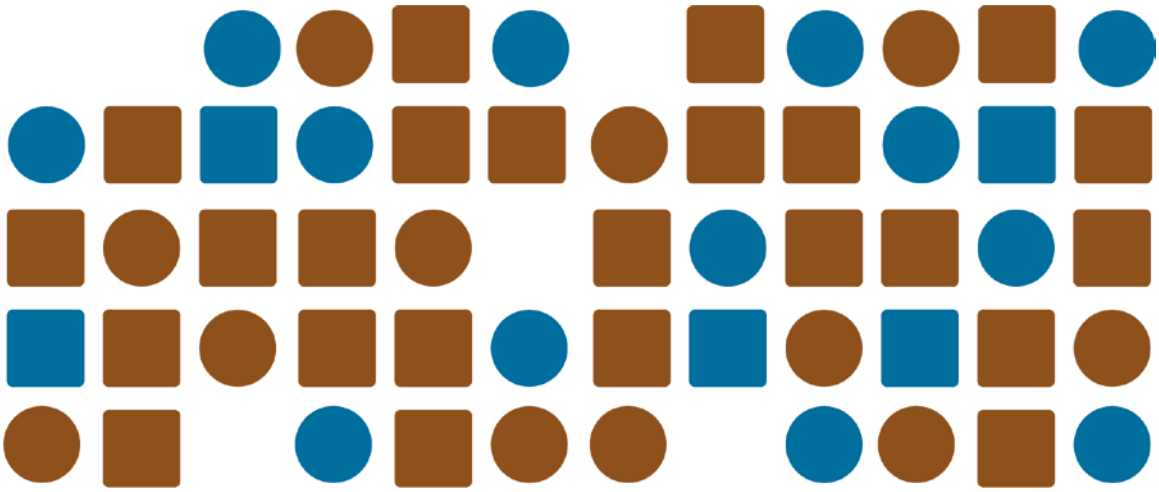


IOC

Institute of Industrial and Control Engineering

Activities Report 2015

UNIVERSITAT POLITÈCNICA DE CATALUNYA
BARCELONATECH
Institute of Industrial and Control Engineering

Table of contents

1. Management's presentation

This report provides some basic information about the Institute of Industrial and Control Engineering (IOC) and a brief summary of the activity performed during the year 2015. I hope this information is of interest to those who are familiar with the Institute and its background as well as to anyone who wishes to find out more about the IOC by reading this report.

The year 2015 did not bring the changes and uncertainties of previous years. As expected, there were not significant changes in the economic situation, the budget of the IOC from UPC was slightly incremented, and the Institute got an additional income from the supported activities in the Fundació Politècnica de Catalunya, which is expected to be more significant in the next years.

During 2015 we also got use to the centralization of the administrative services produced in 2014, which got together the administrative staff of several departments and research institutes in the field of engineering in the South Campus of UPC in Barcelona. This centralization was a lost in several aspects for the IOC, but we had to assume it and got use to work without our own administrative staff inside the Institute.

The scientific production of IOC -according to the UPC criteria- has a small increment respect to the previous year, and, keeping aside the exceptional good production in 2013, it is in the range of the last six years. On the other side, the income obtained through competitive projects and agreements with companies has decreased in 2015, and it reached the lowest value in the last five years; in some sense, it was expected due to the crisis of the previous years, but nevertheless this is a point to care on and that must be strengthened.

The constructions of new buildings at the new campus of UPC at the other extreme of Av. Diagonal advanced during 2015, and several research groups should move there in 2016. Consequently, we expect to have the chance of getting more space inside the Escola Tècnica Superior d'Enginyeria Industrial de Barcelona. At the Institute we have being very tight for many years, but I think this can change in a close future.

Despite the stable situation of the Institute, for sure, there will be always new problems and challenges, but we can face the future with optimism.

Raúl Suárez Feijóo

Director

Barcelona, june 6, 2016

2. Organisational structure and governing bodies

Management

Director	RAUL SUAREZ FEIJOO
Assistant director	ERNEST BENEDITO BENET
Secretary	ARNAU DÒRIA CEREZO
Technical and Management Support Area - UTGAEIB	ANA BELÉN CORTINAS ABAD

The Board

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

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	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	
Costa Castelló, Ramon	
Coves Moreno, Anna Maria	
Dòria Cerezo, Arnau	Secretary
Ferrer Llop, Josep	
Ferrer Martí, Laia	
Fossas Colet, Enric	
García Villoria, Alberto	
Griñó Cubero, Robert	
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	Representative of the Industrial Engineering and Logistics division (until 18/11/2015)
Peña Pitarch, Esteban	
Puerta Coll, Xavier	
Rosell Gratacòs, Jan	Representative of the Robotics division
Suarez Feijoo, Raul	Director

3. 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	LF
CLARET ROBERT	JOSEP ARNAU	ROB	BR
COROMINAS SUBIAS	ALBERT	EOL	Emeritus
COSTA CASTELLÓ	RAMON	CTL	TU
COVES MORENO	ANNA MARIA	EOL	TU
DE LA TORRE MARTÍNEZ	ROCÍO	EOL	AJ
DÒRIA CEREZO	ARNAU	CTL	AG
FERRER LLOP	JOSEP	CTL	CU
FERRER MARTÍ	LAIA	EOL	AG
FOSSAS COLET	ENRIC	CTL	CU
GARCÍA VILLORIA	ALBERTO	EOL	PL
GRIÑÓ CUBERO	ROBERT	CTL	TU
LUSA GARCÍA	AMAIA	EOL	TU
MARTÍNEZ COSTA	CARME	EOL	TU
MAS CASALS	ORESTES	ROB	TU
MATEO DOLL	MANUEL	EOL	TU
MIRÓ VALERO	ENRIC	SSR	LF
MONTAÑO SARRIA	ANDRÉS F.	ROB	BR
MUHAYYUDDIN		ROB	BR
OLIVELLA NADAL	JORDI	EOL	TU

NAME		DIVISIONS/ SERVICE	CATEGORIES
OLM MIRAS	JOSEP M.	CTL	AG
ORELLANA BARCELÓ	MARCOS	CTL	BR
PALOMO AVELLANEDA	LEOPOLD	SSR	LT
PASTOR MORENO	RAFAEL	EOL	CU
PEÑA PITARCH	ESTEBAN	ROB	TU
PORTILLA RODRIGUEZ	HENRY	ROB	BR
PUERTA COLL	XAVIER	CTL	TU
REPECHO DEL CORRAL	VICTOR	CTL	LT
RODRÍGUEZ PACHECO	CARLOS	ROB	BR
ROIG FERNÁNDEZ	VICENÇ	SI	LF
ROJAS DE SILVA GONZÁLEZ	FCO. ABIUD	ROB	BR
ROSELL GRATACÒS	JAN	ROB	TU
RÚA COSTA	CARLES	EOL	PAL
RUIZ PARRA	SERGI	ROB	LT
SUAREZ FEIJOO	RAUL	ROB	DI
ZAPATA PÉREZ	NOEMÍ	ADM	FC
ZAPLANA AGUT	ISIAH	ROB	BR

Visiting Staff

NAME		DIVISIONS	UNIVERSITY
DORMIDO BENCOMO	SEBASTIAN	CTL	UNED
ORTEGA	ROMEO	CTL	UT DALLAS

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

4. 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.

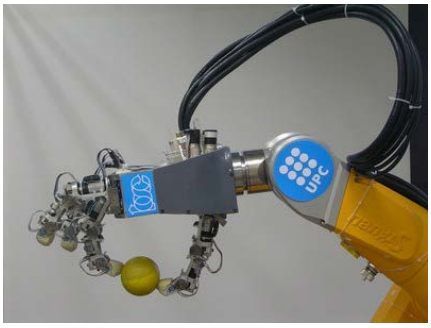
Head: AMAIA LUSA GARCÍA

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: JAN ROSELL GRATACÒS

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

5. Facilities

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

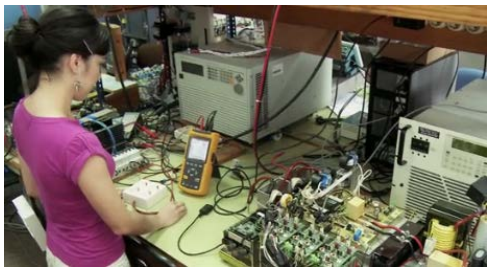
The Institute has a robotics laboratory; a control and electronics laboratory; a remote control laboratory; a logistics laboratory; a computer network equipped with servers, workstations, PCs and software; a WiFi network; a specialised library with around 6,000 books and numerous journals; a classroom 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

- 19 computers: 12 which are designed to make computing experiences; the other 7 are reserved for doctoral, masters and designers
- 18 SAIs
- 9 screens
- 3 switches for keyboards/screens
- Specialized software: IBM ILOG CPLEX Optimization Studio 12.6

6. University masters

Master's Degree in Automatic Control and Robotics

The Master in Automatic Control and Robotics is an official university degree adapted to the European Higher Education Area (EHEA) of the Technical University of Catalonia (UPC) which is offered since the academic year 2006-2007. The master is taught coordinately between the Automatic Control Department (ESAII) and the Institute of Industrial and Control Engineering (IOC).

Shape graduate with a high degree of excellence in the analysis, management and optimization of process control and robotics, engineering, industrial and residential environments, and social services. These activities are key to social progress, economic productivity and quality of life.

This master has been selected within the program of scholarships for Masters of excellence Fundació Catalunya - La Pedrera for the academic year 2015-2016.

Master's degree in Supply Chain, Transport and Mobility

The master's degree in Supply Chain, Transport and Mobility productes technical professionals with a high level of excellence in the analysis, management and optimisation of logistics and transport systems in the fields of civil and industrial engineering. These are basic activities in the organisation of society, the productivity of the economy in a region and the quality of life of the population.

Career opportunities for graduates of this program are related to both the public and private sectors in the fields of logistics, transport and mobility. This master's degree work at a design and management of supply chain and logistics company (responsible for logistics, consulting, etc.), or to delve into directing research towards a PhD, or be able to exercise design features and management of infrastructure and transportation networks (consulting, planning transport companies or government, for example). especially public transport networks.

7. 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's and doctoral degrees.

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

The Doctoral programme in Automatic Control, Robotics and Computer Vision (ARV) emerges 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 is fruit of an increasing thematic affinity and convergence between both programmes, and is 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 has also achieved the Excellence Mention by the Spanish Ministery of Education, with code MEE2011-0453. This mention, which is valid from academic year 2011-2012 until 2013-2014, substitutes previous Quality Mention, which the programme had from academic year 2007-2008 until 2010-2011.

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 2015

A. Coordination program	**RAÚL SUÁREZ FEIJÓO**
B. Number of students	**87** (registration 2014/2015)

Theses defended in 2015

20/02/2015	Enhancing low-level features with mid-level cues
Author	TRULLS FORTUNY, EDUARD
Supervisor	MORENO NOGUER, FRANCESC D'ASSIS
Cosupervisor	SANFELIU CORTES, ALBERTO
Qualification	Excel·lent Cum Laude
17/03/2015	Consensus control in robot networks and cooperative teleoperation: An operational space approach
Author	ALDANA LOPEZ, CARLOS IVAN
Supervisor	BASAÑEZ VILLALUENGA, LUIS
Cosupervisor	NUÑO ORTEGA, EMMANUEL
Qualification	Excel·lent Cum Laude
26/03/2015	On Model Predictive Control for Economic and Robust Operation of Generalised Flow-based Networks
Author	GROSSO PÉREZ, JUAN MANUEL
Supervisor	OCAMPO MARTINEZ, CARLOS AUGUSTO
Cosupervisor	PUIG CAYUELA, VICENÇ
Qualification	Excel·lent
24/04/2015	Detección y Diagnóstico de Fallos Múltiples en Sistemas Dinámicos Usando Análisis de Componentes Principales No Lineal y Residuos Estructurados
Author	RINCÓN CHARRIS, AMILCAR ALEJANDRO
Supervisor	QUEVEDO CASIN, JOSEBA-JOKIN
Qualification	Notable

06/07/2015	Understanding Human-Centric Images: From Geometry to Fashion
Author	SIMÓ SERRA, EDGAR
Supervisor	MORENO NOGUER, FRANCESC D'ASSIS
Cosupervisor	TORRAS GENIS, CARMEN
Qualification	Excel·lent Cum Laude

04/09/2015	Estabilización de vídeo en tiempo real: Aplicaciones en teleoperación de micro vehículos aéreos de ala rotativa
Author	AGUILAR CASTILLO, WILBERT GEOVANNY
Supervisor	ANGULO BAHON, CECILIO
Qualification	Excel·lent

30/10/2015	Social robot navigation in urban dynamic environments
Author	FERRER MÍNGUEZ, GONZALO
Supervisor	SANFELIU CORTES, ALBERTO
Qualification	Excel·lent Cum Laude

17/11/2015	Multi-layer model predictive control of complex water systems
Author	SUN, CONGCONG
Supervisor	CEMBRANO GENNARI, M.GABRIELA ELENA
Cosupervisor	PUIG CAYUELA, VICENÇ
Qualification	Excel·lent Cum Laude

04/12/2015	Disseny i modelització d'un sistema de gestió multiresolució de sèries temporals
Author	LLUSÀ SERRA, ALEIX
Supervisor	ESCOBET CANAL, TERESA
Cosupervisor	VILA MARTA, SEBASTIAN
Qualification	Excel·lent

8. Projects and agreements

Public funding projects

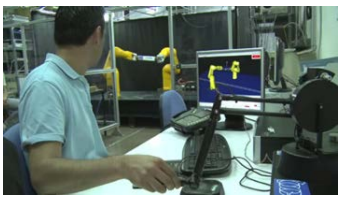
Head researcher	ERNEST BENEDITO BENET
Title	Development of the Lyon-Madrid axis on the TEN-T Mediterranean Corridor (CLYMA)
Funding institution	European Union
Reference	TENT-T-94174-S-CLYMA
Amount	352.566,00 €
Start-up date	15.03.2013
Completion date	31.12.2015

Summary

Within the context of the TEN-T Mediterranean Corridor Global Project, this Action focuses on freight transport connecting Lyon and Madrid (CLYMA) to enable a coordinated implementation of the network. It comprises of studies on the organization and optimal implementation of the TEN-T network, taking into account long-term perspectives, environmental aspects and associated needs, as well as studies that promote environmental sustainability, resource efficiency and low–carbon transport within an integrated transport concept. This should stimulate the deployment of the Green Corridor concept as introduced in the Freight Logistic Action Plan. The project also intends to develop a managerial structure for the intermodal corridor.

Head researcher	LUÍS BASAÑEZ VILLALUENGA
Title	Sincronización y teleoperación con interacción visual 3D de redes de manipuladores móviles y robots con articulaciones flexibles (SYNTENET)
Funding institution	Ministerio de Ciencia e Innovación
Reference	DPI2011-22471
Amount	275.880,00 €
Start-up date	01.01.2012
Completion date	31.12.2015

Summary



Among the current issues of development of robotics prominently telerobotics, rise to numerous research centers worldwide are dedicating a continuous effort. The reason for this interest is manifold. Telerobotics is much more than the remote control of a robot and today is considered as the extension of the sensory faculties and human action. In this sense their uses are extensive, ranging from medicine and surgery to space exploration through mine clearance and explosive and construction of buildings and infrastructure. The communication possibilities offered by the Internet have also contributed decisively to this development.
Many achievements in telerobotics but crucial issues remain to be resolved. On the one hand, the approach of new control algorithms that rigorous, ensure the stability of the systems in most demanding operating conditions and variable lags, joint flexibility, and joint

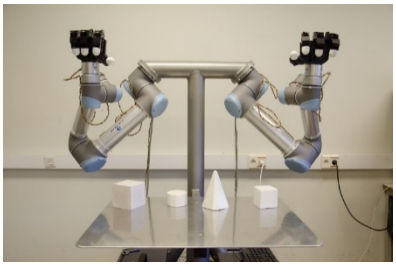
manipulation mobile manipulator robot-robot and human-robot . On the other hand it is necessary to increase aid to the operator, allowing for example, interact with the scene through real three-dimensional images, thus enabling the effective use of tools such as relational positioning. A natural continuation of telerobotics is teleoperation robot presenting network synchronization problems and consensus. These problems are attracting the attention of the scientific community for its possible extension to other fields than robotics such as nonlinear systems described by Euler-Lagrange spanning many physical systems of practical interest and that Robots are a special case.

The project objective is to address the aforementioned issues through rigorous theoretical development, simulation and actual experimentation to validate the results. The expected contribution of the project are both theoretical and application in industrial robotics tasks and service, using both fixed and mobile manipulators as humanoid robots.

Within the context of the TEN-T Mediterranean Corridor Global Project, this Action focuses on freight transport connecting Lyon and Madrid (CLYMA) to enable a coordinated implementation of the network. It comprises of studies on the organization and optimal implementation of the TEN-T network, taking into account long-term perspectives, environmental aspects and associated needs, as well as studies that promote environmental sustainability, resource efficiency and low–carbon transport within an integrated transport concept. This should stimulate the deployment of the Green Corridor concept as introduced in the Freight Logistic Action Plan. The project also intends to develop a managerial structure for the intermodal corridor**.**

Head researcher	RAÚL SUÁREZ FEIJÓO
Title	Prensión y manipulación diestra, móvil y cooperativa (DEMCO)
Funding institution	Ministerio de Economía 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 many 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 many 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	JOSEP MARIA OLM MIRAS
Title	Control avançat de sistemes d'energia
Funding institution	Agència 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	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	JAN ROSELL GRATACOS
Title	Robots manipuladores móviles como co-operarios: autonomía e interacción en la colaboración humano-robot
Funding institution	Ministerio de Economía 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.

Head researcher	RAÚL SUÁREZ FEIJÓO
Title	SIR: Service and industrial robotics
Funding institution	Agència 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.

Head researcher	LAIA FERRER MARTÍ
Title	Desenvolupament de metodologies i aplicatius pel disseny de projectes i la planificació energètica amb energies renovables en diferents contextos i països
Funding institution	Centre de Cooperació per al Desenvolupament , UPC.
Reference	2014 SGR 1433
Amount	8.538,00 €
Start-up date	01.06.2015
Completion date	31.12.2015

Summary

The project aims to optimize the design and efficiency of autonomous systems for rural electrification with renewable energy through the development of models and tools to support decision making. So far, a methodology was developed to optimize the design of the systems, minimizing the cost and considering the wind and solar energy and combining individual and microgrid systems. This project proposes to extend its scope to cover a greater number of contexts and to develop a software that facilitates the design of systems by the promoters of isolated rural electrification in developing countries.

Agreements with companies

Head researcher	RAÚL SUÁREZ FEIJÓO
Title	Estudi del desenvolupament de dos contractes de compra maquinària robotitzada
Funding institution	Solutions Studies Science and Support for Engineering S.L
Reference	2014 SGR 1433
Amount	6.075,00 €
Start-up date	24.10.2014
Completion date	24.05.2015

Summary

The object of the agreement is the completion of a report on the evolution of two contracts for the acquisition of industrial machinery. This project will lead to the development of a set of reports, documents and opinions that will be used by the company to evaluate the levels of execution of a contract for the purchase of industrial machinery. The processes that need significant support from the Polytechnic University of Catalonia are: analysis of the documents relating to the two contracts, defining paths assessing the performance of contracts, evaluation, technical support team the company in making decisions regarding the evaluation of contracts, processes, communication of results, issuing opinions and corresponding attendance at meetings and hearings arising of such opinions.

9. Publications

Articles in Journals

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Books

Division of Automatic Control

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Book chapters

Division of Industrial Engineering and Logistics

- Martinez, M.; Benedito, E.. Greening the corridor work plan. Green corridor development of the Lyon-Madrid axis.Any: 2015.
- Martinez, M.; Mateo, M.; Lusa, A.. A MILP Model for the Strategic Capacity Planning in Consultancy. Enhancing synergies in a collaborative environment Lecture notes in management and industrial engineering. Editorial: Springer. Any: 2015. Pàgs: 361 ~ 370. ISBN: 978-3-319-14077-3.

- Olivella, J.; Benedito, E.; Corominas, A.; Pastor, R.. KPI's for a green corridor. Green corridor development of the Lyon-Madrid axis. Any:2015. Pàgs:9 ~ 60.
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Reports

Division of Industrial Engineering and Logistics

- Ranaboldo, M.; García-Villoria, A.; Ferrer-Martí, L.; Pastor, R.. A novel algorithm for isolated electrification projects. Data: 04/05/2015. URL del text: http://hdl.handle.net/2117/27815.
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Prizes and awards

- Winners: Garcia, N .; Suarez, R .; Rosell, J .. Name Award (edition): Fumio Harashima Best Paper Award in Emerging Technologies. Year: 2015. Best text of the congress. Date: 10.09.2015. Result: First prize. Entity that grants: 2015 20th IEEE International Conference on Emerging Technologies and Factory Automation, ETFA'15.
- Winners: Suarez, R .. Name Award (edition): Outstanding Contribution in Reviewing. Year: 2015. Best reviewer in the journal "utonomous Robotics and Systems". Date: 01.09.2015. Result: Minor. Entity that grants: Elsevier.
- Winners: Suarez, R .. Name Award (edition): Best Reviewer Award ICRA 2015. Year: 2015. Best reviewer form. Date of decision: 28.5.2015. Result: Select. Entity that grants IEEE ICRA 2015.

Courses

Division of Industrial Engineering and Logistics

- Coordinator: Lusa, A. Teaching: Rua, C-UPC; De los Santos, MA-UPC; Reyes, GG- ITESM. Title: Curso de Formación en Logística a los estudiantes del ITESM. Dates: 25/05/2015-20/06/2015. Amount: 3.840,00 €.Collaboration agreement between the Instituto Tecnológico y de Estudios Superiores de Monterrey (México), and the UPC-BarcelonaTech.

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

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, any 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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