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Sauro Longhi

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POSITIONS

President of the Italian Scientific Society of Professors and Researchers in Automation Science (SIDRA)
[13/09/2019 – Present] *http://www.automatica.it/*

Board of Governors of the Joint Research Centre – EU
[6/12/2021 – Present] *https://www.anvur.it/en/activities/third-mission-impact/*

Member of Scientific Advisory Board of Ecosistema Innovazione (PNRR) Tuscany Health Ecosystem (THE), [20/12/2023 – Present] *https://www.tuscanyhealthecosystem.it/index.html*

Member of the Board of Directors of Consortium GARR - The ultra-broadband network dedicated to the Italian research and education community
[26/05/2014 – Present] *https://www.garr.it*

Member of the steering board of the Competence Center ARTES 4.0 Advanced Robotics and enabling digital TEchnologies & Systems 4.0
[01/12/2018 – Present] *https://www.artes4.it/en/web/guest*

Member of the scientific board of the Centre for Innovation and Entrepreneurship (C2I)
[01/11/2012 – Present] *https://c2i.dii.univpm.it/*

Member of the Marche Academy of Sciences, Letters and Arts (*Accademia Marchigiana di Scienze, Lettere ed Arti*) [01/11/2013 – present] *http://accademiamarchigiana.it/*

Honorary Member of the Studio Firmano for the History of Medicine and Science (*Studio Firmano per la Storia della Medicina e della Scienza*), [01/01/2022 – present] https://studiofirmano.net

Member of the Board of Directors of the Marche Oncology Institute - IOM (Istituto Oncologico Marchigiano) a non-profit organization to treat cancer patients free of charge and at home,
[18/10/2023 – Present] https://www.iomancona.it/

Member of the Evaluation Board of New Frontiers program for research projects presented by young researchers of University of Siena, July- October 2023

Coordinator of the Expert Group for the Third Mission Evaluation – ANVUR
[12/10/2020 – 31/10/2022] *https://www.anvur.it/attivita/temi/*

President of Consortium GARR - The ultra-broadband network dedicated to the Italian research and education community [26/05/2014 – 5/06/2022] *https://www.garr.it*

Member of the steering board of the National Cluster “Fabbrica Intelligente” (“Smart Factory”)
[01/06/2014 – 01/06/2022] *https://www.fabbricaintelligente.it/english/*

Member of the steering board of the Conero natural park
[01/05/2019 – 15/12/2020] *http://www.parcodelconero.org/*

Rector of Università Politecnica delle Marche
[01/11/2013 – 31/10/2019] *https://www.univpm.it/*

Member of the steering board of CRUI (Conference of Italian University Rectors) with responsibility for digitalization
[01/01/2015 – 31/12/2018] *https://www.crui.it/*

President of CRUM (Regional Committee for the Coordination of Marche Region Universities)
[28/01/2015 – 16/01/2018]

President of Alumni Association of Università Politecnica delle Marche
[01/01/2019 – 31/10/2019] *https://www.univpm.it/Entra/Ateneo/Associazioni_e_comitati/ALUMNI*

Coordinator of the Marche Hub of the Competence Center ARTES 4.0
[01/12/2019 – 30/06/2020] *https://www.artes4.it/en/web/guest*

Member of the steering board of the National Cluster “Tecnologie per gli Ambienti di Vita” (“Smart Living Technologies”)
[01/06/2014 – 30/06/2020] *https://www.e-living.net/it/cluster-nazionale-tecnologie-gli-ambienti-di-vita-tav*

President of National Cluster “Tecnologie per gli Ambienti di Vita” (“Smart Living Technologies”)
[01/04/2014 – 30/11/2014]

Member of Academic Senate of the Università Politecnica delle Marche
[01/11/2012 – 31/10/2013]

Member of the Impartiality Safeguard Committee - European Quality Institute - Meccano
[12/05/2012 – 31/10/2013] *https://www.meccano.it/*

President of the Alumni association of Enginerering Faculty at Università Politecnica delle Marche (ALFIA)
[15/04/2012 – 31/12/2018]

Director of the Information Engineering Department at Università Politecnica delle Marche
[01/07/2011 – 31/10/2013] *https://www.dii.univpm.it/node/391?language=en*

CEO of University Spin-off 3D Supervision System scrl
[20/04/2011 – 30/11/2011]

CEO of University Spin-off ALPIQUADRO srl
[04/06/2008 – 12/04/2009]

CEO of University Spin-off IDEA scrl
[03/04/2007 – 30/09/2011] *https://www.idea-on-line.it/en/*

Component of scientific board of the University Language Centre (CSAL) at Università Politecnica delle Marche – President from 2010 to 2012
[16/11/2005 – 30/10/2012] https://www.csal.univpm.it/en

President of council for BSc and MSc degrees in Computer and Automation Engineering at Università Politecnica delle Marche
[14/11/2005 – 30/10/2012]

Member of steering board of the Research Centre for economic, social and environmental development and integration in the Adriatic and South Eastern European Region (CIRAB - Centro Interdipartimentale di Ricerca per l'Adriatico e i Balcani) at Università Politecnica delle Marche
[07/05/2003 – 31/10/2010] https://www.cirab.univpm.it/?language=en

Coordinator of PhD courses in “Intelligent Artificial Systems” and “Computer, Management and Automation Engineering” at Università Politecnica delle Marche.
[01/11/2001 – 31/10/2013]

Full professor in Robotics and Automation at Università Politecnica delle Marche
[01/03/2001 – Present]

Associate Professor in Automatic Control Systems at Università Politecnica delle Marche
[01/11/1992 – 28/02/2001]

University Researcher in Automatic Control Systems at Università Politecnica delle Marche
[19/09/1983 – 31/10/1992]

Member of steering committee of the Engineering Faculty of Università degli Studi di Ancona
[19/01/2000 – 31/12/2001]

Didactic Coordinator of the Engineering Faculty for BSc and MSc degrees in Computer and Automation Engineering at Università degli Studi di Ancona
[01/11/2003 – 13/11/2005]

Vice-director of Electronics and Automatics Department at Università degli Studi di Ancona
[20/11/1998 – 31/10/2001]

Research engineer at R&D Laboratory of Telettra S.p.A. – Chieti
[25/08/1981 – 15/09/1983]

Fellowship at the Automation Institute of Università degli Studi di Ancona
[1/8/1980 – 31/7/1981].

Compulsory military service, School of Transmissions - Rome
[10/08/1979 – 30/07/1980]

EDUCATION

Post-graduate Diploma in "Engineering of Control Systems and Automatic Computing" from the University of Rome "La Sapienza",
[22/03/1984], with a thesis on “Controlled invariant subspaces and controllability subspaces for discrete-time periodic linear systems”, Supervisor prof. F. Nicolò

National qualification to the profession of Engineer
[10/12/1979]

Doctor degree in Electronic Engineering, Laurea cum Lode, from the University of Ancona
[25/07/1979] with a thesis on "Structural properties of non-stationary linear systems", Supervisor prof. O.M. Grasselli.

PUBBLICATIONS

Author e/o co-author of:

362	Contributions on International Conferences (Proceeding)
140	Contributions on International Journals (Papers)
53	Chapters on International Books
14	International Books
4	International and National Patents

All publications are available at:

http://prodapps.econ.univpm.it/iris/index.php?docente=SAURO%20LONGHI&facolta=INGEGNERIA

Bibliometric matrix:

	h-Index	Citations number
Google Scholar	**45**	**8811**
Scopus	**37**	**5750**
WoS	**30**	**2950**

ACTIVITES

Didactic Activities

In the current role of Full Professor and former Associate, the teaching activity was mainly developed within the degree courses in Electronic Engineering, Computer and Automation Engineering, Engineering and Production Management, Building Engineering and the Master's Degree courses in Industrial Automation Engineering, Computer Engineering, Electronic Engineering, Biomedical Engineering and Mechanical Engineering at Università Politecnica delle Marche. The developed main courses were:

Technologies for Automation and Robotics,

Modeling and Identification of Dynamic Processes,

Systems Theory,

Industrial Automation,

Control Systems Engineering and Technologies,

Optimization Methods in Control Systems,

Electric Drives,

Measurements and Instrumentation for Automation,

Automation Laboratory,

Computer Aided Design of Control Systems,

Assistive Robotics,

Automatic Control,

Fundamental of Automation,

Automatic Control of Mechanical Systems.

In these teaching activities a classic method was adopted both for the contents and for the lessons in all the courses, with the exception of Engineering and Technologies of Control Systems, Technologies for Automation and Robotics and Automation Laboratory where significant laboratory experimentation was proposed. In these courses, a laboratory activity was added to the classroom lectures for analyzing both the functionalities and the problems related to the use of the various technologies for process control and industrial automation. The same approach was also proposed in the Master Degree for the courses of Assistive Robotics and Measurements and Instrumentation for Automation, with in-depth studies and projects developing in the Robotics Laboratory.

The teaching activity was also widely addressed to the coordination of 596 theses for the degree courses in Electronic Engineering, Master's Degree in Computer Engineering, Master's Degree in Automation Engineering, Master's Degree in Electronic Engineering, Degree and Master Degree in Computer and Automation Engineering. The list of theses is available at https://cad.univpm.it/SebinaOpac/article/catalogo-delle-tesi-di-laurea/catalogo-tesi. The topics are mainly in the area of classical control and process control, industrial automation, industrial and advanced robotics and recently in the service area, sensors for control, and management of renewable energy sources. A coordination and supervision action was also developed for the student training in company internships.

Developing and coordination of the second level master in "Smart Home Engineering" of the Università Politecnica delle Marche, http://mastershe.univpm.it/.

Many courses on robotics and automation have been proposed for Master Degree in Mega Yacht Planning of Università Politecnica delle Marche, “Entrepreneurship and Innovation Management”, of Istituto Adriano Olivetti - ISTAO, "Business tutor" of Parco Scientifico e Tecnologico delle Marche, Ascoli Piceno.

Director of Expert Training Courses (IFTS):

- "CAD-CAM design, product and process innovation - footwear sector", Fermo (FM);
- "Higher Technician in Production / Logistics Planning", Fermo (FM);
- "Higher technician for industrial design and planning - footwear sector", S. Elpidio a Mare (FM);
- "Higher technician of development and industrialization process", Fermo (FM);
- "Higher technician for the realization of high quality products - footwear sector", Fermo (FM).

Design and coordination of the "Underwater Automation and Robotics" course for the Postgraduate School in "Engineering of hydrocarbon production and transport systems by land and sea" of Snamprogetti of Fano.

Contribution to the organization of the study courses and related laboratories of Engineering Faculties in Algeria (Université de Skikda, Université de Bechar and Université de Sidi Bel Abbes), as part of a cooperation contract between the Italian Ministry of Foreign Affairs and Algeria.

Coordination of ERASMUS contracts:

- DANMARKS TEKNISKE UNIVERSITET
- UNIVERSITAT POLITÉCNICA DE CATALUÑA (Escola Universitaria Politecnica de Matarò)
- UNIVERSIDAD POLITÉCNICA DE VALENCIA (Escola Tecnica Superior de Ingenieros Industriales-ETSII)
- NATIONAL UNIVERSITY OF IRELAND, MAYNOOTH
- SLOVENSKÁ TECHNICKÁ UNIVERZITA V BRATISLAVE
- NORGES TEKNISK-NATURVITENSKAPELIGE UNIVERSITET
- UNIVERSIDAD DE CANTABRIA
- UNIVERSITÄT ROSTOCK
- EINDHOVEN UNIVERSITY OF TECHNOLOGY - Dep.of Industrial Engineering and Innovation Sciences

PhD Activities:

Coordinator of the PhD courses in “Intelligent Artificial Systems” and “Computer, Management and Automation Engineering” at Università Politecnica delle Marche, from 01/11/2001 to 31/10/2013, for all didactic activities, research laboratories and structures and collaborations with European Universities and Italian Companies.

Advisor of 38 PhD Thesis:

- Gianluca Ippoliti, "Controllo multimodello con apprendimento integrato per ausili robotici avanzati", XIV ciclo, March 2002.
- Roberto Ciferri, "Networked decentralized control of multirate sampled-data systems", in collaboration with AEA di Angeli di Rosola (AN), March 2004.
- Emidio Pizzingrilli, "Leggi di guida e controllo robusto per sistemi autonomi in grado di intercettare un evasore", in collaboration with MBDA - Rome, March 2005.
- Ammar Asad, "Sistemi intelligenti per l'automazione civile", March 2005.
- Pierluigi Antonimi, "Sistemi di Supporto alla Progettazione di Veicoli da Competizione Basati sull'Analisi delle Prestazioni", February 2006.
- David Fabri, "Telelaboratorio Immersivo", February 2006.

- Mariaelena Marcucci, "L'Analisi Multivariata come Supporto alla Decisione Clinica nella Valutazione Funzionale del Movimento Umano", February 2006.
- Massimo Vaccarini, "Networked Decentralized Model Predictive Control", in collaboration with API Falconara (AN), February 2006.
- Andrea Monteriù, "Model-based Fault Diagnosis for Mobile Robotic Systems", December 2006.
- Marco Luciani, "Priorità State Machine (PriSMa): uno strumento per la descrizione e l'implementazione di sistemi ad eventi discreti modellati con macchine a stati", December 2006.
- Alessia La Manna, "Sistemi intelligenti per la navigazione di robot autonomi, March 2008.
- Matteo Cavalletti, "Veicoli a basso impatto ambientale", March 2009.
- Maurizio Orbisaglia, "Sistemi intelligenti di supporto alla progettazione, al controllo e alla gestione di macchine automatiche di movimentazione e manipolazione" in collaboration with Meloni SpA, March 2009.
- Simon Kidiamboko Guwa Guaband, "Sistemi intelligenti di supporto al trasferimento tecnologico in paesi in via di sviluppo" March 2009.
- Fabio Caponetti, "Sistemi per la previsione, rilevamento e gestione guasti e malfunzionamenti in impianti produttivi", in collaboration with Integra Srl, March 2010.
- Petro Feliciotti, "Controllo e supervisione di impianti per la generazione di energia", March 2010.
- Cristina Carletti, "Sistemi di controllo avanzati per aumentare il comfort di bordo e facilitare la guida di veicoli mobili", (Control systems to augment the comfort and security of marine vessels) March 2011.
- Andrea Cesetti, Controllo intelligente di robot mobili eterogenei per il mapping e l'esplorazione di ambienti interni ed esterni, " (Perception and Sensor Fusion for Flying and Mobile Robots) March 2011.
- Alessandro Freddi, "Sistemi per la diagnosi guasti" (Model-Based Diagnosis and Control of Unmanned Aerial Vehicles: Application to the Quadrotor System), in collaboration with con SPES scrl, February 2012.
- Paolo Bellesi, "Modellazione e controllo sistemi di accumulo energia elettrica" (Energy Storage System Control, Management and Optimization in the Hybrids and Electrics Road Vehicles), February 2012.
- Andrea Giantomassi, "Identificzione e controllo di processi processi produttivi" (Modeling, estimation and identification of complex system dynamics: issues and solutions). February 2012.
- Paolo Raspa, "Navigazione sistemi complessi" (Advanced strategies for control and fault diagnosis of marine surface vessels), March 2013.
- Gianluca Di Buò, "Sistemi domotici e reti sensoriali", (Modularità nella progettazione: dalla robotica mobile alle reti sensoriali wireless) March 2013.
- Ciabattoni Lucio, "Smart Grids intelligenti con immissione programmata, sistemi di accumulo energetico, gestione ottimizzata dei consumi energetici" , March 2014.
- Ferracuti Francesco, "Controllo predittivo nonlineare decentralizzato su reti sensoriali, sistemi di diagnosi gusti e riconfigurazione sistemi di controllo", March 2014.
- Grisostomi Massimo, "Reti sensoriali per il monitoraggio ed il controllo nella robotica, nella home automation ed in altri ambiti applicativi", Murch 2014.
- Benini Alessandro, "Sistemi mobili autonomi e cooperanti con elevate prestazioni di sicurezza e affidabilità, localizzazione cooperativa, sensori UWB", March 2014.
- Flavia Benetazzo, "Tecnologie e metodologie per lo sviluppo di sistemi robotici avanzati in grado di supportare ed incentivare la vita indipendente di persone con bisogni di mobilità e di capacità cognitive" March 2015.

- Matteo Pirro, "Tecniche di controllo vettoriale a tempo discreto atte a migliorare l'efficienza di motori brushless a magneti permanenti in termini di prestazioni e risparmio energetico" , March 2015.
- Mariorosario Prist, "Sistemi sensoriali wireless autoconfigurabili, estendibili, mobili e interoperabili per la sensor fusion in sistemi robotici, domotici e nel monitoraggio ambientali", March 2015.
- Sabrina Iarlori, "Sistemi artificiali intelligenti per l'assistere pazienti affetti da Alzheimer", March 2016.
- Davide Ortenzi, AAL Technologies for independent life of elderly people", March 2017.
- Riccardo De Amicis. “Sistemi innovativi per il controllo attivo di motocicli elettrici”, March 2017.
- Emanuele Pallotta. “Studio e Sviluppo di Modelli Digitali per Sistemi Ciberfisici Industriali” (Digital Twin Study and Development for Industrial Cyber-Physical Systems), March 2019
- Gabriele Foresi. “Tecniche di Intelligenza Computazionale per la gestione dell’energia in sistemi industriali e residenziali”, March 2020.
- Daniele Proietti Pagnotta. “Schemi di risoluzione della ridondanza per manipolatori robotici in scenari con vincoli e guasti” (Redundancy resolution schemes for robotic manipulator systems in constrained and faulty scenarios), March 2020.
- Alessandro Baldini. “Controllo basato sull’osservatore di disturbi: progettazione e applicazione ai sistemi tolleranti ai guasti” (Disturbance Observer Based Control: Design and Application to Fault Tolerant Systems), May 2021.
- Riccardo Felicetti. “Controllo attivo tollerante ai guasti per veicoli sovrattuati senza pilota” (Active Fault Tolerant Control for Overactuated Unmanned Vehicles), May 2021.

Technology Transfer activities

Coordinator of the Fabriano Smiling Lab, a "virtual" incubator for new innovative companies in the field of technologies for living environments (SMart In home LIviNG – SMILING: Innovative technologies for sensing and automation at home). The Lab goal was to encourage the launch and first development of new initiatives for promoting the culture of entrepreneurship on innovative technologies for sensors and automation in living environments. The main objective was to transfer research results in industrial products for home automation, with innovative products and new services for improving the quality of living. The project was developed in collaboration with University of L'Aquila, the Technology Transfer Centers: Meccano and Cosmob, and trade associations: Confindustria Marche, Confindustria L'Aquila, Confindustria Ancona, CNA Ancona, Confapi Ancona, Lega delle Cooperative. Project funded on RIDITT Program by the Ministry of Economic Development, 2012.

Member of the Scientific and Technical Committee of the University Centre Innovation and Entrepreneurship (Engineering Faculty) for technology transfer and the creation of new high technology companies in Ambient Assisted Living.

Member of the Scientific Committee of the research and development consortium HOME LAB (Italian district on Home Automation) focused on energy systems and ambient assisted living for the future Smart Home. Coordinator of the "Campus" Agreement for research and teaching activities between the Engineering Faculty and the Ariston Thermo Group spa.

Mentor and CEO of University Spin-off:

3D-SVS Soc.Coop. Fields: Automotive, Home automation, Robotics. Activities: Development and production of hardware and software systems.

I.D.E.A. - Informatics, Domotics, Environment, Automations - Soc. Coop. Fields: Home automation, energy, industrial, civil and security systems. Activities: Development and production of hardware and software systems.

ALPIQUADRO srl, Fields: Navigation, Sensory Fusion, Artificial Vision. Activities: Development and production of hardware and software systems.

Coordinator of the Expert Group for Third Mission Evaluation – ANVUR, for evaluating the activities carried out by the National Universities and Research organizations, generated impact during the evaluation period 2015-2019, in a given set of fields defining Third mission: exploitation of intellectual or industrial property, academic entrepreneurship, intermediation and technology transfer structures, artistic and cultural heritage, health protection, lifelong learning, public engagement, public goods and policies for inclusion, open science and activities related to the Sustainable Development Goals (SDGs).

Research activities:

Chair of the following national Conferences:

- 10° Italian Forum in "*Ambient Assisted Living*", Ancona,11-13 September 2019;
- 4° Italian Forum in "*Ambient Assisted Living*", Ancona, 23-25 October, 2013;

Chair of the *National Organizing Committee (NOC)* of *IFAC Conference on Control Applications in Marine Systems, CAMS 2004, Ancona,* 7-9 July 2004, http://cams04.univpm.it

Chair of the *International Program Committee (IPC)*, of *IFAC Conference on Control Applications in Marine Systems, CAMS 2007, Bol, Croatia,* 9-21September *2007.*

Member of the *IFAC Technical Committee (TC) on Marine Systems.*

Member of the *Scientific Committee of JMR (Journal of Marine Research) in the field of Automation in Marine Systems.*

Scientific activities for international scientific journal:

- *Journal of Intelligent Robots*, Springer, Editor-at-Large,
- *Control Engineering and Practice, Elsevier, Associate Editor,*
- *Intelligent Industrial Systems, Springer, Associate Editor.*

Scientific activities as member of many *International Program Committee (IPC)* of international conferences:

- *IFAC Conference on Control Applications in Marine Systems*, 2001, Glasgow, United Kindom;
- *IFAC Workshop on Periodic Control Systems*, 2001, Como, Italy;
- *IFAC Conference on Maneuvering and Control of Marine Craft*, 2003, Gerona, Spain.
- *International Conference on Virtual University,* 2004, 2005, 2006, Bratislava, Slovak Republik.
- *International Workshop on Underwater Robotics,* 2005, Genoa; Italy

- *IEE Control*, 2006, Glasgow, UK
- *IFAC Conference on Maneuvering and Control of Marine Craft*, 2006, Lisboa, Portugal.
- *IFAC Symposium on Robot Control*, 2006, Bologna, Italy
- *IEEE MED 2006*, Ancona, Italy
- *IFAC Workshop - Navigation Guidance & Control of Underwater Vehicles*, Limerick, Ireland.
- *EXTREME ROBOTICS, 19th All-Russian Scientific-and-Technological Conference with International Participation*, 2008 Saint-Petersburg, Russia
- *15thINTERNATIONAL CONFERENCE ON AUTOMATIC CONTROL (AUTOMATICS - 2008)*, Odessa, Ukraine
- *UKACC International Conference of Control*, 2008, Manchester, UK
- *First International Conference on Control and Automation(CA 2008)*, 2008, Hainan Island, China
- *14th International Conference on Advanced Robotics*, 2009, Munich, Germany
- *Control Systems Design 2009*, 2009, Bratislava, Slovakia
- *17th Mediterranean Conference on Control and Automation* (MED'09), 2009, Thessaloniki, Greece
- *IFAC Symposium in Intelligent Autonomous Vehicle*, 2010, Lecce, Italy.
- *21th Mediterranean Conference on Control and Automation* (MED'13), June 2013, Platanias-Chania, Crete - Greece,
- *International Conference on Unmanned Aircraft Systems*, May 2013, Atlanta, Georgia, USA,
- *IFAC Symposium in Intelligent Autonomous Vehicle*, June 2013, Gold Coast, Australia,
- *3rd IFAC International Conference on Intelligent Control and Automation Science (ICONS)*, September 2013, Chengdu, China,
- *7th IEEE International Conference on Intelligent Data Acquisition and Advanced Computer Systems*, September 2013, Berlin, Germany,
- *9th IFAC Conference on Control Applications in Marine Systems*, CAMS 2013, September, 2013, Osaka, Japan.
- Convegno ANIPLA *@utomazione 2001*, Ancona, 22-23 Novembre 2001.

Scientific reviewer for many international journals including:

- IEEE Trans. Automatic Control
- IEEE Trans. Robotics & Automation
- IEEE Trans. Systems, Man and Cybernetics
- IEEE Journal of Oceanic Engineering
- Automatica
- Control Engineering and Practice
- Systems and Control Letters

- Linear Algebra and its Applications
- International J. of Control
- Mechanism and Machine Theory

Member of scientific societies:

- AEIT (Associazione Elettrotecnica ed Elettronica Italiana), Automation field;
- IEEE (Institute of Electrical and Electronic Engineering) Senior Member, Control Systems Society, Robotics, SMC, Electronic Consumer.

Research topics

Research interests include modelling, identification and control of linear and non linear systems, control of mobile robots, underwater vehicles, vessels and unmanned aerial vehicles, cooperative control of autonomous agents, service robots for assistive applications supporting mobility and cognitive actions, home and building automation, web technology in process control and remote control laboratories, decentralized control over networks, sensors networks, power management in hybrid cars, electric motor control, embedded control system, management and control of renewable energy resources, efficient management of energy systems, automatic fault detection and isolation.

In recent years, the research activity was focused on the development of innovative solutions for localization and navigation of autonomous mobile robotics, with a focus on unmanned aerial vehicle. The recent activities are coordinated in the project “Robust and Safe Mobile Co-operative Autonomous Systems (R3-COOP)”, EU ARTEMIS Joint Undertaking, for developing cooperative robots in service and domestic fields. Other recent research activities are developed for innovative solutions in robotics and enabling technologies for unconventional fields such as the support to the independent and safe life and the home automation for assisting elderly people. In this context, he coordinated the Research Unit of the Università Politecnica delle Marche in the European project JADE - FP7-CAPACITIES-2010-1 (Regions of Knowledge). aimed to develop new services and platforms for remote healthcare and independent living for the healthy ageing population. The last coordinated project was the project SHELL in the framework of national cluster in Living Environment Technologies.

The research results developed in over forty years of activity were both methodological and applicative and the major contributions can be grouped into the following two areas:

- **Systems theory and control theory,**
- **Robotics and Industrial Automation.**

Systems theory and control theory

In this area the research activity was developed in two sectors, the first one related to stationary linear systems and the second one related to non-stationary linear systems (in particular periodic). The topics can be broadly divided as follows:

I The bilinear systems

I.1 Stabilization of bilinear systems

II Stationary linear systems

II.1 Robust control of linear systems

II.2 Hybrid systems for robust control

II.3 Robust allocation of eigenvalues

II.4 Multi-rate control systems

III Linear periodic systems

III.1 Geometric approach to the control of periodic systems

III.2 Poles and zeros of periodic systems

III.3 Geometric / algebraic tools for the analysis of periodic systems

III.4 Non-interacting control for periodic systems

III.5 Robust control for periodic systems

III.6 Polynomial approach to the control of periodic systems

III.7 Periodic realization of entry-exit performances

III.8 Input-state-output representations of periodic processes.

Robotics and Industrial Automation

In this area, the research activity was developed in several sectors: submarine automation, navigation of mobile robots and control of autonomous aircraft, control of biological purification processes, renewable energy sources, with detection and diagnosis of faults, and finally to service robotics to support fragile users and more generally for home automation applications. The topics can be distinguished as follows:

IV Submarine automation

IV.1 Control of submarine vehicles

V Mobile robots

V.1 Control of mobile robots

V.2 Localization of mobile robots.

V.3 Construction of environmental maps

V.4 Sensory fusion

VI Unmanned Aerial Vehicles

VI.1 Navigation systems

VI.2 Self-localization

VI.3 Fault detection

VI.4 Exploration of hostile and dangerous environments

VII E-learning

VII.1 Remote laboratories for robotics

VIII Process control

VIII.1 Control of biological waste water purification plants

VIII.2 Decentralized predictive control to autonomous agents

VIII.3 Fault detection and diagnostics

VIII.4 Control and management of renewable energy sources

VIII.5 Advanced control of electric motors

IX Smart Homes

IX.1 Assistive and service robotics

IX.2 Smart powered wheelchairs

IX.3 In-door sensor networks

IX.4 User interfaces

IX.5 Energy manager

X.6 Smart cities.

Co-workers at Università Politecnica delle Marche:G. Conte, T. Leo, L. Jetto, G. Orlando, A.M. Perdon, P. Zingaretti e con i ricercatori A. Benini, F. Benetazzo, A. Bonci, E. Canelli, F. Caponetti, C. Carletti, M. Cavalletti, A. Cesetti, L. Ciabattoni, R. Ciferri, F. Ferracuti, A. Freddi, E. Frontoni, A. Giantomassi, M. Grisostomi, S. Iarlori, G. Ippoliti, A. La Manna, A. Mancini, A. Monteriù, M. Pirro, M. Prist, P. Raspa, M. Vaccarini, S. Zanoli e R. Zulli.

Collaboration with national and international institutions:

- Dipartimento di Informatica, Sistemi e Produzione dell'Università di Roma "Tor Vergata" (proff. O.M. Grasselli, A. Tornambè, P. Valigi),
- Dipartimento di Elettronica e Informatica del Politecnico di Milano (prof. P. Colaneri),
- Dipartimento di Matematica ed Informatica dell'Università di Camerino (prof.ssa M.L. Corradini),
- Departimento de Ingegneria de Sistemas y Automatica, Universidad Politécnica de Valencia, Spagna (prof. J. Tornero, Dr. L. Armesto),
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List of main funded projects:

- National CLUSTER "Tecnologie per gli ambienti di vita", Ministero dell'Istruzione, Università e Ricerca, 2012, National coordinator.
- OSTIS - Operating System and Tools for Interoperable smart electrical household appliances, Bando Industria 2015, Ministero dello Sviluppo Economico (Local unit coordinator);
- SEA - Smart Ecologic Area: new technologies for enviromental service, POR MARCHE 2007/2013: Sostegno alla nascita e allo sviluppo di nuove imprese innovative - 1.3.1.07. 01 (Project coordinator);
- iFOOD , POR MARCHE FESR 2007-2013, 1.1.1.04.03 (Local unit coordinator);
- DIAGNOSTIC ROBOTS: new systems based on mobile autonomous robots for diagnosis and testing in the production line and in life tests laboratories of house-hold appliances, POR MARCHE, 1.1.1.04.02 "Promozione della ricerca industriale e dello sviluppo sperimentale in filiere tecnologico-produttive", 2010 (Local unit coordinator);
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- Progetto FIRB 2004 TIGER "Telepresence Instant for hiGher Education in Robotics" (Scientific coordinator);
- Progetti PRIN MISTRAL e MATRICS, 2001, 2003, (Scientific coordinator);
- Progetto di ricerca fondamentale ASI "Metodologie di controllo e di fusione e integrazione sensoriale per robot mobili", 1999/2000, (Scientific coordinator)
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Professional activities

Scientific reviewer for the evaluation of research and innovation projects for MIUR and MiSE, for some universities and research centers and for various regional administrations and national banks.

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Prof. Sauro Longhi