Center of Technology and Systems

NEWSLETTER

July 2018

Towards Cognitive Cyber-Physical Systems

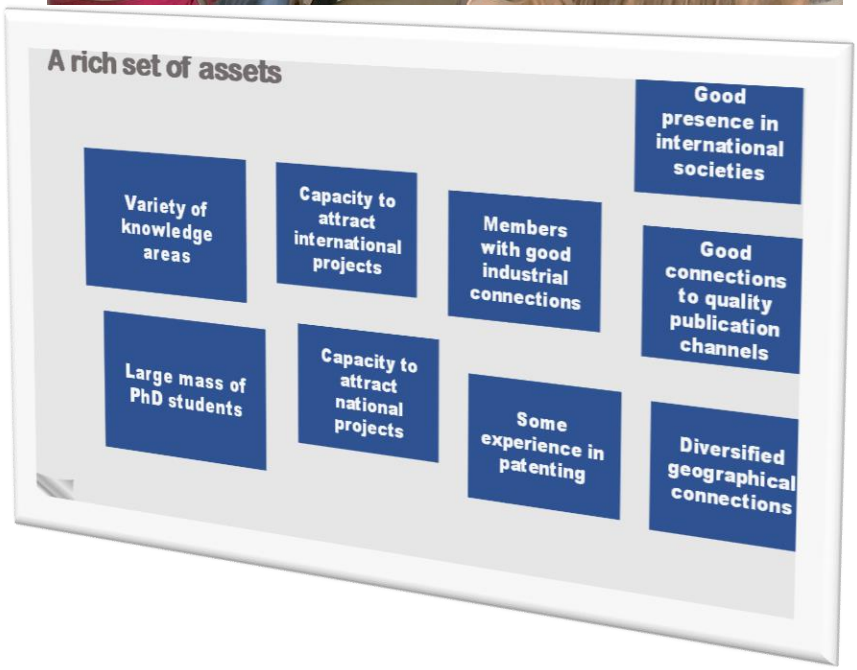
CTS Workshop

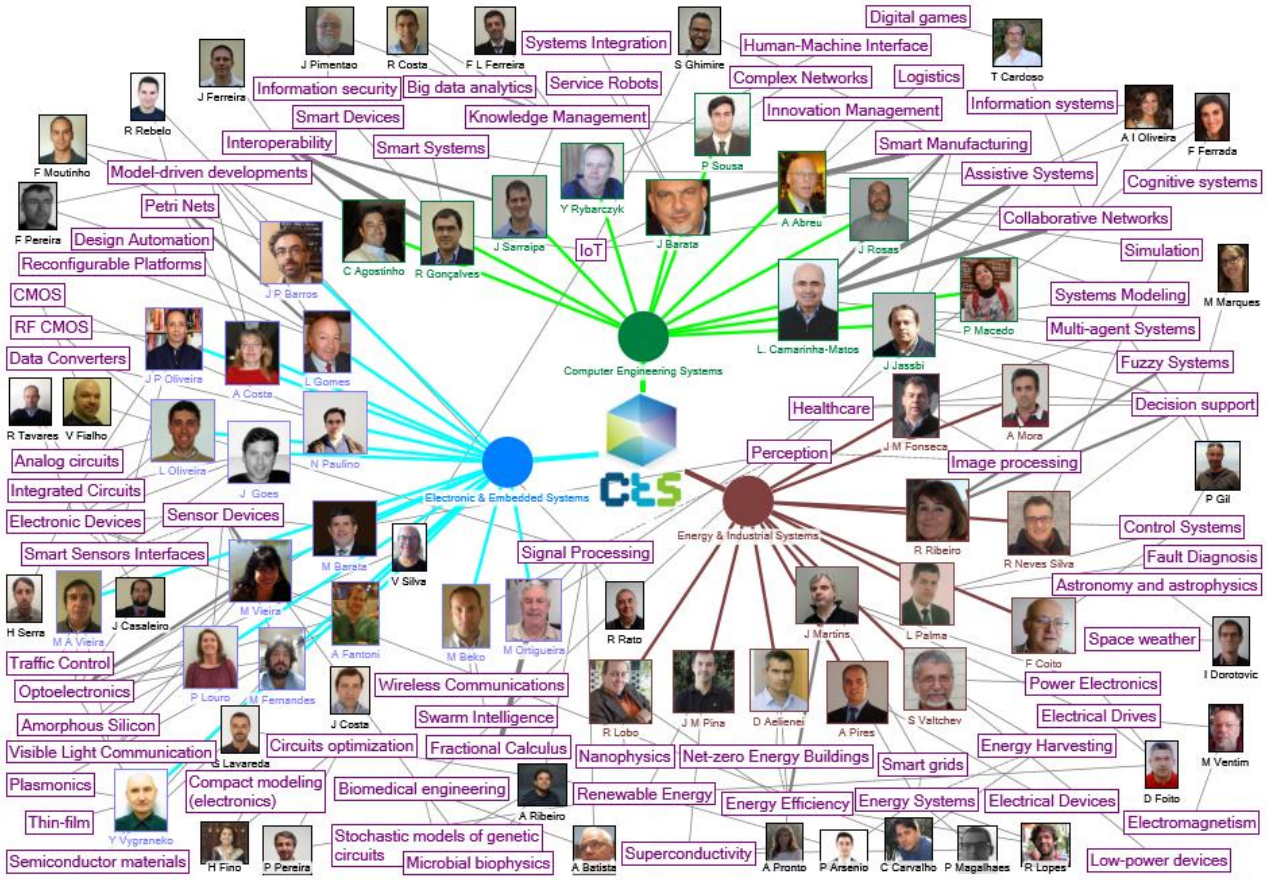
Capuchos Convent, Caparica – 25 Jun 2018

The CTS annual event, held on 25 Jun 2018, was devoted to discussing the convergence towards **Cognitive Cyber-Physical Systems**. It was attended by 29 integrated members and 22 collaborator members. This event constituted an important opportunity for all members to get better acquainted with the research activities going on in the thematic areas of CTS. For this purpose, the morning session included a number of overview presentations:

- Towards Collaborative Cyber-Physical Systems – L. M. Camarinha-Matos (CTS Director)
- Electronic Micro-Systems – L. Oliveira
- Electronic Materials and Processes – P. Louro
- Embedded Systems- L. Gomes
- Signal Processing – M. D. Ortigueira
- Energy Efficiency – J. Martins
- Control Systems – R. Neves Silva
- Computational Intelligence – R. Ribeiro
- Collaborative Networks – L. M. Camarinha-Matos
- Robotics and Automation – J. Barata
- Interoperability of Complex Systems – J. Sarraipa

The afternoon session was devoted to the creation of inter-disciplinary synergies. This was organized around 6 parallel brainstorming sessions, each involving 8 or 9 participants from different backgrounds. Participants were divided into groups following a mix of expertise areas to facilitate a multi-disciplinary perspective. As an introduction, the Director of CTS summarized the rich set of assets available in the center and emphasized the importance of creating synergies through interdisciplinarity as a key success factor.





The brainstorming sessions took as a leading motivation the **United Nations 2030 Agenda for Sustainable Development**, particularly focusing on the challenges:

- 3: Good Health and Well-Being
- 6: Clean Water and Sanitation
- 7: Affordable and Clean Energy
- 9: Industry, Innovation and Infrastructure
- 11: Sustainable Cities and Communities
- 12: Responsible Consumption and Production.

The main question for each group was:

Can we (CTS) build a cognitive CPS for this challenge?


One of the brainstorming groups: Good Health and Well-Being challenge

The environment of Capuchos Convent was particularly inspiring for fruitful discussions. At the end, a rapporteur from each group presented in the plenary a summary of the main conclusions and ideas for a joint plan of actions (position papers, joint project proposals, etc.).

The CTS Workshop was an important event to promote tighter dialogue and collaboration among the various members of CTS, no matter their expertise area.

The traditional informal "groups" of CTS are too small (no critical mass), thus with a limited set of competences. But together, combining our large set of asset, we can build a strong collaborative knowledge ecosystem.

The brainstorming sessions organized in this workshop clearly evidenced the enormous potential of building an interdisciplinary dialogue among the CTS community.

Luis M. Camarinha-Matos
CTS Director

Acknowledgements
We appreciate and thank the great support of the entities that helped CTS organizing this event:

ALMADA CÂMARA MUNICIPAL
FCT Fundação para a Ciência e a Tecnologia
FCT FACULDADE DE CIÊNCIAS E TECNOLOGIA UNIVERSIDADE NOVA DE LISBOA

Electropedia: The World's Online Electrotechnical Vocabulary

Electropedia is produced by the International Electrotechnical Comission (IEC), the world's leading organization that prepares and publishes International Standards for all electrical, electronic and related technologies – collectively known as "electrotechnology". Electropedia, also known as the "IEV Online, contains all the terms and definitions in the International Electrotechnical Vocabulary (IEV) which is published also as a set of publications in the IEC 60050 series.

Electropedia is the world's most comprehensive online terminology database on "electrotechnology", containing terms and definitions in English and French organized by subject area, with equivalent terms in various other languages, including the Portuguese.

The world's experts in electrotechnical terminology work to produce Electropedia under the responsibility of IEC Technical Committee 1 (Terminology), one of the 203 IEC Technical Committees and Subcommittees.

Luis Brito Palma
Member of CTE 1 (Terminology) in Portugal

www.electropedia.org

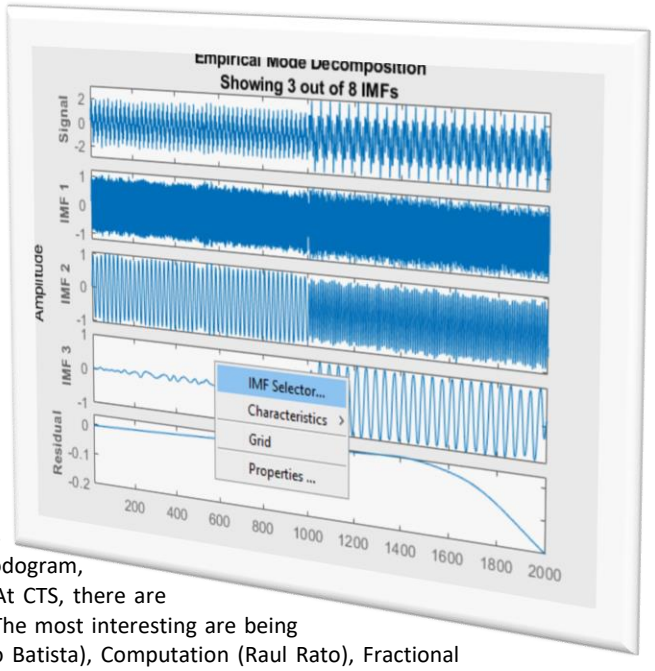
Editorial

In this second number a larger focus is placed on several projects where CTS has significant involvement. This active participation is a proof of CTS vitality and dynamic performance. Without any value judgment it is important to mention the projects related with the large wildfires that affected Portugal with dramatic consequences.
Being aware that is of huge importance to make CTS highly visible in the Portuguese R&D panorama, CTS participated in the annual event promoted by the Portuguese Foundation for Science and Technology.
The newsletter editorial board takes the opportunity to **whish all CTS members a well deserved and relaxed holidays**.

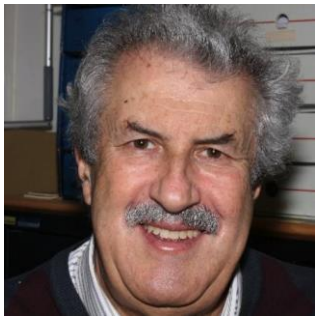
João Martins
CTS Communication Officer

CONTENTS

Signal Processing



In a simplistic vision, Signal Processing (SP) is Mathematical Engineering. It is a like a "marriage" of many mathematical areas with engineering concepts and tools. This brought generality to SP, leading it to be the base of many application areas. Currently it uses: transforms (Laplace, Fourier, Hankel...), vectorial, matricial, and tensorial calculus, complex variable functions, set theory, Galois fields, differential and difference equations, graph theory, stochastic processes theory, statistics, etc. But, in parallel it became also source of new mathematical theories, like: Information theory, Wavelet transform and multiresolution analysis. Many numerical tools currently used were developed in SP. We can trace back the origins of SP to the XVII century, but the most interesting tools were developed by Gauss (he was the first to consider a fast way of computing the Fourier transform) and Fourier (the Fourier series is one of the most important tools), but also Prony (that proposed an algorithm for decomposing a function as sum of exponentials, in 1795), Galois (his group theory is the base of the coding in Telecommunications), Euler (he is everywhere, but most interesting transforms have associated his name), Laplace (probability, transform), Schuster (periodogram, 1898), Heaviside, Carson, Wiener, Kolmogorov, Levinson, and many other. At CTS, there are several persons working in SP and applications, even outside the SP group. The most interesting are being done in Telecommunications (Marko Beko), Biomedical Engineering (Arnaldo Batista), Computation (Raul Rato), Fractional Calculus and Digital Signal Processing (Manuel Ortigueira), and outside the group, Fernando Coito (Sensors) and José Fonseca (Biomedical Image Processing). An EMD algorithm developed by R. Rato and M. Ortigueira was incorporated in the wavelet toolbox of MatLab. The Empirical Mode Decomposition - EMD is a technique to decompose a given signal into a set of elemental signals called Intrinsic Mode Functions - IMFs. The Empirical Mode Decomposition is the base of the so-called "Hilbert-Huang Transform" that comprises also a Hilbert Spectral Analysis and an instantaneous frequency computation. An EMD algorithm developed by R. Rato and M. Ortigueira was published in Mechanical Systems and Signal Processing (DOI: https://doi.org/10.1016/j.ymssp.2007.11.028) and incorporated in the wavelet toolbox of MatLab (https://www.mathworks.com/help/signal/ref/emd.html).

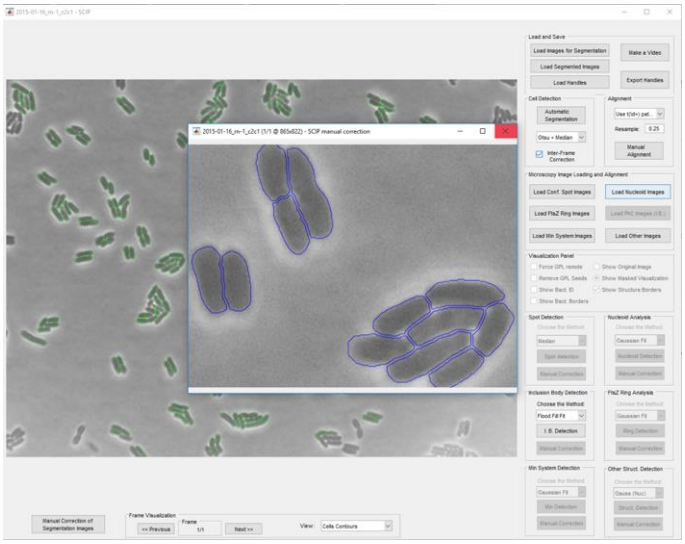


Manuel Duarte Ortigueira

With support of Thomson-Reuters, through free access to the platform https://financial.thomsonreuters.com/en/products/tools-applications/trading-investment-tools/eikon-trading-software.html, a MSc student associated to the area of Signal Processing is involved in the development of algorithms to deal with the stochastic aspects in financial analysis. *R. Rato*

Single-Cell Image Processor

In the framework of its collaboration with the Laboratory of Biosystems Dynamics of Tampere University of Technology, led by Professor André Ribeiro, the CA3 Group has developed a toolbox in MATLAB, named 'SCIP' (Single-Cell Image Processor) to characterize the dynamics of multiple cellular processes from the analysis of images from Live-cell time-lapse Microscopy. SCIP allows the automatic segmentation of cell borders (with manual correction if needed) and tracking of cell lineages over extended periods of time. Further, it allows the multimodal alignment with functional images (where any visible internal cell structure or dynamic process can also be analyzed). A paper describing the toolbox was recently published in Bioinformatics (DOI: https://doi.org/10.1093/bioinformatics/bty505). Software, manuals and application example files and images of *Escherichia coli* cells are publically available at: http://www.ca3-uninova.org/project_scip. Examples include: detection and segmentation of nucleoids, FtsZ-ring, Min System, inclusion bodies, and fluorescent RNA spots.



José Manuel Fonseca

Ciência 2018

The 2018 edition of the ***Annual Meeting of Portuguese Researchers*** took place last July, 2-4. It aimed to promote the broad debate of the main themes and challenges of the scientific agenda beyond the universe of research, stimulating the participation and interaction between researchers, business sector and general public. In the context of the definition of missions to be guided by the 2030 agenda of the United Nations, based on the 17 Sustainable Development Objectives (ODS), the Science 2018 program was organized in sessions designed to stimulate the debate on the conception of the future 9th European Framework Program for Research and Innovation, 2021-2028. CTS participated with three joint presentations addressing **Good Health and Well-being** (Challenge 3), **Affordable and Clean Energy** (Challenge 7) and **Industry, Innovation and Infrastructure** (Challenge 9).

Cyber-Physical Systems in the healthcare and wellbeing area

José M. Fonseca, André Mora, Arnaldo Batista, Tiago Cardoso, João Sarraipa, Luis Palma, Luis M. Camarinha-Matos

The use of information technology ha s an important role in improving efficiency, cost-effectiveness, quality, and safety of medical care delivery. Adopting a multi-disciplinary approach, the Centre of Technology and Systems (CTS) of UNINOVA pays a special attention to the application of information technologies to the healthcare sector. Several initiatives can be found in CTS where cyber-physical systems are developed and applied to improve citizens health and well-being. Looking to the typical human being life cycle, we can say that CTS has a contribution on all the stages, from birth to the elderly age. Beginning by the birth, the Uterine Explorer Project aims at using surface Electromyography for pregnancy monitoring and preterm risk evaluation, which is one of the most relevant obstetric conditions. The initiative games Social Tech Booster finds technological solutions for social causes with youngsters in mind. The technological vehicle has been (serious) Digital Games for the support of young people with cognitive issues. Closely related with this area are the efforts on automatic human-machine adaptation area that improves users' skills, applications usability, and usage security based on devices specially designed for human-computer interaction. To overcome the idea that people with disabilities are not able to perform design using engineering tools, and in particular CAD tools, a setup was developed to empower these persons, being citizens or workers. The tools developed, based on free software of operating system features (e.g. voice recognition) make possible for people with disabilities or low mobility in the upper limbs to draft and perform tasks otherwise hardly accomplished without any type of help. Another initiative combines image processing and machine learning for the analysis of hyper-definition pathology images, facilitating and improving pathologists work on cancer detection. Similar techniques are applied on retinal image analysis for the detection and evaluation of ophthalmologic pathologies. For the elderly, collaborative cyber-physical systems to support ambient assisted living are being developed. These systems create friendly environments that significantly improve citizens safety and wellbeing on their own residence delaying or even avoiding institutionalization. Furthermore, the initiative ECE (elderly care ecosystem) supports personalization and dynamic adaptation of health care services to each individual. The Carelink project is developing a technological setup that can be worn by Alzheimer patients and ensure their safety. Such device, based on low power consumption and long-life battery, will monitor and, in case of risk, will issue an alert to family or caregivers.
This talk presented the mentioned research initiatives, explaining the underlying technologies with specially emphasis on the collaborations with external entities that helps transposing the research carried out in CTS to the society.

Affordable and clean energy – A holistic approach

João Martins, Luis Oliveira, João Murta Pina, Luis M. Camarinha-Matos

Current challenges in energy research require a multi-disciplinary approach, holistically combining contributions from various knowledge areas. In particular, the electrical energy systems are going through a profound transformation which, in addition to a diversification of energy sources with progressive increase of renewable energy, strongly relies on the adoption of novel information and communication technologies in order to better support demand response, address optimal assets management, provide modern energy services, improve energy efficiency, and lead to cleaner energy systems. In this context, the Center of Technology and Systems (CTS) of Uninova develops cognitive collaborative cyber-physical systems targeting the new generation of energy systems. Conducted research targets multiple levels of abstraction, coming from fundamental research at low consumption electronic devices, superconductivity devices for energy, energy harvesting and wireless energy transfer; passing through intelligent devices and sub-systems such as smart meters, non-intrusive load monitoring, efficient drives and intelligent inverters; and ending up in complete autonomous energy systems and procedures such as renewable energies integration strategies, storage optimization algorithms for homes and grid, NZEBuildings

and their grid interaction issues, community NZEBs, micro-grids, smart transformers and collaborative smart grids and virtual power plants. This multi-level perspective naturally requires a cyber-physical systems' approach where the distinct components progressively embed more intelligence and autonomy, traditional control models evolve towards flexible, self-organizing intelligent collaborative networks. This holistic approach is mandatory to achieve a sustainable development needed to improve the efficiency of the multidisciplinary energy field.

Cognitive Cyber Physical Systems to Implement Collaborative Smart Manufacturing - *José Barata, Luis M. Camarinha-Matos, Rui Neves-Silva*

Manufacturing systems are facing many challenges as a result of market and society needs. Personalised products, extended products, improved quality, rapid response, and other factors are forcing manufacturing companies to become smarter and more agile. The smart factory represents a leap forward from traditional automation to a fully connected and agile system. To achieve this goal we are assisting to a convergence of the digital and physical worlds, in which information technologies such as the Cyber Physical Systems (CPS) are fundamental transforming factors. CPSs are the fundamental basic building modules that can be put together to create highly modular manufacturing reconfigurable systems. To achieve the next level of SMARTNESS, manufacturing systems need to be composed of cognitive CPS which will improve intelligence at individual (machine level) and group level. The collaboration between intelligent devices/machinery (Cognitive CPS) is therefore the basis for successful implementations of Smart Manufacturing. Intelligent products can also be implemented using the same kind of analogy, in which products become Cognitive CPS that can interact (collaborate) with other products or entities. Furthermore, the collaborative aspects are at the core of future distributed manufacturing systems. In fact, some important keywords for Industry 4.0 include "networking", "value chains", "vertical and horizontal integration", and "co-engineering / through engineering", which are issues addressed in the area of collaborative networks, where Portuguese research groups play a relevant role. This presentation briefly covers the challenges behind current smart manufacturing systems, and how collaborative cognitive CPS can be used to implement them. The experience of the Center of Technology and Systems (CTS) of Uninova in several research projects in this domain was presented and contextualised.

HTS 2018 MODELLING
6th International Workshop on Numerical Modelling of High Temperature Superconductors

The 6th International Workshop on Numerical Modelling of High Temperature Superconductors took place last June, 26-29. This forum, organized by CTS members João Murta Pina and Anabela Gonçalves, addressed advances in the methods and tools required for boosting the development of superconducting technologies, by fostering discussion and networking among practitioners in the demanding field of HTS numerical modelling. The event held two plenary talks (**HPC for solving multi-physics problems**, Dr. Xavier Sáez and **The open source parallel multi-physics finite element library FEMPAR and its application to HTS**, Prof. Santiago Badia), one invited talk (**Progress of Large-Scale and Fast Electromagnetic Field Analyses of Coils Wound with Coated Conductors for Ac Loss and Shielding Current Calculations**), 44 oral presentations and 21 poster presentations.

In conjunction with the workshop, a **roundtable** addressing High-temperature superconductivity based energy storage for grid applications, was organized under the auspicious of EERA. European Energy Research Alliance is the largest energy research community in Europe. Organized in 17 Joint Research Programmes, EERA coordinates energy research to achieving more efficient and cheaper low carbon energy technologies. Highly participated, this roundtable counted with the presence of Rui Castro (Instituto Superior Técnico, Portugal), Xavier Granados (ICMAB, Spain), Antonio Morandi (University of Bologna, Italy), Nuno Souza e Silva (R&D Nester, Portugal) and Rui Bernardo (EDP, Portugal).

After the workshop the second edition of the International School on Numerical Modelling for Applied Superconductivity joined together 38 trainees (academia**:** FCT NOVA, Oxford Univ., EPFL, Bolonha Univ., Univ. Federal Fluminense, Twente Univ., Karlsruhe Institute of Technology, Southwest Jiaotong Univ. / industry**:** Space and Naval Warfare Systems Center Pacific, Teraloop - Finland, Ion Beam Applications - Belgium) and 14 trainers from some of the world's best scientific centers (Cambridge Univ., Bologna Univ., Univ. Federal Fluminense, CERN, EPFL, ITER). This year, the school selected issues related with the design of conductors for nuclear fusion and magnetic levitation machines and devices.

Innovation prize

CTS Team, composed of Francisco Marques, Eduardo Pinto, André Lourenço, Ricardo Mendonça and José Barata won the Innovation Prize from the Portuguese Mint and Official Printing House (INCM). The team was awarded with 500 000 Euros for the project **INTMOB – Intralogistics Mobile Assistant Unit for Flexible Manufacturing Systems**.

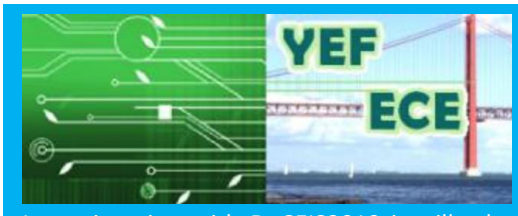
The award ceremony took place on 24th May and was presided by the Portuguese Minister of the Presidency and Administrative Modernisation, Maria Manuel Leitão Marques, who stated that "both public and private institutions need knowledge created at Universities, which enable us to modernize and answering the growing expectations of our citizens". The INTMOB project plans to create and develop an autonomous robot for the INCM logistic based on the industry 4.0 paradigm. This intralogistics system for the passport and citizen cards will be composed of several mobile robots equipped with robot manipulators, and can be simultaneously operators and transporters. It will ensure the localisation, safety, and security of the all high value materials to be transported inside the INCM facility. Moreover, workers can be liberated from heavy and repetitive tasks and be involved in much better qualified tasks. The most relevant research challenges for this project are: indoor localization, human robot interaction, integration of the solution into the existing ERP and the development of an integrated industry 4.0 solution.

Technological Innovation for Industrial and Service Systems

The Advanced Doctoral Conference on Computing, Electrical and Industrial Systems is celebrating its **10th edition** (DoCEIS 2019) with a focus on Technological Innovation for Industrial and Service Systems. The industry and service sectors are going through profound transformation towards digitalization and integration of new levels of "smartness". The idea of a **4th industrial revolution**, represented by terms such as Industry 4.0, Smart Manufacturing and Economy 4.0 are an expression of such transformation. This movement is characterized by an increasing digitalization and interconnection of systems, products, value chains, and business models. The interconnection between the physical and the cyber worlds – Cyber-Physical Systems and Internet of Things – and the integration of the so-called "exponential technologies", are central features of this innovation trend. DoCEIS 2019 provides an ideal venue for Doctoral Students, Researchers and Academicians from all over the world to meet, share, merge, and discuss their work and ideas in a multi-disciplinary context.

IMPORTANT DATES

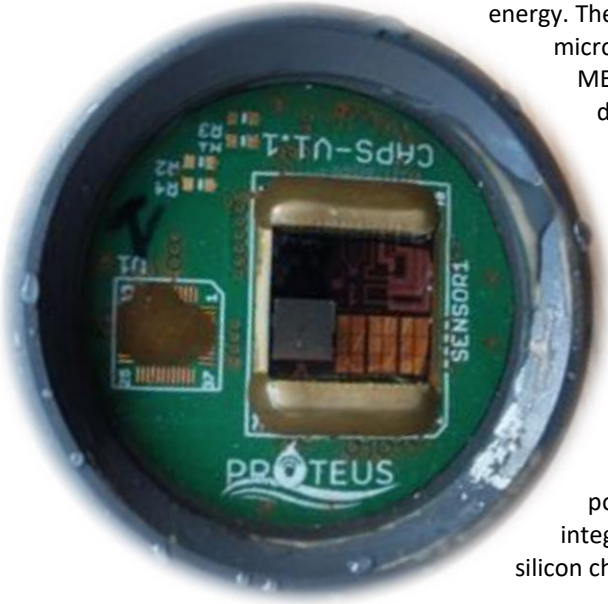
14 Nov 2018	**15 Dec 2018**	**19 Jan 2019**	**9 Feb 2019**
Submission of abstract	Submission of full paper	Notification of authors	Submission of camera ready



In conjunction with DoCEIS2019 it will take place the third edition of the **International Young Engineers Forum** (YEF-ECE). As usual, this event will be a unique opportunity for young engineers to connect with each other enabling experience's sharing and to become internationally active. Last year's edition counted with 17 presented papers, out of 44 submissions from 16 countries.

H2020 PROTEUS Project has been concluded with great success...

H2020 PROTEUS Project has been concluded in the past March with a huge success as it has been recognized by the Project Officers of the European Commission. Among the many compliments, it is worth emphasizing the global comment: "*The project aim was to deliver a reconfigurable MEMS and nano-enabled sensor platform for cognitive water quality monitoring with predictive capabilities and in-built redundancy for increased lifespan. The project has achieved all its objectives and milestones for the 3rd period. Due to the high interest of the consortium in the domain and its motivation, combined with an excellent project management, the project performance was outstanding and fully in line with the DoA. The project outcomes provide good exploitation prospects.*" Water management requires massive, low-cost monitoring means coping with differentiated and evolving requirements. However, the majority of multifunctional water sensors only supports predefined goals hindering interoperability, with a high cost, impeding large scale deployments. Addressing this, PROTEUS aimed at offering x10 reduction in both size and unit function cost compared to state of the art. To this end, an increased number of functions have been integrated at a reduced cost and PROTEUS delivered a reconfigurable nano-enabled sensor platform for cognitive water quality monitoring. Innovative embedded software provides re-configurability of the sensing board to support several differentiated applicative goals while cognitive capabilities manage evolving requirements during exploitation. Energy autonomy has been guaranteed by harvesting water flow energy. The main challenge was related to the heterogeneous integration into a monolithic, microfluidic sensing chip of carbon-nanotubes-based resistive chemical sensors, of MEMS physical and rheological resistive sensors and of a multifunctional adaptive deep-submicron CMOS system-on-chip (SoC). Upstream, high level system design addressing industrial use cases, manufacturability and cost-effectiveness, packaging, energy budget and interfaces between building blocks, enabled consistency and efficiency of the whole approach. Downstream, system validation has been carried out at different levels: benchmarking, reliability assessment to guarantee service time, model deployments and the final field-testing at the SMAS-Almada. The micro-and-nanoelectronics group (João P. Oliveira - local coordinator; João Goes; Nuno Paulino; Luís B. Oliveira and Rui Tavares - collaborator) of the CTS has been responsible for the design, simulation, fabrication and experimental evaluation of the CMOS SoC, as well as for the complete integration of the microfluidic sensing system-into-package (SiP). Moreover, the developed SoC included the several (9) smart and ultra-low-power sensor-to-digital interfaces, a smart power management unit (PMU) a fully-integrated microprocessor (MSP430) and a RAM memory embedded in the fabricated silicon chip.



PhotoAKI: Photonic Biosensor for point of care and Early Diagnostics of Acute Kidney Injury

The project proposal entitled "PhotoAKI: Photonic Biosensor for point of care and Early Diagnostics of Acute Kidney Injury" submitted by the M2P sub-group has been approved for funding by FCT-Compete in the ongoing period 2018-2021.
The goal of the project is the development and characterization of a disposable photonic sensor for the detection of biomarkers of Acute Kidney Injury (AKI). Despite recent improvements in diagnosis, the mortality of AKI remains unacceptably high and early diagnosis of AKI is often problematic, due to the lack of suitable early biomarkers of renal damage and kidney function. Neutrophil gelatinase-associated lipocalin (Ngal) as an early marker of AKI, partially overcomes such limitations making possible diagnosis of AKI in its early stages. The PhotoAKI project targets the implementation of a low-cost method for fast diagnosis, monitoring of disease and patient status: a label-free, high-throughput approach for quantitative analysis of Ngal produced by a low cost photonic sensor based on amorphous silicon technology. The sensor profits from the ability of a-Si:H to yield tunable surface plasmonic resonance (SPR) effects, when used jointly with metal interfaces, metal nanoparticles and graphene multilayers. The proposed sensor structure is based on a a-SiC:H waveguide, coupled to an Aluminum surface. The metal surface is functionalized with antibodies against Ngal. Coupling between the waveguide mode and the surface plasmon generated at the semiconductor-metal interface produces a light intensity modulation of the guided light that is dependent on the Ngal concentration. The output is measured by an a-Si:H thin film photodetector. The waveguide, the SPR coupler and the photodetector are integrated into one unique system targeting the fabrication of a compact device.

CESME: Collaborative & Evolvable Smart Manufacturing Ecosystem

Another project approved by FCT for funding for 2018-2021. The main overall objective of the CESME project is to design and develop an ecosystem capable to deal with CPS for manufacturing. The high degree of heterogeneity of the component-CPS and the potential emergencies that their interactions can generate requires fully integrated engineering approaches for their design, development, operation, maintenance, etc. CESME aims to deal with all the complexity of the usage of CPS, building a complete engineering solution, to coordinate the design/engineering phases and operational stage of the engineering life cycle what is considerably different regarding a CPS based manufacturing system. The project involves J. Barata (PI), L. M. Camarinha-Matos (co-PI), J. Jassbi, J. Rosas, A. I. Oliveira, L. Assunção.

CTS helps preventing large scale wildfires

Considering that Portugal has been severely affected by large wildfires with dramatic consequences, in the past 20 years (and particularly last year), it is mandatory that the scientific community takes its role incorporating scientific knowledge into decision support in operational systems and facilitating the production of new knowledge oriented to the solution of concrete and real large wildfires issues.

In this context, three CTS-UNINOVA projects were recently funded in order to help mitigate this huge calamity (FUELMON, FoRESTER and FoCoR).

FUELMON- FCT granted the project, Remote Fuel Break Monitoring for Forest Fire Protection, with 180k€ for two years, under the SAICT 2017 call for Projects.

The main goal of this project is to demonstrate a novel approach for deriving satellite based maps of fuel treatment and biomass accumulation in the Portuguese primary fuel break network. A fuel break is an area of any size and shape where anthropogenic modifications of forest fuels (i.e. fuel treatments, biomass removal) have been conducted to aid in the protection of that community from future wildfires. Within the project there are three main scientific objectives: 1) Improve image resolution and daily coverage using freely available data from Earth Observation satellites (Sentinel, Landsat); 2) compare alternative image classification approaches for fuel identification in satellite imagery; 3) use a data fusion algorithm to leverage the temporal information contained in the satellite imagery time series to derive up-to-date maps of the temporal and spatial dynamics of fuel treatment and biomass accumulation. The goal and objectives are achieved with a monitoring system capable of fusing and processing satellite imagery and other spatial and cartographic data.
The project will be developed by UNINOVA and ISA – Instituto Superior de Agronomia, in close collaboration with the Institute for Nature Conservation and Forests (ICNF). UNINOVA leads the project and the team is composed by André Mora, Maria Rita Ribeiro, José Manuel Fonseca and António Falcão. The project will also hire one Post-doc, one MSc and two BSc.

FoRESTER project proposal has been granted by the Portuguese FCT, with the maximum allowed funding of 400 k€.

In the last 20 years, Portugal has been severely affected by large wildfires with dramatic consequences. The last year was the worst on record, with the largest burnt area extent and the largest number of casualties. Hence, it is urgent and mandatory that the scientific community provides sound and efficient tools capable of improving decision making during wildfires crisis to minimize its negative
consequences. A key issue is the lack of decision support mechanisms for operational interventions. Due to the complexity of large wildfires, their effective suppression requires suitable and well coordinated resources, up-to-date knowledge of the landscape, and accurate prediction of fire behavior. A Decision Support System (DSS) that can integrate the panoply of required information in a simple and efficient platform is the main scientific challenge of foRESTER. The main goal is to provide fire managers with useful and sound information to improve fire suppression strategy and decisions. To accomplish this, foRESTER proposes a fast, reliable and informative DSS based on advanced computational intelligence and visualization techniques, that integrates innovative technologies from multi-sensor systems, cutting edge satellite image processing, and near real-time (NRT) fire spread predictions (FSP).
Due to the inherent complexity of the system, we gathered a multidisciplinary team from different areas of expertise:

1) CTS/UNINOVA @ NOVA-FCT - hardware design, satellite image processing and multicriteria decision;
2) IT-Lisbon @ IST - image processing;
3) DGT - cartography and IPSen tinel platform;
4) MagIC @ NOVA-IMS - land cover land use classification;
5) CEF @ ISA - fire spread modelling;
6) CESAM @ UA - weather forecast.

The project aims to provide a low-cost framework based on a WSN and new information system tools to produce a pilot demonstrator of the effectiveness of DSS for supporting decision-making in fire suppression context.
Moreover, the plan is to extend the pilot to the Médio-Tejo region and demonstrated it as a
scalable platform for the entire national territory.
Due to its multidisciplinarity, the project involves three different groups of CTS and it is an excelent example of cross-cooperation from different thematic lines. The project proposal has been successfully led and mostly elaborated by Luís B. Oliveira, João P. Oliveira, André Mora and António Falcão.

FoCoR- FCT granted the project, Using Unmanned Aerial Vehicles to Assist Prescribed Fires and Detect Rekindles in Wildfire Managemetn, with ~200k€ for two years, under the SAICT 2017 call for Projects.

The main goal of this project is to develop an automatic UAV based system to support Prescribed Fires and detection of Rekindles in the mop up of forest fires. Prescribed fires are a prevention tool to manage the amount of fuels. Its importance is recognized in several parts of the world and particularly in southern Europe.

For both target missions the project will develop UAVs able to carry different cameras with different wavelengths, and/or and ignition gun to ignite fire. They should be operated manually, semi-autonomously, or totally autonomously. The mission control software to be developed will enable operators in choosing the different operating modes, delimit the area of operation, and configure and control the mission.

The project is coordinated by CTS in collaboration with ISA (Instituto Superior de Agronomia). From the CTS side the following members are involved: J. Barata (IP), L. Camarinha-Matos, T. Cardoso, and the PhD students E. Pinto, A. Rocha, A. Lourenço, F. Marques, and R. Mendonça.

News from M2P sub-group

Under the 3rd edition of the IDI&CA program (Concurso Anual para Projetos de Investigação, Desenvolvimento, Inovação e Criação Artística) supported by IPL (Instituto Politécnico de Lisboa) three project proposals submitted by the M2P sub-group have been accepted. Research themes underneath these proposals range from photonic waveguides, to vehicle to vehicle communication and TFTs on low cost substrates. Each project lasts one year and the very short funding of 5K€ is intended as a boost driving force for research inside the schools of the Lisbon Polytechnic Institute.

Following different research lines and specific goals, all projects share the exploration of photonics as an emerging, full potential technology in the fields of optical communications and optical interconnects in microelectronics. Besides, it can also be framed within current research and development technological trends, such as Smart Cities, c-ITS, IoT and Health-Care.

LAN4CC – LED Assisted Navigation for Connected Cars

Project "LAN4CC – LED Assisted Navigation for Connected Cars" aims to contribute to traffic management using visible light communication. In the proposed work the transmitted information is modulated and coded using the LED lamps of the vehicles and or road infrastructures.
Information recovery at the reception ends is detected with a dedicated device based on a-Si:H/a-SiC:H with selective sensitivity in the visible spectral range for the wavelengths of interest. Positioning and subsequent navigation can be achieved with appropriate design of the communication system, that addresses multiple coding schemes and decoding strategies.
The research topic of the project can thus be framed in the milestones of the current European Strategy research on Cooperative Intelligent Transport Systems (c-ITS).

Nano-TFT - Low temperature Thin Film Transistors on low cost substrates

Project "Nano-TFT - Low temperature Thin Film Transistors on low cost substrates" aims the development of nanocrystalline silicon (nc-Si) thin-film transistors (TFTs) targeting circuit applications. With the advent of IoT, there is a demand on low complexity TFT circuits fabricated on non-standard flexible substrates like metal, plastic foils, paper, or even more exotic materials. This technology would allow to fabricate low cost devices such as electronic tags, medical sensors, etc. A common requirement for the mentioned substrates is the need for low temperature processing techniques which can replace the standard silicon field-effect transistor fabrication process. I is proposed to develop nc-Si TFTs for ambipolar operation (for easy implementation of complementary circuits such as inverters), with high field-effect mobility, up to 150 cm2/V-s, and significantly lower threshold voltage shift under bias stress than that in a-Si:H TFTs. Moreover, nc-Si can be deposited at temperatures as low as 120oC that enables the use of low-cost plastic substrates such as PEN or PET films.

aSiPhoto – Photonic Waveguides

Project "aSiPhoto – Photonic Waveguides" aims to explore the use of amorphous silicon and other thin film materials deposited by PECVD technique (ITO, aSiNx, ZnO) for novel optoelectronic devices based on photonic waveguide structures. An important characteristic of silicon photonics is the possibility of monolithic integration of photonic and electronic devices, and the enabling of wavelength filters and modulators, allowing passive and dynamic photonic devices to be connected, or even built, by waveguides laying on silicon substrates or fabricated together with silicon electronic devices. Amorphous silicon can be deposited by PECVD at temperatures lower than 300°C, an attractive characteristic which makes it back-end compatible to the CMOS process. Moreover, the amorphous silicon technology is much cheaper than the its crystalline counterpart.

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CTS Newsletter is a publication of CTS-UNINOVA

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