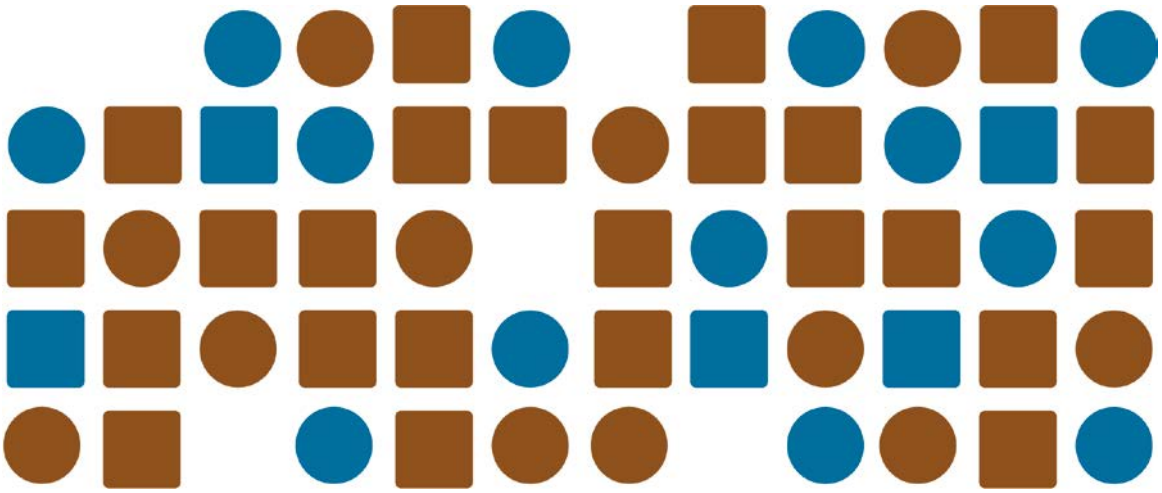


IOC

Institute of Industrial and Control Engineering

Activities Report 2016

UNIVERSITAT POLITÈCNICA DE CATALUNYA
BARCELONATECH
Institute of Industrial and Control Engineering

Table of contents

1. Organisational structure and governing bodies

Management

Until 2016.07.14

Director	RAÚL SUÀREZ FEIJÓO
Assistant director	ERNEST BENEDITO BENET
Secretary	ARNAU DÒRIA CEREZO
Technical and Management Support Area - UTGAEIB	ANA BELÉN CORTINAS ABAD

Since 2016.07.15

Director	ROBERT GRIÑÓ CUBERO
Assistant director	ERNEST BENEDITO BENET
Secretary	JAN ROSELL GRATACÓS
Technical and Management Support Area - UTGAEIB	ANA BELÉN CORTINAS ABAD

The Board

Until 2016.07.14

Management	RAÚL SUÁREZ FEIJÓO
Assistant director	ERNEST BENEDITO BENET
Secretary	ARNAU DÒRIA CEREZO
Representative of the Control division	DOMINGO BIEL SOLÉ
Representative of the Industrial Engineering and Logistics division	RAFAEL PASTOR MORENO (until 18/11/2015)
Representative of the Industrial Engineering and Logistics division	AMAIA LUSA GARCÍA (since 18/11/2015)
Representative of the Robotics division	JAN ROSELL GRATACOS

Technical and Management Support Area - UTGAEIB	ANA BELÉN CORTINAS ABAD
Representative of teaching and research staff who hold a PhD	ROBERT GRIÑÓ CUBERO
Representative of teaching and research staff who do not hold a PhD	GEMA CALLEJA SANZ
Representative of administrative and service staff	LEOPOLD PALOMO AVELLANEDA

Since 2016.07.15

Management	ROBERT GRIÑÓ CUBERO
Assistant director	ERNEST BENEDITO BENET
Secretary	JAN ROSELL GRATACÓS
Representative of the Control division	DOMINGO BIEL SOLÉ
Representative of the Industrial Engineering and Logistics division	AMAIA LUSA GARCÍA
Representative of the Robotics division	JAN ROSELL GRATACOS (until 2016.10.30)
Representative of the Robotics division	RAÚL SUÀREZ FEIJÓO (since 2016.10.31)
Technical and Management Support Area - UTGAEIB	ANA BELÉN CORTINAS ABAD
Representative of teaching and research staff who hold a PhD	Vacancy
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	
Basañez Villaluenga, Luís	
Benedito Benet, Ernest	Assistant director
Biel Solé, Domingo	Representative of the Control division
Calleja Sanz, Gema (until 2016.08.31)	Representative of teaching and research staff who do not hold a PhDr
Cortinas Abad, Ana Belen	Technical and Management Support Area UTGAEIB
Corominas Subias, Albert	
Dòria Cerezo, Arnau	Secretary (until 2016.07.15)
Ferrer Llop, Josep	
Ferrer Martí, Laia	
Fossas Colet, Enric	
García Villoria, Alberto	
Griñó Cubero, Robert	Director (since 2016.07.15)
Lusa Garcia, Amaia	Representative of the Industrial Engineering and Logistics division (since 18/11/2015)
Martínez Costa, M. Carme	
Mas Casals, Orestes	
Mateo Doll, Manel	
Montaño Sarria, Andrés Felipe	
Olivella Nadal, Jordi	
Olm Miras, Josep Maria	
Palomo Avellaneda, Leopold	Representative of administrative and service staff
Pastor Moreno, Rafael	
Peña Pitarch, Esteban	
Rosell Gratacòs, Jan	Representative of the Robotics division (until 2016.10.30) Secretary (since 2016.07.15)
Suarez Feijoo, Raul	Director (until 2016.07.14) Representative of the Robotics division (since 2016.10.31)

2. Staff

NAME		DIVISIONS/ SERVICE	CATEGORIES
AKBARI	ALIAKBAR	ROB	BR
ARIAS PUJOL	ANTONI	CTL	TU
AROCAS PÉREZ	JOSÉ	CTL	BR
BASAÑEZ VILLALUENGA	LUIS	ROB	Emeritus
BATLLE ARNAU	CARLES	CTL	TU
BENEDITO BENET	ERNEST	EOL	AG
BIEL SOLÉ	DOMINGO	CTL	TU
CALLEJA SANZ	GEMA	EOL	AJ
CARDONER PARPAL	RAFEL	SSR	LT
CLARET ROBERT	JOSEP ARNAU	ROB	BR
COROMINAS SUBIAS	ALBERT	EOL	Emeritus
DÒRIA CEREZO	ARNAU	CTL	AG
FERRER LLOP	JOSEP	CTL	CU
FERRER MARTÍ	LAIA	EOL	AG
FOSSAS COLET	ENRIC	CTL	CU
GARCIA HIDALGO	NÈSTOR	ROB	BR
GARCÍA VILLORIA	ALBERTO	EOL	PL
GRIÑÓ CUBERO	ROBERT	CTL	TU
LUSA GARCÍA	AMAIA	EOL	TU
MARTÍNEZ COSTA	CARME	EOL	TU
MARSAL PERENDREU	JULIA	ROB	LT
MAS CASALS	ORESTES	ROB	TU
MATEO DOLL	MANUEL	EOL	TU
MIRÓ VALERO	ENRIC	SSR	LT
MONTAÑO SARRIA	ANDRÉS F.	ROB	BR
OLIVELLA NADAL	JORDI	EOL	TU
OLM MIRAS	JOSEP M.	CTL	AG
PALOMO AVELLANEDA	LEOPOLD	SSR	LT
PASTOR MORENO	RAFAEL	EOL	CU

NAME		DIVISIONS/ SERVICE	CATEGORIES
PEÑA PITARCH	ESTEBAN	ROB	TU
PORTILLA RODRIGUEZ	HENRY	ROB	BR
REPECHO DEL CORRAL	VICTOR	CTL	LT
RIPOLL RUIZ	ALEIX	ROB	LT
ROIG FERNÁNDEZ	VICENÇ	SI	LF
ROJAS DE SILVA GONZÁLEZ	FCO. ABIUD	ROB	BR
ROSELL GRATACÒS	JAN	ROB	TU
RÚA COSTA	CARLES	EOL	PAL
SUÁREZ FEIJÓO	RAÚL	ROB	DI
UD DIN	MUHAYY	ROB	BR
ZAPLANA AGUT	ISIAH	ROB	BR

Visiting Staff

NAME		DIVISIONS	UNIVERSITY
DE LELLIS	PIETRO	CTL	FEDERICO II - NÀPOLS
NUÑO	EMMANUEL	ROB	GUADALAJARA
ROQUEIRO	NÉSTOR	CTL	SANTA CATARINA FLORIANOPOLIS
SHTESSEL	YURI	CTL	ALABAMA

GLOSSARY

DIVISIONS/SERVICE	**ADM**	Administration
	CTL	Division of Automatic Control
	EOL	Division of Industrial Engineering and Logistics
	ROB	Division of Robotics
	SI	Computer Services
	SSR	Resarch Support Services
CATEGORY	**AG**	Senior Lecturer
	AJ	Assistant professor
	BR	Research grantholder
	CU	Professor
	DI	Research supervisor
	EV	Students linked to the IOC
	LT	Technical staff
	PAL	Assistant lecturer
	PL	Assistant lectures
	TU	Lecturer

3. Divisions

Research at the IOC is conducted through three divisions:

Division of Automatic Control

The objective of the Division of Automatic Control is the research and development of techniques of modelling, simulation and process control, including the application to specific industrial projects and the necessary procedures for their implantation.

Head: DOMINGO BIEL SOLÉ

Fields of activity

- Modelling
- Simulation
- Control
- Electronics
- Optimisation of industrial resources
- Automated inspection

Division of Industrial Engineering and Logistics

The thematic scope of the Division of Industrial Engineering and Logistics 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.

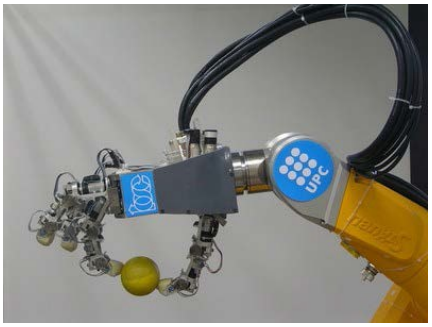
Head: AMAIA LUSA GARCÍA

Fields of activity

- Supply chain design
- Capacity planning
- Aggregate planning
- Design and task assignment of assembly and production lines
- Activity programming
- Working time management
- Task assignment to employees taking into account learning and forgetting effects

- Urban logistics
- Port logistics
- Reverse logistics
- Green logistics
- Simulation of production and logistic systems
- Generator assignment and electrification of isolated areas
- Quantitative techniques
- Lean management

Division of Robotics



The division of Robotics of the IOC comprises basic and applied research on the various aspects of the robot as a machine and on its integration with other elements and units for constituting robotised systems. It also extends to the fields of utilisation of robots in production, exploration and assistance, in both the industrial and service areas.

Head: RAÚL SUÁREZ FEIJÓO

Fields of activity

- Control and programming of robots
- Design of robotised cells
- Perception systems
- Computer vision
- Shape recognition
- Simulation of robotised 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).

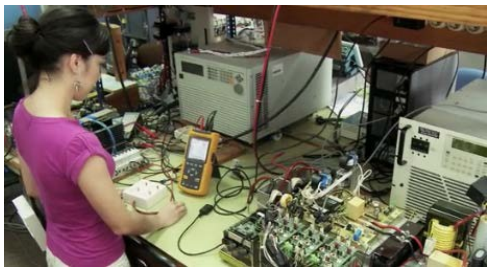
The Institute has a robotics laboratory; a control and electronics laboratory; a remote control laboratory; a logistics laboratory; a computer network equipped with servers, workstations, PCs and software; a WiFi network; a specialised library with around 6,000 books and numerous journals; a classroom 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.
- Capture systems such as video cameras, trackers, force sensors, tactile sensors and 3D cameras.
- A 3D projector with the corresponding glasses.
- A bimanual robotic system composed of a 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

Control and Electronic Laboratory



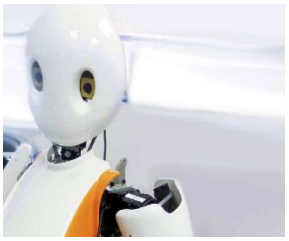
- Oscilloscopes
- Analyzers and signal generators
- Sources and power loads (e.g. sources ac, dc and programmable power load)
- Measuring instrumentation (the multimeter, differential probes, current probes)
- Emulators microprocessors and digital signal processors
- Computers
- The hardware and software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

Logistic Laboratory

- 18 computers: 12 which are designed to make computing experiments; the other 6 are reserved for doctoral, masters and designers
- 1 server for more computationally intensive problems
- 19 SAIs
- 8 screens
- 3 switches for keyboards/screens
- Specialized software: IBM ILOG CPLEX Optimization Studio 12.6

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 managed 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

Master's degree in Supply Chain, Transport and Mobility

The Master in Supply Chain, Transport and Mobility is a master's degree approved by the Government of Catalonia and is part of the master has the Technical University of Catalonia in the field of industrial engineering. Being professional and research orientation and is divided into three areas: logistics, transport and mobility.

The course is taught in coordination between l'Escola Tècnica Superior d'Enginyers de Camins, Canals i Ports de Barcelona (ETSECCPB) and l'Escola Tècnica Superior d'Enginyeria Industrial de Barcelona (ETSEIB).

The trend towards globalization gives more importance to the areas related to the master because of transport issues lie at the heart of business decisions, and highlight recent developments in the figures of mobility of people and goods. These are skills highly valued by the workplace, both from the standpoint of the private sector and public sector, in addition, has a great potential in terms of research. To ensure that our graduates, the degree of excellence sought, has designed a curriculum intended to provide them with broad powers.

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.

Units involved in 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)

- Angulo Bahon, Cecilio
- Griñó Cubero, Robert
- Martínez Velasco, Antonio Benito
- Pastor Moreno, Rafael
- Puig Cayuela, Vicenç
- Rosell Gratacòs, Jan
- Sanfeliu Cortés, Alberto
- Suárez Feijóo, Raúl (Coordinator PhD ARV)

Doctoral data 2016

A. Coordination program	**RAÚL SUÁREZ FEIJÓO**
B. Number of students	**88**

Theses defended in 2016

Date	15/01/2016
Title	**Predictive Control with Dynamic Constraints for Closure and Opening Operations of Irrigation Canals**
Author	GALVIS RESTREPO, EDUARD
Thesis Director	RODELLAR BENEDE, JOSE JULIAN | GOMEZ VALENTIN, MANUEL
Qualification	Excellent

Date	22/01/2016
Title	**Energy efficient control of electrostatically actuated MEMS**
Author	FARGAS MARQUES, ANDREU
Thesis Director	COSTA CASTELLO, RAMON
Qualification	Excellent

Date	28/01/2016
Title	**El Modelo Eléctrico de Conductancias aplicado al isomorfismo de grafos: El método de la estrella**
Author	IGELMO GANZO, MANUEL
Thesis Director	SANFELIU CORTES, ALBERTO
Qualification	Excellent Cum Laude

Date	03/02/2016
Title	**Localización de robots móviles en entornos cerrados mediante características de audio**
Author	MANZANARES BROTONS, MANUEL ANDRÉS
Thesis Director	GRAU SALDES, ANTONI
Qualification	Excellent Cum Laude

Date	05/02/2016
Title	**FAST: a FAult detection and identification Software Tool**
Author	DUATIS JUAREZ, JORDI
Thesis Director	ANGULO BAHON, CECILIO
Qualification	Excellent

Date	09/02/2016
Title	**3D mapping and path planning from range data**
Author	TENIENTE AVILÉS, ERNESTO HOMAR
Thesis Director	ANDRADE CETTO, JUAN
Qualification	Excellent Cum Laude

Date	18/03/2016
Title	**Demand Modeling for Water Networks Calibration and Leak Localization**
Author	SANZ ESTAPÉ, GERARD
Thesis Director	PEREZ MAGRANE, RAMON
Qualification	Excellent Cum Laude

Date	01/04/2016
Title	**Advances in gain-scheduling and fault tolerant control techniques**
Author	ROTONDO, DAMIANO
Thesis Director	NEJJARI AKHI-ELARAB, FATIHA | PUIG CAYUELA, VICENÇ
Qualification	Excellent Cum Laude

Date	07/04/2016
Title	**Distributed large scale systems: a multi-agent RL-MPC architecture**
Author	JAVALERA RINCÓN, VALERIA
Thesis Director	PUIG CAYUELA, VICENÇ | MORCEGO SEIX, BERNARDO
Qualification	Excellent Cum Laude

Date	19/04/2016
Title	**Multi-Robot Cooperative Platform: a task-oriented teleoperation paradigm**
Author	HERNANSANZ PRATS, ALBERTO
Thesis Director	AMAT GIRBAU, JOSEP
Qualification	Excellent

Date	20/04/2016
Title	**Programación de actividades en celdas robotizadas de tipo flowshop con buffers finitos y piezas distintas**
Author	PENDONES, JUAN PABLO
Thesis Director	PASTOR MORENO, RAFAEL | COROMINAS SUBIAS, ALBERT
Qualification	Excellent

Date	23/06/2016
Title	**Parallel Robots with Unconventional Joints to Achieve Under-Actuation and Reconfigurability**
Author	GROSCH OBREGÓN, PATRICK JOHN
Thesis Director	THOMAS ARROYO, FEDERICO
Qualification	Excellent Cum Laude

Date	28/07/2016
Title	**Task-oriented viewpoint planning for free-form objects**
Author	FOIX SALMERON, SERGIO
Thesis Director	ALENYÀ RIBAS, GUILLEM | TORRAS GENIS, CARMEN
Qualification	Excellent

Date	27/10/2016
Title	**Perceiving Dynamic Environments: From Surface Geometry to Semantic Representation**
Author	HUSAIN, SYED FARZAD
Thesis Director	TORRAS GENIS, CARMEN | DELLEN, BABETTE
Qualification	Excellent 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:

- Joaquin Bautista Valhondo
- Albert Corominas Subias
- Laia Ferrer Martí
- Amaia Lusa Garcia
- Rafael Pastor Moreno
- Imma Ribas Vila

Doctoral data 2016

C.	**Coordination program**	**AMAIA LUSA GARCIA**
D.	**Number of students**	**3** (registration 2016/2017)

7. Projects and agreements

Public funding projects

Head researcher	JOAQUÍN BAUTISTA VALHONDO
Title	Convenio marco European Centre for Soft Computing (ECSC) - Cátedra Nissan UPC
Funding institution	European Centre for Soft Computing
Reference	C-ECSC A-00715
Amount	
Start-up date	19.03.2007
Completion date	

Head researcher	JOAQUÍN BAUTISTA VALHONDO
Title	Aspectes tècnics, jurídics i econòmics en Producció (PROTHIUS)
Funding institution	AGAUR. Agència de Gestió d'Ajuts Universitaris i de Recerca
Reference	2014 SGR 271
Amount	
Start-up date	01.01.2014
Completion date	31.12.2016

Head researcher	JOAQUÍN BAUTISTA VALHONDO
Title	Factor humano e incertidumbre sobre la secuenciación y el equilibrado en líneas de modelos mixtos
Funding institution	Ministerio de Economía, Indústria y Competitividad
Reference	TIN2014-57497-P
Amount	38.478 €
Start-up date	01.01.2015
Completion date	31.12.2017

Head researcher	DOMINGO BIEL SOLÉ
Title	Software battery Management Controller (BMC)
Funding institution	AGAUR. Agència de Gestió d'Ajuts Universitaris i de Recerca
Reference	2014 DI 069
Amount	3268.96 €
Start-up date	09.02.2015
Completion date	08.02.2017

Head researcher	DOMINGO BIEL SOLÉ
Title	Eines per a la gestionabilitat de les plantes de generació elèctrica amb fonts renovables.
Funding institution	ACC10
Reference	COMRDI15-1-0043-02
Amount	5.672.25 €.
Start-up date	01.03.2016
Completion date	15.10.2018

Head researcher	LAIA FERRER MARTÍ
Title	Optimización de sistemas de electrificación con energías renovables y microrredes
Funding institution	Ministerio de Economía, Indústria y Competitividad.
Reference	ENE2015-67253-R
Amount	78.650 €.
Start-up date	01.01.2016
Completion date	31.12.2018

Summary

Electrification systems based on the use of renewable energy sources have proved adequate to provide electricity to isolated communities autonomously and also produce electricity in a sustainable and respectful way with the environment. Nowadays, models and design tools in the literature to design these systems do not consider some of its features and/or key constraints. In the previous project ENE2010 - 15509 (Rural Electrification with Solar and Wind Energy) some of these issues were addressed, and models to design wind and/or solar systems were developed, considering local microgrids. As a continuation and expansion of this project, and to increase its applicability, the overall objective of this proposal, OSEERyM, is to optimize the design of rural electrification systems based on the use of wind, solar and also microhydro energy and bioenergy, with inter-community distribuction grids at a regional scale. In addition, a management system will be design to be in charge of the operation, mantainance and technical and economical sustainability of the project.

Head researcher	AMAIA LUSA GARCIA
Title	Conceptos, instrumentos, modelos y algoritmos para el diseño de la supply chain.
Funding institution	Ministerio de Economía, Indústria y Competitividad.
Reference	DPI2015-67740-P
Amount	46.706 €
Start-up date	01.01.2016
Completion date	31.12.2019

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	ROBERT GRIÑÓ CUBERO
Title	Propulsor híbrido para vehículo urbano liviano
Funding institution	National Counsel of Technological and Scientific Development.
Reference	
Amount	116.684 €
Start-up date	06.05.2010
Completion date	31.12.2016

Head researcher	ROBERT GRIÑÓ CUBERO
Title	Técnicas de control para la mejora de la estabilidad en redes eléctricas con convertidores electrónicos operando a potencia constante
Funding institution	Ministerio de Economía y Competitividad.
Reference	DPI2013-41224-P
Amount	145.200,00 €
Start-up date	01.01.2014
Completion date	31.12.2016

Summary

Currently, there are a significant number of power electronic converters – operating at constant power – connected to the electrical grid and this situation is likely to proliferate further. This operation mode of the converters deviates from the usual mode of operation of the traditional electrical devices and, in certain circumstances, may lead to stability problems in the point of common coupling. Given this scenario, the project's objective is the appropriate modification of the control algorithms of static converters to help reduce or minimize the adverse effects on the stability of the network while maintaining adequate operating characteristics in the converters. That is, contribute to improving the stability of the grid with a minimum affectation of the normal function and operation of the converters. To fulfil this objective, the project intends to make theoretical developments in: AFC digital control, sliding mode control, adaptive and model reference adaptive/repetitive control and control of complex systems applied to electric power networks. These developments will specialize to meet the primary objective. In this sense, the project serves the dual purpose of providing solutions, implementable in power converters, to improve stability of the network and to obtain theoretical results in the field of the control techniques that are proposed to work.
Another objective of the project is to ensure that the designed controllers will be interesting, by their complexity and their hardware implementation cost, for the industrial sector.

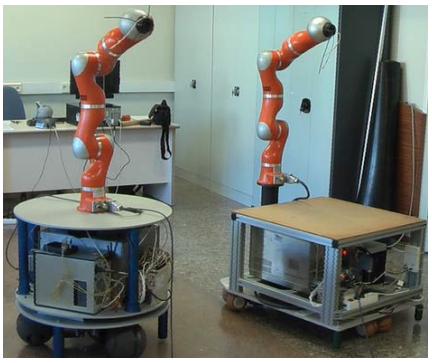
Head researcher	JOSEP MARIA OLM MIRAS
Title	Control avançat de sistemes d'energia
Funding institution	Agency de Gestió d'Ajuts Universitaris i de Recerca
Reference	2014 SGR 267
Amount	30.000,00 €
Start-up date	01.01.2014
Completion date	31.12.2016

Summary

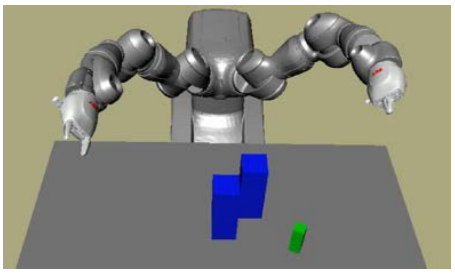
The generic goal of SGR financial supports is to recognise and promote high quality research, technology transfer, and internationalization of the scientific activities of catalan research groups. As regards ACES group, the support is assigne dto complement pre and/or post-doc research contracts, grants for Master Theses Projects, visiting professors and mobilities of the members of the group.

Head researcher	JAN ROSELL GRATACOS
Title	Robots manipuladores móviles como co-operarios: autonomía e interacción en la colaboración humano-robot
Funding institution	Ministerio de Economía, Indústria y Competitividad.
Reference	DPI2014-57757-R
Amount	94.985,00 €
Start-up date	01.01.2015
Completion date	31.12.2016

Summary



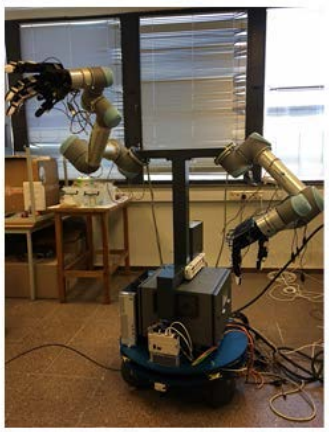
Mobile manipulators with dexterous manipulation capabilities already exist and they can assist man in simple tasks in a versatile manner. In work environments its use as co-workers is possible, acting as logistic transporters and as versatile and dexterous manipulators, to cooperate with human operators to improve the efficiency of the work done. Nevertheless, to make this reality, some improvements in hardware and software are still required in order to allow a higher degree of adaptability. This project pursues a system composed of several mobile manipulators capable of acting in indoor semi-structured environments executing handling and assembly tasks in collaboration with human operators. The system must facilitate the human-robot collaboration that, on the one hand, can be done in an autonomous way (i.e. the mobile manipulators are required to cooperate with humans by performing autonomously complementary tasks while moving around in the humans environment and in their presence) and, on the other hand, can be done through interaction (i.e. with a virtual interaction via teleoperation, or with a physical interaction through an object jointly handled). The project focuses on the development of planning, reasoning and control algorithms, and in the development of the necessary software to provide mobile manipulators with the autonomy and the capacity of interaction to allow the cooperation with humans. In the sought horizon, robot co-workers must provide support to humans and integrate into their tasks and movements in a natural, fluid, safe and minimally invasive way, facilitating the acceptance by human workers of the changes that may result. Upon completion of the project, it will be available a test bed that should allow to investigate the behavior of humans in front of the work jointly carried out with robot co-workers, as well as the perceptions and the possible social acceptance of the changes involved.



The project aims, therefore, to contribute to the resolution of the problem posed by the introduction of robots as co-workers, for the change that it may represent at the social level, and for its individual and collective perception, since the early consideration of these aspects will contribute to the acceptance of robots as an integral part of our lives and to its use without delay.
Among the new applications in robotics, those in which the robots work jointly with the humans, originating the concept of “coworker robots”, have a potential significance from the productive and social point of view. These robots must have, on the one hand, 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. On the other hand, 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. 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.

Head researcher	JAN ROSELL GRATACÓS
Title	Robots autónomos diestros como co-trabajadores con operadores humanos.
Funding institution	Ministerio de Economía, Indústria y Competitividad.
Reference	DPI2016-80077-R
Amount	223.850 €
Start-up date	30.12.2016
Completion date	29.12.2020

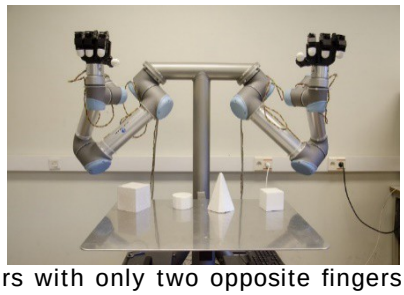
Summary
The robotics field-of-application is constantly growing as the technological advances allow new capabilities and an increment and strength of the already existing ones. Among the new applications, it is worth mentioning, due to their potential significance from the productive and social point 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	RAÚL SUÁREZ FEIJÓO
Title	Prensión y manipulación diestra, móvil y cooperativa (DEMCO)
Funding institution	Ministerio de Economía, Indústria y Competitividad.
Reference	DPI2013-40882-P
Amount	102.850,00 €
Start-up date	01.01.2014
Completion date	31.12.2016

Summary



In recent years there have been significant advances in the area of object grasping and manipulating using robots, both from the point of view of developing new mechanical hands with anthropomorphic structure as in terms of algorithms to search for an efficient use of these hands. However, the actual implementation of these hands in tasks that require some skill is still quite limited and it is still common the use of grippers specially designed for a certain application, and even the use of very simple grippers with only two opposite fingers when looking for usefulness and robustness. One of the main causes of this limitation is the difficulty in determining the appropriate movements to perform a task in the presence of several uncertainty sources, a problem that can be tackled by making greater use of tactile information in all the phases of the grasping and manipulation tasks. On the other hand, mobile robotics has also advanced significantly, to the point of defining its own work field with mYear different applications, but when the mobile device is provided with a device for grasping and dexterous manipulation they generally work in uncoupled way, the mobile device is positioned according to certain criteria and then the grasping device acts as an static one. In this context, the overall objective of the project is to advance towards the elimination of these deficiencies. The robotics group of the IOC has extensive experience in the area of grasping and manipulation objects with robotic hands, planning and optimizing the movements of both the hand and the arm that supports it, and now it is intended to extend that experience in two directions. Basically, on one hand, deepening in the problems concerning the use of dexterous hands with mYear degrees of freedom when there exist different sources of uncertainty, for which there will be special emphasis on the use of tactile information, and, on the other hand, addressing the problem of determining efficient actions when the whole dexterous manipulation device is mounted on a mobile element. As a complementary topic it is also considered the cooperative action of more than one manipulator. Thus, the project aims to make contributions in the three typical levels of these systems: hand level, arm level and body level. As in previous projects of the group, the above problems are addressed with the intention to provide general solutions that are valid both in industrial and service robotics.

Head researcher	RAÚL SUÁREZ FEIJÓO
Title	SIR: Service and industrial robotics
Funding institution	Agency de Gestió d'Ajuts Universitaris i de Recerca
Reference	2014 SGR 1433
Amount	18.000,00 €
Start-up date	01.01.2014
Completion date	31.12.2016

Summary

The group SIR performs the research activity in industrial and service robotics following traditional approaches as well as new paradigms where the robots are allowed to work safely alongside humans in such a way that they become collaborative coworkers and fellows in the factory floor and at home. In this scope, the research work of the group is mainly focused on transversal tools for dexterous, mobile and cooperative manipulation as well as for robot teleoperation. The list of addressed topics includes control and communications through the Internet, relational positioning, vision systems and 3D augmented reality, automatic synthesis of grasps, telemanipulation, programming by demonstration, human-like motion planning, simultaneous task and motion planning, and physics-based manipulation planning. Typical tools used in this research are haptic devices, mobile platforms, industrial robots, dual-arm robots, mechanical hands and sensory systems.

Agreements with companies

Head researcher	ANTONI ARIAS PUJOL
Title	Control Sensorless de Máquinas Eléctricas para tracción de Vehículos Eléctricos
Funding institution	Tecnalia Research & Innovation.
Scope	
Amount	9.000 €
Start-up date	01.09.2015
Completion date	30.12.2016

Summary

Consultancy and advisement for the development of sensorless algorithms for permanent magnet electrical machines for Electric Vehicles' traction is the main frame of such project. On a first stage, the creation and development of simulation models is pursued. Secondly, it is envisaged to provide advice in the experimental implementation. The analysis of the limits of such electrical machines control when being implemented in digital platforms (with limited sampling periods) with the objective of maximizing the electric speed will be studied. Finally, switched reluctance machines will also be addressed as an alternative to permanent magnet machines.

Head researcher	ANTONI ARIAS PUJOL
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, S.L.
Amount	3.000 €
Start-up date	31.10.2016
Completion date	30.10.2017

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	ROBERT GRIÑÓ CUBERO
Title	Diseño y control de un convertidor cc-ca trifásico, aislado galvánicamente, paralelable y de potencia nominal 6 Kva.
Funding institution	Premium, S.A.
Amount	18.200 €
Start-up date	06.05.2016
Completion date	06.01.2017

Head researcher	ESTEBAN PEÑA PITARCH
Title	Càlcul, disseny i fabricació de l'estructura de la màquina de marcatge amb peces fabricades amb materials no definitius, al tractar-se d'un prototipus.
Funding institution	Abeto Rojo Mediterràneo, S.L.
Amount	4.958,67 €
Start-up date	01.07.2016
Completion date	31.12.2016

8. Publications

Articles in Journals

Division of Automatic Control

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Invitation to conferences

Division of Robotics

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o Suarez, R. “Robótica: desde los autómatas hasta la realidad actual”, Universidad de la Punta, San Luis, Argentina, 15-11-16

International stays

Division of Robotics

o Suarez, R. Manipulación bimanual de objetos. Universidad de Guadalajara. Guadalajara (México). 07/03/2016-14/03/2016.

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Books

Division of Automatic Control

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Reports

Division of Industrial Engineering and Logistics

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9. 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

15th 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 Masters 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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