery, mainly due to ischemia. Some methodologies have been proposed to augment cell survival, but they have shown limited effectiveness.

Our approach was to augment cell survival by preconditioning CD34+ cells isolated from umbilical cord blood<sup>1</sup> with several pharmacological agents<sup>2</sup>. Lysophosphatidic acid (LPA) treatment under hypoxia and serum-deprived conditions showed the most promising results. Additionally, cell-free approaches are being characterized.

#### **References:**

[1] Haider, H.; Ashraf, M. J Mol Cell Cardiol 2008, 45, (4), 554-66.[2] Pedroso, D.C., et al., PLoS One, 2011. 6(1): p. e16114.



# Joana Rodrigues

Nationality: Portuguese
PhD in: Bioengineering (BIO-E)
Sub area: Computational Bioengineering, Genomics, Systems and Synthetic Biology
Starting year: 2010/2011
Institutional affiliation: Escola de Engenharia da Universidade do Minho

#### Thesis title:

# Design and construction of a new biosynthetic pathway for the production of curcuminoids in Escherichia coli

**PhD Advisors:** Ligia Rodrigues (UMinho); Leon Kluskens (UMinho); Kristala Prather (MIT)

Curcuminoids are produced by plants and due to their potential as novel cancer-fighting drugs have recently attracted increased attention. Nevertheless, they have a poor bioavailability. Cellular uptake is slow, and they are quickly metabolized once inside cells, requiring repetitive oral doses to achieve sufficient concentration inside the cells for therapeutic activity. The idea of this project is to engineer a model bacterium to trigger the release of a curcuminoid concurrent with ultrasound treatment. The proposed tasks involve several design and engineering steps to program Escherichia coli to execute a new synthetic pathway for curcuminoids production triggered by a temperature increase. The heat shock response (HSR) machinery of E. coli will be used as a sensor in the design of the modelbacterium.





## Joaquim Barbosa

Nationality: Portuguese PhD in: Bioengineering (BIO-E) Sub area: Computational Bioengineering, Genomics, Systems and Synthetic Biology Starting year: 2010/2011 Institutional affiliation: Escola de Engenharia da Universidade do Minho



# José Faria

Nationality: Portuguese
PhD in: Bioengineering (BIO-E)
Sub area: Computational Bioengineering, Genomics, Systems and Synthetic Biology
Starting year: 2010/2011
Institutional affiliation: Escola de Engenharia da Universidade do Minho

#### Thesis title:

#### "Cellsense" - Design of a whole-cell biosensor for biomedical applications

PhD Advisors: Lígia Rodrigues (UMinho); Leon Kluskens (UMinho)

Cancer represents a public health problem worldwide due to high incidence, mortality and prevalence. The difficulties of early stage diagnosis reduce treatments effectiveness.

Cancer diagnosis can be very sensitive if based on molecular features and cell-SELEX methodology may open new ways to distinguish cancerous from healthy cells, based on those features. This may help in the study of changes at the molecular level, but also in the morphology and physiology of cancer cells. Aptamers selected through this method have a high affinity to the target but also high specificity, low molecular weight, easy and reproducible production, versatility and easy discovery and manipulation.

In this work, cell-SELEX will be used to generate aptamers that specifically recognize breast cancer cells. Aptamers will be validated and a multivalent aptamer nanovector for multiple detection will be assessed.

#### Thesis title:

# Modeling microbes: New methods for integrated metabolic and regulatory network reconstruction

**PhD Advisors:** Isabel Rocha (Escola de Engenharia da UMinho); Miguel Rocha (Escola de Engenharia da UMinho); Christopher Henry (Argonne National Laboratory, USA)

Advances in sequencing technology are resulting in the rapid emergence of large numbers of complete genome sequences. High-throughput annotation and metabolic modeling of these genomes is now a reality. The high-throughput reconstruction and analysis of genome-scale transcriptional regulatory networks represent the next frontier in microbial bioinformatics. The fruition of this next frontier will depend on the integration of numerous data sources relating to mechanisms, components and behavior of the transcriptional regulatory machinery, as well as the integration of the regulatory machinery into genome-scale cellular models.



## Marta Cerejo

Nationality: Portuguese PhD in: Bioengineering (BIO-E) Sub area: Neuroscience Starting year: 2010/2011 Institutional affiliation: Faculdade de Ciências e Tecnologia da Universidade Nova Lisboa

#### Thesis title: Identifying new tau protein interactors

**PhD Advisors:** Ana Cristina Rego, (Faculty of Medicine and Center for Neuroscience and Cell Biology of UC); Helena Vieira (DEIO and BIOFig Center, FC-UL); Manuel Nunes da Ponte (FCT-UNL)

The microtubule-associated protein tau (tau) is a component of protein inclusions characteristic of neurodegenerative disorders, known as tauopathies, including Alzheimer's disease (AD). In tauopathies, tau is hyperphosphorylated and aggregated, affecting several cellular processes leading to synaptic and neuronal loss. The development of effective disease-modifying therapies depends on the understanding of the mechanisms underlying tau toxicity. The goal of this study was to study the interaction between tau and another AD hallmark protein-  $\beta$  -myloid - in yeast and to map tau genetic network in yeast. This work will contribute to the understanding of tau-mediated neurodegeneration and provide a novel framework for the identification of new drug targets for development of different therapeutic strategies.



# Patricia Pitrez

Nationality: Portuguese PhD in: Bioengineering (BIO-E) Sub area: Stem Cell, Tissue Engineering and Regenerative Medicine Starting year: 2010/2011 Institutional affiliation: Escola de Engenharia da Universidade do Minho Thesis title: Development of a tissue engineered intestine PhD Advisors: Lino Ferreira (CNC)

A number of gut disorders, including Crohn's disease, can lead to Short Bowel Syndrome (SBS). SBS compromises (i) the nutrient transport function of the mucosa layer and (ii) the peristalsis function of the muscularis propria layer. A potential treatment for SBS would be the development of a living, tissue engineered small intestinal graft to replace the lost tissue. Several attempts have been made to tissue engineer small intestine; however, they fail to reproduce the complexity and functionality of living tissue. The general aim of this work is to develop a tissue engineered intestine.





## Sara Oliveira

Nationality: Portuguese PhD in: Bioengineering (BIO-E) Sub area: Stem Cell, Tissue Engineering and Regenerative Medicine Starting year: 2010/2011 Institutional affiliation: Escola de Engenharia da Universidade do Minho

#### Thesis title:

# Novel 3D scaffolds modified with nanostructured polymeric coatings or micro/nanofibers for tissue engineering applications

PhD Advisors: João F. Mano (UMinho); Rui L. Reis (UMinho)

The ultimate goal in bone tissue engineering is to design patient customizable scaffolds that are able to support or induce bone formation. The relationship between their multiple length-scale properties and cell behavior has yet to be fully understood and controlled.

The main aim of this PhD is to explore the potential of surface modifications of prototyped scaffolds with nanocoatings and nano/ micro structures of human and marine resources materials on the control of bone formation.



# Sofia Rebelo

Nationality: Portuguese PhD in: Bioengineering (BIO-E) Sub area: Stem Cell, Tissue Engineering and Regenerative Medicine Starting year: 2010/2011 Institutional affiliation: Faculdade de Ciências e Tecnologia da Universidade Nova Lisboa

#### Thesis title:

# Development of 3D in vitro models for prediction of hepatic metabolism and toxicity

**PhD Advisors:** Paula M. Alves (IBET/IQTB-UNL); Catarina Brito (IBET/IQTB-UNL)

*In vitro* recapitulation of liver function is a valuable tool for the pharmaceutical industry, for toxicology testing, drug screening and target validation at early stages of the drug development. Moreover, human-based *in vitro* systems play an important role in the clinics, for disease modeling and external support in patients with hepatic failure. The goal of my thesis was to develop physiologically relevant in vitro models of hepatic function, combining three-dimensional (3D) configuration with stirred tank bioreactors to attain a controlled, *in-vivo* like culture system.





## Susana Palma

Nationality: Portuguese PhD in: Bioengineering (BIO-E) Starting year: 2010/2011 Institutional affiliation: Faculdade de Ciências e Tecnologia da Universidade Nova Lisboa

#### Thesis title:

# Design of magnetic nanoparticles for cancer diagnostics and therapy

PhD Advisors: Ana Cecília Roque (FCT-UNL)

This project consists in the production and characterization of iron oxide superparamagnetic nanoparticles (MNP) for biomedical applications such as cell labeling and cancer theranostics with Magnetic Resonance Imaging (MRI). The main tasks are the synthesis of the MNP core and respective functionalization with biocompatible and bioactive molecules, the characterization of physiochemical and magnetic properties and the in vitro evaluation of cell-MNP interactions. For the functionalization, gum arabic and a fucose-rich exopolysaccharide produced by an in-house isolated bacterial strain will be explored, envisaging the development of a passively targeted MRI contrast agent. An active tumor-targeted theranostic agent will also be developed by functionalizing the MNP cores with a multi-layer coating system able to de-shield a drug as a response to the acidic pH of the tumors.



# Veronica Corrales

Nationality: Colombia PhD in: Bioengineering (BIO-E) Sub area: Neuroscience Starting year: 2010/2011 Institutional affiliation: Faculdade de Ciências e Tecnologia da Universidade Nova Lisboa

#### Thesis title:

#### Value-based decision making in drosophila foraging: Genes, computations and behaviour

**PhD Advisors:** Carlos Ribeiro (Champalimaud Neuroscience Programme); Aldo Faisal (Imperial College London)

Animals need to trade-off exploration and exploitation when foraging. We have developed a semi-automated machine-vision setup to investigate how decision making dynamics is modulated by sensory information and internal state. Fruit flies are free to walk and decide among multiple food patches and their dynamic foraging strategies are later quantified and analysed using diverse computational and statistical techniques. We have found that the internal state modulates the departure decision ("explore or exploit") and the arrival decision ("choose or move on") as captured by the differences in the distributions of yeast and sucrose bout durations and by the transition probabilities between patches. We are currently investigating how different neuronal and genetic manipulations modulate these neuroeconomic decisions in *Drosophila melanogaster.* 





Thesis title: High gradient magnetic separation of therapeutics PhD Advisors: Cecilia Roque (FCT-UNL) ;Raquel Aires-Barros (IST)

# Vijaykumar Dhadge

Nationality: Indian PhD in: Bioengineering (BIO-E) Sub area: Bioprocess and Biomolecular Engineering Starting year: 2010/2011 Institutional affiliation: Faculdade de Ciências da Universidade de Lisboa

Research work is mainly focused on development of functionalised magnetic nanoparticles based process technology for monoclonal antibody purification. Amino-phenyl boronic acid modified magnetic nanoparticle were used as basic building blocks for process development for selective capture and purification of antibodies.



## Ana Guedes

Nationality: Portuguese PhD in: Bioengineering (BIO-E) Sub area: Stem Cell, Tissue Engineering and Regenerative Medicine Starting year: 2011/2012 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa



# Ana Silva

Nationality: Portuguese PhD in: Bioengineering (BIO-E) Starting year: 2011/2012 Institutional affiliation: Faculdade de Ciências e Tecnologia da Universidade Nova Lisboa

#### Thesis title:

# Analysis of the gene regulatory network underlying pluripotenciality in mouse embryonic stem cells

**PhD Advisors:** Domingos Henrique (Instituto de Medicina Molecular - FMUL); Elsa Abranches (Instituto de Medicina Molecular - FMUL); Cláudia Lobato da Silva (IST)

Pluripotentiality and self-renewal are the two main features that define the stemness state of Embryonic Stem (ES) cells. Nanog, Oct4 and Sox2 (NOS) network of transcription factors play a central role in regulating ES cell status.

Recent work has revealed a critical interaction of between the NOS network and the FGF/ERK pathway, with the balance playing a crucial role in the maintenance of stemness. In this project, I propose to design novel reporter ES cell lines that can be used as tools to understand the dynamics of the NOS-FGF/ERK interactions, and how fluctuations in Nanog levels and variations in FGF/ERK signaling components underlie a state in which individual stem cells are able to simultaneously manifest their pluripotency features while being ready to respond to differentiation inducing signals.

#### Thesis title:

Aerosolized gold-nanodevices for theranostic lung delivery PhD Advisors: Ana Aguiar-Ricardo (FCT-UNL)

The main goal of this PhD project is to develop and characterize theranostic nano-in-micro particles suitable for aerosolization. The dry powder formulations are produced under supercritical atomization processes and are intended to target and treat lung cancer disease.



# Cláudia Correia

Nationality: Portuguese PhD in: Bioengineering (BIO-E) Sub area: Stem Cell, Tissue Engineering and Regenerative Medicine Starting year: 2011/2012 Institutional affiliation: Faculdade de Ciências e Tecnologia da Universidade Nova Lisboa

#### Thesis title:

# Bioprocessing of induced pluripotent stem cells for cardiac cell therapy

**PhD Advisors:** Paula Alves (ITQB-UNL/IBET); Margarida Serra (ITQB-UNL/IBET)

The main aim of this PhD project is to develop robust and effective approaches for the production of pure and functional human Pluripotent Stem Cells (PSC)-derived cardiomyocytes (CMs) in clinically relevant quantities. First, novel tools for scalable differentiation of human PSC towards CMs will be developed using fully controlled bioreactor systems. Transcriptome, metabolome and fluxome analyses will be applied along the differentiation process to disclose which pathways are differentially activated and/or repressed. Functionalized biomaterials suitable for cell therapy will be used to purify and mature the differentiated product and the quality of the final CMs will be assessed in vitro and in vivo. Lastly, efficient strategies for cryopreservation and for hypothermic storage of PSC-derived CMs after large-scale production will be explored.



# Daniel Simão

Nationality: Portuguese PhD in: Bioengineering (BIO-E) Sub area: Stem Cell, Tissue Engineering and Regenerative Medicine Starting year: 2011/2012 Institutional affiliation: Faculdade de Ciências e Tecnologia da Universidade Nova Lisboa

#### Thesis title:

# Human neural *in vitro* models for preclinical research: 3D culture systems for neural differentiation and genetic modification of human stem cells

**PhD Advisors:** Paula M. Alves (iBET/ITQB-UNL); Catarina Brito (iBET/ITQB-UNL)

The current lack of predictable models in early stage development in the pharma industry strongly contributes for the high attrition rates registered. Thus, there is an increasing need for a paradigm shift towards more human relevant cell models, which can closely recapitulate the *in vivo* cell-cell interactions, presenting higher physiological relevance. The main goal of this project is the development of human 3D *in vitro* neural models, making use of human stem cells as scalable supply of neural-subtype cells for target validation and toxicological assessment.



# Gianluca Selvaggio

Nationality: Italian
PhD in: Bioengineering (BIO-E)
Sub area: Computational Bioengineering, Genomics, Systems and Synthetic Biology
Starting year: 2011/2012
Institutional affiliation: Faculdade de Ciências e Tecnologia da Universidade Nova Lisboa

#### Thesis title:

# Seeking general principles in the design of defense systems against hydrogen peroxide

PhD Advisors: Armindo Salvador (Centre for Neuroscience and Cell Biology - UC)

Cells are occasionally exposed to high  $H_2O_2$  concentrations, often preceding exposure to other electrophylic compounds. Both  $H_2O_2$  and these compounds can irreversibly modify protein thiols, with deleterious consequences. Induction of enzymatic defenses against those agents is too slow to avoid significant damage. We propose that cells solve this conundrum by reversibly "blocking" the thiols once  $H_2O_2$  concentrations begin to increase. We term this mechanism "anticipatory blocking" because it acts in anticipation of irreversible damage upon detection of early signs of stress. We examined the design requirements for the Peroxiredoxin/Thioredoxin-Reductase/Protein-Dithiol System (PTTRDS) to effectively integrate  $H_2O_2$  signaling through a thiol redox relay and anticipatory blocking of protein dithiols as disulfides, and we compared them to the designs found in cells.



# Irina Neves Simões

Nationality: Portuguese PhD in: Bioengineering (BIO-E) Sub area: Stem Cell, Tissue Engineering and Regenerative Medicine Starting year: 2011/2012 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

#### Thesis title:

# An *in vitro* stem cell based model to study stress urinary incontinence using a decellularized matrix

**PhD Advisors:** Cláudia Lobato da Silva (IST-UL); Joaquim Sampaio Cabral (IST-UL); Pedro Baptista (Instituto Aragonés de Ciencias de la Salud)

My work aims at the development of an in vitro model of an urethral sphincter to study stress urinary incontinence. We use decellularization methods to produce organ acellular matrices for Tissue Engineering and Regenerative Medicine and use stem/progenitor cells to repopulate those scaffolds.





### Thesis title:

### Exploring human pluripotent stem cell fate using 3-D cellular microarrays

**PhD Advisors:** Joaquim Cabral (IST); Magarida Diogo (IST); Jonathan Dordick (Renssealaer Polytechnic Institute)

## Jorge Pascoal

Nationality: Portuguese PhD in: Bioengineering (BIO-E) Sub area: Stem Cell, Tissue Engineering and Regenerative Medicine Starting year: 2011/2012 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

Development of a microscale platform for the study of the effects of different molecules during in vitro 3-D expansion and differentiation of human pluripotent stem cells (hPSC), under chemically-defined conditions.



# Marisa Santos

Nationality: Portuguese PhD in: Bioengineering (BIO-E) Sub area: Bioprocess and Biomolecular Engineering Starting year: 2011/2012 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

#### Thesis title:

# Bioproduction of mannosylerythritol lipids aiming at jet biofuel application

**PhD Advisors:** Frederico Ferreira (IST); César Fonseca (LNEG) Mannosylerythritol lipids (MELs) are glycolipids with surface active properties produced by Pseudozyma sp. strains. These biosurfactants are usually produced from vegetable oils but due to competition with food supply chain, their increasing prices and difficult downstream separation the process can hardly be sustainable.

This project focus on the production of MELs starting from lignocellulosic residues, aiming at added value products on the energy and health sectors: namely fuel for aviation and gene delivery. At the center of the current project is MEL production optimization with short lipid chains from Pseudozyma spp. suitable for use as jet fuel. Reactor operation will be investigated for different feed substrate configurations namely, fed batch, continuous and membrane operations.

MEL conversion in fuel by transesterification and hydrogenation will be studied.



# **Ricardo Costa**

Nationality: Portuguese PhD in: Bioengineering (BIO-E) Starting year: 2011/2012 Institutional affiliation: Faculdade de Ciências e Tecnologia da Universidade Nova Lisboa



# Rui Portela

Nationality: Portuguese PhD in: Bioengineering (BIO-E) Sub area: Computational Bioengineering, Genomics, Systems and Synthetic Biology Starting year: 2011/2012 Institutional affiliation: Faculdade de Ciências e Tecnologia da Universidade Nova Lisboa

#### Thesis title:

# The role of the mitochondrial electron transport chain in regulating stem cell behavior and tissue homeostasis

**PhD Advisors:** Leanne Jones (UCLA); Miguel Godinho Ferreira (IGC); António Jacinto (CEDOC - FCM/UNL)

Adult stem cells are responsible for tissue regeneration throughout life and respond to different signals to make decisions whether to proliferate or differentiate. These signals result from a complex network of pathways in which several metabolic mechanisms take place. The goal of this project is to identify individual components of the mitochondrial Electron Transport Chain (ETC) that play a major role in stem cell behavior. After performing a screen to reduce the levels of single subunits of the ETC specifically in the digestive tract of the fruit fly Drosophila melanogaster, we aim to describe the pathways in which candidate components participate.

With the insights gained from this project we hope to contribute with new fundamental descriptions of stem cell regulation and tissue homeostasis, ultimately providing advancements in stem cell therapies or cancer treatments.

#### Thesis title:

#### A hybrid systems framework to design standard biological parts for synthetic biology: Application to pichia pastoris

**PhD Advisors:** Rui Oliveira (Requimte/CQFB, Chemistry Department, FCT-UNL); Anton Glieder (Institute of Molecular Biotechnology Technische Universität Graz)

The objective of this thesis is to develop a hybrid systems framework for the design of standard biological parts for synthetic biology. The first task will be the development of efficient hybrid modeling and computational methods for the description of target biological parts using DNA descriptors to accurately predict kinetic parameters. This framework will then be used to generate in silico a library of biological parts by implementing a mixed integer program that maximizes the biological part strength by manipulating the respective DNA sequence. The third activity is a wet lab activity in order to validate the developed promoters library. We expect that these activities will provide a basis for a hybrid systems framework for synthetic biology and the respective proof-of-concept translated in the improvement of the production of heterologous proteins by P. pastoris.




## Sérgio Gonçalves

Nationality: Portuguese PhD in: Bioengineering (BIO-E) Sub area: Biomedical Devices and Technologies: Hybrid Human - Machine Systems Starting year: 2011/2012 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

#### Thesis title:

# Development of a hybrid model for forward dynamic analysis of biomechanical systems

PhD Advisors: Miguel Tavares da Silva (IST)

Forward dynamic-based models have been successfully applied in the simulation of biomechanical systems, in particular in human gait. A novel methodology is proposed to simulate the human walking, based on hybrid dynamic models. Hybrid models combine the advantages of the methodologies typically used in multibody dynamics with a control-based approach, improving the efficiency and realism of the simulation. The proposed methodology should compare the results of both pathologic and non-pathological simulations, enabling to understand major differences and the steps required to improve subject's performance. New approaches for optimization cost functions will also be considered. The model will be the base of a computational tool developed to support the design of orthopaedic solutions and to support medical decisions.

## 2012/2013



## Ana Lima

Nationality: Portuguese PhD in: Bioengineering (BIO-E) Sub area: Stem Cell, Tissue Engineering and Regenerative Medicine Starting year: 2012/2013 Institutional affiliation: Faculdade de Ciências e Tecnologia da Universidade Nova Lisboa

### Thesis title:

# Generation of cord blood-derived induced pluripotent stem cells using a non-viral reprogramming strategy

**PhD Advisors:** Ricardo Neves (CNC - UC); Tariq Enver (Cancer Research Institute - University College of London)

The aim of this project is to develop a strategy by which induced pluripotent stem cells (iPSCs) can be efficiently generated from human cord blood (CB) derived hematopoietic stem/progenitor cells avoiding viral manipulation and DNA integration. There are several reports of hiPSCs generation from CB using approaches involving viral transduction. Therefore the generation of a biodegradable nanotechnology platform that enables a more efficient reprogramming process and avoiding the use of virus would be a great step in terms of a future use of hiPSCs in the clinical context.



# Andrea Silva

Nationality: Portuguese PhD in: Bioengineering (BIO-E) Sub area: Bioprocess and Biomolecular Engineering Starting year: 2012/2013 Institutional affiliation: Escola de Engenharia da Universidade do Minho

#### Thesis title:

# Development of targeted drug carriers for breast cancer therapy

**PhD Advisors:** Lígia Rodrigues (UMinho); Natalie Artzi (Institute for Medical Engineering and Science, MIT, Cambridge and the Department of Anesthesiology, Brigham and Women's Hospital, Harvard Medical School); Leon Kluskens (UMinho)

Current cancer treatments include surgical intervention, radiation and chemotherapeutic drugs; however these therapies are non-specific, destroying both tumor and healthy cells. In this sense, the development of targeted drug delivery systems is highly desirable. This approach consists in designing smart anticancer therapeutics meant to specifically target unique aspects of tumor biology, improving biodistribution, tissue uptake and pharmacokinetics of therapeutic agents. The aim of this PhD project is to develop a targeted therapeutic nanocarrier for cancer treatment. Novel targeting moieties will be isolated and rationally designed siRNA will be evaluated. Nanocarrier delivery and internalization will be studied and the delivery system optimization is predicted. These studies will undergo in vitro validation using cancer cell models and, eventually, in vivo studies could be conducted.





## Andreia Pimenta

Nationality: Portuguese PhD in: Bioengineering (BIO-E) Starting year: 2012/2013 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

#### Thesis title:

# Surface modifications to control drug release from therapeutic ophthalmic lenses

PhD Advisors: Rogério Colaço (IST-UL); Ana Paula Serro (IST-UL)

The main aim of this work is to develop and optimize surface modified/coated drug-releasing hydrogels to be used in therapeutic ophthalmic lenses. For that, different surface coating/modification strategies will be tested in order to create drug diffusion barriers, which lead to a continuous and gradual dispense of medication to the eye, at adjustable rates, and for extended periods. The drug release kinetics will be investigated through in vitro tests by using an equipment specially conceived to simulate the eye function (tear flow and blinking for SCLs, humour exchange for IOLs), which allows a reliable extrapolation to the biological conditions. Appropriate physicalchemical and biological experimentation will be performed in view of future (pre)clinical validation.



# António Soure

Nationality: Portuguese PhD in: Bioengineering (BIO-E) Sub area: Stem Cell, Tissue Engineering and Regenerative Medicine Starting year: 2012/2013 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

#### Thesis title:

# Selection and expansion of donor antigen-specific regulatory T-cells for subsequent clinical translation

**PhD Advisors:** Joaquim Sampaio Cabral (IST-IBB); Cláudia Lobato da Silva (IST-IBB); João Lacerda (Instituto de Medicina Molecular)

My research focuses on the expansion/selection of regulatory T-cells, using a mesenchymal stem cell (MSC)-based co-culture system. Briefly, MSC are obtained from differente sources (bone marrow and adipose tissue) and cultured in vitro until confluent. Peripheral blood mononuclear cells (PBMC) or purified regulatory T-cells (Treg) are also added to examine the ability of MSC to induce and expand Treg in vitro. To determine if the mechanism by which MSC induce/expand Treg is due to cell-cell contact or the release of soluble factors, transwell experiments are performed and blocking antibodies against relevant soluble factors (e.g. IL-2, IL-10, TGF-[], ILT) are used. Also, I have been studying the influence of a serum-free medium, containing human platelet lysate, in the expansion and immunomodulatory properties of adipose tissue and umbical-cord matrix-derived MSC.



# Bárbara Cunha

Nationality: Portuguese PhD in: Bioengineering (BIO-E) Sub area: Stem Cell, Tissue Engineering and Regenerative Medicine Starting year: 2012/2013 Institutional affiliation: Faculdade de Ciências e Tecnologia da Universidade Nova Lisboa

### Thesis title:

# Development of integrated strategies for the downstream processing of human stem cells for clinical application

PhD Advisors: Margarida Serra (iBET/ITQB-UNL); Paula Alves (iBET/ITQB-UNL)

During the past decade, human stem cells (hSCs) have emerged as a therapeutic alternative for several diseases. Still, their clinical transfer faces major challenges, which include producing high cell amounts, select only the required cell population (purity), while assuring the desired phenotype and function (quality). Although substantial efforts have been put on the production of hSC, the development of scalable purification approaches and fully integrated platforms for hSCs manufacturing has been long awaited.

The aim of this PhD project is to design novel strategies for downstream processing of adult and pluripotent SCs. A systematic approach will be developed by combining membrane technology and chromatographic tools in a robust, scalable, clinical-grade and affordable process, aiming at establishing a flexible platform, which can be transferred to clinical/industrial settings.



# César Costa

Nationality: Portuguese PhD in: Bioengineering (BIO-E) Sub area: Biomedical Devices and Technologies: Hybrid Human - Machine Systems Starting year: 2012/2013 Institutional affiliation: Escola de Engenharia da Universidade do Minho

### Thesis title:

### Delivery of antimicrobial peptides for the treatment of mycobacteriosis

**PhD Advisors:** Miguel Gama (CEB-UM); Jorge Pedrosa (ICVS-UM); Rui Appelberg (IBMC-UP)

*Mycobacterium tuberculosis*, which resides inside macrophages, has always been recognized as one of the most "successful" pathogens. Standard treatments have already been used for decades and resistances to the first-line medicines are increasing. Additionally, poor patient compliance with stringent therapies is often pointed out as a major reason leading to treatment failure. Antimicrobial peptides (AMPs) are less prone to result in pathogen resistances due to their target and rapid action. In our laboratory we search for AMPs with potent activity against mycobacteria and try to develop efficient delivery systems based on self-assembled colloidal nanocarriers. Additionally, this systems are expected to reduce peptide toxicity and enhance selective uptake on infected cells. Finally, the use of encapsulated drugs in mycobacterial therapy may help reducing drug administration schedules.







# Cláudia Saraiva

Nationality: Portuguese PhD in: Bioengineering (BIO-E) Sub area: Neuroscience Starting year: 2012/2013 Institutional affiliation: Faculdade de Ciências e Tecnologia da Universidade Nova Lisboa

#### Thesis title:

### MicroRNAs-loaded nanoparticles as a new promising therapeutic tool for neural stem cell-based brain repair strategies

**PhD Advisors:** Liliana Bernardino (Health Sciences Research Centre); Lino Ferreira (Center for Neuroscience and Cell Biology and Biocant - Center of Innovation in Biotechnology)

The subventricular zone comprises a main germinal niche in the adult mammalian brain. Within this region there are multipotent neural stem cells (NSCs) that can give rise to new neurons and glia cells. Understanding how to efficiently trigger NSCs differentiation is crucial to devise new cellular therapies aimed to repair a damaged brain. It has been shown recently that microRNAs (miRNAs) are essential molecules for the neurogenesis process. The main goal of this work is study the inductive effect of miRNAs-loaded nanoparticles (NPs) in the differentiation of NSCs into neurons in vitro and in an animal model of Parkinson disease. Initially, the bioactivity of miRNAs-loaded NPs in neuronal differentiation and maturation will be evaluated in vitro. Then, the most promising formulation will be tested in vivo and cell phenotype, functionality and animal motor function will be evaluated.



# **Emanuel Quartin Costa**

Nationality: Portuguese PhD in: Bioengineering (BIO-E) Sub area: Stem Cell, Tissue Engineering and Regenerative Medicine Starting year: 2012/2013 Institutional affiliation: Faculdade de Ciências e Tecnologia da Universidade Nova Lisboa

#### Thesis title:

### Modulation of hematopoietic stem cell (HSC) activity

PhD Advisors: Ricardo Neves (CNC-FCTUC); Lino Ferreira (CNC-FCTUC)

Methodologies to increase the number or engraftment efficiency of hematopoietic stem cells (HSCs) could provide substantial clinical benefit. We hypothesize that the transient ectopic delivery of HOXB4 in transplanted HSCs may potentiate their number and final engraftment. The main goal of this project is to study the effect of HOXB4 in terms of HSC renewal and engraftment into an animal model



## Francisco Moreira

Nationality: Portuguese PhD in: Bioengineering (BIO-E) Sub area: Stem Cell, Tissue Engineering and Regenerative Medicine Starting year: 2012/2013 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

#### Thesis title:

# Scalable expansion of human mesenchymal stem/stromal cells as 3-D aggregates towards an improved cellular product

**PhD Advisors:** Joaquim Sampaio Cabral (IST-IBB); Cláudia Lobato da Silva (IST-IBB)

In the last decade, the regenerative and immunomodulatory properties of mesenchymal stem/stromal cells (MSC) have been the focus of tremendous interest. In fact, the therapeutic potential of MSC led to an increasing number of clinical trials worldwide for a wide variety of diseases, namely graft-versus-host disease, myocardial infarction or Crohn's disease among others. Traditional 2-D culture methods have been extensively used to cultivate adherent cells as MSC. However, these are very labor intensive and limited in scalability, turning the large-scale cultivation of MSC a manufacturing challenge in order to achieve clinically and commercially relevant lot sizes. The main goal of this project is to establish a platform for the large-scale production of human MSC as encapsulated 3-D aggregates, able to generate spheroids with controlled size, under defined xenogeneic-free conditions.



# Franklin Nóbrega

Nationality: Portuguese (descent) and South African (birth) PhD in: Bioengineering (BIO-E) Starting year: 2012/2013 Institutional affiliation: Escola de Engenharia da Universidade do Minho

### Thesis title:

## Prokaryotic arms race - From exploration to exploitation

**PhD Advisors:** Leon Kluskens (CEB/UMinho); Joana Azeredo (CEB/UMinho); John Van der Oost (Microbiology Department/WUR)

The gain of antibiotic resistance by pathogens urges scientists progressively to search for other ways to fight bacterial infections. A promising alternative to antibiotics is phage therapy, i.e. the use of bacterial viruses (bacteriophages) that have the capacity to specifically recognize and eliminate bacterial strains. However upon infection, also phages face various resistance mechanisms and their rate of success is determined by their ability to evade these antiviral systems. Therefore, to be able to fully exploit the potential of phage therapy, it is imperative to better understand this relationship. This thesis proposes to explore this phage-host relationship in notorious pathogens. We will focus on the recently discovered CRISPR immune system of these strains, how resistance is gained and how it is avoided by phage.



## Thesis title: Developing artificial zinc fingers with peptidase activity

**PhD Advisors:** Olga Iranzo (Institut des Sciences Moléculaires de Marseille); Cecília Roque (FCT-UNL); Ricardo Brando (REQUIMTE/FCT-UNL)

## **Henrique Carvalho**

Nationality: Portuguese PhD in: Bioengineering (BIO-E) Sub area: Bioprocess and Biomolecular Engineering Starting year: 2012/2013 Institutional affiliation: Faculdade de Ciências e Tecnologia da Universidade Nova Lisboa The overall goal of the project is to redesign the zinc domain of the zinc finger proteins to obtain stable peptidic scaffolds capable of coordinating transition metal ions and displaying peptidase activity. We are also interested in attaching the best candidates to solid supports to develop recyclable catalysts. Therefore, the immobilization of these candidates and the impact in the catalytic activity will be also explored. The outcome of these studies will be very important for the design of recyclable catalysts.



# **Miguel Amador**

Nationality: Portuguese PhD in: Bioengineering (BIO-E) Sub area: Biosystems Innovation, Management and Policy Starting year: 2012/2013

Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

#### Thesis title:

# New adaptive regulatory frameworks towards sustainable patients' access to breakthrough Cell Therapies

**PhD Advisors:** Manuel Heitor (IST-UL); Frederico Ferreira (IST-UL); Miguel Amaral (IST-UL); Kenneth Oye (MIT)

New perspectives on risk governance promise better patients' access to breakthrough therapies, such as the emerging field of Cell Therapies, yet with limited access of patients. This research work is studying the suitability of new adaptive regulatory framework on Cell Therapies, to propose guidance on its implementation and design, which extends to new frameworks of risk management on commercialization, manufacturing and value chains of technology platforms. Evidences will be gathered from case studies therapies, from regulatory impact on patients, and expert opinions. Research will focus on cases identified in Europe, and in USA. It is expected that this work support the definition of new risk governance strategies for guiding stakeholders on the actions needed, aiming to guarantee patients' access to effective breakthrough Cell Therapies that are safe and economical sustainable.



# Patrícia Morgado

Nationality: Portuguese PhD in: Bioengineering (BIO-E) Sub area: Stem Cell, Tissue Engineering and Regenerative Medicine Starting year: 2012/2013 Institutional affiliation: Faculdade de Ciências e Tecnologia da Universidade Nova Lisboa



# Roksana Maria Pirzgalska

Nationality: Polish PhD in: Bioengineering (BIO-E) Sub area: Neuroscience Starting year: 2012/2013 Institutional affiliation: Faculdade de Ciências e Tecnologia da Universidade Nova Lisboa

#### Thesis title:

# Development of hydrogel-based dressings for skin wound regeneration using supercritical fluids technology

**PhD Advisors:** Ilídio Correia (Faculdade de Ciências da Saúde da Universidade da Beira Interior); Ana Aguiar-Ricardo (FCT-UNL)

Asymmetrical structures have arisen over the last two decades as suitable wound dressings. However, the production methods used so far, present some limitations: are time-consuming, need the use of toxic organic solvents and few polymers could be used. In addition, taking into account the worldwide economic status, sustainable procedures should be adopted for wound-management. This project presents a sustainable alternative to the previous methods: supercritical carbon dioxide (scCO2)-phase inversion technique demonstrated to be a suitable method to produce asymmetric membranes, being certainly the method of the future in tissue engineering and regenerative medicine.

#### Thesis title:

The role of catecholaminergic innervation in adipose organ

PhD Advisors: Ana Domingos (IGC); Eugenia Carvalho (CNC)

The ongoing epidemic of obesity and type 2 diabetes has focused a lot of attention on the role of adipose organ in maintaining systemic energy balance.

We hypothesize that the activity of tyrosine hydroxylase (TH) innervation in adipose organ mediates trans-differentiation of white adipocytes into brown-like adipocytes and plays a crucial role in adipose tissue thermogenesis. We will use optogenetics to establish the role of molecularly identified populations of TH neurons in adipose organ, and Translational Ribosome Affinity Purification (TRAP) to identify molecular targets with neuromodulatory activity enriched in those key neurons. Knowledge derived from the proposed study will shed additional light on the role of sympathetic nervous system in the stimulation of thermogenic adipose tissue.





## Tânia Mendes

Nationality: Portuguese PhD in: Bioengineering (BIO-E) Sub area: Computational Bioengineering, Genomics, Systems and Synthetic Biology Starting year: 2012/2013 Institutional affiliation: Escola de Engenharia da Universidade do Minho

# Thesis title:

# Rational design of bacteriophages as a platform for cancer therapy

PhD Advisors: Lígia Rodrigues (UMinho); Leon Kuskens (UMinho)

Conventional chemotherapy is mostly based on systemic administration of highly cytotoxic drugs that non-specifically target any dividing cells, resulting in indiscriminate drug distribution and severe toxicity for patients. Therefore, a new paradigm that moves cancer therapy from the administration of non-selective drugs to the targeted delivery of highly specific agents is required. The aim of this PhD proposal is to engineer bacteriophage-based nanoparticles able to invade and control the cancer with high specificity and reduced adverse effects. Our approach will comprise genetic manipulation and chemical conjugation to endow bacteriophages with cancer-specificity-conferring ligands and with a large payload of cytotoxic drugs, respectively. Additionally, the efficacy and mechanisms underlying the activity of the phage-based nanoparticles will be elucidated.

# Tânia Vieira

Nationality: Portuguese PhD in: Bioengineering (BIO-E) Sub area: Stem Cell, Tissue Engineering and Regenerative Medicine Starting year: 2012/2013 Institutional affiliation: Faculdade de Ciências e Tecnologia da Universidade Nova Lisboa

#### Thesis title:

# Development of a new nanostructured scaffold for neural stem/ progenitor cell transplantation

**PhD Advisors:** Célia Henriques (PhD. FCT-UNL); João Paulo Borges (PhD. FCT-UNL); Ana Sofia Falcão (PhD. FF-UL)

The impact of a spinal cord injury (SCI) is devastating due to loss of neurological functions. The transplantation of stem/progenitor cells (NSPC) supported by a scaffold to the injured site in order to promote axonal regeneration is a promising strategy under investigation. The PhD work consists in the synthesis and chemical characterization of new biodegradable polyurethanes (PU). Electrospinning will be used to produce meshes of randomly oriented and aligned nanofibers from different PU formulations. These fiber meshes will be characterized and using a model cell line, their biocompatibility and potential for promoting cell adhesion will also be evaluated. Primary NSPC neurospheres will be induced to differentiate into a system of neurons, astrocytes and oligodendrocytes. The influence of different fiber meshes on cell populations, axonal growth and myelination will be studied.

## 2013/2014



## **Ana Alves**

Nationality: Portuguese PhD in: Bioengineering (BIO-E) Starting year: 2013/2014 Institutional affiliation: Escola de Engenharia da Universidade do Minho

## Thesis title: Modified liposomes for improved therapeutics against leishmaniasis

**PhD Advisors:** Ana Tomás (IBMC); Gert Storm (Utrecht University); Miguel Gama (UMinho)

Leishmaniasis, a set of neglected diseases caused by protozoan Leishmania parasites and affecting millions worldwide, suffers from the lack of adequate control measures. Among the most effective leishmanicidals is the liposomal formulation of Amphotericin B (AmpB), known as Ambisome, whose performance is still not ideal. By doing some alterations in liposomes surface we expected to induce an anti-parasitic immune response and simultaneously enhance the uptake of AmpB by macrophages. Together, both effects should contribute to an improved leishmanicidal activity relative to the reference drug Ambisome.



# Catarina Rebelo

Nationality: Portuguese PhD in: Bioengineering (BIO-E) Starting year: 2013/2014 Institutional affiliation: Faculdade de Ciências e Tecnologia da Universidade Nova Lisboa

## Thesis title: Nanomedicine to enhance heart regenerative potentia

PhD Advisors: Lino Ferreira (CNC, UC)

During this PhD we will develop a cell-free therapy for myocardial infarction treatment that explores the endogenous modulation of CSCs. We aim at enhancing this intrinsic self-repair mechanism that exists in the mammalian heart. To accomplish this objective, we will use an innovative platform based on opto-nanomedicine for the remote delivery of biomolecules. The main objective of the project is to evaluate the regenerative potential of biomolecules released into the heart after light activation.





## **Denis Santos**

Nationality: Portuguese PhD in: Bioengineering (BIO-E) Starting year: 2013/2014 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

#### Thesis title:

## From sub-cellular imaging to an "imaging Petri-dish" using integrated thin-film silicon photosensors in lab-on-chip system

**PhD Advisors:** João Pedro Conde (IST/INESC MN/IN); Miguel Prazeres (IST/BERG/IBB)

The aim of this thesis involving INESC MN/IN and BERG/IBB is the development of thin-film silicon photodetector arrays on glass substrates and their application towards high sensitivity fluorescence and transmission-based imagers and biosensors in lab-on-a-chip systems. These devices will be applied for the detection of subcellular structures, both by fluorescence and transmission, in individual cells for disease detection and for the implementation of large area sensor arrays for cell culture monitoring ("imaging Petri-dish").



# **Diogo Pinto**

Nationality: Portuguese PhD in: Bioengineering (BIO-E) Starting year: 2013/2014 Institutional affiliation: Faculdade de Ciências e Tecnologia da Universidade Nova Lisboa Thesis title: Development of a cell-based product with enhanced therapeutic features for myocardial regeneration through an integrative bioprocess approach

PhD Advisors: Joaquim Sampaio Cabral - Instituto Superior Técnico



## **Helder Lopes**

Nationality: Portuguese PhD in: Bioengineering (BIO-E) Starting year: 2013/2014 Institutional affiliation: Escola de Engenharia da Universidade do Minho Thesis title:

# Accelerating metabolic engineering tasks by the in silico development of libraries of strain

PhD Advisors: Isabel Rocha, CEB-Universidade do Minho

Saccharomyces cerevisiae is one of the most widely used cell factories in industrial biotechnology. However, the development of optimized yeast strains for the production of novel compounds is a time-consuming process and represents a significant cost and time burden. Key underlying reasons include the unavailability of suitable chassis cells and lack of proven modelling tools. This PhD proposal aims at contributing towards overcoming these limitations by using cutting-edge computational and experimental tools. These will be applied to improved production of polyketides and other industrially relevant compounds that originate from the same precursors.



# Joaquim Ribeiro

Nationality: Portuguese PhD in: Bioengineering (BIO-E) Starting year: 2013/2014 Institutional affiliation: Escola de Engenharia da Universidade do Minho

## Thesis title: Novel anaerobes for a biobased economy

PhD Advisors: Alfons Stams; Madalena Alves; Maria Alcina Pereira

To study the physiology of novel anaerobes that grow with lipids and glycerol and novel LCFA-degrading bacteria. The ability to form LCFA from short chain fatty acids will be further assessed. In particular, the effect of methanogens, hydrogen and electricity on the metabolism of the novel anaerobes will be studied. The strategy is to obtain highly purified cultures by serial dilution technique; then, isolation will be done by using short chain fatty acids and hydrogen as substrates and by applying bromethanesulfonate to inhibit methanogens. The pure cultures obtained of novel lipids-fermenting and glycerol-fermenting anaerobes, will be studied further using genome and proteome approaches.





## Maria Jacinto

Nationality: Portuguese PhD in: Bioengineering (BIO-E) Sub area: Bioprocess and Biomolecular Engineering Starting year: 2013/2014 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

## Thesis title: Virus like particles purification through aqueous two phase systems

PhD Advisors: Raquel Aires Barros (IST); Ana Azevedo (IST)

Virus-like particles (VLPs) are promising candidates for a new generation of biopharmaceuticals not only for conventional vaccination but also for cancer vaccines, delivery vehicles and gene therapy. The technology currently applied to conventional vaccines is not applicable to these new type of vaccines as it is not able to provide sufficient purity and recovery.

Particular focus will be given to the selection of the most suitable Aqueous Two Phase Systems (ATPS) and extraction conditions, including type and concentration of phase forming components (polymers or salts), ionic strength and pH, in microfluidic and macroscale conditions. PEG/phosphate and PEG/acrylate systems will be investigated.



## Maria João Sebastião

Nationality: Portuguese PhD in: Bioengineering (BIO-E) Sub area: Stem Cell, Tissue Engineering and Regenerative Medicine Starting year: 2013/2014 Institutional affiliation: Faculdade de Ciências e Tecnologia da Universidade Nova Lisboa

### Thesis title:

Towards novels stem cell-based therapies for myocardium regeneratio



# Maria Salomé Duarte

Nationality: Portuguese PhD in: Bioengineering (BIO-E) Sub area: Bioprocess and Biomolecular Engineering Starting year: 2013/2014 Institutional affiliation: Escola de Engenharia da Universidade do Minho

## Thesis title: Novel anaerobes for a biobased economy

**PhD Advisors:** Alfons Stams (Wageningen University); Madalena Alves (UMinho); Diana Sousa (Wageningen University)

To study the physiology of novel anaerobes that grow with lipids and glycerol and novel LCFA-degrading bacteria. The ability to form LCFA from short chain fatty acids will be further assessed. In particular, the effect of methanogens, hydrogen and electricity on the metabolism of the novel anaerobes will be studied. The strategy is to obtain highly purified cultures by serial dilution technique; then, isolation will be done by using short chain fatty acids and hydrogen as substrates and by applying bromethanesulfonate to inhibit methanogens. The pure cultures obtained of novel lipids-fermenting and glycerol-fermenting anaerobes, will be studied further using genome and proteome approaches.



# Mauro Luís

Nationality: Portuguese PhD in: Bioengineering (BIO-E) Sub area: Computational Bioengineering, Genomics, Systems and Synthetic Biology Starting year: 2013/2014 Institutional affiliation: Faculdade de Ciências e Tecnologia da Universidade Nova Lisboa

#### Thesis title:

## Engineering culture media for chinese hamster ovary cells: A systems biotechnology approach

PhD Advisors: Rui Oliveira (FCT-UNL); Nuno Carinhas (MediaOmics)

Current methods of cell culture media design are essentially empirical and inefficient when applied to many medium ingredients. The optimization of those media is fundamental and it still remains a challenge in an industry looking for a better cell culture performance but increasingly focused on safety issues.

The general goal of this project is to develop a systems biotechnology framework for advanced and cost-effective cell culture medium design, applying this approach to Chinese hamster ovary (CHO) cells, the most important in the biopharma industry.





# Pawel Bujalski

Nationality: Poland PhD in: Bioengineering (BIO-E) Sub area: Biomedical Devices and Technologies: Hybrid Human - Machine Systems Starting year: 2013/2014 Institutional affiliation: Faculdade de Ciências e Tecnologia da Universidade Nova Lisboa

#### Thesis title:

# Impedance Shaping and Inertial Sensing for the design and control of hybrid Human-Machine systems

**PhD Advisors:** Jorge Martins (DEM Robotics Lab at IST); Dava Newman (MVL at MIT); Leia Stirling (MVL at MIT)

The broad aim of this research project is to explore new designs of robotic devices for physical rehabilitation and augmentation of humans. Under the hypotheses that impedance shaping, achieved through a control network of muscle actuation and proprioceptive sensing, regulates human motion, the proposed research targets the following key points:

- To devise and implement human performance experiments in order to uncover and model the biological impedance variation methods adopted during different tasks in locomotion and manipulation.
- To devise bio-inspired sensing estimation and control algorithms for impedance shaping.
- To explore the embodiment of the developed algorithms in compliant exoskeletons, as well as in functional electrical stimulation.



# Pedro Geada

Nationality: Portuguese PhD in: Bioengineering (BIO-E) Sub area: Bioprocess and Biomolecular Engineering Starting year: 2013/2014 Institutional affiliation: Faculdade de Ciências e Tecnologia da Universidade Nova Lisboa

#### Thesis title:

# Development of a cultivation system to optimize cyanotoxin productivity and cost effectiveness

**PhD Advisors:** António Vicente (UMinho); Bruno Fernandes (UMinho); Vítor Vasconcelos (CIIMAR/University of Porto)

Worldwide occurrence of hepatotoxic cyanobacteria and their toxins pose serious threats to public health. However, cyanotoxins can be used as laboratory standards in human and environmental risk assessment or even as tools for molecular and cell biology studies. Presently, their availability is low due to difficulties found in production and purification processes, which influence the final price. On the other hand, the variation of cyanobacterial blooms toxicity is probably due to environmental factors. Thus, the study of the influence of environmental factors on cyanobacteria growth and toxicity might help to control them just by monitoring environmental factors. The aim of this project is to evaluate the influence of environmental conditions (temperature, etc.) in cyanobacteria growth and toxin production. Cyanotoxin extraction and purification methods will also be developed.



# **Raquel Almeida**

Nationality: Portuguese PhD in: Bioengineering (BIO-E) Sub area: Stem Cell, Tissue Engineering and Regenerative Medicine Starting year: 2013/2014 Institutional affiliation: Escola de Engenharia da Universidade do Minho



PhD Advisors: Manuela E. Gomes (3B's Research Group, UMinho)

Musculoskeletal diseases are one of the leading causes of disability worldwide. Among them, tendon injuries are responsible for substantial morbidity, pain and disability, affecting athletes, active working people, and elder population whose joint movements rely on the biomechanical interplay of intrinsic and extrinsic musculotendinous forces. The combination of the chemical interaction between oppositely charged polyelectrolytes with microfabrication technologies could be useful in designing the biomimetic fiber bundle structures that resemble the native tendon tissue structure. Thus, the goal of this work is to develop biomimetic hydrogels composed of polymers naturally present in tendons to structurally support and/or act as a delivery system, either for cells or growth factors, with feasible properties for tendon regeneration.



# **Raquel Cunha**

Nationality: Portuguese PhD in: Bioengineering (BIO-E) Sub area: Stem Cell, Tissue Engineering and Regenerative Medicine Starting year: 2013/2014 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

### Thesis title:

Development of clinical grade stem cell-based products with enhanced therapeutic potential for cardiac regeneration

**PhD Advisors:** Cláudia Lobato da Silva, Instituto Superior Técnico and MD. António Fiarresga, Centro Hospitalar de Lisboa Central, Hospital de Santa Marta





## **Rui Traquete**

Nationality: Portuguese PhD in: Bioengineering (BIO-E) Starting year: 2013/2014 Institutional affiliation: Faculdade de Ciências da Universidade de Lisboa

## Thesis title: Small molecules drug conjugates as selective cancer therapy

**PhD Advisors:** Gonçalo Bernardes (Instituto de Medicina Molecular); Angela Koehler (MIT)

The targeted delivery of cytotoxic agents capable of selective localization at the site of disease is a promising strategy in cancer therapy. In this project our aim is to rationally design and develop a new class of targeted cytotoxics with improved kinetics and selective recognition of target proteins.



# Siddhi Bianca Camila Lama

Nationality: American PhD in: Bioengineering (BIO-E) Sub area: Biomedical Devices and Technologies: Hybrid Human - Machine Systems Starting year: 2013/2014 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

#### Thesis title:

# Exploring skin-mechanoreceptor sensing for enhanced control of hybrid Human-Machine systems

PhD Advisors: Frederico Ferreira; Jorge Martins

The aim of the proposed research is to contribute to the systemic understanding of the function of mechanoreceptor sensing in motor control, and to investigate on how this function may be integrated in hybrid human-machine control systems to enhance physical interaction. The basic hypothesis underlying this effort is that mechanoreceptor feedback may bring new insight to human motor control as it is understood from a musculoskeletal point of view, muscle spindle and Golgi tendon organ feedback.

This new understanding, supported by specifically devised experiments, will lead the design of new mechanoreceptor sensors, which may adopt a synthetic, biohybrid of even pure biological forms. These developments are to be targeted at enhancing the control of soft exoskeletons, soft orthotics and prosthetics, specifically in fine and precise tasks, inspired by human tactile perception.



## Sofia Ferreira

Nationality: Portuguese PhD in: Bioengineering (BIO-E) Sub area: Bioprocess and Biomolecular Engineering Starting year: 2013/2014 Institutional affiliation: Escola de Engenharia da Universidade do Minho

## Thesis title: Development of novel strains for the production of biofuels

PhD Advisors: Isabel Rocha (UMinho)

Butanol is naturally produced by solventogenic bacteria trough Acetone-Butanol-Ethanol (ABE) fermentation, usually with low productivities. Thus, most of butanol is currently chemical synthesised via petrochemical routes and its price is extremely sensitive to crude oil's price, becoming imperative to seek for alternative ways to produce it. One possible approach is to express novel biosynthetic pathways in more user-friendly hosts as E. coli or Saccharomyces cerevisiae. In this sense, this work aims at evaluating and implementing in vivo novel pathways to produce butanol. These heterologous pathways, previously generated using a (hyper)graphbased algorithm, will be evaluated according to diverse criteria such as size of the solution, yield and novelty. Then, the pathways identified as the most promising ones will be implemented in vivo either in E. coli or S. cerevisiae. Finally, advanced techniques will be used to characterize and further improve the developed strains, including omics analyses and directed evolution.



# **Tiago Resende**

Nationality: Portuguese PhD in: Bioengineering (BIO-E) Sub area: Computational Bioengineering, Genomics, Systems and Synthetic Biology Starting year: 2013/2014 Institutional affiliation: Escola de Engenharia da Universidade do Minho

#### Thesis title:

## Improving predictions in metabolic engineering problems by incorporating enzyme structural information

**PhD Advisors:** Isabel Rocha (Escola de Engenharia - UMinho); Cláudio Soares (iTQB-UNL)

In this post-genomic era, there is an urgent need for the development of new methodologies for predicting and identifying protein functions with a higher level of accuracy and using a broader approach. My research is focused on the development and improvement of tools for more accurate predictions of protein functions and identification of substrate and co-factor specificities. Several methods will be analysed and validated, including methods based on the already significant amount of structure-based information. A final platform will be developed and applied to improve genome-scale metabolic model reconstructions.



## **Alumni Doctoral Programs**

2011



## Ana Margarida Fernandes Platzgummer

Postdoc researcher at Instituto Superior Técnico, Portugal

PhD in: Bioengineering (BIO-E) Year of graduation: 2011 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

#### Thesis title:

# Bioreactor culture systems for the expansion of mouse embryonic stem cells

**PhD Advisors:** Joaquim Sampaio Cabral (IST); Cláudia Martins Lobato da Silva (IST); Maria Margarida Fonseca R. Diogo (IST)



### Thesis title:

## Design and operation of bioreactor systems for the expansion and controlled neural differentiation of stem cells

**PhD Advisors:** Professor Joaquim Cabral (IST-UL) Maria Margarida Diogo (IST-UL); Cláudia Lobato da Silva (IST-UL)

## **Carlos Rodrigues**

Post-Doc/Instituto Superior Técnico, Universidade de Lisboa - Portugal

PhD in: Bioengineering (BIO-E)
Sub area: Stem Cell, Tissue Engineering and Regenerative Medicine
Year of graduation: 2011
Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

#### How has MPP contributed to your career development?

My PhD work within the MIT Portugal Program was an extraordinary experience both in personal and professional terms. A great network of academic and industrial researchers as well as entrepreneurs was built and the knowledge acquired during the advanced studies course was essential for the development of the PhD thesis work as well as the work I am developing now as a post-doc.





## Daniela Coutinho

Consultant at SPI - Sociedade Portuguesa de Inovação, Portugal

PhD in: Bioengineering (BIO-E) Year of graduation: 2011 Institutional affiliation: Escola de Engenharia da Universidade do Minho

### Thesis title:

## Micro/nano-scale strategies for engineering in vitro the cellular microenvironment using biodegradable biomaterials

**PhD Advisors:** Nuno Neves (UMinho); Manuela Gomes (UMinho); Ali Khademhosseini (MIT)



### Thesis title:

# Emergence of tissue engineering and disruption of product development in healthcare

**PhD Advisors:** Manuel Heitor (IST-UL); Joaquim Cabral (IST-UL); Luis Perez Breva (MIT); Charles Cooney (MIT)

# **Daniela** Couto

CEO / Cell2B Advanced Therapeutics S.A. / Portugal

PhD in: Bioengineering (BIO-E)
Sub area: Biosystems Innovation, Management and Policy
Year of graduation: 2011
Institutional affiliation: Instituto Superior Técnico da
Universidade de Lisboa

How has MPP contributed to your career development? Empowered me with knowledge.







# Spectroscopy systems for the detection of gastrointestinal dysplasia

**PhD Advisors:** Graça Maria Henriques Minas (UMinho); José Higino Gomes Correia (UMinho)

## Débora Ferreira

Project Developer at Innovayt A/S, Portugal

PhD in: Bioengineering (BIO-E) Year of graduation: 2011 Institutional affiliation: Escola de Engenharia da Universidade do Minho



Eunice Costa

R&D Drug Product Development, Hovione, Portugal

PhD in: Bioengineering (BIO-E) Year of graduation: 2011 Institutional affiliation: Faculdade de Ciências e Tecnologia da Universidade Nova Lisboa

### Thesis title:

## Bioactive beads for local sensing of proteases in 3D engineered tissues

PhD Advisors: Ana Aguiar Ricardo (FCT-UNL); Paula T Hammond (MIT)



# Biodesulfurization of crude oil by whole cells of Rhodoccocus Erythropolis

PhD Advisors: M.R. Aires Barros (IST); D.I.C. Wang (MIT)

# Isabel Filipa Ferreira

Innovation and R&D product manager, Renova SA, Portugal

PhD in: Bioengineering (BIO-E) Year of graduation: 2011 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa



## **Mariana Fernandes**

Consultant at SPI - Sociedade Portuguesa de Inovação, Portugal

PhD in: Bioengineering (BIO-E) Year of graduation: 2011 Institutional affiliation: Escola de Engenharia da Universidade do Minho

### Thesis title:

# Photonic platform for bioelectric signal acquisition on wearable devices

**PhD Advisors:** Paulo Mendes (UMinho); J. Higino Correia (UMinho); Rajeev Ram (MIT)



## Novel approaches for the isolation and ex-vivo expansion of hematopoietic stem cells from human umbilical cord blood for cell therapy

PhD Advisors: Cláudia Lobato da Silva (IST-UTL); Joaquim MS Cabral (IST-UTL)

## **Pedro Andrade**

COO at Cell2B Advanced Therapeutics, SA

**PhD in:** Bioengineering (BIO-E) **Sub area:** Stem Cell, Tissue Engineering and Regenerative Medicine

Year of graduation: 2011 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

### How has MPP contributed to your career development?

MPP was extremely important in boosting my entrepreneurial nature. It has also been an amazing experience contacting and learning from people from a wide range of backgrounds. It certainly influenced me and my colleagues, as we have incorporated Cell2B Advanced Therapeutics in 2012 which is still our professional challenge.

### 2012

## **Alumni Doctoral Programs**



## Agnieszka Joskowiak

Postdoctoral Fellow Instituto Superior Técnico, Portugal

PhD in: Bioengineering (BIO-E) Year of graduation: 2012 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

#### Thesis title:

## Integration of light sensor arrays with microfluidic networks to scale down 2D fluorescence spectroscopy for high throughput organism/cell condition analysis

**PhD Advisors:** João Pedro Conde (IST), Duarte Miguel Prazeres (IST), Marko Topič (University of Ljubljana)



## Ana Carina Bila da Silva

Post-Doc Researcher at the Centre for Molecular ans Structural Biomedicine (CBME), Universidade do Algarve

PhD in: Bioengineering (BIO-E) Year of graduation: 2012 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

### Thesis title:

# Acoustic biosensors for biitechnology and biomedical applications - A quartz crystal microbalance as a platform for mammalian cell sensing

**PhD Advisors:** Guilherme N.M Ferreira (Universidade do Algarve); Cláudia Lobato da Silva (IST)



# Knowledge discovery in intensive care unit shock patients

PhD Advisors: João Sousa (IST); Stan Finkelstein (MIT)

André Fialho Senior Manager/Philips Healthcare - Netherlands

PhD in: Bioengineering (BIO-E)
Sub area: Computational Bioengineering, Genomics, Systems and Synthetic Biology
Year of graduation: 2012
Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa



# **Carlos Daniel Machado**

PhD in: Bioengineering (BIO-E)
Sub area: Computational Bioengineering, Genomics, Systems and Synthetic Biology
Year of graduation: 2012
Institutional affiliation: Escola de Engenharia da Universidade do Minho

### Thesis title:

# Novel modelling formalisms and simulation tools in computational biosystems

**PhD Advisors:** Eugénio Ferreira (UMinho); Isabel Rocha (UMinho); Bruce Tidor (MIT)



## Optical biosensors for biomedical applications: Detection of semiconductor nanocrystals labeled HIV-1 proteins with hydrogenated amorphous silicon photodetectors

**PhD Advisors:** Guilherme Ferreira (Universidade do Algarve); João Pedro Conde (IST)

# Cláudia Vistas

PhD in: Bioengineering (BIO-E) Year of graduation: 2012 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa



## **Cristiana Paulo**

Chief Technology Officer/ Matera, Lda./ Cantanhede - Portugal

PhD in: Bioengineering (BIO-E) Year of graduation: 2012 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

### Thesis title:

## Permanent antifungal materials and coatings: Bioactivity and cytotoxicity characterization

**PhD Advisors:** Lino Ferreira (Centro de Neurociências e Biologia Celular, Coimbra); Joaquim Cabral (IST)





## **David Malta**

President and co-Founder of Cell2B , Portugal

PhD in: Bioengineering (BIO-E) Year of graduation: 2012 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

#### Thesis title:

## *In -Vivo* engineered combinatorial u-environments for stem cell fate studies - The balance between stem cell self-renewal and differentiation

**PhD Advisors:** Cláudia Silva (IST) ; Joaquim Sampaio Cabral (IST); Sangeeta Narain Bhatia (MIT)



#### Thesis title:

# Preprocessing and misclassifying issues in clinical data sets for prediction and intervention

**PhD Advisors:** João Miguel da Costa Sousa (IST); Stan Neil Finkelstein (ESD MIT); Shane Raymond Reti (DCI BIDMC)

## Federico Cismondi

CTO/Aspersus Innovation - Portugal and USA

PhD in: Bioengineering (BIO-E)
Sub area: Computational Bioengineering, Genomics, Systems and Synthetic Biology
Year of graduation: 2012
Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

#### How has MPP contributed to your career development?

There are two main things that I obtained through the MPP, which are extremely useful now for the development of my company: the knowledge acquired in big data and scientific publications, and the network of contacts I met during my PhD, both in Portugal and in the US. Those contacts have helped me a lot in the initial steps of my company and they currently keep opening doors for me.





## **Filipe Gracio**

Sr Bioinformatician / National Health Service - United Kingdom

PhD in: Bioengineering (BIO-E) Sub area: Computational Bioengineering, Genomics, Systems and Synthetic Biology Year of graduation: 2012 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

## Thesis title: Variability in biological systems: Modeling consequences and applications

PhD Advisors: Bruce Tidor (MIT)

### How has MPP contributed to your career development?

MPP gave me the training, the international exposure, and credibility that facilitated finding employment opportunities that have kept me developing my own skills. I believe it was a crucial and central aspect of my training and I'm thankful to the program and its leaders.



# Maria Sofia Reis d'Orey

Engineer, RoboSavvy Ltd. RoboSavvy Ltd.

PhD in: Bioengineering (BIO-E) Year of graduation: 2012 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

### Thesis title:

## Multibody dynamics and control of hybrid active orthoses

PhD Advisors: Miguel Pedro Tavares da Silva (IST); Dava Newman (MIT); Jorge Martins (IST)





## **Rui Tostoes**

Research Associate, University College London, UK

PhD in: Bioengineering (BIO-E)
Sub area: Bioprocess and Biomolecular Engineering
Year of graduation: 2012
Institutional affiliation: Faculdade de Ciências e Tecnologia da Universidade Nova Lisboa

### Thesis title:

# Bioprocess engineering of Liver cells for drug testing applications

**PhD Advisors:** Paula Alves (IBET); Manuel Carrondo (IBET); Daniel Wang (MIT)

### How has MPP contributed to your career development?

The MPP has exposed me to cutting edge research performed in Portugal and at the MIT. Moreover, it has provided me with basic business skills which are fundamental for evaluating any carrer opportunities, ranging from new jobs to startup founding.



# Swarnadeepa Pandian

Postdoctoral Associate, MIT, USA

PhD in: Bioengineering (BIO-E) Year of graduation: 2012 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

### Thesis title:

# Flailer - a myosin Va neurological mutant displays autistic-like behavior and synaptic defects

PhD Advisors: Ramiro Almeida(CNC); Martha Constantine-Paton (MIT)

## Alumni Doctoral Programs



#### Thesis title:

## Functional and structural studies of two enzymes: Membrane bound kinase and Z-Dna/Z-Rna-binding protein

PhD Advisors: Margarida Archer (ITQB-UNL); Li-Huei Tsai (PILM-MIT)

## Ana Lúcia Rosário

Post-Doctoral Fellow, ITQB-UNL, Portugal

2013

PhD in: Bioengineering (BIO-E) Sub area: Neuroscience Year of graduation: 2013 Institutional affiliation: Faculdade de Ciências e Tecnologia da Universidade Nova Lisboa



# Filipa Castro

Postdoctoral Researcher at IBB - Institute for Biotechnology and Bioengineering, Portugal

PhD in: Bioengineering (BIO-E) Year of graduation: 2013 Institutional affiliation: Escola de Engenharia da Universidade do Minho

## Thesis title:

# Process intensification for the production of hydroxyapatite nanoparticles

**PhD Advisors:** José António Couto Teixeira (UMinho); António Augusto Martins de Oliveira Soares Vicente (UMinho)





## **Geisa A Lopes Goncalves**

Post-doctoral fellow - Kyushu University - Japan

PhD in: Bioengineering (BIO-E) Sub area: Bioprocess and Biomolecular Engineering Year of graduation: 2013 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

#### Thesis title:

# Rational engineering of escherichia coli strains for plasmid biopharmaceutical manufacturing

**PhD Advisors:** Duarte Miguel F T Prazeres (IST); Gabriel A Monteiro (IST); Kristala L Jones Prather (MIT - USA)

### How has MPP contributed to your career development?

MPP has highly contributed to the development of my career, since I had the opportunity to work with wonderful scientists in Portugal and USA during my PhD. The work I have developed during my thesis with the great support of my Portuguese and American supervisors in the context of MPP, have certainly contributed to open new opportunities in the scientific community, such as my current post-doctoral position in Japan, solidifying my international career as a scientist!



## João Guerreiro

Life Sciences Consultant

PhD in: Bioengineering (BIO-E)
Sub area: Stem Cell, Tissue Engineering and Regenerative Medicine
Year of graduation: 2013
Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

### Thesis title:

# Strategies for myogenic differentiation of adult stem cells towards therapeutic applications

**PhD Advisors:** Joaquim Cabral (IST-UTL); Claudia Lobato da Silva (IST-UTL); Daniel Anderson (MIT); Robert Langer (MIT)



## Maria Francisca Eiriz

Science and Technology Management Fellowship, Universidade de Coimbra - Portugal

PhD in: Bioengineering (BIO-E) Sub area: Neuroscience Year of graduation: 2013 Institutional affiliation: Faculdade de Ciências e Tecnologia da Universidade Nova Lisboa

#### Thesis title:

# Migration and differentiation of neuronal precursors in the postnatal brain: Insights from the subventricular zone and cerebellum

**PhD Advisors:** João Malva (UC); Liliana Bernardino (Centro de Neurociências e Biologia Celular - UC); Armen Saghatelyan (Centre Reserche Universite Laval - Robert Giffard); Manuel Nunes da Ponte (UNL)

### How has MPP contributed to your career development?

Thanks to the MPP I got to know several Bioengineering areas wider than my Biochemistry degree. This new perspective of science and engineering, together with the people (students, teachers, mentors) I met opened new perspectives and introduced me to the neuroscience and innovation/ entrepreneurship fields. The tools acquired during the PhD, the project development and the first academic year, helped me to know how multidisciplinarity and team work are key characteristics to succed.

It was without doubt a great oportunity and personal/professional experience.



## Maria Pereira

Head of Adhesive Technologies/ Gecko Biomedical - France

PhD in: Bioengineering (BIO-E)
Sub area: Stem Cell, Tissue Engineering and Regenerative Medicine
Year of graduation: 2013
Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

### Thesis title:

## Platforms for tissue reconstruction: Compliant biomaterials for local drug delivery and tissue adhesion

**PhD Advisors:** Lino Ferreira (CNC Biocant UC); Jeffrey Karp (BWH HST HSCI); Joaquim S. Cabral (IST)

#### How has MPP contributed to your career development?

Opportunity to establish scientific collaborations and a strong professional network in Portugal and abroad.







## Development of a process for production and purification of minicircles for biopharmaceutical applications

PhD Advisors: Gabriel Monteiro (IST)

## Michaela Simcikova Montalbano

Project manager, 5M- Czech republic

PhD in: Bioengineering (BIO-E) Sub area: Bioprocess and Biomolecular Engineering Year of graduation: 2013 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa



#### Thesis title:

# Development of advanced release systems for stem cell based therapies.

PhD Advisors: Nuno Neves (3B's Research Group - UMinho)

## **Nelson Monteiro**

Postdoc/ Tufts University - USA

**PhD in:** Bioengineering (BIO-E) **Sub area:** Stem Cell, Tissue Engineering and Regenerative Medicine

Year of graduation: 2013

**Institutional affiliation:** Escola de Engenharia da Universidade do Minho

#### How has MPP contributed to your career development?

MPP helped me to broaden my knowledge and to mature my research abilities. I gained experiences and capacity to implement and develop projects in the bioengineering area. My motivation is to promote extended life expectancy and improve health status of the population using tissue engineering and regenerative medicine technologies. During my PhD, I worked on bone and cartilage regeneration using tissue engineering approach. Currently, I am working on teeth regeneration, also using tissue engineering approach.



# Phenylboronic acid as ligand for multimodal chromatography

**PhD Advisors:** Raquel Aires-Barros (IST); Ana M. Azevedo (IST); Steven M. Cramer (RPI)

## **Rimenys Junior Carvalho**

Post-doctoral/Universidade Federal do Rio de Janeiro -Brazil

PhD in: Bioengineering (BIO-E) Sub area: Bioprocess and Biomolecular Engineering Year of graduation: 2013 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

### How has MPP contributed to your career development?

MPP has given a great opportunity to improve my skills as researcher in the Bioprocess area as well as expanding my network. Besides, the focus of MPP on innovation helped me to drive my attention to new technologies and real market needs and also joining basic to applied research.



## **Roberto Gallardo**

Postdoctoral researcher/Pontificia Universidad Católica de Valparaíso-Chile

PhD in: Bioengineering (BIO-E)
Sub area: Bioprocess and Biomolecular Engineering
Year of graduation: 2013
Institutional affiliation: Escola de Engenharia da Universidade do Minho

### Thesis title:

# New strategies for the production of butanol and 1,3-propanediol

PhD Advisors: Ligia Rodrigues (UMinho); Madalena Alves (UMinho)





## **Sezin Aday**

Postdoctoral fellow/CNC (Centro de Neurociências e Biologia Celular), Universidade de Coimbra-Portugal

PhD in: Bioengineering (BIO-E)
Sub area: Stem Cell, Tissue Engineering and Regenerative Medicine
Year of graduation: 2013
Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa



Thesis title:

Platforms to modulate the activity of

hematopoietic stem cells and their progenies

**PhD Advisors:** Lino da Silva Ferreira (CNC - Centro de Neurociências e Biologia Celular - UC); Cláudia Lobato da Silva (IST); Robert Langer (MIT)

## Thesis title:

### An approach to develop sustainable medical devices

PhD Advisors: Luis Rocha; Paula Ferreira; Manuel Lopes Nunes (UMinho)

## **Shantesh Hede**

Research Scholar/The Asia Institute/India-South Korea

PhD in: Bioengineering (BIO-E) Year of graduation: 2013 Institutional affiliation: Escola de Engenharia da Universidade do Minho

How has MPP contributed to your career development?

Explore new opportunities in product development and sustainability.



# Understanding the biotechnological potential of ashbya gossypii

PhD Advisors: Merja Penttilä (VTT); Lucília Domingues (CEB-UMinho)

# Tatiana Q. Aguiar

Post Doctoral Researcher / CEB-UMinho - Portugal

PhD in: Bioengineering (BIO-E)
Sub area: Bioprocess and Biomolecular Engineering
Year of graduation: 2013
Institutional affiliation: Escola de Engenharia da Universidade do Minho
## **Alumni Doctoral Programs**

2014



## Iris Luz Batalha

Postdoctoral Research Associate/Department of Chemical Engineering and Biotechnology, University of Cambridge in collaboration with MedImmune - United Kingdom

PhD in: Bioengineering (BIO-E)
Sub area: Bioprocess and Biomolecular Engineering
Year of graduation: 2014
Institutional affiliation: Faculdade de Ciências e Tecnologia da Universidade Nova Lisboa



# Engineered structures for the profiling and enrichment of the phosphoproteome

**PhD Advisors:** Ana Cecilia Afonso Roque (FCT-UNL); Christopher Robin Lowe (Department of Chemical Engineering and Biotechnology -University of Cambridge); Olga Iranzo (ITQB-UNL)

#### Thesis title:

#### Towards a risk assessment model for biocide use

**PhD Advisors:** Ana Teresa Freitas (INESC-ID/IST); Marco Oggioni (Department of Genetics, University of Leicester)

## Joana Rosado Coelho

Director of Analytics / HeartGenetics - Portugal

PhD in: Bioengineering (BIO-E)
Sub area: Computational Bioengineering, Genomics, Systems and Synthetic Biology
Year of graduation: 2014
Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

#### How has MPP contributed to your career development?

MPP gave me amazing networking opportunities and helped me to extend my own learning in Bioengineering.



## Jorge de-Carvalho

Postdoc Researcher / Instituto Gulbenkian de Ciência -Portugal

PhD in: Bioengineering (BIO-E) Sub area: Bioprocess and Biomolecular Engineering Year of graduation: 2014 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

#### Thesis title:

# Impedance spectroscopy analysis of protein-surface interaction using acoustic and interdigital label-free sensors

**PhD Advisors:** Guilherme Ferreira (University of Algarve); Joaquim Cabral (IST)

How has MPP contributed to your career development?

MPP was a fantastic life-learning experience! During the first year I got a broad overview of the Bioengineering hot topics from some of the best researchers in the field. In my opinion, this program was pioneer in the formation of future leaders in technology transfer from academia to market by teaching its students the best paths to drive their projects towards such final goal! During the following years, I did my PhD in one reference lab in the field of Biosensors and had the opportunity to be a period abroad at UCSB. MPP advanced studies had great influence in my decisions to produce innovative knowledge. MPP has the policy to keep everyone updated and to integrate people from its different areas through conferences, innovation contests and newsletters, which I always appreciated!



## Monica Coelho

Senior Research Scientist/Thomson Reuters - United Kingdom

PhD in: Bioengineering (BIO-E)
Sub area: Stem Cell, Tissue Engineering and Regenerative Medicine
Year of graduation: 2014
Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

#### Thesis title:

# Immunomudulatory activity of mesenchymal stromal cells

PhD Advisors: Joaquim Cabral (IST); Francesco Dazzi (Imperial College)



#### Thesis title:

### Yeast mannosylerythritol lipids from lignocellulose: A novel strategy for the production of jet biofuel

**PhD Advisors:** Frederico Ferreira (IST); César Fonseca (LNEG, I.P.); Bruce Tidor (MIT)

## Nuno Faria

PhD in: Bioengineering (BIO-E) Sub area: Bioprocess and Biomolecular Engineering Year of graduation: 2014 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa



#### Thesis title:

# A novel functional electrical stimulation system and strategies for motor rehabilitation

**PhD Advisors:** Miguel Tavares da Silva (IST); Dava Jean Newman (MIT); Jorge Martins (IST)

## Paulo Emanuel Luzio de Melo

Co-founder at Aspersus Innovation

PhD in: Bioengineering (BIO-E)
Sub area: Biomedical Devices and Technologies: Hybrid Human
Machine Systems
Year of graduation: 2014
Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

#### How has MPP contributed to your career development?

MPP gave me the opportunity to work, collaborate and be inspired by highly skilled and passionate people from across the globe. The highly dynamic and impact-driven ecosystem created by this program in Portugal and abroad, made possible for me to continuously learn from fellow colleagues and create professional relationships that still last even after graduation.



## Rúben Duarte Pereira

Scientist at R&D Drug Product Development, at Hovione FarmaCiencia SA, PORTUGAL

PhD in: Bioengineering (BIO-E)
Sub area: Computational Bioengineering, Genomics, Systems and Synthetic Biology
Year of graduation: 2014
Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa



# Data-based modeling and classification to improve outcomes in the intensive care unit

**PhD Advisors:** João Miguel da Costa Sousa (IST-UL); Stan Neil Finkelstein (MIT - USA)



## Rui Pereira

PhD in: Bioengineering (BIO-E)
Sub area: Computational Bioengineering, Genomics, Systems and Synthetic Biology
Year of graduation: 2014
Institutional affiliation: Escola de Engenharia da Universidade do Minho

### Thesis title:

# *S. Cerevisiae* strain optimization using genome scale modeling

**PhD Advisors:** Isabel Rocha (UMinho); Jens Nielsen (Chalmers University of Technology, Sweden)



## Thesis title:

# Routes to advanced vascularized tissue engineering constructs

**PhD Advisors:** Manuela Estima Gomes (3B's Research Group); Alexandra Marques (3Bs Research Group)

## Silvia Maria Mihaila

Postdoctoral fellow / Radboud University Medical Center - Netherlands

PhD in: Bioengineering (BIO-E)Sub area: Stem Cell, Tissue Engineering and Regenerative MedicineYear of graduation: 2014

Institutional affiliation: Escola de Engenharia da Universidade do Minho

### How has MPP contributed to your career development?

MPP fostered the development of my PhD project in world-renowned laboratories and the possibility to witness and engage in state-of-the-art research.





# Training the Leaders of the Future Leaders for Technical Industries



## Leaders for Technical Industries PhD (Engineering Design and Advanced Manufacturing)

## Scope

The increased complexity of modern engineering calls for a kind of engineering leadership that is able to accommodate a combination of technical performance, environmental awareness, and social and political responsibility within a systems perspective. The Leaders for Technical Industries (LTI) doctoral program combines engineering, management, social sciences, innovation, leadership, and systems thinking in a paradigm-shifting approach to the education of new engineering leaders and innovators for technical industries. The LTI program is strongly grounded in an engineering systems approach that couples education and research, and is at the European forefront of doctoral research placements in industry.

The LTI curriculum addresses core areas in product development, advanced manufacturing, and industrial management. It was developed jointly by MIT and Portuguese faculty, in many cases by creating entirely new modules never before offered at either MIT or in Portugal, and reflects continuous refinements based on student and faculty assessments. As a fully cooperative program among three Portuguese institutions and MIT, a new delivery mechanism has been adopted whereby students rotate through intensive one-week modules at each institution. To enhance the



interdisciplinary nature of the program, some modules are intertwined to accommodate a joint project. Two modules in particular – Product Design and Product Development – have a common project in which students combine their acquired knowledge from both subjects to create a new product that combines technical, economic, and social contexts.

Breaking with research methods of the past, the introduction of collaborative mechanisms for conducting research brings together teams of people from multiple universities and industrial partners who have unique capabilities for collaboration and for delivering high-quality outcomes.

Education and research are intimately tied for LTI students, reinforcing the industry and innovation knowledge gained from courses, internships, and research experiences. Furthermore, the students' internship experiences strengthen their understanding of the entire innovation value-chain as taught in the course work. The final piece of the strategy is the involvement of European companies in LTI's research activities. There has been notable success in attracting companies with which LTI students may work.

The LTI program's goal is to train a new generation of leaders for companies that have high technological profiles. LTI graduates will foster innovative application of state-of the art knowledge in successful products and/or processes, enabling a new European paradigm in managing product development and production systems.

## **Student Profile**

The main target population consists of holders of master's degrees in any engineering area, preferably in fields that match the LTI program, such as:

- Mechanical engineering and related areas (aeronautics, aerospace, automotive, naval, etc.)
- Materials engineering and related areas (metallurgy, polymers, etc.)
- Industrial engineering and related areas (production systems, etc.)
- Biomedical engineering and related areas
- Industrial design

Other technical educational backgrounds may be considered (e.g., physics, mathematics, informatics), but such an applicant needs to be well supported by a relevant industrial curriculum. The program seeks candidates who have strong motivation to develop a career in product







development or technical or production management, preferably who have previous professional experience in an industrial environment.

Consideration may be given to an applicant's track record on scientific research (research grants) resulting in published work related to the LTI scope.

## Curriculum

The doctoral program in Leaders for Technical Industries includes a curricular part, industrial internships, and a doctoral thesis. The curricular structure has been specially designed to address the needs of industry. Thus, new topics based on the principles of engineering systems were developed:

- Product Design
- Product Development
- Manufacturing Management
- Engineering Systems
- Engineering Management
- Engineering Systems and Research Methods
- Advanced Seminars
- Leadership (includes Leadership Development Weekend\*)
- Innovation and Entrepreneurship\*
- Innovation Teams\*
- \* courses offered in collaboration with other MPP PhD programs

Along with course content, the delivery mechanism creates a different paradigm from the usual Portuguese standard by using project-based learning, internships, and an intensive case-study approach.

## Main research topics

Research projects based on industry challenges are the central components of the LTI program, making it unique among existing educational programs, especially given its potential impact on the future of Portuguese industry.

The LTI's research strategy has been to develop an educationally-coupled research program, requiring the research to have strong industry interaction. In cooperation with firms that have experience in product development, design, and other aspects of R&D, LTI research projects focus mainly on topics related to design and advanced manufacturing, and on the product development process in the following industrial sectors:

- Automotive
- Railway
- Aerospace
- Medical Devices

This focus should enhance and develop Portugal's knowledge and expertise in these fields, providing capabilities that are critical to Portugal's economic future as it moves toward a technologically-based economy.

## Affiliated Institutions (Universities and or Companies)

The doctoral degree is offered in association by the following institutions, with the support of MIT: University of Lisbon, Instituto Superior Técnico – IST University of Minho, School of Engineering – UMinho University of Porto, Faculty of Engineering – FEUP



## 2008 / 2009



## Alexandra Sepúlveda

Nationality: Portuguese PhD in: Leaders for Technical Industries (LTI-EDAM) Starting year: 2008/2009 Institutional affiliation: Escola de Engenharia da Universidade do Minho

#### Thesis title:

#### Use of nanocomposites for flexible pressure sensors

**PhD Advisors:** António Pontes (Escola de Engenharia da UMinho); Júlio Viana (Escola de Engenharia da UMinho); Luís Rocha (Escola de Engenharia da UMinho)

A fabrication technique to produce conductive polymer nanocomposites was developed in this work and used to fabricate flexible capacitive pressure sensors. The process is based on vertically aligned-carbon nanotubes (A-CNTs) embedded in a flexible and biocompatible matrix of polydimethylsiloxane (PDMS). The sensing capability of this nanocomposite is attributed to the distinctive combination of mechanical flexibility and electrical properties. To demonstrate feasibility for practical applications, the flexible sensor technology was used in a biomedical application, more specifically in the context of abdominal aortic aneurysms. The technology proved successful in sensing applications and due to its biocompatibility and versatility, can be used in other fields of application such as portable medical devices and e-textiles.



## Ioannis Malliaros

Nationality: Greek PhD in: Leaders for Technical Industries (LTI-EDAM) Starting year: 2008/2009 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

#### Thesis title:

### Hmi on sensitivity functions approach: Case of non-visual senses

PhD Advisors: Mihail Fontul (IST); Elsa Henriques (IST)

The current study explores how to define the percept of an in-car interface (ICI) push button, by integrating the kinesthetic and acoustic sense. Results indicate that the AC delivered design requirements are not enough to define the percept and that percept should be defined as an integration of acoustic and kinesthetic related engineering parameters, in order to be used as design requirements in the design process. The contribution of each design requirement together with the interaction among them over the target percept of an in-car interface's push button is assessed. Moreover, the proposed research framework focuses on the impact of the design over the percept, in order to adjust the percept through the design. The results of the current study offers a valid tool for the design process of the ICI, to achieve the target percept, related to non-visual senses, as requested by the AC.

84



#### Thesis title:

## Design for X: Cork as a Suitable Material for Environment and its Implications in Performance

PhD Advisors: Luis Filipe Reis(IST)

Keywords: Sustainable Materials; Composites for Industry; Industrial Components for Industrial Manufacture; Alternative Technologies for Industrial Manufacturing

## **Bruno Simões Soares**

Nationality: Portuguese PhD in: Leaders for Technical Industries (LTI-EDAM) Starting year: 2008/2009 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa



## Maria Manuela Azevedo

Nationality: Portuguese PhD in: Leaders for Technical Industries (LTI-EDAM) Starting year: 2008/2009 Institutional affiliation: Faculdade de Engenharia da Universidade do Porto

#### Thesis title:

# Reconfiguring facilities and logistics in dynamic supply networks of SMEs

**PhD Advisors:** Jorge Pinho de Sousa (FEUP); José Crispim (UMinho); Stanley Gershwin (MIT)

This project aims to develop a methodology or a set of tools to facilitate collaboration and information sharing between different entities (SME), to support the reconfiguration of facilities and logistic systems. This tools will guarantee higher levels of efficiency, flexibility and control of supply networks of SMEs, operating with complex, large added value products, characterized by low volume, large variety and customer centered production.

With this project we expect to create a decision support framework capable of analyzing and assessing different policies and solutions in what concerns the reconfiguration of facilities, in particular by the redesigning currently layouts, and logistic systems, taking into account multiple criteria and perspectives.



## Nino Pereira

Nationality: Portuguese PhD in: Leaders for Technical Industries (LTI-EDAM) Starting year: 2008/2009 Institutional affiliation: Escola de Engenharia da Universidade do Minho

#### Thesis title:

# Golf ball picker robot: path generation in unstructured environments towards multiple targets

**PhD Advisors:** Fernando Ribeiro (UMinho); Jorge Lino (FEUP); Daniel Whitney (MIT)

The new TWIN-RRT\* algorithm solves a motion planning problem in which an agent has multiple possible targets where none of them is compulsory, and retrieves feasible, low cost, asymptotically optimal

and probabilistically complete paths. The TWIN-RRT\* algorithm solves path planning problems for both holonomic and non-holonomic robots with or without kinodynamic constraints especially where a closed loop is required. Initial and final configurations are allowed to be exactly the same. The TWIN-RRT\* algorithm computes an efficient path for one sole agent towards multiple targets where none of them is mandatory. It inherits the low computational cost, probabilistic completeness and asymptotical optimality from RRT\*. It uses efficiency as cost function, which can be adapted depending on the application.

## 2009/2010



## Thesis title: A green composite as a hood part of a buggy vehicle PhD Advisors: Arlindo Silva (IST)

## **Georgios Koronis**

Nationality: Greek PhD in: Leaders for Technical Industries (LTI-EDAM) Starting year: 2009/2010 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa I have investigated the possibility of natural composite application on automobile parts, which included: part evaluation and overview of mechanical performance using experimental testing, life cycle analysis and cost modeling simulation. It was further explored the possibility of developing a novel green composite by the use of bio-polymer (aliphatic polyester with recycled vegetable oils) and natural ramie fiber fabrics in the hood of a buggy vehicle

#### Thesis title:

# New opportunities in passenger cars design for improved efficiency of energy use - An engineering systems approach

PhD Advisors: Arlindo Silva (IST); Ricardo Simões (UMinho)

This dissertation is aimed at proposing a paradigm shift in managing the problem solving of energy use of passenger cars and subsequent emissions, namely CO2 emissions, of fuel-based passenger cars. It shows how redefining the problem statement, the solution space can be enlarged and bring a new logic and new knowledge. The main argument of this dissertation that lead to a redefinition of the problem statement starts by bringing to the analysis of the energy use by passenger cars a new variable: the users; then the original system, the passenger car, is redefining and included in a macro-

system composed by the passenger car and the users. This is now a single entity; is this entity that requires energy to satisfy its automobility requirements (needs and wants) that is studied in terms of downstream and upstream impacts (energy demand and emissions) of using passenger cars.

## Irene Carvalho

Nationality: Portuguese PhD in: Leaders for Technical Industries (LTI-EDAM) Starting year: 2009/2010 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa





## **Nelson Oliveira**

Nationality: Portuguese PhD in: Leaders for Technical Industries (LTI-EDAM) Starting year: 2009/2010 Institutional affiliation: Escola de Engenharia da Universidade do Minho

#### Thesis title:

## Advanced in mould assembling technologies for high precision polymer based optical components

PhD Advisors: António Pontes (UMinho)

This PhD had the objective of develop a new process capable to produce a functional subsystem in an optimized way and with a lower cost compared to actual process. To achieve the objective was studied the concept of manufacturing cell that used the injection molding process and the laser welding technology as their main process. These two processes were chosen mainly due to their capability of producing different components, in a single process with a high rate production.

To achieve the desired process, several tasks were done. In this case was made a market research to define which case study will be used, state-of-the-art of the technologies, the adaption of the chosen case study, to be produced by the process, design of a mold and assembling process and finally a business plan. This PhD was made in collaboration with PIEP and Olesa (Industrial partner).



## Nuno Guitian Oliveira

Nationality: Portuguese PhD in: Leaders for Technical Industries (LTI-EDAM) Starting year: 2009/2010 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

#### Thesis title:

# Towards high strength 3D chitosan-based implants for biomedical applications

**PhD Advisors:** Alexandra Rodrigues (ICEMS-IST); Luís Reis (IST); Luís Pinto (Altakitin)

The aim of the project is to introduce a detailel study on the production and characterization of 3D dense chitosan-based structures. Several specimens were produced and studies were performed in order to mainly assess the cytotoxicity of these specimens and their physical behavior throughout the enzymatic degradation experiments carried out for different periods of time. Importantly, the results point out that glycerol has a high impact in improving mechanical properties. The potential for cell integration was also studied, using hMSC as a cell model, showing promising results. It was concluded that chitosan-based implants for spinal fusion applications can be an appealing application for this technology.





## Sara Marques

Nationality: Portuguese PhD in: Leaders for Technical Industries (LTI-EDAM) Starting year: 2009/2010 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

#### Thesis title:

# Light-duty vehicles energy and emissions "eco-score" considering total life cycle and different end-users

**PhD Advisors:** Carla Silva (IST); Luís G. Reis (IST); João Luiz Afonso (Escola de Engenharia da UMinho)

The development of this work aims the rating of energy and  $CO_2$  emissions of light-duty vehicles considering several technologies (internal combustion engine vehicles, fuel cell vehicles, pure electric vehicles, hybrid vehicles, plug-in hybrid vehicles) and different end users (urban, highway, mix driving and driving frequency). An assessment of the optimization model for possible technology/ end user combinations will be conducted using heuristic methods, considering energy consumption and  $CO_2$  emissions emitted along total life cycle.

A benefit analysis of a smart connection to the grid will be performed, regarding environmental aspects and its inclusion in the rating. The main innovative aspect of this work is to fulfill the gap created by the actual labeling methods for vehicles, which is not set for new vehicle technologies (e.g. electric and hybrid).



# **Senay Sadic**

Nationality: Turkish PhD in: Leaders for Technical Industries (LTI-EDAM) Starting year: 2009/2010 Institutional affiliation: Faculdade de Engenharia da Universidade do Porto

### Thesis title:

### **Collaborative planning in dynamic networks**

**PhD Advisors:** Jorge Pinho de Sousa (FEUP); José António Almeida Crispim, (UMinho)

Dynamic manufacturing networks (DMN) are collaborative networks of autonomous companies (mainly SMEs) that are quickly formed to respond prompt business opportunities. Unlike partnership models, DMNs pool their resources, share real time data and operate via a centralized platform. As order-driven networks, lifecycle of DMNs is composed of network formation, execution/monitoring and dissolution stages. This thesis contributes to DMN literature in the network formation and operational planning area. Utilizing several Mixed Integer Linear Programming (MILP) models, our objective is to support optimal lot sizing and assignment decisions.

Initially, we present an extended model for globally dispersed DMNs with dispersed demand and mode selection functionalities. Later we deal with multi objective models by also taking into account other objectives as performance and reconfigurability.

## 2010/2011



#### Thesis title:

# Methodology for the architecting of emerging assembly systems: An engineering systems approach

**PhD Advisors:** Arlindo Silva (IST); Manuel Freitas (IST); Mihail Fontul (Iber-Oleff SA); Richard Roth (MIT); Antonio Araujo (FEUP)

## **Alvaro Martinez Soto**

Nationality: Mexican PhD in: Leaders for Technical Industries (LTI-EDAM) Starting year: 2010/2011 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa The architecting of manufacturing systems is studied through the lens of the "engineering systems", this research proposes a "holistic architecting" framework supported on the co-evolution of the producttechnology-manufacturing paradigms to address the complexity associated with the conceptual design of the global emerging assembly systems in the automotive industry.

#### Thesis title:

# Development of lightweight and cost-efficient exterior automotive body panels for electric vehicles

PhD Advisors: João Nunes (UMinho); Fernando Alves (INEGI)

Current electric vehicles still present low autonomy as major disadvantage, which with high car prices lead to a low public demand and consequently to small production volumes. A problem that may be solved through several improvements, among them, the reduction of vehicle's weight by using low density materials and cost-efficient manufacturing processes.

Relatively to the exterior body panels, polymer-metal hybrid (PMH) configurations with polydicyclopentadiene (PDCPD) arise as a relevant solution for both weight and cost reduction, contradicting those conventional configurations with high manufacturing costs.

Thus, this research aims to develop and measure in terms of economic and physical attributes some exterior automotive body panels with the previously mentioned PMH configuration, in order to answer to how light and cost-efficient are them to be applied in future electric vehicles.

## André Camboa

Nationality: Portuguese PhD in: Leaders for Technical Industries (LTI-EDAM) Starting year: 2010/2011 Institutional affiliation: Faculdade de Engenharia da Universidade do Porto





#### Thesis title:

# The use of advanced technologies on lifecycle assessment of infrastructures

PhD Advisors: Paulo Lourenço (UMinho); José Matos (UMinho)

## **Bruno Gonçalves**

Nationality: Portuguese PhD in: Leaders for Technical Industries (LTI-EDAM) Starting year: 2010/2011 Institutional affiliation: Escola de Engenharia da Universidade do Minho The PhD has 3 main phases/objectives: 1st - development of a mobile platform to streamline field inspections and infrastructures assessment; 2nd - development of infrastructure degradation/failure Markov-based prediction model for a stock of infrastructures; 3th - integrate previous objectives and apply optimization methods to generate the best management strategy.



## Deborah Perrotta de Andrade

Nationality: Italian PhD in: Leaders for Technical Industries (LTI-EDAM) Starting year: 2010/2011 Institutional affiliation: Faculdade de Engenharia da Universidade do Porto Thesis title:

# Assessment on the efficiency of electric buses for multiple routes considering different energy storage devices

**PhD Advisors:** João Afonso (Escola de Engenharia da UMinho); Rosaldo Rossetti (FEUP); Christopher Zegras(MIT)

In order to effectively assess the potential benefits of implementing a public transport solution based on electric buses, it is imperative to assess not only the performance of their powertrain, but also their interaction with the traffic flow influencing their routes. I propose an integrated simulation framework to support the assessment of electric buses which accounts for these two perspectives.

For the correct representation of the electric bus operation, a mathematical model of an electric bus powertrain is developed, considering motor specifications and its energy storage device. To model traffic interactions, a microscopic simulator was adapted to support the representation of electric vehicles and an appropriate model of the environment, especially regarding network topography, which considers a three-dimensional model of links, number of stops and distance between stops.



## Jean-Loup Loyer

Nationality: French PhD in: Leaders for Technical Industries (LTI-EDAM) Starting year: 2010/2011 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

### Thesis title:

## A Contribution to Statistical Modelling of Life Cycle Cost of Jet Engines

PhD Advisors: Elsa Henriques (IST); Mihail Fontul (IST);

Lifecycle cost is particularly challenging to estimate during the preliminary phases because of the uncertainty in the design and decade-long duration of engine programs. However, thanks to the large volume of data recorded by industrial companies over the last two decades, it is possible to resort to statistical methods to estimate the lifecycle cost of novel engine programs. The research aims primarily at assessing the feasibility of a data-driven statistical approach over the analytical and analogous approaches more commonly used in lifecycle cost estimation, based on a case study involving hundreds of compressor blades from five Rolls-Royce Trent engines and thousands of maintenance visits. Another research objective consists in understanding the nature and relative importance of the drivers on the manufacturing and maintenance costs. The advantages and limits - notably the predictive performance - of several statistical models have been compared on large amounts of actual industrial data.

# João Ventura Fernandes

Nationality: Portuguese PhD in: Leaders for Technical Industries (LTI-EDAM) Starting year: 2010/2011 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

#### Thesis title:

Requirements Change in Complex Product Development – Understanding Causes, Managing Uncertainty and Planning For Change

PhD Advisors: Elsa Henriques (IST); Arlindo Silva (IST);

Requirements change is inevitable during product development and it is dicult to understand and manage for companies realizing large technical systems, such as cars, aircrafts or jet engines. This thesis tackles three aspects of requirements change in complex product development: understanding the causes of change, devising methods to predict and manage uncertainty and using models to investigate the effects of change and support planning.





## Seyyed M. M. Sabet

Nationality: Iranian PhD in: Leaders for Technical Industries (LTI-EDAM) Starting year: 2010/2011 Institutional affiliation: Escola de Engenharia da Universidade do Minho

#### Thesis title:

### **Designing next generation carwashing machines**

PhD Advisors: Joao Miguel Nobrega (UMinho)

The purpose of this PhD project, is to design and develop a new automatic carwash machine to replace an old existing machine in order to accomplish a number of objectives: (a) minimising manufacturing complexity; (b) improving transportation and installation strategies; and (c) reducing weight and size.

The structure is nearly 35% lighter, 10% smaller, and nearly 30% lower in manufacturing time/complexities. It was necessary to ensure it exhibits the same mechanical behaviour. The numerical studies show that the new structure exhibits the required mechanical stability under normal working conditions, lifting for means of transportation and obstruction of a column.

Regarding the drying system, the most relevant components were designed with the help of Computational tools, aiming to obtain even air flow distribution that promotes an effective drying of the all car surface.



## Carlos Nuno Barbosa

Nationality: Portuguese PhD in: Leaders for Technical Industries (LTI-EDAM) Starting year: 2011/2012 Institutional affiliation: Escola de Engenharia da Universidade do Minho

#### Thesis title:

### Integration of engineering, manufacturing and economic issues in design against impact of polymer automotive components

**PhD Advisors:** Scientific supervisors - Ricardo Simões (UMinho); Julio Viana (UMinho); Technical/industrial supervisors - Markus Franzen (Ford Research & Advanced Engineering Europe); Thomas Baranowski (Ford Research & Advanced Engineering Europe)

I am working under a cooperation with Institute for Polymer and Composites (University of Minho, Portugal) and Ford Research & Advanced Engineering Europe (Aachen, Germany). My research project addresses injection molding simulations for predicting local (per finite element mesh model) mechanical properties of injection molded parts that can be an input for structural/crash simulations. The goal is to have an improved design methodology, supported by more precise simulations than what is currently possible. Besides, the project aims at combining this information with a cost model for the part and process. Finally, taking in consideration the technical (mechanical behavior) and economic (costs) aspects, a decision making approach will be setup, at the design stage of the PDD process, in order to establish relatively faster and accurately the most reliable and cost-effective design option.



## Inês Costa

Nationality: Portuguese PhD in: Leaders for Technical Industries (LTI-EDAM) Starting year: 2011/2012 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

## Thesis title: Integrating comfort in air-vents' design

PhD Advisors: António Ribeiro (IST-UL); Mihail Fontul (IBER-OLEFF)

Original equipment manufacturers (OEM) are becoming more interested in the sense of brand and comfort perception of clients, as differentiation strategy. However, these issues are highly subjective and difficult to define, thus the comfort requirements provided to suppliers are generally ill-defined. OEM suppliers usually perform several iterations in a trial and error base, before the approval of the final prototype. The main objective of this project is to develop a methodology to assist OEM suppliers in product development projects, leading to a higher rate of design project success and less iterations. This will be attained by creating a model of comfort, which will correlate the physical performance of the product under development with the perception of the user.



## Jakub Kwapisz

Nationality: Polish PhD in: Leaders for Technical Industries (LTI-EDAM) Starting year: 2011/2012 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

#### Thesis title:

# Standardization and commonality opportunities allowing beneficial platform design

**PhD Advisors:** Virginia Infante (IST); Manuel Freitas (IST); Bruce Cameron (MIT)

This PhD revolves around three different research areas: standardization, commonality and platform design. These are new areas gaining interest of academia and industry.First of all, during my industrial internship I found out that there is no easy way to find components that can be standardized and made common across already defined platforms. I will tackle this first problem by performing manual search in CAD drawings and optimization based on finite element analysis which will lead to standardization of concept and commonality across product platform. Next step will be to create search algorithms for common parts and find out what contextual information can be used to identify parts which can be common. This will significantly speed up the process of looking for commonality opportunities.



## João Azenha

Nationality: Portuguese PhD in: Leaders for Technical Industries (LTI-EDAM) Starting year: 2011/2012 Institutional affiliation: Escola de Engenharia da Universidade do Minho

#### Thesis title:

High strength injection molded thermoplastic composites PhD Advisors: António Pontes (UMinho)

The objective of this project is to analyze the main obstacles and determine a new method to use injection molding to make structural thermoplastics composite parts reinforced with dry continuous fabrics. The very high viscosity of the molten thermoplastics prevents the use of the traditional thermoset based manufacturing processes. However the very high pressure used in injection molding processes opens possibilities for an alternative with specific mold configurations and injection parameters.





### Thesis title:

### New roles for engineering and industrial design in the development of highly complex products

PhD Advisors: Nuno Correia (INEGI); Inês Ruivo (UÉvora); Jorge Lino (FEUP)

## João Figueiredo

Nationality: Portuguese PhD in: Leaders for Technical Industries (LTI-EDAM) Starting year: 2011/2012 Institutional affiliation: Faculdade de Engenharia da Universidade do Porto Departing from a historical retrospective, which relates engineering, industrial design and technology, this research's aims to the development of a multidisciplinary methodological outline in accordance with the current technological and social paradigms. Within this research, technology is considered for the role of mediator between engineering and industrial design, has, in some historical moments, served as an integrator of these two differently rooted disciplines, in processes which have led to innovation. Moreover, in the conflict between technology and society lied the reform and regulation for design practice, in its broadest sense.



## João Lopes

Nationality: Portuguese PhD in: Leaders for Technical Industries (LTI-EDAM) Starting year: 2011/2012 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

#### Thesis title:

### Hybrid CFRP / metallic foils for high performance bolted joints

**PhD Advisors:** Luís Reis (IST); Manuel de Freitas (IST); Pedro Ponces Camanho (FEUP)

Recent research applied to the space industry has shown that a significant increase in bearing resistance of composite bolted joints can be achieved by introducing metallic plies in place of the composite plies in the vicinity of the bolted area, or local hybridization carbon fiber/ metallic laminate. This research is aimed at developing this bolted joint to an aeronautical application where it will have to solve new problems like fatigue, damage tolerance, reparability, and cost-effective design. The major milestones of this research are: The experimental and numerical study of the shear stress of the Carbon Fiber/Steel interface; The experimental an numerical study of fatigue behavior; and a cost model of an hybrid solution applied to a aeronautical component. It is expected with this research an increase in the Technology Readiness Level of this solution.



## Masoud Bodaghi

Nationality: Iranian PhD in: Leaders for Technical Industries (LTI-EDAM) Starting year: 2011/2012 Institutional affiliation: Faculdade de Engenharia da Universidade do Porto

#### Thesis title:

### Dry Fibre Placed Resin Transfer Components: A high volume production process for continues carbon fibre-reinforced thermoset polymer

PhD Advisors: Nuno André Curado Mateus Correia (INEGI)

During my studies I devolved a clear understanding in how far High Pressure Resin Transfer Moulding(HPRTM) can successfully be applied to support automatically carbon fibre reinforced polymer composite in large scale, thereby developing new market opportunities for light-weight composite materials. As a PhD student involved in MIT Portugal program, I wish understand the process variables that is one of the major purposes of the thesis due to limitation of the existing analytical models for fluid flow, lack of knowledge on mechanical performance at macro- and micro-scale, and curing process and void formation mechanism at micro- and macro-scale.



#### Thesis title:

Alternative energy source for agricultural vehicles

PhD Advisors: António Araújo (FEUP); António Baptista (INEGI)

## **Miguel Oliveira**

Nationality: Portuguese PhD in: Leaders for Technical Industries (LTI-EDAM) Starting year: 2011/2012 Institutional affiliation: Faculdade de Engenharia da

Universidade do Porto

Study of an alternative energy source for agricultural vehicles.

- Reduce energy consumption
- Reduce/eliminate dependency of oil
- Reduce CO2 emissions.





## **Miguel Vieira**

Nationality: Portuguese PhD in: Leaders for Technical Industries (LTI-EDAM) Starting year: 2011/2012 Institutional affiliation:Instituto Superior Técnico da Universidade de Lisboa

#### Thesis title:

# Planning and scheduling optimization in biopharmaceutical facilities

PhD Advisors: Tânia Pinto-Varela (CEG-IST); Ana Barbosa-Póvoa (CEG-IST)

The optimal scheduling of industrial operations is crucial for improving resources performance and adjust production flexibility to market demand. The application of mathematical modeling to real industrial problems often stumbles either to represent the complex requirements of the manufacturing process, to tackle large temporal horizons or even to address operational parameters. This research aims to explore and develop efficient modeling techniques to solve large scale scheduling problems in the biopharmaceutical industry. These bio-based drugs have been gathering particular attention due to its effectiveness in the treatment of diseases such as cancer, diabetes or growth disturbances. However, the challenge to model these industrial problems arises in accurately address the specific constraints of the biochemical manufacturing steps and related complex operating conditions.



## **Muhammad Arsalan Farooq**

Nationality: Pakistan PhD in: Leaders for Technical Industries (LTI-EDAM) Starting year: 2011/2012 Institutional affiliation: Faculdade de Engenharia da Universidade do Porto

#### Thesis title:

# Applying systems engineering approaches for quality improvement of manufacturing systems

PhD Advisors: Henriqueta Novoa (FEUP); Antonio Araujo (FEUP)

Complex manufacturing systems are commonly found in different industrial sectors. These systems are composed by high number of components with unknown connections and behaviors. The inherent complexity of these manufacturing systems is critical for producers, as it has direct impact on product quality and cost. Measuring, reducing and managing manufacturing system complexity will increase product quality and maintain or reduce costs.

This research proposes a new methodology to apply Systems Engineering (SE) approaches for quality improvement based on a real-industrial case. SE considers business and technical needs of customers with the goal of providing a quality product meeting user needs. Quality improvement techniques fall under the umbrella of SE approaches that identify root cause of the problem, fix the problem and perform verification and validation testing.



## Nuno Valverde

Nationality: Portuguese PhD in: Leaders for Technical Industries (LTI-EDAM) Starting year: 2011/2012 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

#### Thesis title:

### An engineering model to address kinesthetic and acoustic percept requirements in automotive human-machine interfaces design

PhD Advisors: António Ribeiro (IST-UL); Mihail Fontul (IBER-OLEFF)

I'm developing a research in the framework of designing Human-Machine Interfaces (HMI) for automotive applications. Measured data and other engineering parameters are paired along subjective evaluations in a Kansei/Affective Engineering methodology, where data analysis techniques are enhanced by including evolutionary algorithms. I aim to achieve an engineering model for assisting the design of dash-board interfaces when psychophysical and subjective perceptual requirements are given.

The case-study is a product from a Portuguese manufacturer, supplier to a foreign OEM, where the client has imposed such ill-defined requirements.



# Pouya Samani

Nationality: Iranian PhD in: Leaders for Technical Industries (LTI-EDAM) Starting year: 2011/2012 Institutional affiliation: Faculdade de Engenharia da Universidade do Porto

#### Thesis title:

#### Sustainable prefabricated composite housing

PhD Advisors: Nuno Correia (INEGI); Adélio Mendes (FEUP); Vítor Leal (FEUP)

Developing cost effective technologies and solutions for sustainable prefabricated composite housing consisting of following sections:

- 1. Advanced sandwich-structured composites
- 2. Advanced Photovoltaic systems
- 3. Life cycle assessment including energy analysis (LCEA), inventory analysis (LCI) and impact assessment (LCIA)
- 4. Market analysis and social requirements



2012/2013



# Abdolrasoul Sohouli

Nationality: Iranian PhD in: Leaders for Technical Industries (LTI-EDAM) Starting year: 2012/2013 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

### Thesis title:

# Multi-disciplinary design optimization of curvilinear fiber composites

PhD Advisors: Afzal Suleman (IST)

The objective of work is to develop a multidisciplinary design framework of curvilinear fiber composites as Variable Stiffness Composite Laminates to increase structural performance (such as buckling and fatigue) and, to reduce cost and manufacturing risk with considering manufacturability. The inherent manufacturing risks are associated with gaps and overlaps producing in manufacturing process. The manufacturability of composite consists of continuity of fiber path and curvature of paths. In terms of cost modeling, a comprehensive cost model is modeled including material, cycle time of manufacturing process, labor and lifetime of product. Finally, A decision tree will be modeled as decision support tool to review the possible scenarios to ease judge for decision maker with having a set of optimal designs from the Pareto frontier.



# Ananth Rajkumar

Nationality: Indian PhD in: Leaders for Technical Industries (LTI-EDAM) Starting year: 2012/2013 Institutional affiliation: Escola de Engenharia da Universidade do Minho

#### Thesis title:

### Improved methodologies for the design of extrusion forming tools

**PhD Advisors:** João Miguel Nóbrega (Institute for Polymers and Composites, UMinho); Olga Sousa Carneiro (Institute for Polymers and Composites, University of Minho)

To establish a new design procedures for the forming tools employed in the extrusion of thermoplastic profiles, namely the extrusion die and the calibration/cooling system. The usual experimental-based trial-and-error design approach will be improved through the employment of numerical modeling tools in combination with automatic design procedures. These aims require the development of adequate numerical tools to model the processes involved, and will be done in the framework of the open source computational library OpenFOAM®. The work will be undertaken in close cooperation with Soprefa, Componentes Industriais SA, a Portuguese company that has been designing and producing thermoplastic profiles for more than two decades.



## Bruna Mota

Nationality: Portuguese PhD in: Leaders for Technical Industries (LTI-EDAM) Starting year: 2012/2013 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

## Thesis title:

### Sustainable supply chain design and planning

**PhD Advisors:** Maria Isabel Gomes (Centro de Matemática e Aplicações, FCT-UNL); Ana Paula Barbosa-Póvoa (Centro de Estudos de Gestão, IST-UL)

The increasing societal concern with the environment is pressing industry practitioners and policy makers to reduce the negative environmental impact of supply chains. The same is taking place with the social impact of companies, especially due to the financial crisis the world is facing. Given the number of factors involved, supply chain optimization addressing these concerns constitutes a major challenge. This work plans to be a step forward in this direction. The goal is to define environmental and social indicators, including legislation constraints as well as concepts such as industrial ecology and symbiosis, into a multi-objective generic optimisation model to be used for decision support at the supply chain design and planning level. The outcome should point us towards the best practices in creating a holistic sustainable supply chain.



# Elçin Calado

Nationality: Turkish PhD in: Leaders for Technical Industries (LTI-EDAM) Starting year: 2012/2013 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

#### Thesis title:

## Selection of composite materials considering cost and environmental factors in the early phases of the design process

PhD Advisors: Arlindo Silva (IST); Marco Leite (IST)

The objective of this research study is to create a material selection framework that will lead the designer to select the most suitable composite material for the aerospace applications based on the targets related to product performance, economic achievements and environmental impacts over a product's life-cycle in a multi-disciplinary and multi-objective optimization scenario.





## Jorge Oliveira

Nationality: Portuguese PhD in: Leaders for Technical Industries (LTI-EDAM) Starting year: 2012/2013 Institutional affiliation: Escola de Engenharia da Universidade do Minho

#### Thesis title:

### Automatic detection of drusen associated with age-related macular degeneration in optical coherence tomography: A graph-based approach

**PhD Advisors:** Carlos Silva (UMinho - Industrial Electronics Department); Manuel Ferreira (UMinho - Algoritmi center)

The thesis' goal is the development of an automatic algorithm for drusen segmentation in OCT volumes. Drusen are accumulations of materials at the bottom of the retina. Drusen's volume can give valuable information to the physians about the progress of the age-related macular degeneration, a hazourdous and widespread disease. The segmentation method will be based on the graph cuts framework due to its flexibility, robustness and its good performance in similar tasks.



## Lígia Figueiredo

Nationality: Portuguese PhD in: Leaders for Technical Industries (LTI-EDAM) Starting year: 2012/2013 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

#### Thesis title:

### Process improvement and biologic behavior of chitosan based absorbable implants

**PhD Advisors:** Alexandra Rodrigues (Instituto Superior de Engenharia de Lisboa, Institute of Materials and Surfaces Science and Engineering, IST); Frederico Ferreira (Department of Bioengineering and IBB, IST); Luís Pinto (Altakitin, S.A.)

The aim of this research is to produce dense chitosan-based products to be used as (internal) bioabsorbable fixation devices for orthopedic applications. To do so, it is necessary to find out relevant processing methodologies to produce chitosan-based products in different shapes and sizes with predictable properties. In this regard, experimental research work related with the optimization of the manufacturing process of the 3D chitosan pieces will be performed, involving its mechanical, microstructural and biological characterization.



## Nina Costa

Nationality: Portuguese PhD in: Leaders for Technical Industries (LTI-EDAM) Starting year: 2012/2013 Institutional affiliation: Faculdade de Engenharia da Universidade do Porto

#### Thesis title:

## Transition from product- and service-focused design industry to the co-design of user-centered product-Service system solutions

#### PhD Advisors: Lia Patrício (FEUP)

A PSS is the combination of products and services organized together to deliver functionality and higher value to its users. Different PSS methods are mentioned in the literature but there is no description of the co-creation process or guidelines to implement and conduct a PSS approach in different types industries. To complement the study and attempt to close the gaps, I aim to integrate current Product-Service System design, New Product Design and Service Design Methods into a new PSS method that can support both manufacturing and service companies in moving from traditional product- or service-focused solutions, to the design of integrated solutions; detail the process of user involvement as on form of co-creation in the PSS field and facilitate communication between stakeholders through tools able to support the collaboration process and definition of requirements for new solutions.



# Rita Rodriques

Nationality: Portuguese PhD in: Leaders for Technical Industries (LTI-EDAM) Starting year: 2012/2013 Institutional affiliation: Faculdade de Engenharia da Universidade do Porto

#### Thesis title:

### The user emotions and experience problem: Guidelines to support the development of new institutions centered on users' emotions and experiences

PhD Advisors: João Manuel R. S. Tavares (FEUP)

The aim of this project will be to study the user experience and emotions inside a specific institution, and see their relation with the layout and other physical elements of the institution (for example the signage and informational symbols).

After gathering information about the influence that these elements (layout, signage, etc) have in the overall experience of the user, a set of guidelines, based on the necessary improvements of these elements, will be created to act as a support for the development of new institutions.

By following the resulting guidelines, the developers will be able to avoid problems that exist in the current institutions and they will also be able to build the best environment in the institution that will lead to a better experience and better emotions felt by the users when using the services provided.



# 2013/2014



## Andreia Araújo

Nationality: Portuguese PhD in: Leaders for Technical Industries (LTI-EDAM) Starting year: 2013/2014 Institutional affiliation: Escola de Engenharia da Universidade do Minho

## Thesis title: Protein-based polyurethanes

PhD Advisors: Ana Vera Machado (UMinho); Bradley Olsen (MIT)

Polyurethanes (PUs) are one of the most pervasive engineering plastics in our society, finding widespread applications that include the construction and the automotive industries. The high toxicity of the PU monomers, fluctuations in oil prices, along with the increasing environmental concerns are leading the search for replacements to improve both safety and sustainability.

This work aims to take existing efforts on renewable PU in a new direction, engineering hard blocks from protein biomass, such as wheat gluten and soy protein, to enable fully-renewable PU formulations. A major scientific challenge is the high chemical diversity of the denatured crude protein, making control over the reactive pathway more difficult. The produced materials, in the form of coatings and bulk plastics, will be analysed using a full range of thermal, chemical and mechanical characterization techniques.



# **Carlos Gonçalves**

Nationality: Portuguese PhD in: Leaders for Technical Industries (LTI-EDAM) Starting year: 2013/2014 Institutional affiliation: Escola de Engenharia da Universidade do Minho Thesis title: Healthcare in sporting goods PhD Advisors: Ricardo Simões: Alexandre Ferreira da Silva

The goal of this thesis is develop a suit that can be used for healthcare monitoring during sports activity. For instance the aquatic sports as surf could bring many dangerous situations for the sportsman. Measuring the heart rate, blood pressure, body temperature and tracking the geographic position of the

sportsman would be an advantage preventing dangerous situations.



## **Carlos Teixeira**

Nationality: Portuguese PhD in: Leaders for Technical Industries (LTI-EDAM) Starting year: 2013/2014 Institutional affiliation: Escola de Engenharia da Universidade do Minho

#### Thesis title:

#### **Carbon nanotubes - From material to devices**

**PhD Advisors:** Luis Rocha (UMinho); Alexandre Silva (UMinho); Brian Wardle (NECSTLab - MIT)

Occasionally, new materials or processes emerge and lead to disruptive development cycles in terms of technology evolution. Over the last years, Carbon Nanotubes have been highlighted as the nanostructures that are almost performing the bridge between the materials and the devices. Still, it is not yet possible to find many devices able to take full advantage of the CNTs' properties, mainly at mechanical, thermal and electric level. This research work intends to evaluate this bridge between CNTs as a material and CNTs-based devices through the production of a CNT-based functional transducer. The main tasks include i) the synthesis of Aligned-CNTs forest with the proper monitoring and control of the growth process; ii) synthesis process parameterization study; ii) design and selection of the transducer to be used as case-study; iv) transducer fabrication; v) transducer characterization.



## **Duarte Dinis**

Nationality: Portuguese PhD in: Leaders for Technical Industries (LTI-EDAM) Starting year: 2013/2014 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

#### Thesis title:

### Optimal production planning and scheduling in an aircraft maintenance context

**PhD Advisors:** Ana Póvoa (IST); Abílio Costa e Silva (OGMA - Indústria Aeronáutica)

The aim of the PhD project is to optimize the decision process of an aircraft MRO company, regarding its production planning and scheduling activities, by developing a tool based on mathematical programming algorithms for scheduling of production orders and allocation of resources in an environment of uncertainty and finite resources. Moreover, calculations shall be conditioned by strategic, tactical, and operational directives of the company's structure.





### Thesis title:

## Composite high-pressure hydrogen storage vessels. Design through production.

PhD Advisors: Francisco Pires (FEUP)

## João Pedro Manaia

Nationality: Portuguese PhD in: Leaders for Technical Industries (LTI-EDAM) Starting year: 2013/2014 Institutional affiliation: Faculdade de Engenharia da Universidade do Porto My research is focused on product design and development, materials selection, numerical simulation and optimal design, manufacturing technologies, prototype and test, which will be explored taking into account social and economical aspects with regards to the entire product life.



#### Thesis title:

Study of design issues in dynamic energy transfer systems PhD Advisors: João Luiz Afonso (UMinho)

## Luiz Cardoso

Nationality: Brazilian PhD in: Leaders for Technical Industries (LTI-EDAM) Starting year: 2013/2014 Institutional affiliation: Escola de Engenharia da Universidade do Minho The research plan comprises the study of design issues in dynamic energy transfer systems, targeting electric mobility applications. Static energy transfer techniques by magnetic induction will be reviewed in a first phase, whereas experience with simulation tools will be acquired. In a second phase, the work will cover the proposition, optimization, validation by simulation, scale-down modeling, prototyping and experimental verification of newer design concepts and configurations eventually derived.



## Márcia Baptista

Nationality: Portuguese PhD in: Leaders for Technical Industries (LTI-EDAM) Starting year: 2013/2014 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa Thesis title: Data driven lifecycle cost modeling of jet engines PhD Advisors: Elsa Henriques (IST)

Estimating the lifecycle cost (LCC) of jet engines is particularly challenging due to large uncertainties in (1) manufacturing cost of complex parts and (2) maintenance costs because of the little knowledge of the stochastic processes characterizing the long-term deterioration of jet engines. Nonetheless, accurate LCC estimation methods are crucial to control the costs during the service phase and establish solid financial evaluation of new programs during the preliminary design phase. Whereas a jet engine manufacturer such as Rolls-Royce traditionally relied on analytical methods to estimate LCC, the large amounts of data acquired over the last 15 years from the production systems and from the fleet of engines in service allows the development of statistical methods to estimate LCC.



# Tlago Rebelo

Nationality: Portuguese PhD in: Leaders for Technical Industries (LTI-EDAM) Starting year: 2013/2014 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa Thesis title: To be defined PhD Advisors: To be defined





## **Vitor Anes**

Nationality: Portuguese PhD in: Leaders for Technical Industries (LTI-EDAM) Starting year: 2013/2014 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

# Thesis title:

# Structural health monitoring in composite materials

PhD Advisors: Luis Reis (IST)

Structural weight reduction has a strong effect in the Co2 reduction, this reduction started with the replacement of structural steels by structural lightweight metals and now composites materials tends to replace them in order to go further in the weight reduction. Despite their high strength, stiffness, and low density, composites can exhibit complex types of damages. Recent researches indicate that these type of damages can not be fully characterized using the typical tools used in steels, thus it is required a new approach to fully capture their fatigue damage. This research aims to obtain fatigue models and damage accumulation models that captures fatigue damage in composites in order to be used in structural health monitoring. At the end, the research outcomes will be used in the design of composite structures and in monitoring of their residual fatigue life.
# Alumni Doctoral Programs



# Alexandre Ferreira da Silva

2011

Invited Professor/University of Minho

PhD in: Leaders for Technical Industries (LTI-EDAM)Year of graduation: 2011Institutional affiliation: Escola de Engenharia da Universidade do Minho

### Thesis title:

### PVC Smart-Foil based on Fiber Bragg Grating Sensors

**PhD Advisors:** José Higino Correia (UMinho); Paulo Mateus Mendes (UMinho)

How has MPP contributed to your career development? It changed my line of thought, making it bold and visionary.



## Helena Fernandez

R&D Director,eHealth Area at GRADIANT, Spain

PhD in: Leaders for Technical Industries (LTI-EDAM)Year of graduation: 2011Institutional affiliation: Escola de Engenharia da Universidade do Minho

### Thesis title:

# Remote vital signs monitoring based on wireless sensor networks

**PhD Advisors:** José Higino Correia (UMinho); Ricardo Simões (Instituto Politécnico do Cávado e do Ave); José Afonso (UMinho)



# Sérgio Tavares

Senior Researcher INEGI, Portugal; Co-Founder / CEO Flicks Systems, Portugal

PhD in: Leaders for Technical Industries (LTI-EDAM) Year of graduation: 2011 Institutional affiliation: Faculdade de Engenharia da Universidade do Porto

### Thesis title:

### Design and Advanced Manufacturing of Aircraft Structures using Friction Stir Welding

**PhD Advisors:** Paulo de Castro (FEUP); Pedro Vilaça (IST); Thomas Eagar (MIT); J. dos Santos (HZG, Germany); M. Pachione (Airbus, Germany)

# Alumni Doctoral Programs



2012

### Thesis title:

### A Framework to Analyse and Improve Engineering Processes

PhD Advisors: Elsa Henriques (IST); Daniel Whitney (MIT)

## **Carla Pepe**

Chief of Sub-system for Structures & Transmissions at Rolls-Royce, United kingdom

PhD in: Leaders for Technical Industries (LTI-EDAM) Year of graduation: 2012 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa



## Ivo Ferreira

Space System Engineer

PhD in: Leaders for Technical Industries (LTI-EDAM)
Sub area: Automotive; Aeronautics
Year of graduation: 2012
Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

### Thesis title:

### Enhancing the conceptual design phase of complex engineering systems with a n integrated methodology and support tools

PhD Advisors: Paulo Gil (IST); Olivier de Weck (MIT)





### Thesis title:

# Techno economic evaluation in materials selection for multiple parts under OEM-Tier relations.

PhD Advisors: Arlindo Silva (IST); Elsa Henriques (IST)

## **Marco Leite**

Assistant Professor / Instituto Superior Técnico da Universidade de Lisboa - Portugal

**PhD in:** Leaders for Technical Industries (LTI-EDAM) **Sub area:** Integrated Cost and Life Cycle considerations in EDAM

Year of graduation: 2012 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

### How has MPP contributed to your career development?

I am currently a Lecturer in the Mechanical Engineering department at Instituto Superior Técnico and an Invited Lecturer in Product Development at ISCTE Business School. My research is focused in 3 main areas: Materials and Technology Selection, Product Development and Innovation Management and Additive Manufacturing, major topics in the EDAM focus area.



## **Pedro Marques**

Universidade Lusofona

PhD in: Leaders for Technical Industries (LTI-EDAM) Year of graduation: 2012 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

### Thesis title:

### **Creativity in product development**

**PhD Advisors:** Arlindo Silva (IST); Elsa Henriques (IST); Chris Magee (IST)



### Thesis title:

### Designing the travel experience: identification and incorporation of passengers' experience requirements in new bus body development

**PhD Advisors:** Lia Patrício (FEUP); Renato Natal (FEUP); Chris Magee (MIT)

## **Rui Carreira**

Senior Researcher/ Faculdade de Engenharia da Universidade do Porto

PhD in: Leaders for Technical Industries (LTI-EDAM)
Sub area: Automotive; Aeronautics
Year of graduation: 2012
Institutional affiliation: Faculdade de Engenharia da Universidade do Porto

### How has MPP contributed to your career development?

The most relevant contribution that MPP has given me was the opportunity to learn from and with engineering design experts, in order to be able to understand the customer experience with products or services and afterwards to incorporate it into complex product-service system development.

# Alumni Doctoral Programs

2013



### Thesis title:

### From Tooling Design to Tools Life Cycle Design: Shifting the Paradigm

**PhD Advisors:** Paulo Peças (IST); Elsa Henriques (IST); António Pontes (UMinho); Rich Roth (MIT)

# Inês Ribeiro

PhD in: Leaders for Technical Industries (LTI-EDAM) Year of graduation: 2013 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa



## Isa Santos

PhD in: Leaders for Technical Industries (LTI-EDAM)
Sub area: Medical Devices and Micromanufacturing
Year of graduation: 2013
Institutional affiliation: Faculdade de Engenharia da
Universidade do Porto

### Thesis title:

# Product development methodologies: the case of medical devices

**PhD Advisors:** Luís Alexandre Machado da Rocha (UMinho); João Manuel Ribeiro da Silva Tavares (FEUP)

# 13

111



### Thesis title:

Mobi-System: Towards an Information System to Support Sustainable Mobility with Electric Vehicle Integration

PhD Advisors: Joao Afonso (UMinho); Alberto Silva (IST)

## João Ferreira

Professor Adjunto at ISEL-Lisbon, Portugal

PhD in: Leaders for Technical Industries (LTI-EDAM)
Sub area: Sustainable Solutions
Year of graduation: 2013
Institutional affiliation: Escola de Engenharia da Universidade do Minho

How has MPP contributed to your career development? Not at all.



# Lia Coelho de Oliveira

**PhD in:** Leaders for Technical Industries (LTI-EDAM) **Year of graduation:** 2013 **Institutional affiliation:** Faculdade de Engenharia da Universidade do Porto

### Thesis title:

# Dealing with uncertainty in supply chain design in the automotive industry

**PhD Advisors:** Jorge Manuel Pinho de Sousa (FEUP); João Alberto Vieira de Campos Pereira Claro (FEUP)





### Thesis title:

### Fracture Characterization of Composite Bonded Joints Under Fatigue Loading

PhD Advisors: Marcelo Moura (FEUP); Lucas Silva (FEUP)

## Maria Victoria Castro Fernandez

**PhD in:** Leaders for Technical Industries (LTI-EDAM) **Year of graduation:** 2013 **Institutional affiliation:** Faculdade de Engenharia da Universidade do Porto



### Thesis title:

# Sustainable automotive components for interior door trims

**PhD Advisors:** José Esteves (FEUP); Júlio Viana (UMinho); Satyabratha Ghosh (UMinho)

## Nuno Calçada Loureiro

Professor Adjunto - Coordenador de Curso / Instituto Superior de entre Douro e Vouga - Portugal

PhD in: Leaders for Technical Industries (LTI-EDAM)
Sub area: Sustainable Solutions
Year of graduation: 2013
Institutional affiliation: Faculdade de Engenharia da Universidade do Porto

### How has MPP contributed to your career development?

The MPP presents a Ph.D. course focus on R&D with industrial partners and in Management and Product Development tools. Combining this new skills wih the Ph.D. diploma I've been able to present a different and interesting profile that ISVOUGA was looking for: A Ph.D. Graduate with knowledge in Product deveploment, management and at the same time experience on working in R&D with industrial partners.



# **Raquel Folgado**

Operations Trainee, Philip Morris International, Germany

PhD in: Leaders for Technical Industries (LTI-EDAM) Year of graduation: 2013 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

### Thesis title:

### Eterogeneity and Variability on Human-Centered Assembly Systems

**PhD Advisors:** Elsa Maria Pires Henriques (IST); Paulo Miguel Nogueira Peças (IST)



# Rui Rocha

Post-doc UM-Bosch, Project "HMIEXCEL – Critical R&D about the development cycle and advanced multimedia solutions production para automobiles"

PhD in: Leaders for Technical Industries (LTI-EDAM)
Sub area: Medical Devices and Micromanufacturing
Year of graduation: 2013
Institutional affiliation: Escola de Engenharia da Universidade do Minho

# Thesis title:

### **Microlenses for Optical Microsystems**

**PhD Advisors:** José Higino Correia (UMinho); João Paulo Carmo (UMinho)



## Alumni Doctoral Programs

2014



### Thesis title:

# Single line for assembly just-in-sequence multiple models

PhD Advisors: Valério Carvalho (UMinho); Ana Póvoa (IST/UTL)

# Cláudia Duarte

Continuous improvement projects manager/ Hospital de Braga - Portugal

PhD in: Leaders for Technical Industries (LTI-EDAM)Year of graduation: 2014Institutional affiliation: Escola de Engenharia da Universidade do Minho

### How has MPP contributed to your career development?

The MPP contributed to the development of skills as leadership, communication, innovation, and interpersonal skills that are all fundamental requirements of the jobs of today and tomorrow.



### Thesis title:

# Development of an Integrated Framework for the definition of Technology Strategies

PhD Advisors: Madalena Araújo (University of Minho); Nuno Correia (INEGI)

# **Cláudio Santos**

Researcher/INEGI - Portugal

PhD in: Leaders for Technical Industries (LTI-EDAM) Year of graduation: 2014 Institutional affiliation: Escola de Engenharia da Universidade do Minho

### How has MPP contributed to your career development?

It is really too soon for me, since I recently graduated. Notwithstanding this, I believe that key contribution of the MPP for my carreer is mainly related to the development of multidisciplinary skills and in infusing a management perspective over engineering projects.



## **Michael Donauer**

Management Consultant / Kemény Boehme & Company / Germany

PhD in: Leaders for Technical Industries (LTI-EDAM)
Sub area: Automotive; Aeronautics
Year of graduation: 2014
Institutional affiliation: Faculdade de Engenharia da Universidade do Porto

### Thesis title:

### Identification of cost effective inspection strategies by means of tailored quality tools, cost modeling and simulation

**PhD Advisors:** Américo Azevedo (FEUP); Paulo Peças (IST); Richard Roth (MIT)

### How has MPP contributed to your career development?

MPP enabled me to explore problems scientifically that companies face in manufacturing. I extended the scientific knowledge by publishing articles. It prepared me to my industrial career in 3 ways. 1) I developed skills as a scientist 2) During the collaboration with a company I understood how to communicate with workers & managers to address identified problems & proposed scientifically analyzed solutions 3) I improved my Engl skills and learned Portuguese. As a Management Consultant I'm engaged in projects with clients of the autom.industry. To compete in global markets we help them developing products of higher quality.The sc.knowledge in quality management and the ind. experiences I gained were distinguishing features for my job entry. Good commands of languages may be key to my future career.



# Training the Leaders of the Future Sustainable Energy Systems



# A scope of the doctoral program including a typical / desired student profile

The Sustainable Energy Systems (SES) PhD program was initiated in 2007. Since its inception, this program has received approximately 915 applications, an average of 130 applications per year. The SES doctoral program has admitted 193 students, and 39 have already graduated. Between 2007 and 2012, participants in the SES program reported production of 37 books, more than 300 papers in international journals, more than 400 communications in international meetings, and several patents. SES PhD graduates are employed at international research centers (JRC, UFRJ Brasil, Business School's Energy Centre University of Auckland New Zealand, Chalmers University), Portuguese research centers (INESC TEC, LARSYS), and companies (Tractebel Belgium, REN-Portuguese TSO, EFACEC and ISA in Portugal).

One of the keys to the success of the PhD program has been the highly collaborative association among Portuguese universities and MIT. This has promoted not only educational and scientific connections between universities and companies, but activities fostering entrepreneurship. Some of the students own or are employed by start-up companies they founded, in many cases with their PhD supervisors (SDSIL at UL and PRE-WIND at UP and UL, WATT-IS and URBMET at UTL, SMARTWATT at UP and WSBP Electronics at UC).

The study of SES involves a complex framework characterized by multiple time and spatial scales, from the global/international level down to the sub-national level of supply and demand. Action should be fostered by different policy instruments based on solid knowledge in multiple fields, including: economics, social science, environment, technology, policy, and systems design.

A key goal of the program is a multidisciplinary approach to understanding and managing complex, large-scale, socio-technical systems through use of systems engineering and design. Graduate-level training in SES should prepare students to:

- Foster technology integration of SES so energy demand is fulfilled with a minimum use of non-renewable resources.
- Establish markets for new technology, clarify the role of industrial and government policy in directing pathways to future sustainability, and serve as agents of change, with an understanding of the important role of entrepreneurship.
- **Develop innovative control, and management solutions** for electricity systems, under the Smart Grid concept, involving the participation of all players with a large inte gration of information and communications technology (ICT) solutions.

• Promote new forms of interaction among universities, enterprises, governement, and society for the identification and implementation of sustainable energy policies and technology innovations.

Devising strategies to cost-effectively meet SES challenges requires new energy methodologies that capture the dynamics and drivers of energy demand, including consumer behavior, energy resources (especially renewable resources), and the networks that connect the two. With these challenges in mind, the SES PhD program provides innovative research and education to develop advanced solutions.

Improving the flexibility of the energy sector and its long-term performance will require new methods and policies. Engagement with industry and governmental agencies on specific projects will support such change, while also addressing climate change and energy security concerns. To achieve this, the doctoral program focuses on energy systems within a multidisciplinary framework, including engineering and economics, at the level of energy systems analysis, ICT, and design.

The overall goal of the SES PhD program is to use a multi-disciplinary approach to educate a new generation of leaders with expertise in energy systems and policy. A focus on energy system research, design, and analysis, as well as leadership and entrepreneurship, provides graduates with the tools to be at the forefront of SES development. Graduates who have these advanced capabilities in sustainable energy will contribute to Portugal's competitiveness and innovation capacity, supporting growth of the Portuguese economy.

The target population consists of young researchers holding a master's degree or a four/fiveyear pre-Bologna degree, with an excellent academic record in engineering, computer science, physics, architecture, economics or management. Professionals with excellent academic records and specific research objectives may also be considered. Candidates must be highly motivated to conduct research activities in one of the broadly defined research areas (energy planning and policy, sustainable built environment, and smart energy networks), and should demonstrate strong skills in communication, leadership, and entrepreneurship.

The SES program has so far received students from five continents and 70 countries, and remains open to excellent students regardless of their geographical origin. The program is taught entirely in English. It has attracted students from Portuguese and non-Portuguese speaking countries, such as the USA, Germany, and China. All the host universities have international student offices dedicated to facilitating the integration of students from abroad.

## Curriculum

The SES PhD Program has the following curricular structure:

### YEAR 1:

Mandatory curricular units (CUs) totaling 30 European Credit Transfer and Accumulation System (ECTS) credits plus 30 credits in elective CUs chosen from those offered by the partner institutions. The mandatory CUs provide the backbone of the curriculum, within which students can design their own specialization preferences. All students gain a common background on sustainability, energy systems, and environmental issues. They also acquire the tools necessary for developing applied research that leads to innovative products and services. Courses on innovation and entrepreneurship and research methodologies are provided as intensives over two weeks in events where students from all four PhD programs are together at the same location.





The 30 mandatory credits are distributed as follows:

- In the Research Methodologies course (6 credits) students get acquainted with the main paradigms and methodologies of research, encouraging a critical analysis of their use. They are also introduced to the steps involved in planning, conducting, and publishing research work.
- In the Thesis Project course (12 credits) students select their potential PhD topic and develop, with faculty supervision, a credible research path for it, defining the scope, objectives and methodology. In parallel they participate in invited lectures and workshops involving more advanced students, faculty and industry. By the end of Year 1, the research proposal will be discussed and assessed.

- In the Innovation and Entrepreneurship course (6 credits) students learn the process of generating and transforming a vague business idea into an organizational entity, how to manage teams in innovation processes, and how to make innovation more effective, improving its probability of success.
- In the Energy Environment and Sustainability course (6 credits) students internalize th concept(s) of sustainability in its multiple facets, especially relating to energy. Challenges prospective solutions, policy options, and current trends are addressed, establishing common background and comprehensive view of the research themes addressed in th program.

The 30 elective credits are obtained by taking type A or type B courses. Each CU is 6 credits.

Type A elective courses are co-hosted by different institutions that have the same program, the sam type of evaluation; they benefit from videoconference interaction when needed. Faculty member from different schools participate in the lectures and in student evaluations. These CUs includ Energy Planning, Energy Demand Management, Energy in Buildings, and Renewable Resource and Energy Conversion.

Type B elective courses are hosted by only one of the institutions, taking advantage of its particula competencies. These courses are available to any student in any of the institutions and include Electric Power Systems, Wind Energy, Photovoltaic Technologies, Smart Grids, Energy System-Integration, Energy Efficiency, Energy in Transports, Energy Systems Optimization, Project Management, Risk Management, Decision Analysis, Industrial Ecology, Energy Markets and Regulation, Environmental Economics.

### **YEARS 2-4:**

PhD thesis preparation (180 credits). During this period, each student may optionally extend training by taking elective CUs offered by any partner institution. These CUs will be listed in a diploma supplement.

Students choose their elective CUs under the guidance of their thesis supervisors and the program director. Individual study plans ensure that students can obtain the specific knowledge needed to develop their work and the complement to their original background (engineering, science, architecture, economics, or other). Students profit from the rich multidisciplinary offerings of the partner institutions, providing them the flexibility needed to build a curriculum tailored to their needs and aspirations.



## Main research topics and synergies

**Energy Planning including Economics:** This research area is built upon energy and environmental values and economic domains at the level of energy systems analysis and design. This area provides a modeling framework to support a national effort on sustainable energy systems planning and forecasting. The framework takes into account factors such as the dynamics of energy demand, local and regional renewable energy resources, and the impact of cogeneration on the supply of electricity.

**Sustainable Built Environment:** This research area is focused on the development of a spatially comprehensive and temporally broad physical accounting of resource consumption in urban centers. Of particular interest are the resource consumption characteristics between cities of distinct characteristics such as geography and topography, economic base, and social and demographic composition. A special emphasis will be given to analyzing the energy consumption in buildings and to provide new and innovative solutions to promote the concept of "Sustainable Buildings."

**Smart Energy Networks:** This area involves the topics focused on the new paradigm of the development of electric power systems characterized by large-scale integration of distributed/ renewable energy resources and large-scale consumer engagement (e.g. demand efficiency, demand control, microgeneration, and interaction through smart metering). Research in this area is focused on active management of distribution grids, dispersed generation, storage and end-users (through responsive loads and consumers) in local and regional areas in order to improve system operating conditions and improve local reliability.

The SES area of the MIT Portugal Program hosts many of excellence teams in these research areas; the first phase of the program has demonstrated how their cooperation produces important synergies.

The analysis of the complementarity and synergies of the different teams can be based on their contribution to three main research areas (see "Affiliated Institutions," below for a list of institutions):

- i) Energy Planning including Economics: Energy Planning–National and EU (UP, UL IST/ISEG); Energy Planning–Local and Regional (MIT, UL IST/ISEG); End-Use Energy Demand (UC, MIT, UP, UL IST/ISEG); Renewable Resources: Wind (MIT, UP, UL FCUL); Solar (MIT, UL FCUL); Biofuels (UC); Wave Energy (UL IST/ISEG); Energy Technologies (MIT, UC, UL FCUL, UL IST/ISEG, UP); Emissions Markets (MIT, UC); Energy Markets (MIT, UC); Market Regulation (MIT, UL IST/ISEG); Economics (UC, UL IST/ISEG); Risk Management (UL IST/ISEG).
- ii) Sustainable Built Environment: Buildings Technology (MIT, UC, UP, UL IST/ISEG); Energy in Buildings (UC, UL - FCUL, UP); Urban Studies (UC, MIT, UL - IST/ISEG); Mi crogeneration (UC, MIT, UL - FCUL, UP); Urban Metabolism (MIT, UL - IST/ISEG); Stor age and Electrical Vehicles (UC, UP); Distributed Energy Resources Modeling (UL -IST/ISEG).

iii) Smart Energy Networks: Management of large scale grid integration of renewable sources (UL - FCUL, UP); Smart Grids in Grid Planning and Expansion (MIT, UP); Smart Grids and Vehicle Transportation (UP, UL - IST/ISEG); Smart Energy Demand (the Energy Box) (MIT, UC, UL - IST/ISEG, UP).

Collaboration is not merely theoretical. The first phase of the program produced many examples of collaboration between institutions. For example, co-supervision of students was required between UP and UL - IST/ISEG, UP and UC, UL - IST/ISEG and UC, UL - FCUL and UL - IST/ ISEG, and MIT. MIT faculty has also been involved in supervision and co-supervision. In addition, virtually every thesis committee includes faculty from MIT and from participating Portuguese universities other than the one where the student is officially registered.

Cooperation between universities' teams also has been demonstrated in joint research publications and joint research projects, such as "Power demand estimation and power system impacts resulting of fleet penetration of electric/plug-in vehicles" and "Net Zero Energy School Reaching the community." In a third level of synergies, the institutions co-teach courses on topic of their mutual expertise.

### Affiliated Institutions (Universities and Companies)

The consortium includes three of the main Portuguese universities and the Massachusett Institute of Technology. The key faculty members at the three Portuguese universities are affiliate with eight R&D institutes that provide an ideal research environment for the PhD students. As result, there are 12 institutions involved in the program:

### University of Porto (UP)

School of Engineering (FEUP)

### University of Lisbon (UL)

Faculty of Sciences (FCUL); School of Engineering (IST); School of Economics and Management (ISEG)

### University of Coimbra (UC)

Faculty of Economics (FE) and the Faculty of Science and Technology (FCT)

### Massachusetts Institute of Technology (MIT)

### **Participating R&D institutes**

INESC-TEC (UP), LAETA (UP, UL - IST, UC), LARSYS (UL - FCUL, UL - IST), INESC Coimbra (UC), CICC (UC), SESUL (UL - FCUL), IDL (UL - FCUL) and CESA (UL - ISEG)



# 2007 / 2008

# Raquel Segurado Silva

Nationality: Portuguese PhD in: Sustainable Energy Systems (SES) Starting year: 2007/2008 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

### Thesis title:

### Energy planning for increasing the penetration of renewable energy resources in isolated regions energy supply

**PhD Advisors:** Mário Costa (IST); Neven Duic (University of Zagreb); Maria da Graça Carvalho (IST)

Concerning energy production, most islands depend mainly on the importation of fossil fuels. On the other hand, islands present generally, a considerable potential in renewable energies (wind, solar, waves, among others). Several initiatives have been carried out in some islands, mostly in Europe, for the exploitation of this potential in the production of electricity and water, the last one being another resource that is usually very scarce in islands. The present work intents to develop a methodology for the optimization of the penetration of renewable energies in isolated energy systems, with emphasis for islands and remote regions, based on the H2RES model, adding the necessary modules, and an economic analysis of the modeled scenarios.



# **Gonçalo Mendes**

Nationality: Portuguese PhD in: Sustainable Energy Systems (SES) Starting year: 2008/2009 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

### Thesis title:

### Microgrids as key for energy efficiency: A multi-country investigation of community-scale power systems' adoption patterns under different demand, climate and regulatory characteristics

**PhD Advisors:** Paulo Ferrão (IST); Chris Marnay (Lawrence Berkeley National Laboratory); Christos loakimidis (Deusto Institute of Technology)

The research, in cooperation with the Lawrence Berkeley National Laboratory from the University of California, Berkeley, addresses the economic optimization of community-scale microgrids Distributed Energy Resources (DER) generation mix in case-studies of Portugal, the U.S. and Japan. The approach is customer-centered and intents to provide valuable insights to political decision makers, legislators and urban planners, on which directions to take in the design of modern cities, accommodating the new distributed energy paradigm.



# Pedro Fazenda

Nationality: Portuguese PhD in: Sustainable Energy Systems (SES) Starting year: 2008/2009 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

### Thesis title:

# Energy efficiency monitoring and management to promote sustainable behaviors

**PhD Advisors:** Pedro Manuel Urbano de Almeida Lima (ISR, IST, UTL); Una-May O'Reilly (CSAIL, MIT)

Smart buildings are expected to extend beyond just simple automation to include advanced automatic management systems capable of interacting in real-time. This research focuses on of enhancing the heating, ventilation and air conditioning system. Considering that tenants tend to forget to adjust the operation of this system appropriately and that, in many spaces, the conditioning requirements are not adjusted to the context of those spaces, the result is unnecessary energy waste. An optimal supervisory control for such a system should consider the cost of energy, activity schedules, occupancy patterns, the individual preference of each user, and any other information that might contribute to increase performance. The result will be an adaptive controller that learns the statistical regularities of the environment and operates to meet comfort requirements, while optimizing energy costs.



# Sérgio Casimiro

Nationality: Portuguese PhD in: Sustainable Energy Systems (SES) Starting year: 2008/2009 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

### Thesis title:

### The pairing of CSP and desalination: Technico-economic feasibility analysis

PhD Advisors: Paulo Ferrão (IST); Christos Ioakimidis (Krea Energía s.l.)

The research work is focused on the technical-economic feasibility analysis of simultaneous production of clean water and electricity using Concentrating Solar Thermal (CSP) plants coupled with Desalination units (CSP+D). The main goal is to obtain a tool that allows a first analysis on such type of investments. A tool was created based on the System Advisor Model (SAM) developed by the National Renewable Energy Laboratory (NREL) to simulate the operation of CSP plants. Several desalination models were added to SAM, improving the existing code, and allowing the simulation of a cogeneration scheme of CSP+D. The research also includes the analysis of case studies to understand where it makes sense to use CSP+D, and for each case which desalination technology should be used, namely Multi-Effect Distillation (MED) or Reverse Osmosis (RO).

### Thesis title:

# Thermal energy storage control for space conditioning systems based on ground source heat pump

PhD Advisors: Aníbal De Almeida (ISR - University of Coimbra)

The main goal of this research is to analyze the feasibility and to optimize the coefficient of performance of a latent heat storage system coupled to a ground source heat pump and evaluate their potential for better management of the load profile and large-scale integration of intermittent renewable energy sources. This research proposal is integrated within the European Project from FP7 – Ground-Med. The work consist of several steps including: selection of phase change material (PCM), design of the storage system, definition of the algorithm control and installation of the control system, experimental tests in order to optimize the system operation and evaluation of technical and economic performance.

# Anabela Carvalho

Nationality: Portuguese PhD in: Sustainable Energy Systems (SES) Starting year: 2009/2010 Institutional affiliation: Faculdade de Ciências e Tecnologia da Universidade de Coimbra

# Diana Neves

Nationality: Portuguese PhD in: Sustainable Energy Systems (SES) Starting year: 2009/2010 Institutional affiliation: Faculdade de Ciências da Universidade de Lisboa

### Thesis title:

# Thermal storage in isolated minigrids to optimize renewable integration

PhD Advisors: Carlos Santos Silva (IST-UL); António Vallera (FC-UL)

Evaluate if thermal storage by hot water solar systems, can be used to integrate more renewable resources on isolated mini grids, and which decisions of energy management and demand response, optimize best the electric dispatch and operation costs. Corvo island, in Azores is used as a case-study, and integrates the project Green Islands.









# Helena Monteiro

Nationality: Portuguese PhD in: Sustainable Energy Systems (SES) Starting year: 2009/2010 Institutional affiliation: Faculdade de Ciências e Tecnologia da Universidade de Coimbra

### Thesis title:

# Extended life cycle assessment of single-family houses in the Mediterranean climate

PhD Advisors: Fausto Freire (UC); John Fernandez (MIT)

This research goal is to support the development of single-family houses in a Mediterranean climate, considering a life cycle (LC) perspective in order to avoid problem-shifting, and it has two objectives: 1) to comparatively assess LC energy and environmental impacts of different passive construction measures for a house; 2) to assess the influence of alternative Portuguese locations and expand the conclusions to a Mediterranean context. A LC model has been implemented for a house including 3 LC phases: construction, maintenance, operational (heating and cooling). An integrated life-cycle assessment and building dynamic simulation of the dwelling has been performed in order to assess passive construction measures, such as: the envelope insulation level, the total ventilation rates, the use of single or double glazing, and the influence of different exterior wall solutions.



# João Santos

Nationality: Portuguese PhD in: Sustainable Energy Systems (SES) Starting year: 2009/2010 Institutional affiliation: Faculdade de Ciências e Tecnologia da Universidade de Coimbra

### Thesis title:

### Determination of the role of electricity storage on Zero Energy Houses connected to the grid and development of electricity management schemes

PhD Advisors: Aníbal Almeida (DEEC-UC); Pedro Moura (DEEC-UC)

An assessment of the electricity storage capacity role considering it management together with the demand and the generation in order to achieve maximum electrical efficiency. This will have a local impact but can also influence on the grid. A characterization of the demand and generation profile of the house must be done allowing evaluating the role and benefits of the storage capacity. Then the way of managing the electricity in the house will be focused for optimizing the utilization of the capacities of generation and storage to satisfy the demand from the house and from the grid. Some schemes will be considered for the electricity management addressing distinct objectives and algorithms will be developed to implement these schemes.



### Thesis title:

# Provision of advanced ancillary services through demand side integration

PhD Advisors: Manuel Matos (FEUP); João Peças Lopes (FEUP)

## **Miguel Heleno**

Nationality: Portuguese PhD in: Sustainable Energy Systems (SES) Starting year: 2009/2010 Institutional affiliation: Faculdade de Engenharia da Universidade do Porto In the context of Smart Grids, the intermittence of renewable sources requires new ancillary services. This thesis aims at developing a technical framework on the provision of electricity reserve services through Demand Response (DR) strategies. Methods to quantify the potential of the domestic appliances to provide upward and downward reserve to the system are developed and the market and regulation aspects of DR are discussed.

#### Thesis title:

Moorings of floating wave energy converters in arrays

PhD Advisors: António Falcão (IST); Luís Gato (IST)

## **Pedro Vicente**

Nationality: Portuguese PhD in: Sustainable Energy Systems (SES) Starting year: 2009/2010 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa Developing research work on hydrodynamics of arrays of floating point-absorber wave energy converters. Research work involves mathematical/numerical modeling and laboratory testing of innovative array configurations of wave energy devices. Emphasis is given on theoretical and numerical modeling of the wave device hydrodynamic interaction, to the operation of the power absorption mechanism, to the hydrodynamic interference between devices within an array and finally, to the influence of the mooring system in the devices operation, either isolated or inserter within an array.



# Vasco Portugal

Nationality: Portuguese PhD in: Sustainable Energy Systems (SES) Starting year: 2009/2010 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

### Thesis title:

# Computational framework to generate and optimize the built environment

**PhD Advisors:** Manuel Correia Guedes (IST); Kent Larson (MIT Media Lab); Mark Goulthorpe (MIT)

The next generation of Computer Aided Design (CAD) software must add a certain degree of intelligence and information, comprising a number of procedures from parametric to generative strategies, simulation, optimization and information modeling. This thesis shapes a new computational strategy for a broader methodology to develop buildings. It outlines a framework to generate Built Environment (BE) proposing a Building Information Modeling (BIM) cloud-based interface that enables a fully parametric visual programming CAD environment to facilitate assorted information exchange and systematize the process of simulating, optimizing and manufacturing BE. The proposed framework allows the integration of mathematical optimization while allowing the necessary exploration of subjective decisions for design purposes.

## 2010/2011



## Thesis title:

### Electricity market modeling with electric vehicles

**PhD Advisors:** João Peças Lopes (University of Porto); Mauro Rosa (INESC Brazil); Frances Sprei (Chalemrs University of Technology, Sweden)

# Ahmad Karnama

Nationality: Iranian PhD in: Sustainable Energy Systems (SES) Starting year: 2010/2011 Institutional affiliation: Faculdade de Engenharia da Universidade do Porto The thesis aims to address the problem of large scale deployment of Electric Vehicles (EVs) from an electricity market perspective. An agent-based model for electricity market with EVs (called EMMEV) is developed.

The agents are ESCos (Energy Service Companies) and it is assumed that the ESCos in EMMEV can provide at least one of the following energy solutions; power generation, electricity retailing and EV aggregation.



# Ana Soares

Nationality: Portuguese PhD in: Sustainable Energy Systems (SES) Starting year: 2010/2011 Institutional affiliation: Faculdade de Ciências e Tecnologia da Universidade de Coimbra

### Thesis title:

# Real-time integrated management of residential energy resources (Energy Box)

**PhD Advisors:** Carlos Henggeler Antunes (University of Coimbra/INESC Coimbra); Alvaro Gomes (University of Coimbra/INESC Coimbra)

The goal of the research is to design a methodology to be implemented in an energy management system for controlling domestic energy resources in a smart grid scenario, considering different input signals and sources of uncertainty to obtain robust decisions. Domestic energy resources comprise typical manageable loads, plug-in electric vehicles, storage and micro-generation systems. The management strategy must consist of local energy monitoring and load control algorithms assuring the quality of the energy service provided and end-user's comfort requirements/preferences to minimize the electricity bill while minimizing the discomfort associated with the management of the several loads. Adequate models are used to reproduce the consumption of each one of the manageable loads and an evolutionary strategy is used in the decision process.



# Andreia Carreiro

Nationality: Portuguese PhD in: Sustainable Energy Systems (SES) Starting year: 2010/2011 Institutional affiliation: Faculdade de Ciências e Tecnologia da Universidade de Coimbra

# Thesis title: The role of an energy box aggregator

PhD Advisors: Carlos Henggeler Antunes (INESCC); Humberto Jorge (INESCC)

The increased penetration of renewable generation in the electric power system has been leading to a higher complexity of grid management due to its inherent intermittency, also with impact on the volatility of electricity prices. Setting the adequate operating reserve levels is one of the main concerns of the System Operator (SO), since the integration of a large share of intermittent generation requires an increased amount of reserve that is needed to balance generation and load. An aggregator has been designed to operate as an intermediary between individual energy management systems (local energy boxes - LEB) and the SO/Energy Market (EM) capable of facilitating a load follows supply strategy in a Smart Grid context.



# Catarina Rolim

Nationality: Portuguese PhD in: Sustainable Energy Systems (SES) Starting year: 2010/2011 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

### Thesis title:

### Impacts of adopting on board ICT and training on driving behaviour, safety, energy and environment: Application to light duty vehicles and buses

**PhD Advisors:** Tiago Farias (IST); Yoram Shiftan (Technion - Israel Institute of Technology)

This thesis research aims at characterizing driving patterns and driving behaviour considering dynamics, safety and comfort, which will allow obtaining a general overview of driving patterns and driving behaviour considering drivers personal characteristics like age, gender, driving experience. Another objective is to quantify and assess the impacts of ICT, like on-board monitoring devices, and feedback on driving behaviour, safety and environmental performance, specifically on energy consumption and pollutants emissions.



## **Gonçalo Pereira**

Nationality: Portuguese PhD in: Sustainable Energy Systems (SES) Starting year: 2010/2011 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

### Thesis title:

# Energy consumption in the residential sector, a portuguese case study

PhD Advisors: Carlos Silva (IST); Susana Vieira (IST)

The research questions addressed in this thesis are: Can we predict energy consumption with a given set of features (from surveys, environment parameters, past consumption, etc.)? And if so, what is the impact of demand-side management (using energy storage, feedback, etc.) on energy performance classification? Given the implementation of smart-meters in the residential sector, how can building energy performance classification be improved by the influx of new and more detailed consumption data, reducing the performance gap?

Can we create a performance classification based on consumption data? Is a unified performance classification of both building envelope and inhabitants (behavior) possible? What are the possible applications, advantages, behavior or policy impacts?

### Thesis title:

### Socio-economic-environmental assessment of commuting

PhD Advisors: Pedro Ramos (FEUC); Luis Cruz (FEUC)

Urban population has been growing consistently worldwide, with large metropolitan areas experiencing persistent expansion phenomena. Unsurprisingly these processes are not occurring homogeneously throughout the territories. Over the last decade, population in suburbs has largely increased while the population living in Central Business Districts has shrunk in many large European and American cities. Portugal is not an exception.

The main aim of this work is to establish a modelling framework suitable for the regional and national assessment of economic, social and environmental impacts of changes in urban forms and commuting patterns.

Accordingly, this research proposes the construction of a commuting satellite account embedded in a Multi-Regional Input-Output framework.

# João Ferreira

Nationality: Portuguese PhD in: Sustainable Energy Systems (SES) Starting year: 2010/2011 Institutional affiliation: Faculdade de Economia da Universidade de Coimbra 133





## Mariana Pereira

Nationality: Portuguese PhD in: Sustainable Energy Systems (SES) Starting year: 2010/2011 Institutional affiliation: Faculdade de Engenharia da Universidade do Porto

### Thesis title:

# The thermal assessment of the architectural design of housing for portugal

**PhD Advisors:** Eduardo Oliveira Fernandes (FEUP); Manuel Arriaga Brito Correia Guedes (IST-UTL)

The research aims to define the order of merit or of design priority of the architectural and construction parameters that have more influence in the thermal behavior of housing in Portugal and to develop a straightforward tool to be used in the very beginning of the architectural building design.

### Thesis title:

# Modelling energy behaviours in buildings towards energy efficiency

**PhD Advisors:** Carlos Henggeler Antunes (FCT-UC; INESC Coimbra); Nelson Martins (Universidade de Aveiro)

Energy behaviours represent a significant untapped potential for end-use energy efficiency in buildings and are deemed to play an increasingly relevant role during the ongoing transformation of electric grids into smart(er) grids.

This PhD research aims to develop a behavioral modelling approach that will enable to quantify behavioral energy savings and foresee behavioral changes when transitioning to smart(er) grids. This research is expected to be most valuable for energy policy making and of utmost interest for energy efficiency stakeholders such as governments, regulators, utilities, or energy service companies.

# Marta Lopes

Nationality: Portuguese PhD in: Sustainable Energy Systems (SES) Starting year: 2010/2011 Institutional affiliation: Faculdade de Ciências e Tecnologia da Universidade de Coimbra





## **Michal Monit**

Nationality: Polish PhD in: Sustainable Energy Systems (SES) Starting year: 2010/2011 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

### Thesis title:

### Material consumption of economies: An exploratory analysis

PhD Advisors: Paulo Ferrão (IST); André Pina (IST)

In the last 40 years, world population's growth has been virtually linear, far outpaced by the growth in global GDP (Gross Domestic Product). What about the demand for materials?

Different data sources are merged and validated in order to construct a consistent, plug-and-play approach to quantification of material consumption at the country level. Evolution of the consumption and trade patterns is investigated: over time, by material type and across different ranges of socio-economic variables. Trends are quantified and underlying patterns are analyzed with the objective of contributing to the current debate on policies targeting resource productivity and efficiency. The thesis is concluded by a deliberation on possible applications and extensions to the method developed at the country level.

Special attention is paid to use of non-proprietary data and information visualization.



# Rita Garcia

Nationality: Portuguese PhD in: Sustainable Energy Systems (SES) Starting year: 2010/2011 Institutional affiliation: Faculdade de Ciências e Tecnologia da Universidade de Coimbra

### Thesis title:

### Dynamic fleet-based life-cycle assessment of electric mobility pathways: An application to light-duty passenger vehicles in Portugal

PhD Advisors: Fausto Freire (ADAI-LAETA, DEM-UC)

This research aims to assess the conditions under which the introduction of electric vehicles in the Portuguese (PT) light-duty vehicle fleet is environmentally beneficial compared to existing vehicle systems (with a focus on greenhouse gas [GHG] emissions). Furthermore, it aims to assess the major sources of uncertainty associated with these conditions. A dynamic fleet-based life-cycle (LC) model will be developed by integrating a vehicle stock model of the PT fleet with dynamic vehicle LC models in order to assess fleet LC GHG emissions over time (1995-2030). Scenario analysis will be used to evaluate the technologies adopted as well as changes in vehicle and contextual characteristics and their effect in the fleet GHG emissions through 2030. A probabilistic scenario analysis will be performed in order to understand the implications of changing assumptions on the outcomes of the study.

# **Rita Paleta**

Nationality: Portuguese PhD in: Sustainable Energy Systems (SES) Starting year: 2010/2011 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

### Thesis title:

# Remote autonomous energy systems design for developing countries

PhD Advisors: Carlos Augusto; Santos Silva (IST); André Pina (IST)

My PhD thesis is focused on rural electrification methodologies, more specifically, from the demand point of view. I expect to achieve not only an efficient electrification methodology by defining sustainable pathways to accomplish it, but also to work on its business model, since I am working directly with an energy services company in their remote electrification projects' market approach. My goal is to develop a modeling tool able to estimate current and future energy demand of developing countries' isolated communities, based on development indicators. This tool will be important for electrification projects as it helps to customize solutions for each location depending on the development status and energy resources availability. The aim is to develop a business activity of this area and this tool will give a competitive advantage, when compared to the currently available solutions.



# Zeus Guevara

Nationality: Mexican PhD in: Sustainable Energy Systems (SES) Starting year: 2010/2011 Institutional affiliation: Faculdade de Ciências da Universidade de Lisboa

### Thesis title:

### Three level energy decoupling

PhD Advisors: Tiago Domingos (IST); Tânia Sousa; Tiago Domingos (IST)

Reducing the energy intensity of the economy (energy decoupling) is one of the top priorities of the sustainability agenda. Primary energy intensity, which is the standard indicator for energy decoupling analysis, has a high degree of aggregation and therefore is unable to give enough information about its components. This thesis aims to improve the understanding of energy decoupling by including into the analysis the different levels of energy consumption: Primary, final and useful. The main contribution consists of the decomposition of the primary energy intensity indicator into self-explaining components, e.g. technical efficiency, primary-to-final conversion structure or the intensity of energy services, in order to give better insights into the design of energy policy.

2011/2012



# **Alexandre Freire**

Nationality: Portuguese PhD in: Sustainable Energy Systems (SES) Starting year: 2011/2012 Institutional affiliation: Faculdade de Engenharia da Universidade do Porto

### Thesis title:

# Adaptive thermal comfort under mechanically conditioned environments

**PhD Advisors:** Jose-Luis, Alexandre (FEUP); Fergus, Nicol (London Metropolitan University)

This subject relates to the expansion of the scope of the adaptive comfort theory, originally designed for naturally ventilated buildings, to spaces suited with HVAC systems or combinations with natural and mechanical cooling.

Based on filed work, where data is collected directly from occupancy in such buildings, the thermal comfort contidions are determined and described so a comfort correlation and set of constrains of can be found.



# Catarina Serra

Nationality: Portuguese PhD in: Sustainable Energy Systems (SES) Starting year: 2011/2012 Institutional affiliation: Faculdade de Ciências e Tecnologia da Universidade de Coimbra

### Thesis title:

# Use of thermography in assessing hygrothermal performance of building elements

**PhD Advisors:** António Tadeu (Department of Civil Engineering, FCT-UC); Nuno Albino Vieira Simões (Department of Civil Engineering, FCT-UC)

In this research, numerical and experimental studies of heat transfer using Infrared Thermography (IRT) applied to buildings envelope thermal behavior are proposed. By developing and implementing analytical solutions and using numerical models to simulate transient heat transfer in layered media and studying heat and moisture diffusion features experimentally using active IRT, it is expected that the basis for the successful use of quantitative IRT in building inspections is set. This aims to further support the use of IRT in building diagnostics as an effective tool in the predictive maintenance of constructions and for promoting better thermal performance of building envelopes an essential aspect in reducing energy consumption in constructions.





Thesis title: Green Island solar energy potential PhD Advisors: Miguel C. Bito (FCUL); Pedro M. M. Soares (FCUL)

# **Clarisse Magarreiro**

Nationality: Portuguese PhD in: Sustainable Energy Systems (SES) Starting year: 2011/2012 Institutional affiliation: Faculdade de Ciências da Universidade de Lisboa Solar radiation in Azores is significantly characterized by its diffuse component. The mean annual values of insolation and the complementary to the wind potential more abundant in the winter makes solar energy essential to any solution concerning energy supply. A full characterization, temporal and spacial, of the solar energy potential in Azores is addressed using in situ measurements and high resolution climate models.



# Joana Prata

Nationality: Portuguese PhD in: Sustainable Energy Systems (SES) Starting year: 2011/2012 Institutional affiliation: Faculdade de Ciências e Tecnologia da Universidade de Coimbra

### Thesis title:

# Dynamic behaviour of linear and point thermal bridges of buildings - numerical and experimental simulations

**PhD Advisors:** António Tadeu (Department of Civil Engineering, UC); Nuno Simões (Department of Civil Engineering, UC)

In this research it will be evaluated the importance of performing the analysis of linear and point thermal bridges dynamically during the design phase of buildings, in order to choose high performance solutions, preventing weaknesses in the construction processes and techniques, which might compromise the building's envelope hygrothermal behaviour and energy performance of buildings. The final goal is to understand how a dynamic analysis of the thermal bridges (TB) may influence the evaluation of the thermal behaviour and energy performance of buildings, when compared with the steady state analysis from the methodologies given by the European standards and to evaluate the impact of TB on the dynamic simulations of buildings. For that purpose, the dynamic behaviour of different types of TB will be analysed using dynamic and experimental simulations as well as in-situ assessment.





## João Aleluia

Nationality: Portuguese PhD in: Sustainable Energy Systems (SES) Starting year: 2011/2012 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

### Thesis title:

# Assessing the sustainability impacts of municipal solid waste management options in developing Asia

PhD Advisors: Paulo Ferrão (IST)

The overall goal of the research is to assess the impact of different options for managing municipal solid waste (MSW) in developing countries in Asia. The levels of social and economic development of these countries are reflected on several aspects of relevance to the waste sector, including the characteristics of waste streams or the role played by the informal economy, requiring different approaches from those usually adopted in high-income countries.

In this context, the research work will evaluate three issues related to the management of MSW in developing Asia: i) the energy flows and the carbon footprint of different MSW approaches applying LCA methods; ii) the trade-offs among different technologies for processing waste with respect to their sustainable development benefits; and iii) the impacts on job and welfare creation of improved MSW methods in the informal sector.



# João Francisco Barreiros

Nationality: Portuguese PhD in: Sustainable Energy Systems (SES) Starting year: 2011/2012 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

### Thesis title:

Watts turning water into a crucial energy challenge? Integrating water in an energy portfolio modelling analysis - research on the energy-water nexus PhD Advisors: Carlos Santos Silva (IST)

The development of hydraulic fracturing combined with horizontal drilling (fracking), in order to get much more oil and gas from a single hole, has opened up the perspective of accessing vast reserves of fossil energy trapped in shale rock formations. Recovery of unconventional oil & gas, however, involves injecting huge amounts of water at high pressures, and considerable concern has been arising on how this extraction technics might affect surface & groundwater water resources. Further, there's a growing consensus that water is a strategic issue as its scarcity, or difficulty to guarantee access at an acceptable cost, will affect industries and increase their business risk over the next 10-20 years. Thus, my research aims to determine how water scarcity/ cost variability may impact, in a life-cycle perspective, the way energy sources (particularly unconventional) compete in the market.



# João Dias Carrilho

Nationality: Portuguese PhD in: Sustainable Energy Systems (SES) Starting year: 2011/2012 Institutional affiliation: Faculdade de Ciências e Tecnologia da Universidade de Coimbra

## Thesis title: Optimal control of indoor climate

PhD Advisors: Manuel Gameiro da Silva (FCT-UC)

The focus of this research is on using engineering modeling, control and optimization techniques to develop a control strategy for maintaining the indoor climate within requirements, using a minimum of energy. Engineering methods are used in modeling the dynamics of heat transfer and air]ow in buildings, along with system identi]cation theory and model predictive control techniques, to develop an innovative control strategy for energy-e]cient indoor climate control. This implies quantifying the compromises between con]icting objectives in order to provide assistance in the selection of the most adequate strategy. Having identi]ed the best realizable strategy, the ultimate purpose is to develop a supervisory control algorithm, capable of taking decisions based on predicted environmental conditions, suitable for deployment both in new buildings and in retro]tting scenarios.



# José Gonçalves

Nationality: Portuguese PhD in: Sustainable Energy Systems (SES) Starting year: 2011/2012 Institutional affiliation: Faculdade de Ciências e Tecnologia da Universidade de Coimbra

### Thesis title:

# Feasibility study of a stationary urban distributed energy storage system

PhD Advisors: António Martins (UC); Luís Neves (Inst. Politécnico de Leiria)

The work presents a methodology to assist decision makers on the assessment of feasible solutions to the integration of a distributed electric energy storage system (DEESS) in an urban environment as a tool to provide power and energy services to the electric network. The developed methodology uses profile prototypes based on real data, obtained through clustering techniques. These profiles, of electricity demand, electricity prices and renewable electricity production, are used to optimize the placement of electric energy storage units by an improved genetic algorithm, based on NSGAII. The work considers the main stakeholders expected attitudes towards DEESS implementation and discusses the possible regulatory framework options to define the DEESS business model.





## Luísa Dias Pereira

Nationality: Portuguese PhD in: Sustainable Energy Systems (SES) Starting year: 2011/2012 Institutional affiliation: Faculdade de Ciências e Tecnologia da Universidade de Coimbra

### Thesis title:

# Modernised portuguese schools: From IAQ and thermal comfort towards energy efficiency plans

PhD Advisors: Manuel Gameiro da Silva

The purpose of my research is to develop energy efficiency plans (EEP) for modernised Portuguese schools (geographical and climatically distributed). These are to be adopted after the analysis of monitored indoor environment quality (IEQ) parameters (CO2 concentration values, relative humidity and temperature).

School energy management programs tend to focus on management control and benchmarking comparison to access energy efficiency, rather than reflecting occupants' satisfaction or performance. The study starts with an energy consumption assessment between the pre and post-intervention phases. It focuses on the relationships between energy performance and occupant feedback and explores whether energy use is related to occupant satisfaction and comfort. It aims to enlarge the actual EEP by reaching an equilibrium between IEQ evaluation and students' performance.



## Nathan Lee

Nationality: American PhD in: Sustainable Energy Systems (SES) Starting year: 2011/2012 Institutional affiliation: Faculdade de Engenharia da Universidade do Porto

### Thesis title:

## National energy planning in developing countries: An implementation focused decision support methodology

PhD Advisors: Vítor Leal (FEUP)

The objective of this thesis is to contribute to the advancement of methodologies supporting national energy planning practices in developing countries. It will address the need for an EP methodology allowing actors to identify objectives specific to the geographic context and to account for them in the construction of and multiple-objective evaluation of multiple energy policy plans. The Economic Community of West African States (ECOWAS) was chosen to limit the scope. Specifically, it will evaluate how the supplementary EP objectives of maintainability of the final energy system and the level of access to energy services affect the outputs of a decision processes supporting national energy planning in the ECOWAS region. The methodology will be applied to a case study of national EP for the ECOWAS country of Ghana.
## Nélson Soares

Nationality: Portuguese PhD in: Sustainable Energy Systems (SES) Starting year: 2011/2012 Institutional affiliation: Faculdade de Ciências e Tecnologia da Universidade de Coimbra

#### Thesis title:

### Passive latent heat thermal energy storage systems with phase change materials for the improvement of lightweight buildings' energy efficiency

**PhD Advisors:** José J. Costa (DEM-UC); Adélio R. Gaspar (DEM-UC); Paulo Santos (DEC-UC)

Nelson's research is focused on the study of renewable energy based applications of PCMs in construction solutions towards the improvement of buildings' energy efficiency. His research interests include sustainability, light steel framing, thermal behavior and energy efficiency of buildings, passive thermal energy storage systems, numerical modeling of heat transfer with phase change and dynamic simulation of energy in buildings. The problems to be studied lie in the mainstream area of the passive thermal heat storage in buildings considering latent heat loads from PCMs phase change processes. It is believed that the proposed work will give new and relevant contributions to the present knowledge in this field.



## Nuno Carvalho Figueiredo

Nationality: Portuguese PhD in: Sustainable Energy Systems (SES) Starting year: 2011/2012 Institutional affiliation: Faculdade de Economia da Universidade de Coimbra

#### Thesis title:

## Evaluation of key determinants of electricity market integration in a context of high penetration of renewables

PhD Advisors: Patrícia Pereira da Silva (FE-UC)

The interaction between the large-scale deployment of renewable energy sources (RES) and spot electricity markets poses a significant upcoming challenge requiring detailed study. The literature is scarce in addressing these issues simultaneously. Appropriate modelling can be developed to allow the evaluation of the key determinants of electricity market integration, considering the penetration of RES-E by including new exogenous variables.

The objective of this research is therefore to assess the influence of the high penetration of RES-E on the level of electricity market integration. With this research we aim to achieve robust quantitative analysis to stakeholders in both the public and private sectors, helping them to understand the wider picture.





## **Pedro Miguel**

Nationality: Portuguese PhD in: Sustainable Energy Systems (SES) Starting year: 2011/2012 Institutional affiliation: Faculdade de Ciências e Tecnologia da Universidade de Coimbra

#### Thesis title:

### Simulation of large scale application of residential energy management systems (REMS) in the portuguese electric grid

PhD Advisors: António Martins (UC); Luís Neves (Polytechnic Institute of Leiria)

The outcome of this research consists in the development of a methodology and a tool to evaluate the energy and power resources that can be made available by the large deployment of a Residential Energy Management System (REMS) based on the Energy Box. The Energy Box was proposed, by Livengood and Larson in the Service Science Journal in 2009, as a 24/7 background processor operating on a local computer, managing a dwelling electrical energy usage taking into consideration the homeowners preferences and desired comfort level.

The Energy Box concept will be studied, as an instrument to assess the attractiveness to the distribution system operator, among other agents, to promote the installation or use of REMS.

## 2012 / 2013



## Carla Caldeira

Nationality: Portuguese PhD in: Sustainable Energy Systems (SES) Starting year: 2012/2013 Institutional affiliation: Faculdade de Ciências e Tecnologia da Universidade de Coimbra

#### Thesis title:

## Blending optimization of biodiesel produced with waste and virgin oils

PhD Advisors: Luís Dias (FE-UC); Fausto Freire (FCT-UC)

The main aim is to develop a multiobjective optimization (MO) model to optimize blends of virgin and waste oils (WO, i.e., waste cooking oils and animal fats) for biodiesel production that minimize costs and environmental impacts in a life-cycle perspective, incorporating uncertainty and variability.

Analyses based on this model will allow industry stakeholders to obtain blends for biodiesel production in compliance with technical standards that are efficient in terms of cost and environmental impact, and will inform policy makers on the effects of changes to biodiesel regulations.



## **Carla Rodrigues**

Nationality: Portuguese PhD in: Sustainable Energy Systems (SES) Starting year: 2012/2013 Institutional affiliation: Faculdade de Ciências e Tecnologia da Universidade de Coimbra

#### Thesis title:

## Sustainability assessment of building retrofit: An integrated life-cycle approach

PhD Advisors: Fausto Freire (UC)

The main goal of my PhD research is to assess retrofit strategies for improving the environmental and economic life-cycle (LC) of residential and commercial buildings in Mediterranean climates. Major retrofit measures are currently being modeled in two buildings to perform a critical review and assessment of building environmental assessment (BEA) methods and certification tools (e.g. BREEAM (UK), LEED (US)). Final and primary energy, environmental impacts and (equivalent annual) costs are being assessed and trade-offs will be identified. This research is expected to be valuable in promoting life-cycle environmental and economic sustainability for building retrofit to support building stakeholders (sustainability consultants, users and designers) to optimize the environmental performance of buildings in different LC phases, as well as policy makers and the LCA community.





## Catarina Sabino

Nationality: Portuguese PhD in: Sustainable Energy Systems (SES) Starting year: 2012/2013 Institutional affiliation: Faculdade de Ciências e Tecnologia da Universidade de Coimbra

#### Thesis title:

## Large scale impacts of energy and power demand management: The Portuguese case

PhD Advisors: António Martins (UC)

The main goal of this work is to analyze the effect, caused by the implementation of Demand-side Management (DSM) measures in the Portuguese residential sector, on energy consumption, on economy and on GHG emissions. The Portuguese electric power system, some economic aspects of the country, and general characteristics of the Portuguese population concerning energy saving behaviors will be considered.

The results will help understanding and quantifying the effects and benefits of three DSM measures – peak shaving, load shifting and strategic conservation – and will support those decision makers responsible for implementing and designing energy efficiency measures in planning, choosing and designing instruments for DSM and behavior change programs before implementation.



## **Chongyang Du**

Nationality: Chinese PhD in: Sustainable Energy Systems (SES) Starting year: 2012/2013 Institutional affiliation: Faculdade de Ciências e Tecnologia da Universidade de Coimbra

#### Thesis title:

## Integrating multi-criteria decision analysis in life cycle sustainability assessment

**PhD Advisors:** Fausto Freire (Center for Industrial Ecology, UC); Luis Dias (INESC Coimbra, UC)

Life Cycle Sustainability Assessment (LCSA) is nowadays the only life cycle based sustainability assessment tool with the focus on a product throughout its life cycle. A Life Cycle Sustainability Assessment study is composed of three dimensions of the assessment including Environmental Life Cycle Assessment, Social Life Cycle Assessment, and Life Cycle Costing. This doctoral research project aims at contributing on the methodological development of Life Cycle Sustainability Assessment, testing the feasibility of LCSA through case studies, and providing decision support for policy makers according to LCSA results.



## **Felipe Calabrial**

Nationality: Brazilian PhD in: Sustainable Energy Systems (SES) Starting year: 2012/2013 Institutional affiliation: Faculdade de Engenharia da Universidade do Porto

#### Thesis title:

### Enhancing flexibility and ensuring efficiency and security: Improving the electricity market in Brazil via a virtual reservoir model

PhD Advisors: João Tomé Saraiva (FEUP)

The Brazilian electricity market has certain particularities that contribute to considerably distinguish it from other markets. With a continental interconnected transmission system in which around 70% of the total installed capacity comes from hydropower plants, this electricity market contains a number of special features. Nevertheless, the conciliation between the commercial commitments of the market participants and the physical dispatch is not smooth. This research proposes a solution pointing towards the enhancing of the flexibility for market participants to bear their contracts, while still ensuring the efficient use of the energy resources and maintaining the current level of the security of supply. Finally, a new framework is designed and tested based on a virtual reservoir model and on Agent-Based Model.

#### Thesis title:

## Novel multivariate adaptive self-learning methodology for efficient energy systems in buildings

PhD Advisors: Carlos Silva (IST)

With my PhD, I am developing strategies to improve energy efficiency in a University building by developing algorithms that are able to model energy consumption, optimize the functioning of some utilities (e.g. lightning) for reducing energy consumption and educate the users with interactive platforms. Generally, the algorithms will structure a system that will have self-learning skills for being adapted under different contexts based on neuro-fuzzy and evolutionary programing. Additionally, I am developing models that can describe energy consumption in up to 2,000 households and, based in different layers of information, I will develop targeted energy efficiency measures to each house, supporting the development of energy saving policies at local and regional levels.

## **Henrique Pombeiro**

Nationality: Portuguese PhD in: Sustainable Energy Systems (SES) Starting year: 2012/2013 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa





## Thesis title: Impact of renewables on electricity prices and the transmission grid development

PhD Advisors: João Santana (IST)

## **Hugo Valente**

Nationality: Portuguese PhD in: Sustainable Energy Systems (SES) Starting year: 2012/2013 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa Did the incentives to promote renewables changed electricity prices and in what way did they contribute to increase the tariff deficit? In what way did this increase of renewables, mainly wind, changed the development of the transmission grid? What were the alternatives? Are there lessons to be learned?



#### Thesis title:

#### Energy markets, real options and game theory

PhD Advisors: Paulo Ferrão (IST); Artur Rodrigues (UMinho)

## Luciana Salles Barbosa

Nationality: Brazilian PhD in: Sustainable Energy Systems (SES) Starting year: 2012/2013 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa The aim of this work is to apply real options theory and game theory to analyze investments in renewable energy projects. Our models provide a methodology to better value investment projects in the presence of uncertainty, flexibility, timing, and the effect of strategies employed by the competing firms.

In addition, we analyze the impact of different types of feed-in tariff policies on important economic variables and the social welfare.



## Luis Rodrigues Jr.

Nationality: Portuguese / Brazilian PhD in: Sustainable Energy Systems (SES) Starting year: 2012/2013 Institutional affiliation: Faculdade de Ciências da Universidade de Lisboa

## Thesis title:

#### Advanced wind power management and optimal market involvement

PhD Advisors: Ana Estanqueiro (LNEG/FCUL); Ricardo Lima (LNEG)

The original contribution of this work is to provide wind energy producers with an optimization decision-support tool that take into account the state of the art of renewable generation control technology. Optimal bidding strategies will be investigated considering the actual working mechanisms of electricity markets, the influence of wind power clusters on market clearing price and envisioning trends in market design. Moreover, the wind turbines rich variety of technical capabilities regarding power production curtailment will be modeled and made available for the decision-support tool.



## **Miguel Serpa Oliva**

Nationality: Portuguese PhD in: Sustainable Energy Systems (SES) Starting year: 2012/2013 Institutional affiliation: Faculdade de Ciências e Tecnologia da Universidade de Coimbra

#### Thesis title:

### Optimization of building envelope in healthcare buildings towards better indoor environmental quality and energy performance

**PhD Advisors:** José António Raimundo Mendes da Silva (FCTUC); António José Barreto Tadeu (FCTUC)

Healthcare buildings are amongst the biggest energy consumers due to their operating requirements and intense utilization, whilst simultaneously keeping the indoor air quality steady. This environment poses a big challenge to the building envelope, which can not be only a separator between inside and outside but it must have a dynamic behavior towards the external conditions, adopting a resource-efficient strategy according to the interior needs. Is it possible to develop a product that includes new generation materials and passive strategies to improve energy performance, whilst being economically attractive? This work aims at creating a tool to help professionals in the area of construction making a correct choice and to point out to owners and administrators the best practices to an effective reduction in energy consumption, towards better indoor environmental quality.





## Development of a climate performance indicator for analysis of low energy buildings

PhD Advisors: Guilherme Carrilho da Graça (SESUL/FCUL)

## **Nuno Martins**

Nationality: Portuguese PhD in: Sustainable Energy Systems (SES) Starting year: 2012/2013 Institutional affiliation: Faculdade de Ciências da Universidade de Lisboa

Development of a climate performance indicator, that focuses on a given building's energy performance and its relation with local climate.



#### Thesis title:

Climate responsive building skin, development and physical behaviour of green roofs and facades

PhD Advisors: António Tadeu (UC); Nuno Simões (UC)

## **Ricardo Almeida**

Nationality: Portuguese PhD in: Sustainable Energy Systems (SES) Starting year: 2012/2013 Institutional affiliation: Faculdade de Ciências e Tecnologia da Universidade de Coimbra

This project aims the Green Roofs and Facades settings study adjusted to the Mediterranean climate towards the selection and evaluation of possibilities for optimization.



## Atmospheric water vapour processing (AWVP) technologies and their contribution to the mitigation of the hydrological risk

PhD Advisors: Carlos Silva (IST); Maria João Rodrigues(IST)

## **Ricardo Barbosa Vicente**

Nationality: Portuguese / Cape Verdean PhD in: Sustainable Energy Systems (SES) Starting year: 2012/2013 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa This research is an experimental approach on the development of a method to compare different atmospheric water vapor processors (AWVP). These processors extract water vapor from the atmosphere, making water available in liquid state.

The overall goal is to create an adaptive atmospheric water vapor processor to diverse environments, remotely controllable and that can provide a service of water with very low energy cost.

## 2013/2014



## Thesis title: Urban heat island effect in mediterranean cities [provisional] PhD Advisors: Samuel Niza (IST)

Ana Oliveira

Nationality: Portuguese PhD in: Sustainable Energy Systems (SES) Starting year: 2013/2014 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa Urban Heat Island is among the most important environment problems within cities. Considering the growing importance of urban areas, supported by the urbanization prospects for the 21st century, and the specific case of Mediterranean bio-regions as one of the most sensitive to the climate change predictions, here, we consider five cities within Mediterranean climatic zones to assess the presence of surface urban heat island effect during the day, using ETM+/Landsat 7 data. The differences and similarities throughout the five cities are analyzed, and then compared to potential biophysical driving factors, such as green infrastructure, weather averages and land cover albedo. [provisional]



## André da Cruz Parreiral

Nationality: Portuguese PhD in: Sustainable Energy Systems (SES) Starting year: 2013/2014 Institutional affiliation: Faculdade de Economia da Universidade de Coimbra

#### Thesis title:

## Economic impacts of disasters: A regional input-output analysis

PhD Advisors: Pedro, Ramos (FE-UC); Eduardo Barata (FE-UC)

The central objective of this project is the study of economic effects on stocks and flows of products derived from possible disasters using regional input-output models. This project will reference the empirical Multi-sectoral Multi-regional Coimbra Model - MULTI2C. This model is being developed by a group of researchers from University of Coimbra and allows the construction of input-output tables for different regional configurations. Through the MULTI2C approach we aim to develop a set of simulations, including restrictions on the supply side. Specifically, we propose simulations trough input-output models, understanding the economic impact derived from catastrophic situations directly related to energy and sustainability areas.

## **Behrang Chenari**

Nationality: Iranian PhD in: Sustainable Energy Systems (SES) Starting year: 2013/2014 Institutional affiliation: Faculdade de Ciências e Tecnologia da Universidade de Coimbra

#### Thesis title:

## Optimization of indoor climate and energy consumption in buildings integrating hybrid ventilation

**PhD Advisors:** Manuel Gameiro (ADAI - LAETA, Department of Mechanical Engineering, UC)

Among several methods for improving energy efficiency in buildings, this work aims to develop several control strategies in order to optimize indoor climate and energy consumption by implementing a "Smart Window" on building facade. This technology is supposed to employ hybrid ventilation for providing the indoor climate and mitigating energy consumption related to building ventilation. Temperature difference indoor and outdoor, the concentration of CO2, wind speed and its orientation are considered as input data for this technology which can be applied either to new buildings or existing buildings throughout their retrofitting process. Engineering methods as well as optimization methods will be used in order to simulate different types of ventilation in buildings.



## Claudia A. Sousa

Nationality: Portuguese PhD in: Sustainable Energy Systems (SES) Starting year: 2013/2014 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

#### Thesis title:

#### **Disaggregating/expanding urban metabolism**

PhD Advisors: Paulo Ferrão (IST); André Pina (IST)

Cities are multifunctional systems involving a high level of flows and resources consumption for maintaining urban life.

In identifying potential research topics under this heading, special attention will be given to the construction of a model to expand/ disaggregate urban metabolism at city level regarding different urban functions.

By adding uses, people and places to the framework, the goal is to answer Who is using? What flows? Where? To do what? This research intends to look for the built environment and draw a model able to attribute flows to urban functions and to infrastructures and technologies that support them. This will allow us to understand the variables and relations involved, achieving a more detailed approximation of the city's metabolism, so in the future not only the economic but also the social aspects of sustainability can be integrated with the environmental aspect.



## Danyela Samaniego

Nationality: Mexican PhD in: Sustainable Energy Systems (SES) Starting year: 2013/2014 Institutional affiliation: Faculdade de Ciências e Tecnologia da Universidade de Coimbra

#### Thesis title:

## Proposal of guideline elements dedicated to a central tower solar energy facilities

PhD Advisors: Manuel Carlos Gameiro da Silva; Almerindo Ferreira

Solar thermal plants have increased their number because of the increasing motivation of countries to use renewable energy systems for electricity production.

the solar thermal technology is based on the concept of concentration of solar radiation, which can be used to produce electricity.Due to this concentrated radiation, many risks may exist. Through the assessment of potential risks, this investigation aims to achieve the overall purpose of this doctoral research, which is to propose technical security elements in thermal solar power facilities and the development of an elements proposal for a standard, the determination of the solar radiation exposure levels and also define the dose of exposure, in other words, the amount of solar radiation in a period of time. The definition of these elements will allow the development of a method to evaluate the impact in the eyes and skin.



#### Thesis title:

Economic evaluation of energy storage systems and their impact on electricity markets in a smart-grid context

PhD Advisors: João Tomé Saraiva (FEUP)

## **Dennis Metz**

Nationality: German PhD in: Sustainable Energy Systems (SES) Starting year: 2013/2014 Institutional affiliation: Faculdade de Engenharia da Universidade do Porto The objective of the research is to evaluate the commercial benefits of distributed energy storage systems and determine the market risks associated with an investment in such a system. To assess the economics of energy storage and establish a clear value proposition, different storage implementations and operations will be simulated. This will provide an understanding of the benefits that a storage device can provide, including barriers and drivers to its deployment. Furthermore, reciprocal effects on market prices will be determined and analyzed to understand the impact of a wide-scale implementation of storage.

153



## Thesis title: Urban metabolism in Africa megacities PhD Advisors: Paulo Ferrão (IST)

## Francisco

Nationality: Portuguese PhD in: Sustainable Energy Systems (SES) Starting year: 2013/2014 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

Study and deploy breakthrough techniques to model and infer conclusions regarding urban metabolism around mega cities in Africa.



## Gisela Mendes

Nationality: Portuguese PhD in: Sustainable Energy Systems (SES) Starting year: 2013/2014 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa Thesis title: Sustainable energy systems in cities PhD Advisors: Carlos Silva (IST); André Pina (IST)

My research intends to develop political and technical solutions and also to explore new business opportunities related to energy consumption in cities. The ultimate goal is the optimization of resource consumption, contributing to cities' overall energy efficiency and GHG emissions reduction.

Firstly, an econometric model for the Portuguese residential energy consumption related to both electricity and natural gas is going to be developed, using as inputs data from census that are available at neighbourhood scale. Therefore, the model allows us to compute the energy demand for smaller areas within cities, whose values are unknown but are a requisite for effective energy planning.





## Graça Ribeiro

Nationality: Portuguese PhD in: Sustainable Energy Systems (SES) Starting year: 2013/2014 Institutional affiliation: Faculdade de Ciências e Tecnologia da Universidade de Coimbra

#### Thesis title:

Thesis title:

#### Domestic consumers as electric service providers

PhD Advisors: Humberto Jorge (FCTUC)

Aggregators play an important rule as mediators between demand and supply sides, once they can offer significant blocs of management potential through the joint of a large number of small size end users. The aim of the present work is to characterize a set of representative domestic load curves, disaggregated by appliance and by region. Based on those diagrams, the following simulations are made: (1) Load management by scheduling and interrupting sets of eligible charges; (2) Scenarios for the penetration of electric vehicles in the national fleet park and the respective impacts in domestic consumption; (3) Scenarios for the penetration of micro generation and storage. The referred curves and simulations intend to provide a working basis for future cost/benefit analysis about the expectable impacts on the electric grids and in terms of Aggregator's business.

## Mafalda Silva

Nationality: Portuguese PhD in: Sustainable Energy Systems (SES) Starting year: 2013/2014 Institutional affiliation: Faculdade de Engenharia da Universidade do Porto



A multi-scale decision-support model to

integrate energy urban planning

PhD Advisors: Vitor Leal (FEUP)

Urban renewal is a slow process. As such, the importance of accounting for the impacts of urban planning choices in advance is increasingly acknowledged.

The research is expected to contribute with a tool that enables to evaluate in an integrated way the impact of different patterns of urban development on energy consumption, deriving from the physical structure of the city only. This pulls further the state-of-the-art by analyzing simultaneously the buildings and transports sectors, and by modelling the parameters of urban form in order to understand their impact on the energy demand of cities. The development of the proposed model is expected to enable more informed urban decisions and to formulate sustainable policies for urban development.

155

## Malgorzata Zych

Nationality: Polish PhD in: Sustainable Energy Systems (SES) Starting year: 2013/2014 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

#### Thesis title:

## Urban efficiency enclosed within the life of inhabitant - smart society in the smart city

PhD Advisors: Manuel Correia Guedes

As the sustainable urban development gathers pace, more cities become aware of the efficient future planning, which generate various challenges for engineers and city planners. Residents, aware of the sustainability, contribute a significant success for the municipality where efficiency of the simplest activities, repeated daily along the year, have an extensive value. As well as managing each unit of energy within the city, it is important to predict the activity of each inhabitant as if he/she was a single cell of the cities' body. In order to provide a sustainable development of the whole, each part should develop itself simultaneously and remains equally important. The advantages of this approach for the future solutions compliant with extremities are presented along with the inconveniences related to the power of social environment.



## Maria do Rosário Fino

Nationality: Portuguese PhD in: Sustainable Energy Systems (SES) Starting year: 2013/2014 Institutional affiliation: Faculdade de Ciências e Tecnologia da Universidade de Coimbra

#### Thesis title:

## The application of ICB as external thermal insulating composite system - An experimental and numerical study

**PhD Advisors:** António Tadeu (Department of Civil Engineering UC); Nuno Simões (Department of Civil Engineering UC)

Expanded cork agglomerate (ICB) has been used on an ad hoc basis as an alternative to external thermal insulating composite systems, but without a detailed technical characterization. This project aims to contribute to the characterization and development of this system by incorporating ICB boards, both when they are used in new building construction and for retrofitting projects. Special attention will be given to hygrothermal properties, water tightness, mechanical properties and fitness for use. Experimental and numerical analysis of the hygrothermal behavior of different constructive solutions will be performed. The system's behavior in terms of heat, vapor and moisture transfer will be modeled using numerical simulation techniques. Numerical models based on analytical solutions, boundary element method and finite element method will be developed for this purpose.



Thesis title: Energy efficiency/conservation and demand response in industry PhD Advisors: Henrique Matos (IST); Paulo Bento (ISCTE Business School)

## Nelson Patrício Guerreiro

Nationality: Portuguese PhD in: Sustainable Energy Systems (SES) Starting year: 2013/2014 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

Energy Efficiency/Conservation and Demand Response in Industry | Smart Regulation | Service Innovation in ESCO

#### Thesis title:

### A novel approach for optimal integration of electric vehicles with internal combustion engines vehicles in urban freight transport

PhD Advisors: Tiago Farias (IDMEC/IST);Sandra Melo (IDMEC/IST);

We propose a mixed-integer programming formulation for determining an economically and environmentally optimal combination of electric vehicles with ICE vehicles in urban freight transport applications over some planning horizon. The developed model takes into account the risk associated to some uncertainties such as fossil fuel price uncertainty, electric vehicles purchasing cost uncertainty, and battery technology uncertainty, which is a novel approach in this regard. We also examine various risk measurements for analyzing the risks associated to such uncertainties. A thorough analysis of the involved risks would lead to more economically and environmentally viable decisions by the concerned private and public policymakers.

## Parisa Ahani

Nationality: Iranian PhD in: Sustainable Energy Systems (SES) Starting year: 2013/2014 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa 157



Decision support methodology based on multi-criteria analysis in the context of energy efficiency in buildings, with incorporation of uncertainty models in the robustness analysis of the solutions obtained

PhD Advisors: Carlos Silva (IST)

## **Ricardo Santos**

Nationality: Portuguese PhD in: Sustainable Energy Systems (SES) Starting year: 2013/2014 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa Sustainable planning for the household energy consumption through the electrical appliances in residential sector, by developing a mixed integer programming algorithm, that incorporates not only the economical issue, but also the life-cycle environmental and technical concerns, as well as human behavior and thermal comfort. It is intended to better support the consumer decisions in a long and short run, dealing at the same time with the existed economic and technological uncertainties.

#### Thesis title:

Development of a building energy consumption template

PhD Advisors: Carlos Silva

## **Ricardo Gomes**

Nationality: Portuguese PhD in: Sustainable Energy Systems (SES) Starting year: 2013/2014 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa From this first year of the PhD, I realized that Smart Grids, Intelligent Buildings and Energy Building Management through demand aggregation are important concepts that can contribute significantly to building energy savings. However, is still difficult to conciliate these areas in such a way that stakeholders can access to relevant information. With this, in my PhD I would like to develop and study an aggregator energy supplier tool that could be one major step to provide relevant data to reduce total energy demand. To create this tool I will consider building energy certificate data, economic and services data and building energy simulation results.



## Samuel Granadeiro

Nationality: Portuguese PhD in: Sustainable Energy Systems (SES) Starting year: 2013/2014 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

#### Thesis title:

### Numerical and experimental evaluation of the impact of adopting alternative electricity powered vehicles in urban mobility solutions

**PhD Advisors:** Tiago Farias (IST); Gonçalo Gonçalves (IST); Patrícia Baptista (IST)

The main goal of this research is to study the real energy, environmental and economic efficiency of different electricity powered technological solutions according to usage and application profiles, in order to identify the best combination between the vehicle technologies and innovative urban mobility solutions.

A detailed collection, using experimental monitoring tools, of representative data of vehicle technologies, urban mobility solutions usage profiles, and urban site characteristics will be performed. Such data collection will be integrated in a simulation tool to be developed during the research program, enabling the identification of the best combination between electricity powered technological solutions and innovative urban mobility solutions. The simulation tool developed will be prepared to analyze different urban contexts, and applied to case studies in different cities.



## Sara Freitas

Nationality: Portuguese PhD in: Sustainable Energy Systems (SES) Starting year: 2013/2014 Institutional affiliation: Faculdade de Ciências da Universidade de Lisboa

## Thesis title: Photovoltaic potential in the urban landscape

PhD Advisors: Miguel Centeno Brito (FCUL)

Sustainable solutions for electricity production in the urban environment such as photovoltaics (PV) are gaining crescent interest, since a great amount of electricity is consumed in cities. However, cityscapes provide a complex environment where solar radiation is unevenly distributed due to the dynamic overshadowing effects present on building surfaces. Quantifying these phenomena is essential for predicting solar radiation availability and sophisticated models for solar potential evaluation that couple radiation algorithms with accurate representation of the terrain, vegetation canopy and building structures can provide insight into several features of the commissioning of urban PV plants. The main goal of my research is to compare the PV potential computed by some of these models with data from real systems, aiming at the improvement of their diffuse radiation and shadow algorithms.





## Seyedeh Shiva Saadatian

Nationality: Iranian PhD in: Sustainable Energy Systems (SES) Starting year: 2013/2014 Institutional affiliation: Faculdade de Ciências e Tecnologia da Universidade de Coimbra

#### Thesis title:

### Integrated life-cycle analysis of fenestrations: A multi-criteria approach

PhD Advisors: Fausto Freire (ADAI-LAETA, UC); Nuno Simões (CICC - UC)

Fenestration and building envelope technologies have a multi-functional role in buildings such as, lighting, ventilation, solar heat gain and energy saving. The main goal of this PhD thesis is to assess and improve the building fenestration taking into account the characteristics of window components (type of glazing and frames, spacers, gas filled between glazings and type of shadings), following an integrated (environmental, energy and cost) life-cycle approach. An integrated life-cycle cost (LCC) and environmental lifecycle assessment (LCA) combined with energy simulation will be implemented together with a multi-criteria decision analysis (MCDA) to assess different window components to identify improved design solutions. Fenestration will be assessed in the context of the new Portuguese reference building.



## **Vivek Kumar Singh**

Nationality: Indian PhD in: Sustainable Energy Systems (SES) Starting year: 2013/2014 Institutional affiliation: Faculdade de Ciências e Tecnologia da Universidade de Coimbra

#### Thesis title:

### Assessing energy-efficiency market transformation: The case study of a developing Asian country

**PhD Advisors:** Carla Henriques (Coimbra business school); António Manuel de Oliveira Gomes Martins (INESCC)

The enhancement of energy planning requires the formulation of a proper economy-energy-environmental (E3) model that supports energy decision-makers with the definition of more efficient policies regarding the allocation of energy resources in meeting the future energy needs in Asian countries. In this context, from the different approaches available in scientific literature to model E3 systems, multi objective linear programming (MOLP) Input –Output (I-O) models seem particularly interesting, since they allow exploring the trade-offs between multiple and conflicting objectives, considering at the same time the production system imposed by the I-O analysis framework, enabling to take into account different impacts consistent with different energy policy options.

## Alumni Doctoral Programs



2011

## Kiti Suomalainen

Research Fellow at the Energy Centre, University of Auckland Business School, New Zeland

PhD in: Sustainable Energy Systems (SES) Year of graduation: 2011 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa



## Wind dynamics - Daily patterns in energy systems planning

**PhD Advisors:** Paulo Ferrão (IST); Carlos Silva (IST); Stephen Connors (MIT)



#### Thesis title:

### Evaluation of the impacts the introduction of alternative fuelled vehicles in the road transportation sector

**PhD Advisors:** Tiago Farias and Carla Silva (IDMEC - IST); John Heywood (Sloan Automotive Laboratory, MIT)

## Patrícia Baptista

Post-doctoral researcher - IDMEC, Instituto Superior Técnico, Portugal

PhD in: Sustainable Energy Systems (SES)
Sub area: Energy Planning including Economics
Year of graduation: 2011
Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

### How has MPP contributed to your career development?

MPP has allowed me to perform innovative research with several national and international partners, through the participation in R&D projects and visits to MIT.

## **Alumni Doctoral Programs**

2012



## André Pina

Postdoctoral researcher/Instituto Superior Técnico da Universidade de Lisboa - Portugal

PhD in: Sustainable Energy Systems (SES) Sub area: Energy Planning including Economics Year of graduation: 2012 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

#### Thesis title:

### Supply and demand dynamics in energy systems modeling

PhD Advisors: Paulo Ferrão (IST); Carlos Silva (IST)

#### How has MPP contributed to your career development?

The MPP has given me the skills to perform high quality research with partnertships at MIT.



#### Thesis title:

### Economic. Energy and Environment impacts in the electric systems of mass introduction pf Plug-in vehicles

PhD Advisors: Tiago Farias (IST); Jorge Esteves (ERSE)

## **Cristina Camus**

Adjunct Professor/ISEL/Politechnic Institute of Lisbon - Portugal

PhD in: Sustainable Energy Systems (SES)
Sub area: Energy Planning including Economics
Year of graduation: 2012
Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

How has MPP contributed to your career development? Consolidated my position in the institute.

163



## **Daniel Wiesmann**

Partner at Urbmet - Portugal

PhD in: Sustainable Energy Systems (SES) Sub area: Sustainable Built Environment Year of graduation: 2012 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

#### Thesis title:

## Quantifying the drivers of residential urban metabolism

**PhD Advisors:** Paulo Ferrão (IST); John Fernandez (MIT); Ines L Azevedo (CMU)

#### How has MPP contributed to your career development?

The MIT Portugal Program has been an essential influence on my career path, both in terms of learning and networking. During my PhD I acquired the skills that I now use on a daily basis in my applied work, such as GIS programming and big data analysis. I was able to develop those skills by following my interests, which is encouraged in MPP. Freely choosing work topics and methods in a stimulating environment was a great basis to develop my work.

Through the program I was also introduced to a network of people that has ultimately lead to my current revenue stream and work position. After graduating, I co-founded a consulting company with David Quinn, a close colleague from the program. Some of our most important clients are contacts that we have made during the program.



#### Thesis title:

Impact of the deployment of electric vehicles in grid operation and expansion

PhD Advisors: João Peças Lopes (FEUP)

## **Filipe Soares**

Senior Researcher, INESC TEC - Portugal

PhD in: Sustainable Energy Systems (SES)
Sub area: Smart Energy Networks
Year of graduation: 2012
Institutional affiliation: Faculdade de Engenharia da Universidade do Porto

#### How has MPP contributed to your career development?

The PhD degree obtained in the MPP was fundamental for my career as it provided the opportunity to strengthen my knowledge in energy systems, which is the area of research where I am currently working on. It gave me the opportunity to integrate the research team of INESC TEC, a leading R&D institution in the smart grid area, and to be an Assistant Professor at Universidade Lusófona do Porto.



A multi-objective decision support methodology for developing national energy efficiency plans PhD Advisors: Vítor Leal (FEUP); Luis Dias (FEUC)

Gustavo Haydt

Research Analyst/EPE - Brasil

PhD in: Sustainable Energy Systems (SES)
Sub area: Energy Planning including Economics
Year of graduation: 2012
Institutional affiliation: Faculdade de Engenharia da Universidade do Porto

How has MPP contributed to your career development? I only got my position due to the knowledge acquired during the PhD.



## Joana Abreu

Behavior Scientist Member of Technical Staff, Fraunhofer Center for Sustainable Energy Systems, USA

PhD in: Sustainable Energy Systems (SES)
Sub area: Sustainable Built Environment
Year of graduation: 2012
Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

#### Thesis title:

## Routines and feedback a study about electricity consumption in households

**PhD Advisors:** Jorge Vasconcelos (IST/UTL); Francisco Câmara Pereira (MIT Singapore); David H. Marks (MIT)



### Evaluation of technical, economic and environmental impacts resulting from large scale integration of microgrids

**PhD Advisors:** João Abel Peças Lopes (FEUP), Manuel António Cerqueira da Costa Matos (FEUP)

## Julija-Vasiljevska

PostDoc Scientific Researcher , European Commission, Joint Research Centre, Netherlands

PhD in: Sustainable Energy Systems (SES) Year of graduation: 2012 Institutional affiliation: Faculdade de Engenharia da Universidade do Porto



## Leonardo Rosado

Assistant professor at Chalmers University, Sweeden

PhD in: Sustainable Energy Systems (SES) Year of graduation: 2012 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

### Thesis title:

A standard model for urban metabolism -Accounting material flows in metropolitan areas PhD Advisors: Paulo Ferrão (IST); Samuel Niza (IST)

166



## **Manuel Rocha**

Managing Director at Efacec South Africa / Mozambique

PhD in: Sustainable Energy Systems (SES) Year of graduation: 2012 Institutional affiliation: Faculdade de Engenharia da Universidade do Porto

#### Thesis title:

## Transmission expansion planning, a multiyear approach considering uncertainties

PhD Advisors: João Tomé Saraiva (FEUP); Stephen Connors (MIT)



## Maria Kapsalaki

Consultant/INIVE

PhD in: Sustainable Energy Systems (SES)
Sub area: Sustainable Built Environment
Year of graduation: 2012
Institutional affiliation: Faculdade de Engenharia da Universidade do Porto

#### Thesis title:

Economic-efficient design of residential net zero energy buildings with respect to local context PhD Advisors: Vitor Leal (FEUP); Mat Santamouris (NKUA)



## Nuno Clímaco Pereira

Energy Efficiency Consultant at ADENE - National Energy Agency

PhD in: Sustainable Energy Systems (SES) Sub area: Sustainable Built Environment Year of graduation: 2012 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

#### Thesis title:

### Energy-efficient retrofit of residential buildings -Lisbon 1960's-70's case-study

PhD Advisors: Luísa Caldas (FA/UL); Manuel Correia Guedes (IST/UL)

#### How has MPP contributed to your career development?

The PhD in the scope of MPP, gave me a broad and multidisciplinary perspective about the energy sector, as well as a detailed knowledge in the Energy in Buildings field. Definitely, these research years and the experience at MIT, contributed to a development of several skills, especially in the area of Energy Efficiency, Building Thermal Simulation and Building Energy Retrofit. Based on this knowledge, I'm currently enrolled in ADENE, in the supervision of the Buildings Certification Scheme, Management of National/European Projects and Development of Energy Efficiency Studies to support Public Policies and the Design of Incentive programs.



## Pedro Rocha Almeida

Power System Engineer, Tractebel Engineering, Brussels

PhD in: Sustainable Energy Systems (SES) Year of graduation: 2012 Institutional affiliation: Faculdade de Engenharia da Universidade do Porto

#### Thesis title:

## Impact of vehicle to grid in the power system dynamic behaviour

PhD Advisors: João Peças Lopes (FEUP); James Kirtley (MIT)





Influence of control patterns for lighting and shading systems on the predicted energy performance of buildings

PhD Advisors: Vitor Manuel Silva Leal (FEUP); Marilyne Anderson (MIT)

## Pedro Silva

PhD in: Sustainable Energy Systems (SES) Year of graduation: 2012 Institutional affiliation: Faculdade de Engenharia da Universidade do Porto

## Alumni Doctoral Programs



2013

Thesis title: Income-based carbon responsibility PhD Advisors: Tiago Domingos (IST); João Rodrigues (IST)

## Alexandra Marques

Postdoc - iDiv, Germany

PhD in: Sustainable Energy Systems (SES) Year of graduation: 2013 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

How has MPP contributed to your career development? MPP has allowed me to consolidate a solid multidisciplinary background required in the Sustainability field.



## **Alexandre Lucas**

Energy Systems Engineer, European Commission, Joint Research Centre, Italy

PhD in: Sustainable Energy Systems (SES) Year of graduation: 2013 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

### Thesis title:

# Evaluation of energy supply infrastructure in the context of life-cycle analysis of alternative light-duty vehicle

**PhD Advisors:** Carla Alexandra Silva (IST); Rui Pedro Neto (IST); Randolph Kirchain (MIT)



### Decision support methodology for local sustainable energy planning

**PhD Advisors:** Vítor Leal (Department of Mechanical Engineering - FEUP); João Lourenço (CEG-IST)

## **Ana Rita Neves**

Climate Alliance, Belgium

PhD in: Sustainable Energy Systems (SES)
Sub area: Energy Planning including Economics
Year of graduation: 2013
Institutional affiliation: Faculdade de Engenharia da Universidade do Porto



#### Thesis title:

## Block-oriented agent-based architecture to support the power distribution system operation

**PhD Advisors:** João Abel Peças Lopes (FEUP); Mauro Augusto da Rosa (INESC TEC)

## Diego Issicaba

Area Leader, INESC P&D Brasil

PhD in: Sustainable Energy Systems (SES)
Sub area: Smart Energy Networks
Year of graduation: 2013
Institutional affiliation: Faculdade de Engenharia da Universidade do Porto

#### How has MPP contributed to your career development?

Finishing the Ph.D. course on the MPP constituted an important step in my professional career. Besides the knowledge acquired during the four-year course, the MPP helped me to build a large contact network which will enhance my professional life henceforth.



### A retrofit decision support approach for improving energy efficiency and indoor environmental quality in buildings

**PhD Advisors:** Manuel Gameiro da Silva (UC); Carlos Henggeler Antunes (UC); Luis Dias (UC); Leon Glicksman (MIT)

## Ehsan Asadi

Post-doc fellow/ UC- Portugal

PhD in: Sustainable Energy Systems (SES)
Sub area: Sustainable Built Environment
Year of graduation: 2013
Institutional affiliation: Faculdade de Ciências e Tecnologia da Universidade de Coimbra

#### How has MPP contributed to your career development?

MPP brought me the opportunity to have access to some of the best class research faculties and laboratories in both Europe and USA.



## **Fllipa Reis**

Patent Examiner/ INPI

PhD in: Sustainable Energy Systems (SES)
Sub area: Methodology and Technology
Year of graduation: 2013
Institutional affiliation: Faculdade de Ciências da Universidade de Lisboa

#### Thesis title:

## Development of photovoltaic systems with concentration

**PhD Advisors:** Miguel Centeno Brito (FCUL); Gianfranco Sorasio (WS Energia)





## Distributed energy resources for a sustainable built environment

PhD Advisors: Paulo Ferrão (IST); Ana Póvoa (IST)

## **Gonçalo Cardoso**

Post Doctoral Fellow at Lawrence Berkeley National Laboratory - USA

PhD in: Sustainable Energy Systems (SES)
Sub area: Sustainable Built Environment
Year of graduation: 2013
Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

#### How has MPP contributed to your career development?

The MIT Portugal Program has allowed me to transition from a background in civil engineering to the area of energy systems and has helped me open doors in world class research institutions.

In the private sector it has also contributed to my career progression by providing me with additional skills and competences that expanded my areas of intervention.



#### Thesis title:

### Feasibility assessment of carbon capture and storage technology in the portuguese energy system

**PhD Advisors:** Paulo Manuel Cadete Ferrão (IST); Edward Stephen Rubin (Carnegie Mellon University); Christos Ioakimidis (Deusto Institute of Technology)

## Hana Gerbelova

Researcher/Insituto Superior Técnico/Portugal

PhD in: Sustainable Energy Systems (SES)
Sub area: Energy Planning including Economics
Year of graduation: 2013
Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

#### How has MPP contributed to your career development?

MIT | Portugal Program opened for me a lot of new opportunities. Program itself is very well internationally recognized, which essentially helps in career development. During my studies, I had a chance to collaborate with an excellent professors and colleagues, working on interesting topics, visit University abroad and participate in different conferences and seminars. At each of this step, I had learnt a lot and I had established many great contacts. I believe this is a fundamental support for my future research career.



### Advances on the sequential monte carlo reliability assessment of generation-transmission systems using cross-entropy and population-based methods

**PhD Advisors:** Vladimiro Miranda (FEUP); Mauro Rosa (Universidade Federal de Santa Catarina - Brasil)

## **Leonel Carvalho**

Senior Researcher/INESC TEC - Portugal

PhD in: Sustainable Energy Systems (SES) Year of graduation: 2013 Institutional affiliation: Faculdade de Engenharia da Universidade do Porto



## Marta Mota

Assistant Professor at ISMAI Maia Institute of Higher Education, Portugal

PhD in: Sustainable Energy Systems (SES)Year of graduation: 2013Institutional affiliation: Escola de Engenharia da Universidade do Minho

#### Thesis title:

#### On corporate sustainability reporting -Case of electric utilities

**PhD Advisors:** Eduardo Guimarães Oliveira Fernandesa (FEUP); Maria Isabel Rebelo Teixeira Soares (FEP)





## **Miguel Covas**

Head of New Generation Data Center at Portugal Telecom, Portugal

PhD in: Sustainable Energy Systems (SES) Year of graduation: 2013 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa



## Multi-criteria decision analysis for the development of sustainable data centers

PhD Advisors: Carlos Santos Silva (IST); Luís Dias (FCTUC)



## Miguel Moreira da Silva

Head of Asset Management/REN - Portugal

PhD in: Sustainable Energy Systems (SES)
Sub area: Energy Planning including Economics
Year of graduation: 2013
Institutional affiliation: Faculdade de Engenharia da Universidade do Porto

#### Thesis title:

Energy planning with electricity storage and sustainable mobility: The study of an isolated system

PhD Advisors: João Peças Lopes (FEUP); Manuel Matos, (FEUP)

#### How has MPP contributed to your career development?

Applying to the PhD in Sustainable Energy Systems, of the MPP, was the most significant decision of my professional life. The PhD offered cutting-edge expertise spread among several Portuguese Research Centers and Universities, and enabled the set up of a multicultural network of researchers.

In addition, the rigorous and proficient guidance provided by my Supervisors, throughout the thesis development, stamped robustness to my research.

The PhD has therefore leveraged my know-how, as well as a set of "soft skills".

I have the fortune of working in the energy industry, dealing with topics fairly related with my PhD research. Surely, it has been worth it!



### A combined multi-criteria and system dynamics methodology for mid-term planning of light duty vehicle fleets

PhD Advisors: Vitor Leal (FEUP); Jorge Pinho de Sousa (FEUP)

## Reza Fazeli

Postdoctoral Researcher, University of Iceland, Iceland.

PhD in: Sustainable Energy Systems (SES)
Sub area: Energy Planning including Economics
Year of graduation: 2013
Institutional affiliation: Faculdade de Engenharia da Universidade do Porto



## **Ricardo Bessa**

Senior Researcher and Area Manager/INESC TEC - Portugal

PhD in: Sustainable Energy Systems (SES)
Sub area: Smart Energy Networks
Year of graduation: 2013
Institutional affiliation: Faculdade de Engenharia da Universidade do Porto

#### Thesis title:

Methodologies for the participation of an electric vehicles' aggregator in the electricity markets PhD Advisors: Manuel Matos (FEUP)





## Wave energy extraction from oscillating systems: numerical modelling and experimental testing

PhD Advisors: Luís Gato (IST); António Falcão (IST)

## **Rui Gomes**

Postdoctoral fellow, LAETA, Portugal

PhD in: Sustainable Energy Systems (SES)
Sub area: Methodology and Technology
Year of graduation: 2013
Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

#### How has MPP contributed to your career development?

The MPP has given me the opportunity to expand my knowledge in the field of ocean energy by integrating technical aspects with economic and policy prespectives of sustainable energy systems.



## Vasco Granadeiro

Postdoctoral Research Fellow, Institute of Mechanical Engineering, Faculty of Engineering of the University of Porto (IDMEC-FEUP)

PhD in: Sustainable Energy Systems (SES)
Sub area: Sustainable Built Environment
Year of graduation: 2013
Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

### Thesis title:

### Early design and optimization of the building envelope: Integrating architectural generative design systems and energy performance calculation

**PhD Advisors:** José P. Duarte (Faculty of Architecture, UL); João R. Correia, (IST-UL); Vítor M. S. Leal (FEUP)

## 178

## 2014

## **Alumni Doctoral Programs**



#### Thesis title:

### Modeling urban growth and electricity consumption: The power of power laws

PhD Advisors: Tiago Domingos (IST)

## Ana Gonçalves

Certification Analyst at Carbon Trust, UK

PhD in: Sustainable Energy Systems (SES) Sub area: Energy Planning including Economics Year of graduation: 2014 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

#### How has MPP contributed to your career development?

By giving me the possibility of studying energy use and energy markets integrating various topics and a broad knowledge of the energy research field.



## **Bernardo Silva**

Senior Researcher, INESC Technology and Science - Associate Laboratory coordinated by INESC Porto, Portugal

PhD in: Sustainable Energy Systems (SES) Year of graduation: 2014 Institutional affiliation: Faculdade de Engenharia da Universidade do Porto

#### Thesis title:

### Multi-terminal HVDC grids: control strategies for ancillary services provision in interconnected transmission systems with offshore wind farms

**PhD Advisors:** Hélder Filipe Duarte Leite (FEUP); Carlos Coelho Leal Monteiro Moreira (FEUP)




#### Thesis title:

Environmental sustainability assessment of soybean and palm biodiesel systems: A life-cycle approach PhD Advisors: Fausto Freire

### Érica Geraldes Castanheira

Associate Professor / University of Coimbra

PhD in: Sustainable Energy Systems (SES)
Sub area: Energy Planning including Economics
Year of graduation: 2014
Institutional affiliation: Faculdade de Ciências e Tecnologia da Universidade de Coimbra

#### How has MPP contributed to your career development?

I have no doubt that having done my PhD SES within the MPP will contribute significantly for the success of my career. MPP brings together faculty from several teaching and research institutions, which offers an interesting opportunity to develop research in emergent fields. MPP provided me various and exciting personal and professional experiences (participate in projects with multidisciplinary teams, work together with companies and developing research abroad) that will be useful in the future.



### **Eugénio Rodrigues**

Researcher/University of Coimbra - Portugal

PhD in: Sustainable Energy Systems (SES)
Sub area: Sustainable Built Environment
Year of graduation: 2014
Institutional affiliation: Faculdade de Ciências e Tecnologia da Universidade de Coimbra Thesis title: Automated floor plan design: Generation, simulation, and optimization PhD Advisors: Adélio Gaspar (UC); Álvaro Gomes (UC)

### 179



# **Filipa Amorim**

Researcher / Instituto Superior Técnico da Universidade de Lisboa - Portugal

PhD in: Sustainable Energy Systems (SES) Year of graduation: 2014 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

#### Thesis title:

# Planning generation in liberalising and decarbonising electricity systems: The Portuguese case

**PhD Advisors:** Victor Martins (ISEG-UL); Patrícia Pereira da Silva (FE-UC); Jorge Vasconcelos (IST)

#### How has MPP contributed to your career development?

Wanting to fully understand the reasons behind electricity upwards price trends and the current transitions occurring in the electricity sectors made me enter in one of the most complex and fruitful research areas in sustainable energy systems field: energy markets combined with climate/energy policy. My PhD research allowed me to formulate citizenship worries into a useful scientific frame that contributes to the public understanding of such a complex and so many times ideological world in the most independent and transparent way.



# **Filipa Carlos**

Senior Researcher, IES - Social Entrepreneurship Institute, Portugal

PhD in: Sustainable Energy Systems (SES) Year of graduation: 2014 Institutional affiliation: Faculdade de Engenharia da Universidade do Porto

#### Thesis title:

# Prioritizing renewable energy resources based on environmental and energy quality criteria

**PhD Advisors:** Eduardo Guimarães Oliveira Fernandesa (FEUP); Maria do Rosário Sintra de Almeida Partidário (IST)





#### Thesis title:

#### Market power evaluation in electricity markets

**PhD Advisors:** Álvaro Martins (ISEL/UL); Jorge Sousa (ISEL/IPL); Paulo Ferrão (IST/UL)

### João Lagarto

PhD in: Sustainable Energy Systems (SES) Sub area: Energy Planning including Economics Year of graduation: 2014 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa



### Leonardo Bremermann

Researcher/Universidade Federal de Santa Catarina - Brazil

PhD in: Sustainable Energy Systems (SES)
Sub area: Methodology and Technology
Year of graduation: 2014
Institutional affiliation: Faculdade de Engenharia da Universidade do Porto

#### Thesis title:

# Impact evaluation of the large scale integration of electric vehicles in the security of supply

PhD Advisors: Manuel Matos (FEUP); João Abel Peças Lopes (FEUP)



#### Thesis title:

# Time-domain impedance-based fault location for hvdc transmission lines

**PhD Advisors:** Maria Teresa Ponce de Leao (FEUP); Helder, Leite (FEUP); Paulo De Oliveira (Universidad Simon Bolivar)

# Luis de Andrade

PhD in: Sustainable Energy Systems (SES)
Sub area: Methodology and Technology
Year of graduation: 2014
Institutional affiliation: Faculdade de Engenharia da Universidade do Porto



# Training the Leaders of the Future **Transportation Systems**



# A scope of the doctoral program including a typical / desired student profile

The Doctoral Program in Transportation Systems (DPTS) is designed to prepare students for transportation-related careers in academia, including teaching and advanced research, as well as professional practice careers in both the public and private sectors. Upon completion of the program, students will be intellectual leaders within their chosen fields and organizations.

Established in 2007, the DPTS has already gained worldwide recognition, attracting highly qualified candidates from around the globe. The transportation systems PhD program is offered in association with the University of Lisbon (IST), the University of Porto (FEUP), and the University of Coimbra (FCTUC), with Massachusetts Institute of Technology (MIT) collaborating in the program's research component and also in teaching.

The goal of the program is to prepare students to become leading actors in the transportation world by providing excellence and innovation in teaching and research through:

- Providing a solid scientific education covering both methodological approaches and institutional factors required to understand the transportation enterprise as an inter modal integrated system
- Conducting cutting-edge research for the development of a world-class transportation system for passengers and freight for Portugal that can serve as a model for the rest of Europe though multi-disciplinary research collaborations between Portugal and MIT.
- Working with industrial, government, and laboratory collaborators to provide added value to the program through research collaboration and teaching involvement.

The DPTS covers all transport systems topics, from transport policy and planning to infrastructure design and maintenance, at the various spatial levels – from international to local – and for the various modes: air, rail, road, etc.

Candidates from a wide variety of backgrounds including engineering, urban planning, computer science, economics, and other social sciences are encouraged to apply.

### Curriculum

The DPTS PhD program is typically three years long. The first year of the program is devoted primarily to course work, worth 60 European Credit Transfer and Accumulation System (ECTS) credits. Coursework includes two mandatory courses – "Research Methodologies" (6 credits) and "Thesis Project in Transport Systems" (30 credits) – and four optional courses.

At least two of the optional courses must be chosen among the ones listed in the table below. The remaining ones can be chosen among any other doctoral course offered in the participating schools or in any schools with which they have doctoral collaboration agreements.

The second and third years of the DPTS are dedicated to the preparation of a doctoral thesis, worth 120 credits.

Course	ECTS credits	Mandatory/Optional	Semester
Road Traffic Management	6	Optional	1
Research Methodologies	6	Mandatory	1
Transport Demand Modelling	6	Optional	1
Transport Infrastructure and Operations Optimization	6	Optional	1
Risk and Decision-Making	6	Optional	1
Highway and Airport Infrastructure Engineering	6	Optional	2
Business Models and Contracts	6	Optional	2
Transport Policies and Institutions	6	Optional	2
Railway Infrastructure Design and Maintenance	6	Optional	2
Simulation of Land-Use/Transport Systems Simulation	6	Optional	2
Thesis Project	30	Mandatory	Annual

#### Structure of the doctoral program in Transportation Systems

#### **Road Traffic Management**

Objectives: Provide students with a deep knowledge and with advanced R&D skills and competencies on the subject of road traffic management.

#### **Research Methodologies in Natural and Social Sciences**

Objectives: Provide students with a deep knowledge on advanced research methodologies and work plan development skills.

#### **Transport Demand Modeling**

Objectives: Provide students with a deep knowledge and with advanced R&D skills and competencies on the subject of transport demand modeling.



#### Infrastructure Optimization and Transport Operations

Objectives: Provide students with a deep knowledge and with advanced R&D skills and competencies on the subject of optimization of transport infrastructure and operations.

#### **Risk and Decision Making**

Objectives: Provide students with a deep knowledge and with advanced R&D skills and competencies on the subject of risk and decision-making.

#### **Road and Airport Infrastructure Engineering**

Objectives: Provide students with a deep knowledge and with advanced R&D skills and competencies on the subject of road and airport infrastructure engineering.

#### **Business Models and Contracts**

Objectives: Provide students with a deep knowledge and with advanced R&D skills and competencies on the subject of business models and contracts in the transport sector.

#### **Transport Policy and Institutions**

Objectives: Provide students with a deep knowledge and with advanced R&D skills and competencies on the subject of transport policy and institutions.

#### Project and Maintenance of Railway Infrastructure

Objectives: Provide students with a deep knowledge and with advanced R&D skills and competencies on the subject of rail infrastructure design and conservation.

#### Simulation Systems for Land-Use / Transport

Objectives: Provide students with a deep knowledge and with advanced R&D skills and competencies on the subject of land-use/transport systems simulation.

#### **Thesis Project in Transport Systems**

Objectives: Provide students with the skills and competencies to prepare a research proposal and the corresponding work plan.

#### **Doctoral Thesis in Transportation Systems**

Objectives: Provide students with the skills and competencies to coordinate and develop high-level R&D.

### Main research topics

- Air transport systems
- Railway infrastructure and operation systems
- Road infrastructure and operation systems
- Land-use/transport systems
- Innovative urban transport modes/services
- Urban mobility and accessibility
- Intelligent transport systems
- Traveler information systems
- Transport safety systems

### Affiliated Institutions (Universities and or Companies)

University of Lisbon (IST) University of Porto (FEUP) University of Coimbra (FCTUC) Massachusetts Institute of Technology (MIT)

# 2008 / 2009



### Diana Silva Leal

Nationality: Portuguese PhD in: Transportation Systems (DPTS) Starting year: 2008/2009 Institutional affiliation: Faculdade de Ciências e Tecnologia da Universidade de Coimbra

#### Thesis title:

#### Rail cargo on the Lisbon-Madrid high-speed rail line

**PhD Advisors:** Luís Picado-Santo (IST); Bruno Filipe Santos (Delft University of Technology)

The study analyses a life-cycle application to deal with the introduction of containerized cargo on the high-speed rail line between Lisbon and Madrid. The idea is to explore the new concept to deliver perishable goods. To minimize additional costs, cargo use free slots in the passenger service such that no changes are necessary to use the planned line for cargo services. The main improvements are the inclusions of a range of stakeholder perspectives as part of a multi-dimensional decision process. Stakeholders have different objectives and concerns and solutions need to find compromising between those objectives. Results show the investment ability to integrate cargo trains in the daily routine and improve the crucial role that freight transport has in the day life of the society. The study uses MATE methodology, usually applied to aerospace field and here applied to transport systems.



# Maria Spandou

Nationality: Greek PhD in: Transportation Systems (DPTS) Starting year: 2008/2009 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

#### Thesis title:

#### Institutional design as performance factor: A comparative institutional analysis of two metropolitan public transport systems

PhD Advisors: Rosário Macário (IST)

Urban public transport systems have significant influence on everyday life and activities of modern cities, with the institutional component playing a crucial role. This PhD dissertation contributes to this academic discussion by (i) delving into the knowledge base on institutional design theory and performance management, (ii) mapping, understanding and assessing the decision-making processes of metropolitan public transport policy, planning and operations level, as well as the interrelations among relevant stakeholders, and (iii) identifying, analyzing and evaluating the institutional design parameters that constitute determinants of good institutional, as well as overall performance. The analysis is based on an interdisciplinary and mixed methodological framework, namely a combination of qualitative and quantitative analysis, primarily based on comparative case study research.





### **Rui Santos**

Nationality: Portuguese PhD in: Transportation Systems (DPTS) Starting year: 2008/2009 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

#### Thesis title:

#### Development of planning and scheduling models for efficient utilization of heavy railway track maintenance equipment

PhD Advisors: Paulo Fonseca Teixeira (IST); António Pais Antunes (UC)

The research focus of this dissertation is railway track maintenance, where integrated planning and scheduling models are developed, related to tactical and operational decisions for heavy maintenance intervention on tracks. The purpose is to achieve efficient use of maintenance resources in alignment with suitable track quality levels. Methodologically, the dissertation evolved from an optimal formulation of the problem, continuously improved through heuristic processes, resulting in a decision rules model. Through the application of the latter model in a conventional railway line in Portugal, it was possible to achieve significant economical savings in maintenance unitary costs for the case of railway tamping works.

# Merkebe Getachew Demissie

Nationality: Ethiopia PhD in: Transportation Systems (DPTS) Starting year: 2009/2010 Institutional affiliation: Faculdade de Ciências e Tecnologia da Universidade de Coimbra

#### Thesis title:

# Combining datasets from multiple sources for urban and tranportation planning: Emphasis on cellular network data

PhD Advisors: Gonçalo Correia (UC); Carlos Bento (UC)

In this thesis we explore the use of datasets from new sources for the planning of urban and transportation systems in cities. Three types of passive mobile positioning data were used: (1) Call Volume, which is the number of calls; (2) Erlang, which is used to measure the equivalent cellphone traffic per hour; and (3) Handover, which is the process of transferring an ongoing call from one base station to another without interruption of service. Our observations are based on hourly aggregated cellphone data obtained from a dataset from a telecom company in Lisbon, Portugal. For validation of our results, we collaborated with other data providers in Lisbon to gather different ground truth datasets that could improve our understanding of urban dynamics such as census data, taxi movement, bus movement, traffic count, points of interest, and presence of people.



# Mohammad Mahdi Hajizamani

Nationality: Iranian PhD in: Transportation Systems (DPTS) Starting year: 2009/2010 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

#### Thesis title:

# An advanced technological in-vehicle system aiming to reduce the hazardous driving actions

PhD Advisors: Luís Picado Santos (IST)

Driver's error is the main cause of accidents and casualties in road transportation. As working in road safety area, this project aims to design an in-vehicle intelligent surveillance and control system (system "X") which can communicate with the driver, vehicle and environment. This system will warn, help and potentially control the driver to drive in a stable and safe condition. This procedure will lead to less accident and casualties.

A software modeling will be used to calibrate the system "X" parameters which could be used for different drivers in different driving conditions to decrease the chance of having accidents. This system will collect the information from different sources and after processing the information and analyzing the associated risk to the driver behavior, different level of actions will be made.

2010/2011



# **Bahareh Tavallaee**

Nationality: Iranian PhD in: Transportation Systems (DPTS) Starting year: 2010/2011 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

#### Thesis title:

# A framework for sustainable pavements implementation applied to portuguese conditions

**PhD Advisors:** Luís Picado Santos (Full Professor of Transport Infrastructures, Department of Civil Engineering and Architecture - IST); José Manuel Neves, Professor Auxiliar of Transport Infrastructures, Department of Civil Engineering and Architecture - IST)

Proposing a comprehensive framework (e.g. Mechanistic Empirical Pavement Design Guide (MEPDG) and its software DARWin ME) for sustainable pavement implementation applied to Portuguese conditions that includes data preparation to locally calibrate the MEPDG procedure and adopting a proper behavior model for Portuguese conditions which may result in delivering pavement catalogue for Portuguese conditions and developing implementation guidelines for the future adoption of DARWin-ME in Portugal.



# Diana Jorge

Nationality: Portuguese PhD in: Transportation Systems (DPTS) Starting year: 2010/2011 Institutional affiliation: Faculdade de Ciências e Tecnologia da Universidade de Coimbra

#### Thesis title:

# Optimization and simulation of one-way carsharing operations

PhD Advisors: Gonçalo Correia (TU Deldt); Cynthia Barnhart (MIT)

One-way carsharing systems are more attractive to the users than others based on round-trip schemes, since each user can pick up a vehicle in a station and return it to a different one. However, there are few one-way carsharing systems implemented around the world, because they present several managerial problems to the operators. Moreover, there are few studies addressing this issue. The goal of this research is to develop decision-aid tools to help analyzing and planning the deployment of flexible one-way carsharing systems, using both optimization and simulation techniques.





# **Edgar Jimenez**

Nationality: Colombia PhD in: Transportation Systems (DPTS) Starting year: 2010/2011 Institutional affiliation: Faculdade de Engenharia da Universidade do Porto

#### Thesis title:

#### Long-term strategies for low-cost airports: Flexibility for sustainable development

**PhD Advisors:** Jorge Pinho de Sousa (FEUP); João Claro (FEUP); Richard de Neufville (MIT)

We argue that a new paradigm in airport strategic development should incorporate in the same process the planning and design of infrastructure and the definition of a matching business strategy. It must take into account the existence of different airline business models that entail differences in airport facilities and operation, or that may challenge airport strategies. Furthermore, airline business models will inevitably continue to evolve and their requirements may differ slightly in the near future and substantially in the long-term, thus a new paradigm must as well embrace the inherent uncertainty of the aviation industry.

#### Thesis title:

An integrated framework for parking pricing and modeling

PhD Advisors: Jorge Pinho de Sousa, Antonio Pais Antunes

In recent years studies on parking management and parking pricing have grown up fast to deal with congestion problems, and at the same time researchers became more interested in parking pricing instead of road pricing. The main reason for this interest is that parking pricing is in general less costly than road pricing. To find a proper framework for this problem knowing the elements of this problem is critical. We are trying to clear the different aspects of the parking pricing problem. Proposing a comprehensive model that connects the 4-step travel demand modeling to the optimization model is the next step to have a broader framework in this study. The goal of optimization model will be the optimizing of the net cost revenue to find a practical solution for the costly structure of off-street parking buildings.

# Farzam Salimi

Nationality: Iranian PhD in: Transportation Systems (DPTS) Starting year: 2010/2011 Institutional affiliation: Faculdade de Engenharia da Universidade do Porto





# **Guineng Chen**

Nationality: Chinese PhD in: Transportation Systems (DPTS) Starting year: 2010/2011 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

### Thesis title:

#### The regional impacts of high-speed rail: Case study of Portugal and Spain

PhD Advisors: João de Abreu e Silva (IST)

The objective of this dissertation is to explore the relationship between High-Speed Rail (HSR) investment and regional development both qualitatively and quantitatively. Specifically, to demonstrate the evolutions of various regional development indicators (e.g. accessibility, private sector production, employment, private investment, active population, land-use, etc.) to the introduction of the HSR service; define the methodology for evaluating each linkage and the interactions among the different linkages; construct a model to represent the dynamics and measure the overall impacts; evaluate the model with case studies and refine it for the application in reality.

#### Thesis title:

Improving cost-benefit analysis of transport infrastructures: New insights in a lifecycle perspective

PhD Advisors: Filipe Moura (IST); Tiago Domingos (IST)

### **Heather Jones**

Nationality: USA PhD in: Transportation Systems (DPTS) Starting year: 2010/2011 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

Improving CBA by analyzing residual value procedures and including a life-cycle assessment to account for total lifetime environmental impacts all in the context of the impact of the discount rate selected and the proposal of a new hyperbolic discount rate.



# Luis Caetano

Nationality: Portuguese PhD in: Transportation Systems (DPTS) Starting year: 2010/2011 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

#### Thesis title:

# Strategic model to optimize railway track maintenance and renewal operations

PhD Advisors: Paulo Teixeira (IST)

The main focus of this research is on the development of new methodologies that consider robust railway track degradation models, calibrated and validated with historical data from inspections in the Portuguese railway network, to support railway track maintenance and renewal decisions. Furthermore, decision support methods such as life-cycle costs will be used to cut expenditures on railway track maintenance and renewal works and at the same time guarantee a reliable and available infrastructure. A decision support system that integrates these features will be a useful tool for track managers and engineers to analyze the railway track condition and decide, with more accuracy, when maintenance is necessary and when is the best time to replace railway track components.



# Tomás Eiró

Nationality: Portuguese PhD in: Transportation Systems (DPTS) Starting year: 2010/2011 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

#### Thesis title:

#### An agent-based simulation approach to model an urban mobility system. An application to the Lisbon metropolitan area

PhD Advisors: Luis Martínez (International Transport Forum)

With this research we intend to develop a simulation tool that allows analyzing the mode choice behavior on the Lisbon Metropolitan Area. This behavior will be influenced by the introduction of new more demand responsive transport options like the minibus, carsharing and shared taxis. These new transport operators will emerge as small private companies that intend to gain position in an already existent mobility market. This model will act as a decision support tool to guide the LMA mobility market to a more sustainable and efficient configuration



195

# 2011/2012

# Aleksandr Prodan

Nationality: USA PhD in: Transportation Systems (DPTS) Starting year: 2011/2012 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

#### Thesis title:

# Linking railway infrastructure costs to infrastructure charges

PhD Advisors: Paulo F. Teixeira (IST); Joseph Sussman (MIT)

Over the past 20 years, the railway sector in Europe has been undergoing a restructuring process, where Infrastructure Management has been separated from Train Operations in order to improve performance of railways and to introduce competition into the sector. Trains pay to use the infrastructure, and they are subject to certain new access rules. Competition within the sector is slowly being introduced. This thesis studies the financial relationship between Infrastructure Managers and Train Operators to see how existing charging schemes work and whether they comply with European legislation. This thesis then aims to relate infrastructure maintenance costs to infrastructure charges and, in the last step, to develop a toolkit that will be useful for Infrastructure Managers in creating new charging schemes that are compliant with current legislation.



# André Romano Alho

Nationality: Portuguese PhD in: Transportation Systems (DPTS) Starting year: 2011/2012 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

#### Thesis title:

#### Improved mobility and more sustainable urban logistics through the configuration and enforcement of (un)loading bays

PhD Advisors: João de Abreu e Silva (IST); Jorge Pinho de Sousa (FEUP)

The objective of this thesis is to study the relation between improved traffic conditions and more sustainable urban logistics, through the spatial configuration (location, number, size) of loading/unloading bays and usage enforcement. The phenomenon to be studied is double parking derived from the inadequate spatial configuration, or inadequate occupation, of loading/unloading bays.



# **Dimitrios Papaioannou**

Nationality: Greek PhD in: Transportation Systems (DPTS) Starting year: 2011/2012 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa Thesis title:

# A comprehensive quality indicator for public transport systems evaluation

PhD Advisors: Luis Miguel Martinez (IST)

This research deals with quality in public transport (PT) systems. The goal is to examine the quality of various fields in PT and understand their effect on ridership and mode choice. However the main focus of this work is PT system layout and service design. A survey on urban mobility and PT satisfaction has been designed and launched. The collected data will be used in a series of structural equation models that will attempt to model the connection between different elements of PT and perceived quality. The end goal of this research is the development of a global indicator that will be able to rate and rank PT systems' quality and measure the change in ridership when improving or downgrading a specific element.



### Thesis title: Bike-sharing systems design PhD Advisors: Anabela Ribeiro (UC); Christopher Zegras (MIT)

# Inês Frade

Nationality: Portuguese PhD in: Transportation Systems (DPTS) Starting year: 2011/2012 Institutional affiliation: Faculdade de Ciências e Tecnologia da Universidade de Coimbra Strategic design of public bicycle sharing systems concerning the definition of bike-sharing demand, the location of public bicycle stations and the combination of both models to design a bike-sharing system in coordination with public transport.

Development of a methodology to help the decision-making of transportation planners, policymakers and investors in the implementation of bike sharing systems.





# Liliana Magalhães

Nationality: Portuguese PhD in: Transportation Systems (DPTS) Starting year: 2011/2012 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

#### Thesis title:

# A decision support tool for flexible airport passenger terminals

PhD Advisors: Vasco Reis (IST); Rosário Macário (IST)

This study is about flexible airport development. It focuses on how to improve and adapt the development process of an airport terminal, in order to cope with air transport uncertainty and dynamism. The goal is to study the airport terminal flexibility by analysing its processes for passenger and luggage. One of the hypotheses of this thesis is that a terminal with flexible processes is a flexible airport terminal. Uncertainty results of several factors, such as demand, economic cycles, environmental constraints or land-use restrictions. Flexibility has been pointed as a key mechanism to face uncertainty. Therefore, airport development must be based on flexible options. The approach in this study is to analyse the terminal processes for passengers and luggage and herein, apply flexible options. The goal is to evaluate which flexible options produces more benefits.



#### Thesis title:

#### Uncertainty and risk analysis in transportation demand modeling

PhD Advisors: João de Abreu e Silva (IST); Filipe Moura (IST)

# Olga Petrik

Nationality: Russian PhD in: Transportation Systems (DPTS) Starting year: 2011/2012 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa The study aims at classifying uncertainty present in each component of a demand forecast model. It aims to identify the main contributors to the outcome uncertainty and quantify the uncertainty associated with them, and, finally, determine its impact in risk taking for decisionmaking. The research methodology is applied to a case study, the High-Speed Railway (HSR) project in Portugal. The study focuses on improving the quality of demand modeling practice.

# **Ryan F Allard**

Nationality: Trinidad and Tobago PhD in: Transportation Systems (DPTS) Starting year: 2011/2012 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

#### Thesis title:

# Operator-based analysis of intercity passenger intermodality

**PhD Advisors:** Filipe Manuel Mercier Moura (Assistant Professor, Transportation Systems CESUR/DECIVIL, IST); Joseph Sussman (Professor of Civil and Environmental Engineering and Engineering Systems/ MIT)

Research in intermodality (closely connected transportation systems) has typically been of a qualitative nature, and very little has any measurement of intermodal benefits.

#### The Research Questions are:

- What is the value that passengers attach to long-distance intermodal transport services?
- How can offering long-distance intermodal services affect transport operators?

The idea is to measure and demonstrate the benefits that could motivate operators to pursue intermodality as an organizational strategy. This would henceforth be valuable for improving the connectedness of long-distance transportation systems worldwide. Policy recommendations will then be presented.

**Methodology:** Perform Game Theoretical Analysis of travel within the Iberian Peninsula fed by a market share model of modal choice.

#### Thesis title:

# Managerial decisions and performance in european urban public transport – A comparative analysis

PhD Advisors: Álvaro Fernando de Oliveira Costa (FEUP)

The defined work plan for the 3rd year of the doctoral project (PhD program on Transportation Systems) at FEUP (Faculdade de Engenharia da Universidade do Porto) has been finished successfully. Among other activities, long-term production

data from public transport companies has been collected and analyzed based on their annual economic reports. This involved a considerably large set of companies. A detailed comparison between the cases of Dresden and Porto has already been

performed, using a DEA approach (conference paper at EWGT2014). More recently the student started modeling gathered data from Hochbahn Hamburg by Regression Analysis. The research focused on decision analysis to develop a broad framework to for the general decision-making processes in public transport management.

# **Sebastian Ebert**

Nationality: German PhD in: Transportation Systems (DPTS) Starting year: 2011/2012 Institutional affiliation: Faculdade de Engenharia da Universidade do Porto





# Sofia Kalakou

Nationality: Hellenic PhD in: Transportation Systems (DPTS) Starting year: 2011/2012 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa Thesis title:

### Flexibility of airport passenger buildings: A pedestrian and technology-oriented approach

PhD Advisors: Filipe Moura (IST)

This research project aims to explore the flexibility of airport passenger buildings. The provision of high Level of Service (LOS) is guaranteed while estimating adequately space configuration and minimizing the corresponding full costs involved. Space analysis, pedestrian planning, passenger behavior, airport performance evaluation, simulation modeling and flexibility analysis are the key scientific areas.Future uncertainty and the effect of new technologies are also taken into account. The developed methodology is applied at Lisbon Portela airport.

#### Thesis title:

#### The impacts of high-speed rail on urban configurations

**PhD Advisors:** João Abreu e Silva (IST); Luis Miguel Martínez (IST and ITF at OECD); Jinhua Zhao (MIT)

# Yu Shen

Nationality: China PR PhD in: Transportation Systems (DPTS) Starting year: 2011/2012 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa This doctoral project deals with the accessibility impacts of High-Speed Rail (HSR) on urban configurations. The thesis incorporates two parts: the first part is the ex-post study focusing on the existent impacts of HSR in Spain, based on spatial discrete choice methods; the second part is based on cellular automata and agent-based simulation, of which the main goal is to predict the potential impacts of future HSR in Portugal on land-use/land-cover change, socioeconomic activities growth, etc. in various Portuguese urban areas.

# 2012/2013



#### Thesis title:

Numerical and experimental evaluation of pedestrians and cyclists exposure to local pollution and collision risks in urban neighborhoods

PhD Advisors: Tiago Farias (IST)

# Ana Marta Faria

Nationality: Portuguese PhD in: Transportation Systems (DPTS) Starting year: 2012/2013 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

This work aims to develop a methodology that allows the determination, through numerical and experimental analysis, of indicators that integrate pedestrians and cyclists' exposure to traffic-related air pollution, noise and safety for urban trips using soft modes (walking and cycling).



# Cristina Vilarinho

Nationality: Portuguese PhD in: Transportation Systems (DPTS) Starting year: 2012/2013 Institutional affiliation: Faculdade de Engenharia da Universidade do Porto

#### Thesis title:

#### Intelligent traffic signal control

**PhD Advisors:** Jose Pedro Tavares (CITTA, FEUP); Rosaldo Rossetti (LIACC, FEUP)

The proposed research aims to develop a real-time traffic control at isolated intersections. The control strategies for traffic signals are a high-importance topic due to impacts on economy, environment and society, affecting people and freight. Traffic signal plans optimization has been the main topic of focus of the research community. In addition to the definition of the best traffic plan at the design phase, it is important to add the target of maintaining the system optimized during the operation phase. In this way our research target is to develop an approach for controlling traffic signals that rely on a flexibility and maximal level of freedom in control where the system is updated frequently to match current traffic demand taking into account different traffic users.



# Joana Silva Carreira

Nationality: Portuguese PhD in: Transportation Systems (DPTS) Starting year: 2012/2013 Institutional affiliation: Faculdade de Ciências e Tecnologia da Universidade de Coimbra

#### Thesis title:

#### Airline fleet composition: Analysis and planning

**PhD Advisors:** António P. Antunes (FCTUC); Amedeo R. Odoni (MIT); Morton O'Kelly (Ohio State University)

This research work focus on airline fleet composition. The two main objectives are: 1) the analysis of how the fleet of airlines has changed throughout time; 2) the development of decision support models/tools for helping airlines at making better informed decisions about the configuration of their fleet.



# João Crucho

Nationality: Portuguese PhD in: Transportation Systems (DPTS) Starting year: 2012/2013 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

#### Thesis title:

# Use of nanomaterials to improve the surface properties and the durability of road pavement wearing courses

PhD Advisors: José Neves (IST); Silvino Capitão (ISEC)

This research aims to explore and take advantage of the introduction of nanomaterials in transportation infrastructures, in particular road and airport pavements. It is expected to achieve significant improvements in the performance and durability with the introduction of this new materials. A methodology based on experimental research will be developed to determine the influence of the nanomaterials in the asphalt pavements. A set of laboratory tests will be performed in order to formulate an asphalt mixture modified with nanomaterials, then, a set of performance tests will be realized to find the most adequate formula for more sustainable road pavements.



# Jóni Santos

Nationality: Portuguese PhD in: Transportation Systems (DPTS) Starting year: 2012/2013 Institutional affiliation: Faculdade de Ciências e Tecnologia da Universidade de Coimbra

#### Thesis title:

# Understanding and predicting the impact of events on urban mobility

PhD Advisors: Gonçalo Correia (UC); Francisco Camara Pereira (UC)

Ever since the beginning of this century, urban flows and events have been projected online at an increasing rate. These digital footprints are progressively available and represent the connection between the physical and the digital part of the city. We intend to take advantage this huge amount of data spread all across the internet (to the city of Lisbon). We want to understand the impact that events have in a city and then we plan to build models that will predict their impact on the mobility systems. These models will after be used to empower the transportation planners and policy makers with precise information about what will be likely to happen in the next events of the city. This research topic has not been explored much in the past, so there is an opportunity to produce a significant impact on the transportation research state of the art through the completion of this thesis.



# **Marco Amorim**

Nationality: Portuguese PhD in: Transportation Systems (DPTS) Starting year: 2012/2013 Institutional affiliation: Faculdade de Engenharia da Universidade do Porto

#### Thesis title:

# EMS network optimization models with different levels of uncertainty

**PhD Advisors:** António Couto (CITTA, School of Engineering - UP); Sara Ferreira (CITTA, School of Engineering - UP)

The main objective of this research is to measure the social impact of improving the EMR by optimizing the system planning: is a more efficient system also more effective?

The research will go through three phases on how to make the system more effective: in the long term (macro-management), in the mid-term (dynamic management), and in the short term (dynamic micro-management).

The study will comprise all types of EMR calls and the social impact will focus on the road accident victims.



# **Marcos Schlickmann**

Nationality: Brazil PhD in: Transportation Systems (DPTS) Starting year: 2012/2013 Institutional affiliation: Faculdade de Engenharia da Universidade do Porto

#### Thesis title:

#### Incorporating land-use impacts on BRT and LRT decision making

PhD Advisors: Jorge Pinho de Sousa (FEUP); Luis Martínez (IST)

When governments face the need of improving a transit system they normally have to choose between a set of technological and operational alternatives (e.g., Bus Rapid Transit (BRT), Light Rail Transit (LRT)). In this context, to help correctly evaluate each transport option and its impacts a decision support tool should be used, based for example in a Cost Benefit Analysis or Multiple Criteria Decision Analysis.

#### The objectives of this research are:

- To identify, understand and measure the impacts of BRT and LRT systems on accessibility, land uses, land values and densities.
- To consider those impacts on decision making focusing in sustainability as the major guide to be considered.

## 2013 / 2014



#### Thesis title:

# Value co-creation in urban public transport using pervasive mobile computing services

PhD Advisors: Teresa Galvão Dias (FEUP); João Falcão e Cunha (FEUP)

# **António Nunes**

Nationality: Portuguese PhD in: Transportation Systems (DPTS) Starting year: 2013/2014 Institutional affiliation: Faculdade de Engenharia da Universidade do Porto This project focuses on the application of mobile information technologies to the urban public transport domain. The availability of timely and reliable information for passengers plays an important role on travel experience. In light of this, a new paradigm of value co-creation based on collaborative exchanges of information between passengers and public transport operators in real-time is proposed. The development of a tool for dynamically connecting passengers based on the spatiotemporal similarity of travel patterns is a key element for putting the proposals into action. The goal of the project is to raise the attractiveness of public transport modes and ultimately contribute towards the sustainability of urban travel.



# **Marcos Correia**

Nationality: Portuguese PhD in: Transportation Systems (DPTS) Starting year: 2013/2014 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa Thesis title: The influence of transport policies and infrustrctures on the urban sprawul of Lisbon PhD Advisors: João de Abreu e Silva

It is pretended through analyse the influence of transport policies and infrastructures on urban sprawl on the Lisbon Metropolitan Area in the last 40 years. It will be made an extended Literature Review to find the best methodologies. It will be developed a continuous database set at census subsection level for the complete period of time. Finally, modelling and econometric tests will be used to assess the relations between land-use and transportation.





# Marta Campos Ferreira

Nationality: Portuguese PhD in: Transportation Systems (DPTS) Starting year: 2013/2014 Institutional affiliation: Faculdade de Engenharia da Universidade do Porto

### Thesis title: Enhancing public transport service through mobile integrated service offerings

PhD Advisors: João Falcão e Cunha (FEUP); Teresa Galvão (FEUP)

The main purpose of transport is access: to work, school, cinema, concerts, and other activities. Hence, it can be said that mobility is the centre of a constellation of services and goods, which must be analysed holistically. So the proposed research is mainly concerned on the co-creation of integrated service offerings among systems, people, technologies and other resources of the traveller value constellation. The proposed research will also focus on technological based service encounters, and more precisely on the use of mobile devices as the channel of interaction. This adds additional innovation to the research, since mobile devices are starting to be introduced in the service delivery process of service providers.

Therefore, the problem shall be defined as: How mobile devices can be used to provide integrated service offerings that enhance travellers' experience?





# Mohammad Reza Manshadian

Nationality: Iranian PhD in: Transportation Systems (DPTS) Starting year: 2013/2014 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa Thesis title: Planning of personal rapid transit system PhD Advisors: Rosário Macário

Personal rapid transit system (PRT) that defines as an emission-free mode with fully automated and driverless vehicles on a system of specially built, and elevated guide ways. This PRT system is considered to be a solution to many worldwide and environmental issues related to the car dependency. Therefore, it is selected to study in this research because of innovative, sustainable, accessible, flexible, safe and electrically driven and produces zero local emission. As a result, the main aim of this research is to highlight sustainable planning of PRT system in Lisbon, which is caused to decrease car dependency. Also, the outcomes lead to the modification of sufficient information for recommendation to related stakeholders to implement integrated PRT system with other modes in urban areas for its feasibility, sustainability and reliability before its transfer to other cities.

205



# **Pedro Rodrigues**

Nationality: Portuguese PhD in: Transportation Systems (DPTS) Starting year: 2013/2014 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

#### Thesis title:

#### Railway geometrical defects evolution analysis and modelling - Integration of the phenomenon in a decision support tool

PhD Advisors: Paulo Teixeira (IST); Patrícia Ferreira (IST)

The ocurrence of punctual defects in rail tracks implies the need for maintenance actions to be undertaken, which represent significantly large investments to be made.

It is intended for the punctual defects evolution phenomenon to be studied, whether as a function of time or of the accumulated tonnage. Also their degradation rates values will be ascertained for several Portuguese railway lines, including data segregation by various clusters. Finally, the problem of maintenance resources allocation will be adressed and a cost-benefit analysis will be undertaken with the aim of better understanding the possible economical and financial advantages that having in hand additional information provided by the model created (and better maintenance needs predictions) may represent.

### **Alumni Doctoral Programs**

2012



#### Thesis title:

#### Air transportation design for effective and efficient service to small remote communities: Policy options under regulatory reform

PhD Advisors: Álvaro Costa (FEUP); Richard de Neufville (MIT)

### Alda Metrass-Mendes

Research Associate/The Icelandic Tourism Research Centre/University of Akureyri - Iceland

PhD in: Transportation Systems (DPTS) Year of graduation: 2012 Institutional affiliation: Faculdade de Engenharia da Universidade do Porto



# Diana Carvalho e Ferreira

Postdoctoral Researcher at Dublin City University Ireland

PhD in: Transportation Systems (DPTS) Year of graduation: 2012 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

#### Thesis title:

# Fighting cruising for parking through online parking space reservations

PhD Advisors: João de Abreu e Silva (IST)



# João Pita

Strategic Planning Executive, GRU Airport, São Paulo, Brazil

PhD in: Transportation Systems (DPTS)Year of graduation: 2012Institutional affiliation: Faculdade de Ciências e Tecnologia da Universidade de Coimbra

#### Thesis title: Air traffic network design

PhD Advisors: Antonio Antunes (FCTUC); Cynthia Barnhart (MIT)

#### How has MPP contributed to your career development?

The MPP has been a very important element for my development. First I had the change of being embedded on a world-class research center where I met extraordinaire colleagues and friends. Secondly, the research was applied to real cases which make it closer to what is expected from us on a corporate environment. Last but not the least, the supervisor support was unique combining a mix of experiences and knowledge that were essential for my professional and personal development.



Jorge Lopes

Information Management Officer at Brisa, Portugal

PhD in: Transportation Systems (DPTS) Year of graduation: 2012 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

### Thesis title: Traffic prediction for unplanned events on motorways

PhD Advisors: João Bento (IST); Moshe Ben-Akiva (MIT)



### Alumni Doctoral Programs

2013



#### Thesis title:

#### Improved active traffic management system for motorway safety and efficiency: The benefits of reducing the task demand of drivers

PhD Advisors: Luís de Picado Santos

# **Filmon Habtemichael**

Post-doctoral research associate at Old Dominion University

PhD in: Transportation Systems (DPTS) Year of graduation: 2013 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

#### How has MPP contributed to your career development?

MPP was very helpful as it provided the education that my career requires. Its diverse research activities and collaboration with multiple universities makes MPP very supportive.



#### Thesis title:

#### Modelling the vulnerability of complex transport network systems: An application to seismic risk in urban environment

PhD Advisors: Rosário Macário (IST); Carlos Oliveira (IST)

# **Gonçalo Caiado**

Urban planner at Lisbon Municipality

PhD in: Transportation Systems (DPTS) Year of graduation: 2013 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

#### How has MPP contributed to your career development?

The MPP was a major milestone in my career development. Not only has it significantly broaden my technical skills and working methods as it also allowed extending my professional contacts network.



# Thesis title:

# Dynamic vehicle routing for demand responsive transportation

PhD Advisors: Jorge Pinho de Sousa (FEUP); Teresa Galvão (FEUP)

# **Rui Gomes**

Post-Doc Researcher/Faculdade de Ciências e Tecnologia da Universidade de Coimbra - Portugal

PhD in: Transportation Systems (DPTS) Year of graduation: 2013 Institutional affiliation: Faculdade de Engenharia da Universidade do Porto

#### How has MPP contributed to your career development?

MPP has given me the opportunity of pursuing the PhD, addressing new challenges, meeting new people and finding some research avenues,

### Alumni Doctoral Programs

2014



#### Thesis title:

# Prediction and optimization of maintenance and renewal actions related to rail track geometry

PhD Advisors: Paulo Fonseca Teixeira (IST)

### António Andrade

Research Fellow in Institute of Railway Research at the University of Huddersfield (UK)

PhD in: Transportation Systems (DPTS) Year of graduation: 2014 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa

#### How has MPP contributed to your career development?

The MIT Portugal program was decisive to understand the complexities of the railway system in the transportation field. It provided me the opportunity to learn several methods and techniques and broad my horizons not only in research but also in consultancy.



#### Thesis title:

# Probabilistic safety analysis using traffic microscopic simulation

**PhD Advisors:** João Cardoso (LNEC); Moshe Ben-Akiva (MIT); Filipe Moura (IST)

# **Carlos Lima Azevedo**

SMART, Singapore

PhD in: Transportation Systems (DPTS) Year of graduation: 2014 Institutional affiliation: Instituto Superior Técnico da Universidade de Lisboa How has MPP contributed to your career development?

The opportunity to visit MIT allowed me to meet and work with several experts in my research topic and to enhance my technical and research skills. These two aspects were the key factors from MPP regarding my career development.

# **MIT** Portugal

Training the Leaders of the Future Doctoral Students 2014

#### Academic Institutions Providing PhD Degrees in Association

Escola da Engenharia da Universidade do Minho Faculdade de Ciências da Universidade de Lisboa Faculdade de Ciências e Tecnologia da Universidade de Coimbra Faculdade de Ciências e Tecnologia da Universidade Nova de Lisboa Faculdade de Economia da Universidade de Coimbra Faculdade de Engenharia da Universidade do Porto Instituto Superior de Economia e Gestão da Universidade Técnica de Lisboa



#### Other Institutions Involved in R&D Activities

Instituto Politécnico de Portalegre Instituto Politécnico de Setúbal Instituto Superior de Agronomia da Universidade Técnica de Lisboa Instituto Superior de Ciência do Trabalho e da Impresa Universidade de Aveiro Universidade da Beira Interior Universidade de Tras-os-Montes e Alto Douro

