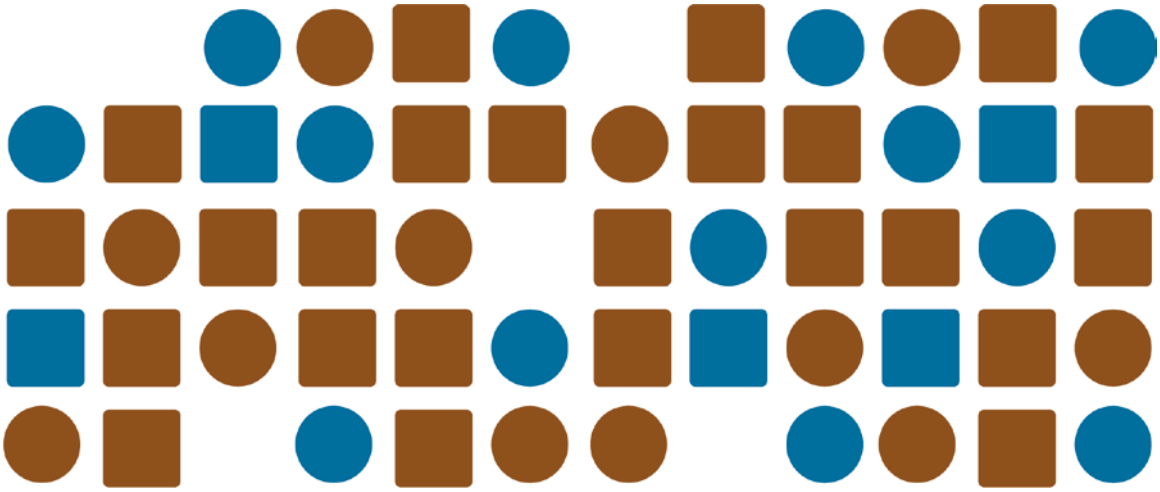


IOC

Institute of Industrial and Control Engineering

Activities Report 2020

UNIVERSITAT POLITÈCNICA DE CATALUNYA
BARCELONATECH
Institute of Industrial and Control Engineering

Table of contents

1. Organisational structure and governing bodies

Management

Director	ROBERT GRIÑÓ CUBERO
Assistant director	ERNEST BENEDITO BENET
Secretary	JAN ROSELL GRATACÒS
Technical and Management Support Area - UTGAEIB	M. LOURDES DURANY VIDAL

The Board

Management	ROBERT GRIÑÓ CUBERO
Assistant director	ERNEST BENEDITO BENET
Secretary	JAN ROSELL GRATACÒS
Representative of the Control division	DOMINGO BIEL SOLÉ
Representative of the Supply chain and operations management (SCOM) division	AMAIA LUSA GARCÍA
Representative of the Robotics division	RAÚL SUÁREZ FEIJÓO
Technical and Management Support Area - UTGAEIB	M. LOURDES DURANY VIDAL
Representative of teaching and research staff who hold a PhD	LAIA FERRER MARTÍ
Representative of teaching and research staff who do not hold a PhD	Vacancy
Representative of administrative and service staff	LEOPOLD PALOMO AVELLANEDA

The Council

Arias Pujol, Antoni	
Batlle Arnau, Carles	
Bautista Valhondo, Joaquin	
Benedito Benet, Ernest	Assistant director
Biel Solé, Domingo	Representative of the Control division
Calleja Sanz, Gema	
Domenech Lega, Bruno	
Dòria Cerezo, Arnau	
Durany Vidal, Ma Lourdes	Technical and Management Support Area UTGAEIB
Ferrer Llop, Josep	
Ferrer Martí, Laia	
Fossas Colet, Enric	
García Villoria, Alberto	
Griñó Cubero, Robert	Director
Lusa Garcia, Amaia	Representative of the Supply Chain and Operations Management-SCOM division
Martínez Costa, M. Carme	
Mas Casals, Orestes	
Mateo Doll, Manel	
Olivella Nadal, Jordi	
Olm Miras, Josep Maria	
Palomo Avellaneda, Leopold	Representative of administrative and service staff
Pastor Moreno, Rafael	
Peña Carrera, Marta	From 13/11/2020
Peña Pitarch, Esteban	
Roig Fernández, Vicenç	Representative of administrative and service staff
Rosell Gratacòs, Jan	Secretary
Suárez Feijóo, Raúl	Representative of the Robotics division

2. Staff

NAME		DIVISIONS/ SERVICE	CATEGORIES
Arias Pujol	Antoni	CTL	TU
Arocas Pérez	José	CTL	BR
Batlle Arnau	Carles	CTL	TU
Bautista Valhondo	Joaquin	ROB	CU
Benedito Benet	Ernest	SCOM	AG
Biel Solé	Domingo	CTL	TU
Calleja Sanz	Gema	SCOM	AJ
Cardoner Parpal	Rafel	SSR	LT
Cunillera Marquez	Albert	ROB	LT
Domènech Lega	Bruno	SCOM	LT
Dòria Cerezo	Arnau	CTL	AG
Ferrer Llop	Josep	CTL	CU
Ferrer Martí	Laia	SCOM	CU
Fossas Colet	Enric	CTL	CU
Galleguillos Pozo	Rosa	SCOM	BR
García Villoria	Alberto	SCOM	AG
Griñó Cubero	Robert	CTL	TU
López González	Alejandro Esteban	SCOM	LT
Lusa García	Amaia	SCOM	CU
Martínez Costa	Carme	SCOM	TU
Mas Casals	Orestes	ROB	TU
Mateo Doll	Manuel	SCOM	TU
Miró Valero	Enric	SSR	LT
Montaño Sarria	Andrés F.	ROB	BR
Olivella Nadal	Jordi	SCOM	TU
Olm Miras	Josep M.	CTL	AG
Palomo Avellaneda	Leopold	SSR	LT
Pastor Moreno	Rafael	SCOM	CU

NAME		DIVISIONS/ SERVICE	CATEGORIES
Peña	Marta	CTL	AG
Peña Pitarch	Esteban	ROB	TU
Repecho Del Corral	Victor	CTL	LT
Rosell Gratacòs	Jan	ROB	TU
Sharafeldeen	Mohammed	ROB	BR
Suárez Feijóo	Raúl	ROB	DI
Ud Din	Muhayy	ROB	BR
Zaplana Agut	Isiah	ROB	BR

PhD Students

NAME		DIVISIONS/ SERVICE	CATEGORIES
Díaz Pacheco	Raúl Antonio	SCOM	EV
Ferreira Vicente	Jéssica	SCOM	EV
Guirao Berruezo	José Juan	ROB	EV
Portilla Rodriguez	Henry	ROB	EV
Rafiezadeh	Roya	CTL	EV
Rodríguez Pacheco	Carlos	ROB	EV
Rojas De Silva González	Fco. Abiud	ROB	EV
Urra González	Fernando	ROB	EV

GLOSSARY

DIVISIONS/SERVICE	CTL	Division of Automatic Control
	SCOM	Division Supply Chain&Operations Management
	ROB	Division of Robotics
CATEGORY	AG/TU	Associate professor
	AJ/PAL/PL	Assistant professor
	BR	Research grantholder
	CU	Professor
	DI	Research supervisor
	LT	Technical staff

Visiting Staff

NAME		DIVISIONS	UNIVERSITY
Ponsich	Antonin	SCOM	Univ. Autón. Metropolitana - Mèxic
Rodríguez-Seda	Erick J.	CTL	United States Naval Academy

Incoming Students

NAME		DIVISIONS	UNIVERSITY
Quiñones Busquets	Oscar	ROB	Tecnológico Nacional - México
Thibault	Gilbert	ROB	ENSEA - França
Seiller	Noémie	ROB	ENSEA - França
Volkov	Alexey	CTL	Tomsk Polytechnic University - Rússia

3. Divisions

Research at the IOC is conducted through three divisions:

Division of Automatic Control

The principal projects in this division are set in the following thematic areas: research area of Control Theory, research area of Energy Systems and research area of Automotive Applications.

Head: DOMINGO BIEL SOLÉ

Research fields:

- Advanced linear controllers (Resonant and repetitive control).
- Nonlinear control techniques (Passivity-based control, Adaptive control, Sliding mode control).
- Complex dynamical networks.
- Modelling and control of electronic power systems (generation and conversion).
- Control algorithms for an overall improvement of the vehicle performance.
- Autonomous and cooperative driving applications.

Division of Supply Chain & Operations Management

The Division of Supply Chain and Operations Management covers the design and management of the supply chain, namely production and logistic systems to generate goods and services, as well as the necessary techniques for solving efficiently its derived problems.

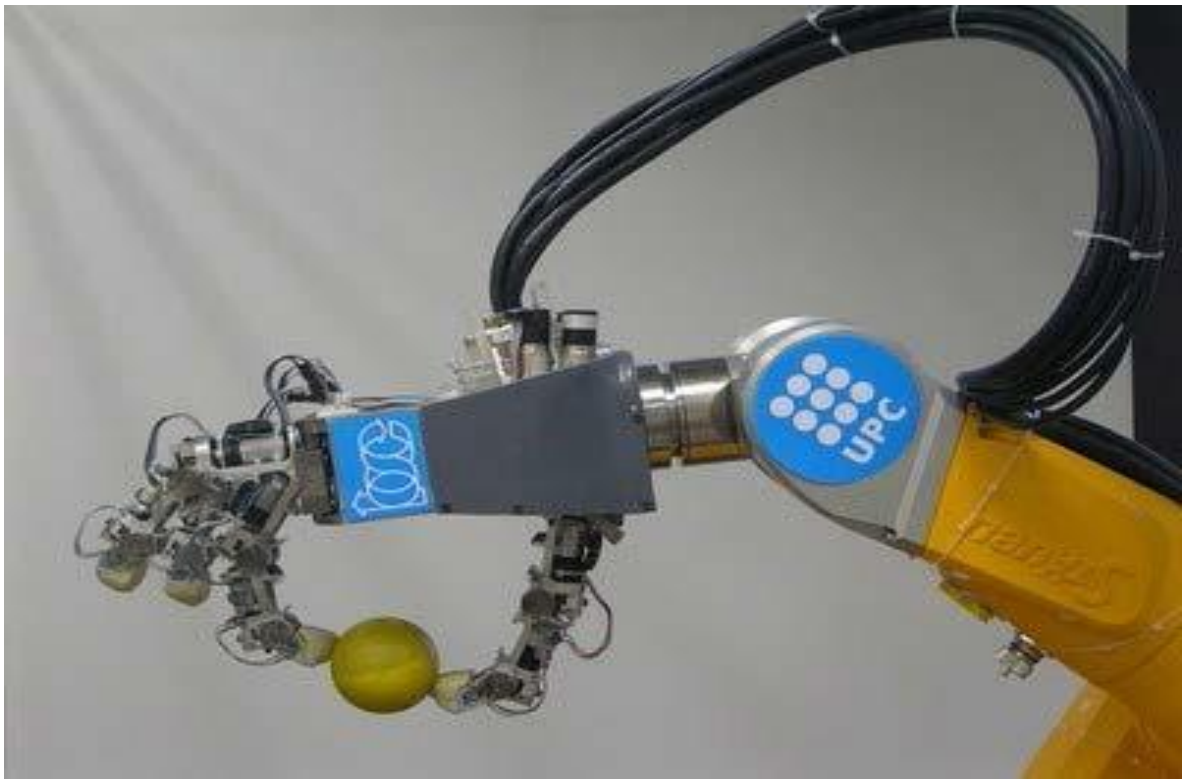
Head: AMAIA LUSA GARCÍA

Research lines:

- Supply Chain management and design
- Operations management
- Scheduling
- Assembly line design and balancing
- Working time planning and scheduling
- LEAN management
- Integrated aggregate planning
- Strategic capacity planning
- Urban logistics
- Sustainability in transportation and distribution
- Rural electrification with renewable energy and sustainable development in isolated areas

Research group linked with the Division: Supply Chain and Operations Management

Division of Robotics



The Division of Robotics of the IOC deals with basic and applied research on different aspects of robotics, either considering the robot as a single machine or integrated with other elements and devices within a robotized system. The research extends to different application fields in both the industrial and service areas.

Head: RAÚL SUÁREZ FEIJÓO

Main fields of activity

- Task and motion planning
- Grasping and dexterous manipulation
- Mobile manipulators
- Robot co-workers
- Human-robot interaction
- Teleoperation and haptic systems
- Control and programming of robots
- Perception systems and sensor integration
- Computer vision
- Simulation of robotized systems
- Industrial applications of robotics
- Service robots

4. Facilities

The IOC is located on the 11th floor of building H of the Barcelona School of Industrial Engineering (ETSEIB).

The Institute has a robotics laboratory; a control and electronics laboratory; a remote control laboratory; a logistics laboratory; a computer network equipped with servers, workstations, PCs and software; a WiFi network; a specialised library with around 6,000 books and numerous journals; a classroom that can hold 25 people; and a meeting room with a digital blackboard and a projector with a capacity for 10 people.

Equipping research laboratories

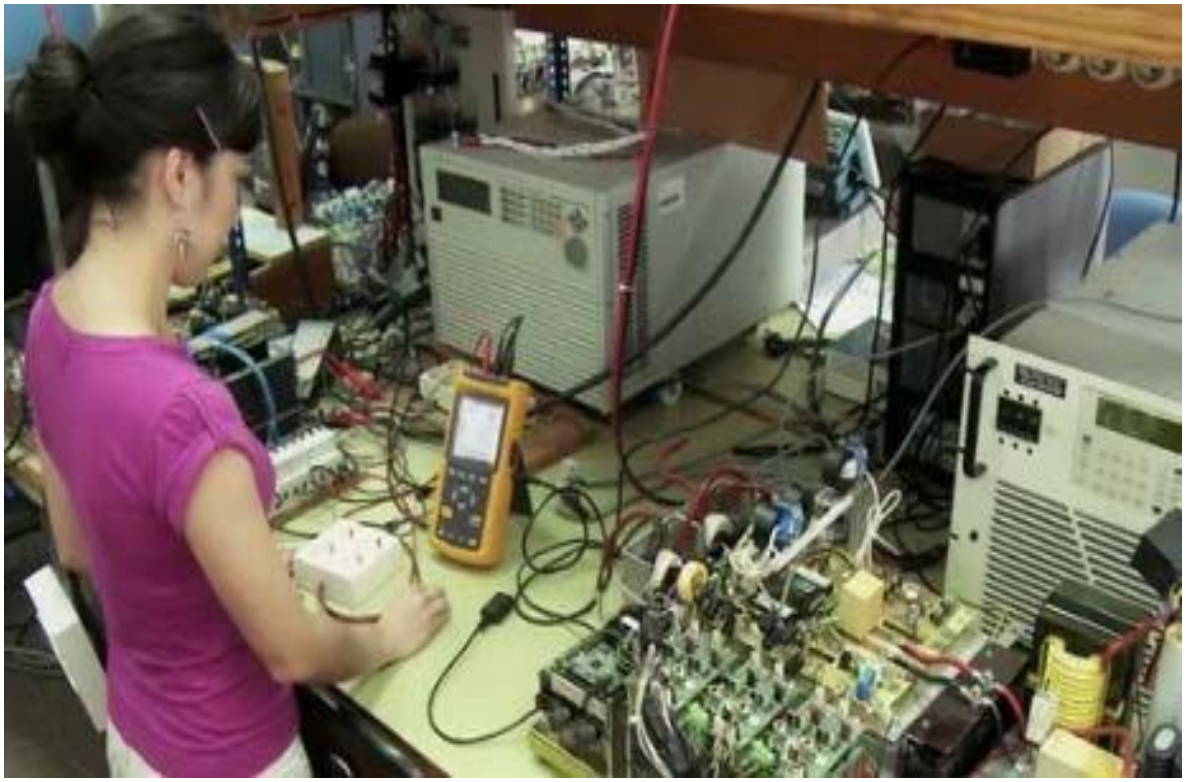
Robotics Laboratory

- 2 Stäubli TX90 robots, one is mounted on a motorised rail.
- 2 Kuka LWR robots with 7 axes, each one mounted on a mobile platform (BMM1 and BMM2).
- Several grippers and robotic hands: Schunk SAH, Schunk SDH and 3 Allegro hands.
- Haptic devices: Phantom Omni, Phantom Premium 1.5/6DOF and Phantom Premium 1.5/6DOF High force.
- Sensory systems such as video cameras, trackers, force sensors, tactile

sensors and 3D cameras.

- A 3D projector with the corresponding glasses.
- An omnidirectional mobile dua-arm robot (equipped with two Universal UR5 arms).
- 1 YuMi ABB robot.
- Several servers, PCs, monitors.
- 2 virtual reality glasses Oculus Rift
- 1 Drone DJI Phantom 2 Vision+
- 1 Drone Parrot AR.Drone 2.0
- 1 Pal Robotics TIAGo

Control and Electronic Laboratory



- Oscilloscopes
- Analyzers and signal generators
- Sources and power loads (e.g. sources ac, dc and programmable power load)
- Measuring instrumentation (the multimeter, differential probes, current probes)
- Emulators microprocessors and digital signal processors
- Computers
- The hardware and software for the design and implementation of electronic circuits
- Tools and equipment essential to the realization of small-scale mechanical assemblies
- Thermographic camera

SCOM Calculation Laboratory

- 16 computers: 12 which are designed to make computing experiments; the other 4 are reserved for doctoral, masters and designers
- 1 server for more computationally intensive problems
- 16 SAIs
- 7 screens
- 3 switches for keyboards/screens
- Specialized software: IBM ILOG CPLEX Optimization Studio 12.7

5. University masters

Master’s Degree in Automatic Control and Robotics

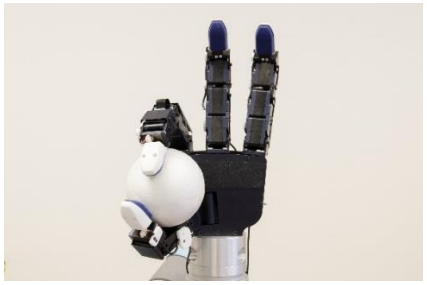
The Master's degree in Automatic Control and Robotics is an official degree adapted to European Higher Education Area (EHEA) offered by the Technical University of Catalonia (UPC) since the academic course 2006-07. The Masters is promoted by the Department of Systems Engineering, Automation and Industrial Informatics (ESAII) and the Institute for Systems and Control Engineering (IOC). It is a research oriented master in the area of Automatic Control and Robotics.

The UPC is considered the first Spanish university in the discipline of Automatic Control and Robotics in the 5th edition (2014) of I-UGR Ranquing over the period 2009-2013. Selected by the Catalunya-La Pedrera Foundation for it's scholarships programme for Masters of Excellence.

6. Doctoral degrees

The Institute of Industrial and Control Engineering (IOC) was set up for the purposes of conducting research and training researchers to a high level of specialisation. It is actively involved in teaching master and doctoral degrees.

Doctoral programme in Automatic Control, Robotics and Computer Vision (ARV)



The Doctoral programme in Automatic Control, Robotics and Computer Vision (ARV) emerged in 2006 from the fusion of the Doctoral programme in Advanced Automation and Robotics of the Institute of Industrial and Control Engineering (IOC) and of the Doctoral programme in Control, Vision and Robotics of the Automatic Control Department (ESAII), both with Quality Mention of the Spanish Ministry of Education (MEC). The fusion was fruit of an increasing thematic affinity and convergence between both programmes, and was carried out taking advantage of the opportunity to adapt the programme to the new syllabus of the Official Postgraduate Programmes in the framework of the European Higher Education Area.

The ARV Doctoral programme achieved from the beginning the Quality Mention, from the academic year 2007-2008 until 2010-2011. Then this award was replaced by the Excellence Mention by the Spanish Ministery of Education, with code MEE2011-0453. This mention was awarded from the academic years 2011-2012 until 2013-2014, and the programme ARV always obtained it.

The units responsible for the program are:

- Automatic Control Department (ESAII)
- Institute of Industrial and Control Engineering (IOC)

Doctoral Committee for the doctoral degree in Automatic Control, Robotics and Computer Vision (ARV)

- Dr. Suárez Feijóo, Raúl (Coordinator PhD ARV)
- Dra. Alícia Casals Gelpí (before course 2017-18 Dr. Antonio Benito Martínez Velasco)
- Dr. Andreu Català Mallofré (before course 2017-18 Dr. Cecilio Angulo Bahon)
- Dr. Robert Griñó Cubero
- Dr. Rafael Pastor Moreno
- Dr. Vicenç Puig Cayuela
- Dr. Jan Rosell Gratacòs
- Dr. Alberto Sanfeliu Cortés

Doctoral data 2020

A.	**Program Coordinator**	**RAÚL SUÁREZ FEIJÓO**
B.	**Number of students**	**90** (2020/2021)

Date	22/01/2020
Title	3D Partial Scans Models for People Recognition With A RGB-D Sensor
Author	TREJO RAMÍREZ, KARLA ANDREA
Thesis Director	ANGULO BAHON, CECILIO
Qualification	Notable

Date	24/01/2020
Title	Heat pump controls to exploit the energy flexibility of building thermal loads
Author	PÉAN, THIBAULT QUENTIN
Thesis Director Thesis Codirector	COSTA CASTELLO, RAMON SALOM TORMO, JAUME
Qualification	Excel.lent

Date	06/02/2020
Title	Active power sharing and frequency regulation in inverter-based islanded microgrids subject to clock drifts, damage in power links and loss of communications
Author	ROSERO CHANDI, CARLOS XAVIER
Thesis Director Thesis Codirector	VELASCO GARCIA, MANUEL MARTI COLOM, PAU
Qualification	Excel.lent Cum Laude

Date	25/02/2020
Title	Lidar-Based Scene Understanding for Autonomous Driving Using Deep Learning
Author	VAQUERO GÓMEZ, VÍCTOR
Thesis Director Thesis Codirector	SANFELIU CORTES, ALBERTO MORENO NOGUER, FRANCESC D'ASSIS
Qualification	Excel.lent Cum Laude

Date	09/03/2020
Title	Adapting robot behavior to user preferences in assistive scenarios
Author	ANAL CAMPRODON, GERARD
Thesis Director Thesis Codirector	ALENYÀ RIBAS, GUILLEM TORRAS GENIS, CARMEN
Qualification	Excel.lent Cum Laude

Date	24/03/2020
Title	Advances in planning and control for autonomous vehicles
Author	ALCALÁ BASELGA, EUGENIO
Thesis Director Thesis Codirector	PUIG CAYUELA, VICENÇ QUEVEDO CASIN, JOSÉBA-JOKIN
Qualification	Excel.lent Cum Laude

Date	27/03/2020
Title	Advanced Energy Management/Control Strategies for Smart Manufacturing Systems
Author	DÍAZ CASTAÑEDA, JENNY LORENA
Thesis Director	CAMPO MARTINEZ, CARLOS AUGUSTO
Qualification	Excel.lent Cum Laude

Date	23/07/2020
Title	Control and management of energy storage systems in microgrids
Author	RAVEENDRAN NAIR, UNNIKRISHNAN
Thesis Director	COSTA CASTELLO, RAMON
Qualification	Excel.lent Cum Laude

Date	24/07/2020
Title	Health-aware Predictive Control Schemes Based on Industrial Processes
Author	KARIMI POUR, FATEMEH
Thesis Director Thesis Codirector	PUIG CAYUELA, VICENÇ CEMBRANO GENNARI, M.GABRIELA ELENA
Qualification	Excel.lent

Date	23/09/2020
Title	Collaborative Social Robot Navigation in Accompanying and Approaching Tasks
Author	REPISO POLO, ELY
Thesis Director Thesis Codirector	SANFELIU CORTES, ALBERTO GARRELL ZULUETA, ANAíS
Qualification	Excel.lent Cum Laude

Date	29/09/2020
Title	Robust Navigation for Industrial Service Robots
Author	DERAY, JEREMIE
Thesis Director Thesis Codirector	ANDRADE CETTO, JUAN SOLÀ ORTEGA, JOAN
Qualification	Excel.lent Cum Laude

Date	11/12/2020
Title	Guidance, navigation and control of multirotors
Author	RUBí PERELLÓ, BARTOMEU
Thesis Director Thesis Codirector	MORCEGO SEIX, BERNARDO PEREZ MAGRANE, RAMON
Qualification	Excel.lent Cum Laude

Doctoral programme Supply chain and operations management (SCOM)

The aim of the doctoral program SCOM (Supply Chain & Operations Management) is to promote and develop research into the supply chain and thus contribute to improve the economic and environmental efficiency of all kind of organizations.
Currently, the concept of supply chain, which includes and exceeds operations management and logistics, articulates the research on supply, production, distribution and recovery. Although, strictly speaking, the concept of supply chain management includes operations management, the fact of joining them in the name of the PhD program indicates which is the aspect of the SC management in which the program focuses most.
SCOM begins in 2016 with the participation of the academic staff of the Department of Management (OE) and the Institute of Industrial Engineering of Control (IOC) has recognized extensive teaching, research and thesis experience in the monitoring program. Moreover, the participation of these personnel in conferences and research projects and publications in high impact journals, show their own experience of research on the item of SCOM.
Doctoral Committee for the doctoral degree:

- Dr Joaquin Bautista Valhondo
- Dr Ernest Benedito Benet
- Dr Laia Ferrer Martí
- Dr Amaia Lusa Garcia
- Dr Rafael Pastor Moreno
- Dr Imma Ribas Vila

Doctoral data 2020

A.	**Program Coordinator**	**AMAIA LUSA GARCIA**
B.	**Number of students**	**11** (2020/2021)

7. Projects and agreements

Public funding projects

Head researcher	BAUTISTA VALHONDO, JOAQUÍN
Title	Optimización de la Producción de talleres híbridos enlazados por unidades en secuencia.
Funding institution	Agencia Estatal de Investigación
Reference	PGC2018-095080-B-I00
Start-up date	01/01/2019
Completion date	31/12/2021

Summary

We will solve programming and sequencing problems in mixed-model lines and workshops of regular flow (Flow Shop environment), as well as mixed-product assembly line balancing problems, taking as reference the Automotive sector. In our formulation, we will consider: the influence of the human factor, the uncertainty of the environment and the flexibility of the productive system. We will model, the effects produced by the human factor, the uncertainty of the demand and the flexibility to execute the operations, on the following elements:

(i) Work stations, series and parallel, with assigned tasks that present homogeneous and heterogeneous processing times.
(ii) The limitations on time, space and security, between production stages.
(iii) The sequence of models conditioned by the delivery in batches of pieces or jobs.
(iv) Operational costs due to production drops and downtime.
(v) The robustness of the attributes of a solution versus the variation of the technological and economic environmental conditions.

Head researcher	BENEDITO BENET, ERNEST
Title	Customer Quality 4.0
Funding institution	Agència de Gestió d'Ajuts Universitaris i de Recerca
Reference	2019 DI 033
Start-up date	16/09/2019
Completion date	04/12/2022

Summary

We carry out a comprehensive evaluation of technical queries to ensure the excellence of the final products of SEAT. With the help of emerging technologies such as Internet of Things, Big Data & Analytics, Artificial Intelligence and Blockchain, among others, new services and applications of Customer Quality can be created. The main goal of this project is to develop new technological solutions that allow SEAT to streamline the process of analysis and resolution of technical queries in Customer Quality department.

Head researcher	FERRER MARTÍ, LAIA
Title	Optimización de Microredes con Energías Renovables bajo Incertidumbre y Futura Integración a la Red.
Funding institution	Agencia Estatal de Investigación
Reference	RTI2018-097962-B-I00
Start-up date	01/01/2019
Completion date	31/12/2021

Summary

Microgrids and renewable energy have proven beneficial in increasing access to electricity, to reduce transmission losses and increase security of supply, among others. In Spain, self-consumption and distributed generation with smart micro-grids (smart grid) is significantly increasing and, as a result, costs are reduced for consumers, renewable generation increases and CO2 emissions are reduced, and it is a new business model and a source of job creation.

The optimization of the detailed design of these microgrids is a very complex combinatorial problem given the huge amount of alternatives for locating equipment, distribution structures considering microgrids isolated or connected (initially or in the future) to the main grid with purchase-sale of energy, considering uncertainty in the generation and demand data, and the multicriteria nature inherent to the system. In this context, the general objective of this proposal, OMER-IFIR, is to optimize the design and management of micro-grids with renewable energy as well as technical, economic, social, environmental and management constraints and criteria.

In short, the aim is to have multicriteria models and tools for the design of microgrid electrification systems with renewable energy, that consider the constraints and characteristics of the promoters and future users, thus guaranteeing the efficiency and time sustainability of the obtained solutions.

Head researcher	DÒRIA-CEREZO, ARNAU
Control del sonido para la seguridad de la nueva generación de vehículos eléctricos. SS4S.	
Funding institution	Agencia Estatal de Investigación
Reference	EIN2020-112372
Start-up date	01/11/2020
Completion date	31/10/2022

Summary

There is an undeniable trade-off in new electric and hybrid vehicles regarding their sound quality. Comfort and sound brand perception compete with safety-related issues because their current quietness and low detectability endanger vulnerable road users. This new scenario requires the traditional strategy of noise reduction to be reconsidered and re-shaped into a more refined strategy based on the improvement of noise quality, annoyance reduction, and improved vehicle recognition. This is the reason why its development for the next generation of vehicles requires international cooperation of multiple disciplines in electrical and mechanical engineering.

In this context, SS4S (Sound shaping for safety in the next generation of electric vehicles) will create a unique interdisciplinary network of leading OEMs, automotive industries, automotive research companies, and top European universities to successfully write research and training oriented proposals to address the major sound quality challenges of the next generation of vehicles. The result of this project will be the presentation of an MSCA proposal under Horizon Europe (2021-27).

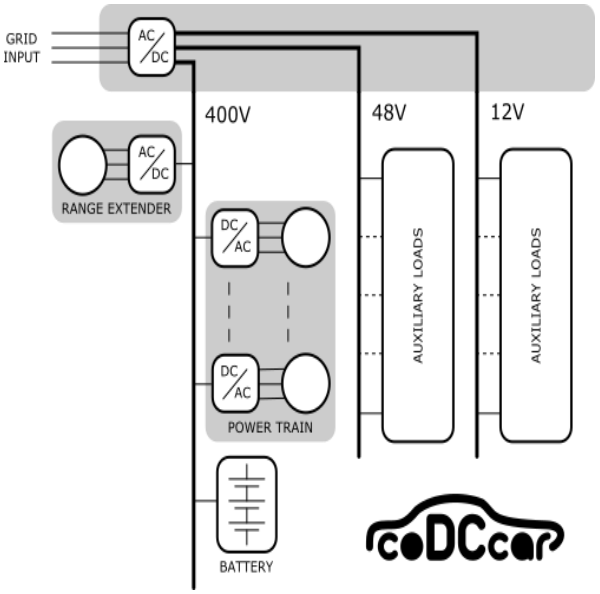
Head researcher	DOMENECH, BRUNO
Title	Desenvolupament d'eines per a l'avaluació de projectes energètics.
Funding institution	Centre Cooperació per al Desenvolupament
Reference	CCD-2019-B014
Start-up date	01/03/2019
Completion date	28/02/2020

Summary

The research group SCOM carries out research on rural electrification in developing countries with renewable energy since more than 10 years. From the beginning, the research focused on developing optimization and multicriteria tools to support electrification promoter in decision-making. Hence, it is necessary to evaluate projects several years after implementation to identify the strengths and weaknesses, to be included in the design of future cases. In addition, the technological advances make accessible new options, such as the connection to the national electricity grid, that can influence the design. In this context, with this application funding is requested for the trip to Venezuela to evaluate electrification projects in situ (new and where we have already worked), study the technical and social performance, and identify aspects to be improved. Recently, the group is expanding the research scope, including the new identified conditionings in the optimization and multicriteria tools for a better design of future projects.

Head researcher	DÒRIA-CEREZO, ARNAU / GRIÑÓ CUBERO, ROBERT
Title	Advanced control of on-board DC multibus systems in vehicles.
Funding institution	AGENCIA ESTATAL DE INVESTIGACION
Reference	DPI2017-85404-P
Start-up date	01/01/2018
Completion date	31/12/2021

Summary



In the last years two main challenges raised up in the automotive sector: for one hand, the CO2 reduction that implies a weight reduction and increasing the efficiency of the vehicle components and, for another hand, the customer's requirements, mainly, in terms of performance and security. Consequently, the use of electrified systems emerged as an alternative to be considered by the OEMs(Original Equipment Manufacturers). This new tendency does not only consider the electrification of the power train (i.e. electrical and hybrid vehicles) but is also evident in many auxiliary devices that are increasingly being electrified.
However, the major electrification of vehicles could imply problems related to on-board DC micro-grids. This implies the necessity of designing: controllers that ensure grid stability in front of the connection of constant power loads (CPLs), but also offer good robustness and efficiency properties, and optimization algorithms for the dc micro grid.

This project considers a DC multi-bus, with the most, used automotive voltages (400V, for power the train, and 48 V and 12 V, for auxiliary devices), composed by only one storage element (batteries). The dc buses will be connected by one multiport converter (400/48/12 V DC) that will also offer charger functionalities thanks to a single-phase 230 V, or tree-phase 400 V, controlled unitary power. actor rectifier. The main advantage of using only one battery and one power converter is the size and weight reduction.

The aim of this project is to study and develop control strategies for a DC multi-bus and a multi-port power converter that provides energy management among the dc buses and AC/DC charging functionalities. During the project several control techniques will be used; resonant digital control, sliding-mode control, adaptive control, control based on systems with complex coefficients, control of complex networks and continuous optimization methods. The obtained control algorithms will

be tested in the experimental plants and, the obtained results are expected to be of interest of the industrial and automotive sectors.

Keywords: Control of power electronic converters, stability and regulation, constant power loads, on-board dc networks.

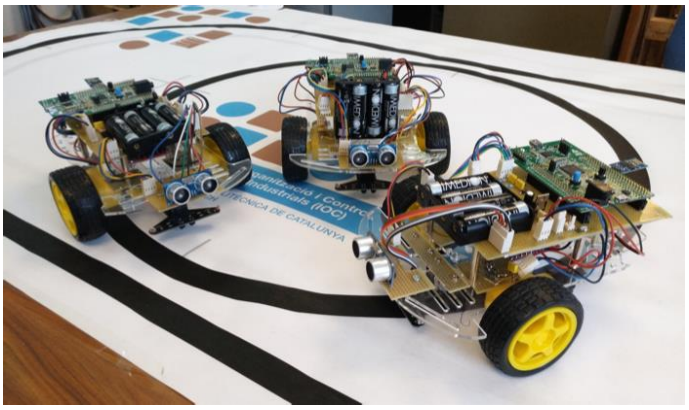
Head researcher	LUSA GARCIA, AMAIA
Title	Gender Equality in Engineering through Communication and Commitment.
Funding institution	European Commission
Reference	H2020-741128-GEECCO
Start-up date	01/05/2017
Completion date	30/04/2021

Summary

The underrepresentation of women continues to characterise the STEM field (Science, Technology, Engineering, and Mathematics). Whereas in Europe approximately half of the PhD students are female, only 21% of PhD graduates in computing and 25% of PhD graduates in engineering are women. Given the relevance of technologies in our societies an adequate participation of all genders in the STEM field is of outstanding importance. With technologies, we shape structures that have long-term impacts on how people live, work, communicate, travel, and consume. Therefore, the gender dimension in research and innovation, their contexts and their outcomes, is significant. GEECCO is an EU funded project, which brings together a consortium that is characterised by the focus on the STEM field. GEECCO will increase the number of Research Performing Organizations (RPOs) and Research Funding Organizations (RFOs) that start to implement gender equality plans (GEP) pursuing the 3 objectives mentioned in the challenge, namely: (1) Removing barriers to the recruitment, retention and career progression of female researchers; (2) Addressing gender imbalances in decision making processes; (3) Strengthening the gender dimension in research programmes. GEECCO will be a step forward to a new way of establishing tailor-made GEPs in RPOs and implementing the gender dimension in research funding programmes. An effective and efficient dissemination and exploitation strategy has the aim of making the GEECCO approach accessible to other actors.

Head researcher	OLM MIRAS, JOSEP M.
Title	Control Avançat de Sistemes d'Energia.
Funding institution	Agència de Gestió d'Ajuts Universitaris i de Recerca
Reference	2017 SGR 872
Start-up date	01/01/2017
Completion date	30/09/2021

Summary



This project is aimed at recognizing and funding the research activities of the group Advanced Control of Energy Systems (ACES) by the Generalitat de Catalunya. Already funded in the calls SGR 2005-2008, SGR 2009-2013, and SGR 2014-2016, ACES is a multidisciplinary constituted by engineers, physicists and mathematicians belonging to Electrical Engineering, Electronics Engineering, Automatic Control, and Mathematics Departments of UPC.

The research interests of ACES are mainly focused on the modelling and control of complex systems, as well as on its application to problems related to the electrical grid (generation, conditioning, storing, and managing of electrical energy) and automotive systems. On the one side, the theoretical working lines encompass: internal model principle-based linear control; nonlinear control, including adaptive, sliding, energy-based, and complex networks control; order reduction in large-scale models; nonsmooth systems, and differentially flat systems. On the other side, the applied works deal with power electronics converters, electrical machines, power networks, control of automotive electrical components, vehicle dynamics, traffic flow analysis, cooperative driving, and fuel cells.

Head researcher	ROSELL GRATACÒS, JAN / SUÁREZ FEIJÓO, RAÚL
Title	Robots autónomos diestros como co-trabajadores con operadores humanos.
Funding institution	Ministerio de Economía, Industria y Competitividad.
Reference	DPI2016-80077-R
Start-up date	30/12/2016
Completion date	30/06/2021

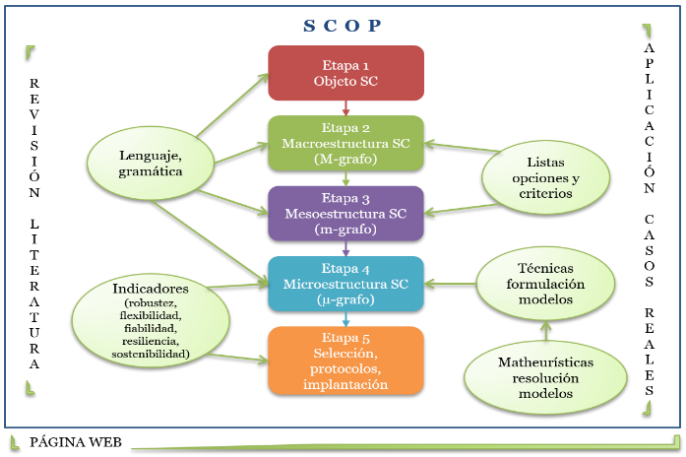
Summary

The robotics field-of-application is constantly growing as the technological advances allow new capabilities and an increment and strength of the already existing ones. Among the new applications, it is worth mentioning, due to their potential significance from the productive and social point of view, those in which the robots work jointly with the humans, originating the concept of "coworker robots". In this type of applications, the robots require some special features. On the one hand, they must have certain level of autonomy and capacity of decision, as their role is no longer doing repetitive tasks in the classical way but on the contrary, they must adapt themselves with swiftness to changing conditions, especially to those produced by the humans in the same workspace. This adaptation implies an interaction with the human operators that constraint the robot movements and actions with the aim of avoiding potential injuries to humans, but without affecting the robot efficiency. In order for the coworker robots to be useful for the human operators, it is necessary that they have an important level of dexterity so that they can perform a number of different actions usually required in the human activities. In this context, the project aims for solutions that increment the performance of the coworker robots to allow their permanent establishment in our society, and, at the same time, facilitate their acceptance by the humans. With this aim, the project will deal with the topics mentioned above, developing algorithms and procedures that make easy the efficient cooperation between coworker robots and humans. Specifically, contributions are expected in relevant topics, as: the increment of the robot capability to autonomously manage the required tasks and the movements to execute them, using ontologies to represent the knowledge; the increment of the dexterous and bimanual manipulation capabilities, monitoring the movements to prevent potential failures; and the improvement of the interaction with the human operators regarding reactive, cooperative and exchange-objects movements, considering approaches based on demonstrations or on teleoperation. All the theoretical developments will be checked and validated experimentally using the systems

specifically prepared for it in the project. Besides, as usual in the developments of the group, the mentioned problems will be addressed with the intention of providing general solutions, valid for both industrial and service robotics, taking care of the productive and social components.

Head researcher	LUSA GARCIA, AMAIA
Title	Conceptos, instrumentos, modelos y algoritmos para el diseño de la supply
Funding institution	Ministerio de Economía, Industria y Competitividad.
Reference	DPI2015-67740-P
Start-up date	01/01/2016
Completion date	31/12/2020

Summary



The purpose of this project is to develop tools and concepts for an efficient and correct design of supply chains (SC), under the SCOP method (Supply Chain Outline Process). The design of the SC consists of determining what elements are to be present in the SC and the relationships between them and includes decisions that are highly irreversible once implemented, and with associated significant costs and long-term implications. SCOP comprises five stages: the first one involves the definition of the object of the SC, the analysis of the environment and the formalization of objectives (the decisions made at this stage –such as a lean or an agile SC- determine the subsequent stages); the second, third and fourth respectively correspond to the definitions of the structure of the SC at a macro level (large blocks that comprise it), meso level (product structure and activities taking place in the SC; for each activity an option must be chosen from those available) and micro (includes defining and optimizing, by means of mathematical programming, the relations between the facilities in which the activities can potentially be carried out) level; in the fifth stage the configuration of the SC is selected, the protocols to apply in case of incidents are defined and the implementation of the SC is done. The proposed elements to be developed in this project are closely related, and are inserted into the framework defined in SCOP and help developing and strengthening the method.

Head researcher	PEÑA, MARTA
Title	Systemic University Change Towards Internationalisation for Academia.
Funding institution	Commission of European Communities
Reference	2019-1-PL01- KA203-065656
Start-up date	01/09/2019
Completion date	31/08/2022

Summary

The aim of this project is to raise awareness and shift the internal culture of our institutions towards internationalization, thus creating a systemic change in our institutions and in European Higher Education. While many activities exist for internationalising students and the predecessor project SUCTI (2016-2019) concentrated on the administrative staff, SUCTI Academia (SUCTIA) aims at empowering the third pillar, the academic staff, by providing them with knowledge and skills related to their university's internationalisation process.

Investments have been made in the internationalization of this group in an attempt to increase their impact on more international research and publications, more internationalized courses, more international programs. However, in order to perform those international tasks, the academics (scholars, researchers, teachers) need to have the right preparation, training, skills and knowledge to do it properly. What is more, if they are convinced of the importance and added value of internationalisation they can become genuine change agents. In this way, they can make a key contribution to the overall objective of the project which is to transform the internal mind-set of universities and enable them to become truly internationalised institutions.

Agreements with companies

Head researcher	LUSA GARCÍA, AMAIA
Title	Creació d'algoritme d'optimització de procés de fabricació d'una planta de
Funding institution	ITHINKUPC, S.L.
Reference	
Start-up date	04/11/2019
Completion date	20/04/2020

Summary

The project consists in designing an optimization algorithm for scheduling production orders in a set of production lines. There are setup times that depend on the production sequence and there are some resources that are shared by two production lines. The algorithm consists of an heuristic to build an initial solution and a local search algorithm to improve it. Different drivers are included in the objective function.

Head researcher	LUSA GARCÍA, AMAIA
Title	Formació en logística per estudiants del Tecnológico de Monterrey.
Funding institution	Instituto Tecnológico y de Estudios Superiores de
Reference	
Start-up date	30/04/2019
Completion date	29/04/2024

Summary

The project consists in organizing and developing a summer school for students coming from the Instituto Tecnológico y de Estudios Superiores de Monterrey. All courses are focused on logistics and transportation and visits to different companies are also organized. Some trainers belong to IOC and others to other departments or organizations.

Head researcher	LUSA GARCÍA, AMAIA
Title	Suport tècnic ELIX POLYMERS
Funding institution	ITHINKUPC, S.L.
Reference	
Start-up date	20/09/2020
Completion date	10/05/2021

Summary

The main objective is the development of a tool to support planning for finished and semi-finished products, which based on MTO and MTF production strategies, and complying with established restrictions, can make the current system more efficient. To this end, the team is requested to provide the necessary advisory support for the design of the algorithm with the following characteristics: (i) incorporation of planning drivers such as inventory costs, service level and product margin; (ii) respect the current structural manufacturing constraints such as dependencies between products, plant capacities and incompatibilities of production lines; (iii) be able to simulate various planning scenarios according to drivers and constraints.

Head researcher	LUSA GARCÍA, AMAIA
Title	Assessorament en la creació d'un algorisme d'optimització del sistema de planificació a curt termini
Funding institution	ITHINKUPC, S.L.
Reference	
Start-up date	02/03/2020
Completion date	26/07/2020

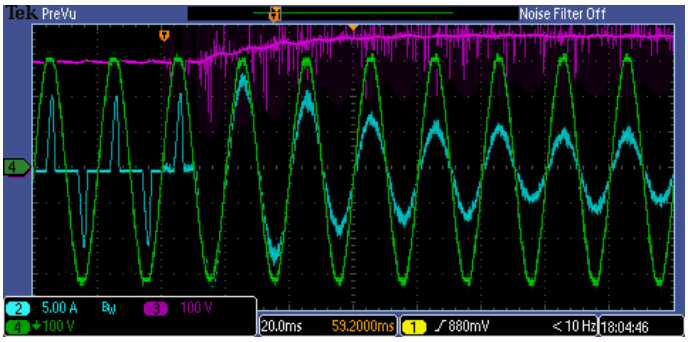
Summary

The objective is the development of a tool to support the planning of manufacturing orders that allows to generate agilely a plan that takes into account the forecast of the demand and its forecast accuracy. Also, it must be considered that the products are perishable. To this end, the team is requested to provide the necessary advisory support for the design of the algorithm incorporating: (i) planning drivers such as inventory costs, non-service costs and product margin; (ii) the current structural constraints of manufacture such as product expiration dates, plant capacities and incompatibilities of production lines; (iii) option for simulating various planning scenarios according to the drivers and constraints.

Head researcher	ARIAS PUJOL, ANTONI
Title	Assessorament pel disseny i posterior implementació en microprocessadors d'algorismes digitals pel control d'altres prestacions per a fonts d'alimentació.
Funding institution	POWER INNOTECH
Reference	
Start-up date	01/01/2019
Completion date	31/12/2020

Summary

The main objective it to provide consultancy and advice for the theoretical design of digital algorithms to obtain high performance control for power supplies.



The feasibility analysis for implementtation on digital platforms, preferably in high-performance microprocessors, is an asset.

It is also planned to participate actively in the dissemination of results at the level of scientific articles and/or participation in prestigious international congresses.

Head researcher	ARIAS PUJOL, ANTONI
Title	Power Factor Conditioner. 230V 400W
Funding institution	POWER INNOTECH
Reference	
Start-up date	20/12/2020
Completion date	20/12/2021

Summary

A 1.2kW single phase AC mains connected (230VAC 50Hz) and DC (400V) output power supply a with power factor compensator has been designed. This collaboration is a continuation of the previous one.

Head researcher	ARIAS PUJOL, ANTONI
Title	Power Supplies Control
Funding institution	UNIVERSIDAD DEL PAIS VASCO
Reference	
Start-up date	30/10/2020
Completion date	30/06/2021

Summary

A digital control for a DC/DC 4V 1200A power supply has been designed as a prototype for the CERN particle accelerator.

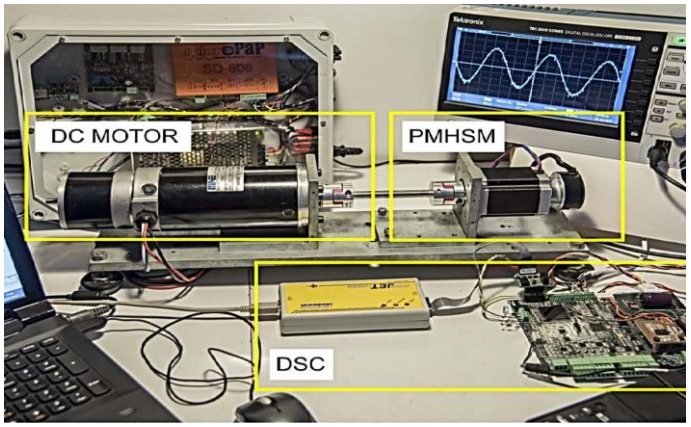
Head researcher	OLIVELLA, JORDI
Title	EIT InnoEnergy Introductory course on Technical Project Management
Funding institution	EUROPEAN INST OF INNOV. & TECHNOL..
Reference	
Start-up date	01/06/2020
Completion date	31/12/2020

Summary

The objective of the activity has been the development of digital contents on Project Management. To do so, a full course on Project Management has been converted to digital. Digital materials are necessary both for online activities as well as a support for in person activities. Digital materials are now particularly necessary given the difficulties we face to participate in in person meetings. The course assumes no previous level of Project Management. The materials are structured in a modular way, so they can be used individually. The digital format and the modular structure facilitate the use of the materials within project-based activities. The materials are addressed to master level students with technical background.

Head researcher	ARIAS PUJOL, ANTONI
Title	Assessorament pel disseny i posterior implementació en microprocessadors d'algorismes digitals pel control d'altres prestacions de motors pas a pas.
Funding institution	MICROPAP ENGINEERING SL
Reference	C10722
Start-up date	31/10/2016
Completion date	30/07/2020

Summary



The main goal is the design and further implementation in digital microprocessors of state-of-the-art algorithms to improve the overall performance of the well-known stepper motors. On a second step, the use of a position transducer (typically and encoder) will be considered in order to develop field oriented control and therefore industrially compete with their counterparts (permanent magnet synchronous machines) in order to gain market.

It is also expected to publish the scientific results in prestigious international conferences and high impact factor journals.

Head researcher	PEÑA PITARCH, ESTEBAN
Title	Copropietat patent/Aparell per mesurar la força del
Funding institution	FUNDACIÓ ALTHAIA.
Reference	P201130449
Start-up date	25/03/2011
Completion date	25/03/2031

8. Publications

Journals articles

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8. Bautista, J.; Alfaro, R.. Mixed integer linear programming models for minimizing ergonomic risk dispersion in an assembly line at the Nissan Barcelona factory. Dirección y organización. Revista de ingeniería de organización. Any: 2020. Volum: 65. Pàgs: 72 ~ 89. URL del text: https://www.revistadyo.es/DyO/index.php/dyo/article/view/529. DOI:https: //doi.org/10.37610/DYO.V0I65.529.

9. Benedito, E.; Martinez, M.; Rubio, S.. Introducing Risk Considerations into the Supply Chain Network Design. Processes. Any: 2020. Volum: 8. Número: 6. Pàgs: 743/1 ~ 743/21. Nombre de citacions: 2. URL del text: https://www.mdpi.com/2227-9717/8/6/743. DOI:https: //doi.org/10.3390/pr8060743.

10. Diab, M.; Pomarlan, M.; Beßler, D.; Rosell, J.; Akbari, A.; Bateman, J.; Beetz, M.. SkillMaN — A skill-based robotic manipulation framework based on perception and reasoning. Robotics and autonomous systems. Any: 2020. Volum: 134. Pàgs: 103653/1 ~ 103653/17. Projecte o conveni finançador: Robots autónomos diestros como co- trabajadores con operadores humanos. Nombre de citacions: **4**URL del text: https://www-sciencedirect-com.recursos.biblioteca.upc.edu/science/article/pii/S0921889020304930. DOI:https: //doi.org/10.1016/j.robot.2020.103653.

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small wind turbines for rural electrification: case studies from extreme climatic conditions in Venezuela. Energy. Any: 2020. Volum: 209. Pàgs: 1 ~ 12. Projecte o conveni finançador: Optimización de Microrredes con Energías Renovables bajo Incertidumbre y Futura Integración a la Red. Nombre de citacions: 4.URL del text: https://www.sciencedirect.com/science/article/abs/pii/S0360544220315589.

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Conference publications

1. Anich, N.; Mateo, M.. Analysis of synergies in the supply chain with distribution to multiple types of clients. https://eventos.uc3m.es/43190/detail/14th-international-conference-on-industrial-engineering-and-industrial- management.html. Lloc de publicació: Madrid, Espanya. Any: 2020. Pàgs: 61 ~ 61.

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16. Serra, F.M.; Doria-Cerezo, A.; De Angelo, C.H.; Martín-Fernández, L.L.; Bodson, M.. Complex pole placement control for a three-phase voltage source converter. 2020 IEEE International Conference on Industrial Technology : Buenos Aires Institute of Technology (ITBA), Buenos Aires, Argentina, 26-28 February, 2020: proceedings. Lloc de publicació: Buenos Aires, Argentina. Editorial: Institute of Electrical and Electronics Engineers (IEEE). Any: 2020. Pàgs: 901 ~ 906. ISBN/ISSN: 978-1-7281-5754-2. URL del text: https://ieeexplore.ieee.org/xpl/conhome/9047988/proceeding.

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Books

1. Bautista, J.. Metaheurísticas en Ingeniería. Editorial: DEXTRA Editorial S.L.. Any: 2020. ISBN: 978-84-17946-43- 2.

2. Bautista, J.. Teoría de juegos en entornos competitivo y colaborativo. Editorial: DEXTRA Editorial S.L.. Any: 2020. ISBN: 978-84-17946-36-4.

3. Bautista, J.. Modelos y herramientas de decisión. Editorial: DEXTRA Editorial S.L.. Any: 2020. ISBN: 978-84- 17946-32-6.

Book chapters

1. Bautista, J.; Alfaro, R.. A MILP approach to maximize productivity in mixed-model assembly lines. Advances in engineering networks. Editorial: Springer. Any: 2020. Pàgs: 145 ~ 153. ISBN: 978-3-030-44530-0.

2. Bautista, J.; Mateo, M.; De La Torre, R.. Assignment of volunteers in a sports event: case restricted fitness by cut- off mark. Advances in engineering networks. Editorial: Springer. Any: 2020. Pàgs: 105 ~ 112. ISBN: 978-3-030- 44530-0.

3. Calleja, G.; Olivella, J.; Sole, F.. Technology forecasting: recent trends and new

methods. Research methodology in management and industrial engineering. Editorial: Springer. Any: 2020. Pàgs: 45 ~ 69. ISBN: 978-3-030-40895-4.

4. Peña-Pitarch, E.; Vives, J.; Lopez, J.A.; A. Al Omar; Alcelay, J. I.; Ticó, N.. Introductory analysis of human upper extremity after stroke. Research anthology on rehabilitation practices and therapy. Editorial: IGI Global. Any: 2020. Pàgs: 828 ~ 844. ISBN: 9781799834328.

9. Prizes and awards

1. Premiats: Rodríguez, P.; Martinez, M.; Calleja, G.. Nom del premi (edició): II Congreso Iberoamericano de Jóvenes Investigadores en Ciencias Económicas y Dirección de Empresas. Any: 2020. Motiu/treball reconegut: Mejor comunicación presentada - Capacidad de innovación en los sistemas de propiedad industrial para la obtención de indicaciones geográficas y denominaciones de origen en los países BRICS (Brasil, Rusia, India, China y Sudáfrica). Data de resolució: 29/11/2019. Resultat: Primer premi.

10. Extracurricular activities

Executive en Lean Supply Chain Management. Direcció d'Operacions I Logística - Master's degree. Face-to-face.

Academic management: Rúa Costa, Carles

Presentation

16th year

Traditional functions in companies such as production, distribution, planning or logistics have evolved with the change in economic cycles. The productive function has adapted to the new needs of markets, incorporating new trends such as Lean Manufacturing¿ and embracing quality control, training or staff motivation as part of its tasks. Likewise, logistics have also changed, and the concept Integrated Logistics has come to comprise all the value chain between the customer and the supplier, as well as the flow of information and materials.

Integrated management of the distribution chain, production and supplies is now known as Supply Chain Management. The emergence of logistics has forced governments to work on improving and updating infrastructures roads, railway, ports and airports and this, together with staff training and research and innovation as key aspects to increase the level of competitiveness in the business fabric.

This Master's Degree aims to be unique and exclusive, a reference point for all professionals aiming to develop their career in the areas of logistics, distribution, supplies and, in general, Year aspect relating to the supply chain management and design. To make this possible, the course has included prestigious professionals from the main European universities (CRANFIELD) and leading schools in specific areas (European Short Sea Shipping School). For this Masters we also have the collaboration of managers from the leading logistics companies in Spain, who will transmit their experiences to the students.

AIMS

- TO PUT INTO QUESTION, THE CURRENT ORGANISATIONAL AND MANAGEMENT SYSTEMS IN THE LOGISTICS CHAIN.
- TO STRATEGICALLY ANALYSE, ORIENT AND DEFINE THE ENTIRE LOGISTICS CHAIN AND ALL OF ITS DIFFERENT SECTORS, IMPLEMENTING AND ADAPTING NEW TECHNOLOGIES TO BOOST COMPANIES LOGISTICS

SERVICES.

- TO DESIGN AND IMPLEMENT NEW SYSTEMS AND METHODOLOGIES TO IMPROVE THE MANAGEMENT OF THE RELATIONSHIPS AMONG PROVIDERS, BUSINESSES, OPERATORS AND END CLIENTS.
- TO EFFECTIVELY MANAGE PERSONNEL TEAMS THAT NEED TO COLLABORATE WITH THE CULTURAL CHANGE IMPLIED IN IMPLANTING AN INTEGRATED STRATEGY OF SUPPLY CHAIN MANAGEMENT

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