SUMMARY CURRICULUM OF THE SCIENTIFIC, TEACHING AND ORGANIZATIONAL ACTIVITIES OF

ENRICO RAVINA

Enrico Ravina, born in Lavagna (Genoa) on 22/10/1949, graduated in Mechanical Engineering from the Faculty of Engineering of the University of Genoa on 26/07/1974.
Full-time full professor in the Scientific-Disciplinary Sector until 31.10.2019
ING- IND/13 (Mechanics applied to machines), Scientific-Disciplinary Area 09 (Industrial and Information Engineering).
He was employed at DITEN, the Department of Naval, Electrical, Electronic and Telecommunications Engineering of the Polytechnic School of the University of Genoa until 31.10.2019.
He has been retired since November 1, 2019, having reached the age limit, but continues his teaching activity with teaching contracts and his scientific activity with research in specific areas of interest.

Updated: June 2025 by Prof. Enrico Ravina

SCIENTIFIC ACTIVITY

The author's scientific activity has spanned 43 years of active service and continues today. His former office was the Institute of Applied Mechanics of the Faculty of Engineering of the University of Genoa, which later became the Department of Mechanics and Machine Construction (DIMEC) and subsequently the Department of Mechanical, Energy, Management, and Transport Engineering (DIME). For the past six years, his office has been at the DITEN (Department of Naval, Electrical, Electronic, and Telecommunications Engineering).

This activity has spanned various theoretical and experimental topics, as detailed below. The author has always sought to work on original and innovative themes, taking into account the evolution of knowledge in the specific topics addressed.

Scientific production has always been oriented towards issues consistent with the disciplines of the scientific-disciplinary sector ING-IND/13 – Mechanics applied to machines (formerly I07x). The temporal continuity of scientific production from 1976 to the present is demonstrated by publications, distributed among journal contributions, contributions to volumes, monographs, contributions to conference proceedings, editorials, and other publications, detailed below. In addition to the publications cited, there are numerous research reports and technical papers, not included here, relating to national and international research as well as to activities carried out in collaboration with various industrial entities, which have oriented certain lines of study towards applied research.

RESEARCH TOPICS

The scientific activity carried out is summarised below, with a subdivision into the disciplines characterising the scientific-disciplinary sector.

Computer-aided analysis of mechanical systems : automatic analysis of multi-degree-of-freedom systems, symbolic representation of graphical outputs, computer-aided design of machines on anti-vibration supports, self-learning expert systems, CAD menu organization in machine mechanics, hypermedia approaches to support automatic design. This work culminated in the development of an integrated interdisciplinary computer-aided analysis system (*MODUs* , Mechanical Open Design Universal System), which was patented (registered with the Italian Society of Authors and Publishers, June 1991).

Modeling and simulation of mechanical systems : dynamic simulation of planar mechanisms, optimal synthesis, simulation of nonlinear mechanical systems, application of self-learning expert systems in mechanics, implementation of dynamic simulation modules for foundations of vibrating machines, mechanical modeling and simulation techniques, modeling oriented to mechanical automation, simulation and identification approaches for fluid systems, simulation of servo-assisted electro-hydraulic units, modeling and identification of flexible hoses in hydraulics, simulation of hydraulic circuits on aircraft, modeling procedures based on the synergic use of codes used even in unconventional ways, implementation of mechanical analysis and design procedures by exploiting in an integrated way options implemented in different codes, customization of codes (use of computerized catalogs, automatic recognition of symbolic representations, interface routines between codes with automatic congruence control,..), in-depth analysis of dynamic analyses with comparisons between different methodologies (block diagrams, state space analysis, bondgraphs,...), modules oriented to "on-line" simulation. line".

The activity culminated in the implementation of integrated and automated procedures for the study of mechanical components using cooperative codes.

Mechanical system diagnostics : diagnostic methodologies using vibration surveys, hypertextual procedures for the maintenance of mechanical components, hypertextual manual for fault diagnosis of fluid components, diagnostic approaches for distributed control pneumatic systems, multimedia simulation, maintenance of hydraulic and pneumatic components, use of programmable controllers to support diagnostic and troubleshooting procedures, monitoring methodologies with virtual instrumentation, in-depth studies on the use of expert systems and neural networks in mechanics, development of original solutions for both diagnostics and tutorials, creation of operational tools to support maintenance and troubleshooting for hydraulic and pneumatic systems based on hypertextual, hypermedia, and virtual instrumentation approaches, procedures based on artificial intelligence codes (neural networks and fuzzy logic), monitoring and diagnostics of fluid systems with virtual instrumentation, experiences with self-intervention procedures in maintenance.

The most significant results achieved by the author consist in the creation of an automated diagnostic system for pneumatic components and in diagnostic techniques for fluid components based on the use of virtual instrumentation.

Mechanics applied to machines : analysis and synthesis of planar and spatial mechanisms, creation of a mechanics manual on personal computers, integrated management of codes for mechanical design, mechanics of hydraulic and pneumatic components.

The most important theme was the creation of an “intelligent manual” of machine mechanics on personal computers.

Mechanics of drives, automatic machines, and robots : drives for solar power concentrators, heliostat mechanics, automated drives, pneumatic and oleohydraulic actuators, flexible design of fluid circuits for drives, performance optimization of electro-hydraulic servo-axes, multi-axis pneumatic units, proportional actuators in perirobotics, pneumatic drives for special machines, large-scale pneumatic gantry robots for handling probes, IPC applications in pneumatic drives, hybrid multi-axis drive units, test benches for experimenting with cooperating pneumatic units with distributed control, servo-pneumatics applied to automatic handling and assembly, pneumatic servo-positioners, proportional actuation of oscillating pneumatic motors, pneumatic climbing robots, characterization of fluid servo-drives, high-performance pneumatic servo-systems, parallel pneumatic robots.

In particular, the undersigned has conceived, designed and built specific test benches for servo-pneumatic and servo-hydraulic actuators, a large gantry robot for moving microphone probes, a pneumatic Cartesian robot, four prototypes of climbing and walking robots and a parallel delta-type robot with proportional pneumatic actuation.

Vibration mechanics : seismic testing of solar boiler towers, studies of mounting on anti-vibration supports, dynamic simulation of machine foundations, vibration diagnostics, ultra-filtration techniques with vibratory methods, measurements and analysis of vibration response on the human body, automated acoustic analysis of machines, acoustic identification of hydraulic components, development of a complex of equipment for laboratory tests (modal analysis, life tests and qualification of components subject to vibration, static and dynamic balancing, etc.), with experience in experimental modal analysis applied to specific problems (e.g., robot structures), use of sub-structuring techniques and integration between different modal models.

Among the original aspects of activity in this sector are the development of specific codes for measuring the response of the human body to vibration phenomena (HUMEX code) and automated acoustic intensity procedures for the characterization of noise generated by mechanical systems.

Functional mechanical design : investigations into means of transport for the disabled, optimal selection of manufacturing tolerances, participation in the drafting of a functional design guide for machines, interactive design of mechanisms, CAD experiences for modeling and identification of mechanical components, functional design of pneumatic and hydraulic components and circuits, hypermedia approaches to design support, design of power steering systems, procedures for sizing and selecting circuit components based on original and/or commercially available codes, procedures integrated with computerized catalogs, systematic methods based on the use of neural networks for optimal selection, original design and/or redesign of specific components and/or construction details.

Characterizing experiences of the activity have concerned the intensive use and customization of CAD codes integrated with other programs for the optimal selection of components.

Regulation and control of mechanical systems : automatic regulation components for solar power plants, non-thermal energy storage systems, low-cost positioning control of pneumatic modules, centralized and distributed control to support mechanical drives, customized use of programmable logic controllers, micro-PLCs, fieldbus units, and ASI (Actuator-Sensor-Interface) technologies in fluid automation, pressure and force control using piezoelectric valves, ASI controls applied to manipulators, control of electric axes with brushless and stepper motors, control of hydraulic motors with general-purpose units.

Among the most significant topics addressed were those related to the regulation and control of prototypes built, in which PLCs, micro-PLCs, fieldbus and ASI units, as well as their hybrid combinations, were used.

Experimentation on mechanical systems : “intelligent” hydraulic and pneumatic actuators, interfacing between mechanical systems and electronic units, identification of fluid systems through animated synoptics and circuit supervision, proportional hydraulic systems, braking units for linear pneumatic actuators, dynamic identification of rodless pneumatic actuators, experimentation on sensors in automatic fluid systems, pneumatic servo-positioners, validation methodologies for innovative fluid actuators, pneumatic-electric hydrid units, characterization of high-pressure flexible hoses, test benches for the characterization of specific components (shock absorbers, pneumatic suction cups, etc.), multifunctional hydraulic test bench served by virtual instrumentation, distributed control through integrated electronic units, use of programmable logic controllers as multipurpose units for driving, control, data acquisition, and online processing. Integration between processing and acquisition procedures of different electronic units (PLC and/or dedicated electronic boards), remote management of circuits via modem, with analysis of mechanical issues related to communication, creation of original animated circuit diagrams, original virtual instrumentation applications, experimentation on innovative components and systems of industrial interest such as synchronized hydraulic actuators controlled by proportional valves, electro-hydraulic servocylinders with integrated distributors and transducers, hydraulic servomotors controlled with unconventional control techniques, "intelligent" pneumatic linear actuators, manipulation units made with latest-generation rodless pneumatic actuators, proportional piezoelectric pneumatic valves, pneumatic parallel robots, pneumatic climbing robots, sensorization with experiences oriented towards monitoring and diagnostics, transducers interfaced with animated diagrams, integrated transducers, innovative and "intelligent" transducers.

Among the original topics addressed, we recall all the experimental experiences on prototypes and fully built test benches.

Tribology and lubrication : corrosive phenomena in solar systems, advanced diagnostic methodologies for wear, friction and lubrication problems, component maintenance through defect diagnosis.

The main topic addressed led to the creation of a hypertext that, through image analysis of damage to mechanical components (wear, abnormal friction, lack of lubrication, etc.), identifies the causes and proposes possible remedies.

Fluid automation and mechatronics : in these disciplines, the author's theoretical and experimental work has been specifically oriented towards new trends in fluid power and pneumatics, as well as the innovative fields of fluid power and pneumatic technology. Experimental work is consistently focused on industrial components and applications, thanks in part to ongoing collaborations with numerous manufacturers and/or distributors in the sector.

A significant amount of the work carried out cannot be directly documented through publications since it refers to the complete creation of the Fluid Automation and Mechatronics section of the General Mechanics and Vibration Mechanics laboratory and, more recently, to the development of the DREAMS laboratory.

Much of the work involved the conception, design, and construction of innovative prototypes and test benches for specific fluid automation and mechatronics. A summary of the main experimental projects designed and implemented by the author is provided below. The work undertaken, spanning years of activity, required direct personal commitment from the author, partly due to the lack of technical support staff and research personnel.

The author is now the contact person for this broad sector of the DREAMS Laboratory, specifically focused on the drives and experimental automation of naval systems. The laboratory as a whole is equipped to conduct tests for third parties in accordance with regulations and/or specific procedures.

More specifically, here we briefly refer only to the most recent and innovative topics explored since 1991 in the fields of fluid automation and mechatronics, with reference to two general areas of interest: on the one hand, *motion control* , and on the other, *sensors and diagnostic supports* . In ***motion control,*** the following are mentioned:

- ***Distributed control techniques*** . The application of fieldbuses in pneumatics is explored in depth, exploiting "intelligent" master-slave functions and analyzing the problems induced on the mechanical system by communication protocols. Unconventional diagnostic issues and experiences with remote control and remote maintenance are explored using prototypes of actual pneumatic units.
- ***Servo systems*** . Specific motion control experiments are being conducted on linear and angular motion axes with high mechanical performance, actuated by proportional flow control valves and position feedback. The experimentation involves both pneumatic (parallel robot with proportional control) and hydraulic (multifunctional test bench served by virtual instrumentation) stations;
- ***On/off systems with electronic timing*** . Pneumatic actuators controlled by digital valve units are used to propose movement experiences characterized by periods of permanence at different speed levels; with particular reference to pneumatic units, comparisons with proportional control drives are proposed;
- ***Fuzzy control experiences*** . Pneumatic units for single-, dual-, and three-axis drives have been developed, controllable by fuzzy techniques. They allow for customized experiences,

operating both on conventional control devices (on/off directional valves) and on high switching frequency components, capable of being managed with PWM techniques;

- ***Vacuum-based handling techniques*** . Design and construction of prototype pneumatic climbing robots, with on-board PLC and/or ASI control. Static and dynamic characterization of pneumatic suction cups.

In the field of ***sensors and diagnostic supports,*** the following are mentioned:

- ***Innovative transducers*** . Experiments are proposed on position transducers combined with or integrated into pneumatic drive components, analyzed from a performance perspective. Experiments on magnetostrictive transducers and unconventional piezoelectric transducers appear particularly interesting;
- ***Multimedia-based approaches*** **.** Originally designed multimedia-based pneumatic system identification procedures are implemented as external diagnostic support, capable of operating online in conjunction with programmed handling procedures.
- ***Monitoring and diagnostics with virtual instrumentation*** . Different experiences are explored on pneumatic and hydraulic components and subassemblies in which the monitoring instrumentation and active control functions are entirely managed by a flexible multifunctional unit interfaced with virtual instrumentation.

The writer has also carried out other activities on interdisciplinary topics such as those connected to ***mechanics applied to non-conventional energies*** such as solar energy of interest to the Department because the Solar Station of Genoa - S. Ilario, which is affiliated with it, is relevant. He collaborated with Professor Giovanni Francia.

Again, much of the activity carried out at the Sant'Ilario solar station cannot be documented through publications, as it was typically operational and experimental. It culminated in 1984 with the commissioning of experimental boilers, system modifications, and the assembly of sensors and specific instrumentation. These activities were always carried out with direct personal involvement, partly due to the lack of technical support staff and research support personnel.

Most recent activities: from 2008 to 2019.

Without interruption with the previous scientific work, the activity of this period was essentially carried out first within the Fluid Automation Laboratory of the DIMEC of the Faculty of Engineering of the University and then in the DREAMS Laboratory of the Naval Center of the DITEN of the Polytechnic School.

In the five-year period 2008-2012 the writer carried out his scientific activity in the context of three main strands:

- pneumatic and hydraulic drives
- applied mechatronics
- Vibrations and acoustics of unconventional mechanical systems

In the scientific research fields of **pneumatic and oleo-hydraulic drives and applied mechatronics,** the writer has developed specific activities as manager **of the Fluid Automation and Mechatronics** section of the laboratory **.** In particular, he addressed the following topics:

- fluid systems with distributed control ;
- monitoring and diagnostics of fluid systems ;
- dedicated mechatronic units ;

- experimentation on hydraulic systems and components ;
- fluidic muscles and their applications ;
- special hydraulic drives .

In the scientific field of **Vibrations and Acoustics of Unconventional Mechanical Systems,** the author has initiated entirely new and innovative activities at the Genoa headquarters in little-explored areas of applied mechanics, such as the mechanics of acoustic musical instruments and the mechanics of theatrical machinery. He was the creator and promoter of the **Multidisciplinary Research Center for Choral and Instrumental Music** , established at the University of Genoa in 2007, of which he was director until 2013, when the Center closed. It has brought together expertise and scientific contributions from five different departments of the University of Genoa (Physics, Biophysics and Electronics, Experimental Medicine, Modern and Contemporary History, Mechanics and Machine Construction) and is aimed at conducting multidisciplinary research on the many issues inherent in musical instruments and the voice. In this context, the author has made his scientific contribution to the issues of the mechanical behavior of instruments: to this end, he has established a **specific experimental laboratory section** dedicated to research on the **dynamics, vibrations, and acoustics of musical instruments.**

The initiative had innovative scientific content both in Italy and internationally, and the related research activities focused on the **mechanics of musical instruments,** a multidisciplinary field of applied mechanics. The musical instrument is viewed as a "sound-generating machine," and theoretical and experimental investigations specific to its scientific discipline are applied to it. Specifically, specific studies on vibrational behavior and its interaction with the sound produced are addressed. In this scientific field, the author has specifically addressed the following topics:

- design and implementation of automated acoustic signal acquisition modules ;
- experimental modal analysis on instruments ;
- structural dynamic modeling and analysis ;
- special analyses ;
- vibration analysis of individual parts ;
- – dimensional mapping and acoustic holography.

In the last six years (2014-2019) the writer moved from the DIME department to the DITEN department of the University of Genoa and further oriented his research activity towards the mechanical issues of the naval sector, at the same time as his own transfer and that of the laboratory which changed its name to DREAMS (DRives and Experimental Automation for Marine Systems).

The main research activities have been developed along the following lines:

- fluid drives for naval systems
- mechatronic systems for naval inspection
- Vibrations and acoustics of unconventional mechanical systems

In the scientific field of **fluid drives for naval systems,** the writer has studied in depth the topics related to

Vibration and acoustic analysis in naval environments and on board components

- Dynamic analysis with 3D modeling
- Experimental modal analysis
- Acquisition and processing with portable units
- Surveys with variable geometry microphone strings
- Acoustic mapping
- Acoustic holography

Monitoring, diagnostics and maintenance of naval structures, drives and systems

- Operation of fatigue test benches with servo-controlled hydraulic units (in collaboration with MASTEL)
- Thermographic analysis of structures
- Dynamic response diagnostics of innovative actuators for marine drives

Control of rudders with fluidic muscles

Automation of primary and secondary drives

- Lifting Units: Analysis of Load Sensing Drives
- Blade trim in variable pitch propellers: dynamic modeling and simulation of components and circuits

In the scientific field of **mechatronic systems for naval inspection,** the writer has studied in depth the issues relating to

- αυτοματεδ ship inspection systems
- characterization of naval drives through a multipurpose test bench "martronic"
- autonomous units for cleaning bodies of water

Automated ship inspection systems

- Worm robot for duct inspection powered by fluidic muscle
- Hold inspections with self-propelled and instrumented robotic units
- Inspection of double bottoms

Martronic" test bench for the characterization of naval drives

Self-contained units for cleaning bodies of water

- *Fleet of autonomous cleaning units managed from a support island*
- *Implementation of preliminary designs for individual vessels, using surface oil residue recovery systems with wool rollers*

In the scientific field of **vibrations and acoustics of unconventional mechanical systems,** the author has continued to study in depth theoretical and experimental issues regarding the mechanical response of stringed musical instruments.

Other topics have been studied and are currently considered amenable to further investigation. In particular, the following are cited:

- the experimental experiences conducted at the naval tank of the DITEN Naval Center on the measurements of resistance to motion of models in the presence of air bubbling
- simulations of platform anchoring in extremely adverse weather χονδιτιονσ
- the dynamic structural interaction between propulsion systems and naval structures the detection of structural defects using unconventional vibro-acoustic techniques
- diagnostic and maintenance methodologies of on-board subsystems with the aid of expert σψστεμσ

Below are a brief summary of some of the main theoretical and experimental activities related to these topics.

Last theoretical-experimental activities carried out before retirement

Digitally controlled wave generator project for naval tank

Diagnostic and maintenance methodologies for on-board subsystems (thrusters

Dynamic structural interaction in marine propulsion system supports

Detection of defects on naval structures with vibro-acoustic techniques

Simulation of platform anchoring under extreme conditions (squalls)

Applications of virtual instrumentation-based codes in active monitoring and control in unconventional testbeds

For the main and most recent funded research projects in which the author has been involved, please refer to the following summary.

Project (role)	**Start year and duration (months)**
FluMarTurb - DM62588 – Fluid dynamics design of turbomachinery for power plants low environmental impact marine energy	2012 (48)
Sea WAtch Dog SWAD, Unmanned Surface Vehicle for Blue Water (DM62572), presented to the MIUR through the Ligurian Marine Technologies District in agreement in art. 13 DM 593/2000 – APQ – Liguria Region (university scientific director of the entire project in which researchers from two departments participated, DINAEL, later became DITEN and DSA, later became DAD during the project)	2013 (36)
Integrated Mast for Military Ship System – Pyxis (DM62578, Integrated mast for naval ship systems – Pyxis), presented to the MIUR through the Ligurian District of Marine Technologies in accordance with Article 13 of Ministerial Decree 593/2000 – APQ – Liguria Region (responsible for the project's shipbuilding activities, various implementation objectives, studies theoretical and experimental)	2013 (36)
Higher education projects related to the funding of research grants under the CRO OP European Social Fund Liguria Region 2007-2013 Axis IV "Human Capital" specific objective I/6 (Ligurian research and innovation hubs and technological districts) Code Project: DPU12UNIGE82/6200 Title: Optimization of the filling procedure for naval and nautical units	2014 (24)
Higher education projects related to the funding of research grants under the CRO OP European Social Fund Liguria Region 2007-2013 Axis IV "Human Capital" specific objective I/6 (Ligurian research and innovation hubs and technological districts) Code Project: DPU12UNIGE82/6100 Title: Design of a composite hull with ballistic protection features	2014 (24)
Higher education projects related to the funding of research grants under the CRO OP European Social Fund Liguria Region 2007-2013 Axis IV "Human Capital" specific objective I/6 (Ligurian research and innovation hubs and technological districts) Code Project: DPU12UNIGE82/7400 Title: Development of methodologies for the design of naval engines	2013 (24)
EU Horizon 2020 project: Robotic Technology for Inspection of Ships, Grant Agreement number: 779776 - ROBINS – EU H2020-ICT-2016-2017/H2020-ICT-2017-1	2018 (36)
Study and development of an innovative propulsion system with modular blades, with high efficiency, particularly for hybrid and electric propulsion systems in the nautical sector. Regional Operational Programme 2014-2020 Action 1.2.4 Call for proposals "Support for implementation of complex research and development projects for companies aggregated to the Research and Innovation Hubs"	2018 (24)
Liguria Region Operational Programme European Social Fund 2014-2020, POR ESF Liguria 2014-2020 Axis 3 "Education and Training", Financing of three-year scholarships PhD DGR 30 November 2017 N. 992	2018 (36) In progress

Note: *Research projects and third-party activities funded by private companies and institutions, as well as projects funded by competitive tenders in which the undersigned participated, are not listed in detail. Nor are third-party services relating to experimental activities, which also require the design of large-scale, unconventional trials and the scientific analysis of the results, indicated. Numerous research activities were developed without the support of specific contracts.*

Other scientific initiatives

As regards scientific initiatives, the writer has been and is a member of numerous scientific committees, including permanent ones, organizers of national and international conferences international. During numerous conferences and symposiums he was and is chairman of specific sessions.

Furthermore it was or is:

- member of the Mechatronic Forum since 1994;
- member of the Italian National Association for Automation (ANIPLA);
- member of the scientific committee of the Oleodinamica – Pneumatica magazine ;
- member of 30 International Program Committees of international conferences and congresses;
- referee of national and international journals (such as, for example, Mechatronics International Journal, Pneumatic Hydraulics, Fluid, Journal of Mechanics and Advanced Materials and Structures);
  member of the UNI "Oil-hydraulic and Pneumatic Transmissions" commission, as well as of four specific sub-commissions;
- expert at ISO for the international review of specific standards (ISO/TC 131/SC1/WG2)
- member of the Permanent Register of Reviewers of Research Programmes of Significant National Interest (MIUR);
- Scientific director of 25 MIUR research programs, 10 CNR projects, 4 National Strategic Projects, and 6 University Projects. Over the years, he has been part of numerous research groups and has been the scientific director of many contracts and research agreements with Italian companies. Among the companies with which the writer has carried out research activities:
  scientific collaboration includes (in alphabetical order): Atos, Bosch, Duplomatic, Europa Metalli, Festo, Hoerbiger-Origa, Homberger, Pneumax, Square D, Telemecanique, Univer.
- director of the Multidisciplinary Research Centre for Choral and Instrumental Music (MUSICOS) of the University of Genoa from 2008 to 2013;
- delegate of the Rector of the University of Genoa for the development of the University's Musical Activities from 2006 to 2013;
- member of the Transport Research Center, University of Genoa;
- referee for innovation projects of the Finmeccanica Group;
- member of the teaching staff of the PhD in Mechanical Engineering – School of Innovative Sciences and Technologies for Industrial Engineering;
- Member of the selection committee for the PhD in Mechanical Engineering – School of Innovative Sciences and Technologies for Industrial Engineering .

The author has conducted 12 experimental workshops at the laboratory: one of the most notable is the one in 2012 for a research delegation from the Advanced Robotics Lab of the Italian Institute of Technology (IIT), led by Prof. Caldwell, on the topics "Pneumatics, Oil-Hydraulics, Mechatronics and Mechanical Systems".

He oversaw all experimental activities at the Fluid Automation and Mechatronics Laboratory and the DREAMS laboratory regarding the aforementioned topics. Despite the lack of funding, the author has established multiple collaborations with companies operating in the research sectors, receiving support on several occasions through the provision of specific hardware and software.

Some quotes

The writer's activity is explicitly cited by:

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5. G.Poggio, **E.Ravina** “Graphical-analytical method for the evaluation of shadows in solar systems”, Ingegneria, n.7/8, pp.3-10, July/August 1976.

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8. A.Lucifredi, **E.Ravina** “Optimal Synthesis of Mechanical Systems”, IMAM Report n.29, September 1976.

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21. Lucifredi, **E.Ravina** , M.Bisagni, P.Castellazzi “Theoretical and experimental study of paraboloidal dish concentrators with plane absorbers”, in Proc. International Solar Energy Society, Silver Jubilee Congress, Atlanta, USA, pp.482-486, June 1979.

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Patents:

VALIDATION METHOD OF ROBOTIC TECHNOLOGIES FOR INSPECTION OF A NAVAL ENVIRONMENT
Patent for industrial invention in Italy No. 102020000027432 in the name of the UNIVERSITY OF GENOA
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TITLE: METHOD FOR VALIDATION OF ROBOTIC TECHNOLOGIES FOR THE INSPECTION OF A NAVAL ENVIRONMENT
RANKING: G01M
FILING DATE: 11/16/2020
Rome, 12/12/2022

EDUCATIONAL ACTIVITIES

The author's institutional teaching activity was carried out entirely at the Faculty of Engineering first and then at the Polytechnic School of the University of Genoa, first at the Institute of Mechanics Applied to Machines, then at the Department of Mechanics and Machine Construction (DIMEC), then at the Department of Mechanical, Energy, Management and Transport Engineering (DIME), and currently at the Department of Naval, Electrical, Electronic and Telecommunications Engineering (DITEN).

From 08/16/1974 to 09/29/1976: assistant professor at the 1st Chair of Applied Mechanics for Machines.

From September 30, 1976, to January 31, 1978, he collaborated on practical exercises for the courses in Applied Mechanics of Machines (Mechanical Engineering, Naval Engineering, and Chemical Engineering). During the same period, having won a competitive exam, the writer was a graduate technician at the Technical Services Division of the University of Genoa, working as an engineering technologist. As part of this work, he received two written ***commendations*** from the Rector of the University of Genoa.

From 01/02/1978 to 16/04/1978: full assistant to the Chair of Technical Drawing (following a successful competition).

From 17/04/1978 to 19/09/1982: full assistant of Mechanics applied to machines.

From 22/02/1979 to 19/09/1982: lecturer in Technical Drawing (confirmed by 1 /11/1980).

From 09/20/1982 to 12/31/2007 (with classification for legal purposes only starting from 01/08/1980): associate professor in the scientific-disciplinary sector ING-IND.13 – Mechanics applied to machines (eligible for the first round of suitability assessments for associate professor).

From 1.1.2008 to 31.12.2010, associate professor of the ING-IND/13 Applied Mechanics sector;

From 1.1.2011 to today full professor of the sector ING-IND/13 Mechanics applied to machines.

TEACHINGS HELD

Below is a chronological list of the courses taught in various capacities from 1978 to today:

1978/1979: Technical Drawing (Chemical Engineering)
1979/1980: Technical Drawing (Chemical Engineering)
1980/1981: Technical Drawing (Chemical Engineering)
1981/1982: Technical Drawing (Chemical Engineering)
1982/1983: Mechanics applied to machines (Electrical Engineering)
1983/1984: Mechanics applied to machines (Electrical Engineering)
1984/1985: Mechanics applied to machines (Electrical Engineering); Mechanics applied to machines with special hours (for working students)

1985/1986: Applied Mechanics of Machines (Electrical Engineering); Applied Mechanics of Machines (Special Hours) (for working students)
1986/1987: Applied Mechanics of Machines (Electrical Engineering); Applied Mechanics of Machines (Special Hours) (for working students)
1987/1988: Mechanics applied to machines (Electrical Engineering); Mechanics applied to machines with special hours (for working students)
1988/1989: Applied Mechanics of Machines (Electrical Engineering); Applied Mechanics of Machines (Special Hours) (for working students)
1989/1990: Applied Mechanics of Machines (Electrical Engineering); Applied Mechanics of Machines (Special Hours) (for working students)
1990/1991: Fluid Automation (Mechanical Engineering); Applied Mechanics for Machines (Electrical and Electronic Engineering)
1991/1992: Fluid Automation (Mechanical Engineering and Naval Engineering); Applied Mechanics for Machines (Electrical and Electronic Engineering)
1992/1993: Fluid Automation (Mechanical Engineering and Naval Engineering); Applied Mechanics for Machines (Electrical and Electronic Engineering)

1993/1994: Fluid Automation (Mechanical Engineering and Naval Engineering); Mechatronics (Mechanical Engineering)
1994/1995: Fluid Automation (Mechanical Engineering and Naval Engineering); Mechatronics (Mechanical Engineering)
1995/1996: Fluid Automation (Mechanical Engineering and Naval Engineering); Mechatronics (Mechanical Engineering); Vehicle Mechanics (Part II) (Mechanical Engineering)
1996/1997: Fluid Automation (Mechanical Engineering and Naval Engineering); Mechatronics (Mechanical Engineering); Vehicle Mechanics (Part II) (Mechanical Engineering)
1997/1998: Fluid Automation (Mechanical Engineering and Naval Engineering); Mechanics Applied to Machines (Diploma in Mechanical and Naval Engineering); Vehicle Mechanics (Part II) (Mechanical Engineering); Mechanical Engineering Laboratory (Mechanical Engineering)
1998/1999: Fluid Automation (Mechanical Engineering and Naval Engineering); Mechanics Applied to Machines (Diploma in Mechanical and Naval Engineering); Vehicle Mechanics (Part II) (Mechanical Engineering); Mechanical Engineering Laboratory (Mechanical Engineering)
1999/2000: Fluid Automation (Mechanical Engineering and Naval Engineering); Mechanics Applied to Machines (Diploma in Mechanical and Naval Engineering); Vehicle Mechanics (Part II) (Mechanical Engineering); Mechatronics 1 (Mechanical Engineering); Mechanical Engineering Laboratory (Mechanical Engineering)
2000/2001: Fluid Automation (Mechanical Engineering and Naval Engineering); Applied Mechanics of Machines (Naval Engineering); Vehicle Mechanics (Part II) (Mechanical Engineering); Mechanical Engineering Laboratory (Mechanical Engineering)
2001/2002: Fluid Automation (Mechanical Engineering and Naval Engineering); Applied Mechanics for Machines 1 (Naval Engineering)
2002/2003: Fluid Automation 1 (Mechanical Engineering and Naval Engineering); Applied Mechanics for Machines 1 (Naval Engineering)
2003/2004: Fluid Automation 1 (Mechanical Engineering and Naval Engineering); Applied Mechanics for Machines 1 (Naval Engineering)
2004/2005: Fluid Automation 1 (Mechanical Engineering and Naval Engineering); Applied Mechanics for Machines 1 (Naval Engineering); Industrial Technical Design 2 (Mechanical Engineering)
2005/2006: Fluid Automation 1 (Mechanical Engineering and Naval Engineering); Applied Mechanics for Machines 1 (Naval Engineering); Industrial Technical Design 2 (Mechanical Engineering)
2006/2007: Fluid Automation 1 (Mechanical Engineering and Naval Engineering); Applied Mechanics for Machines 1 (Naval Engineering); Industrial Technical Design 2 (Mechanical Engineering)

2007/2008: Fluid Automation 1 (Mechanical Engineering and Naval Engineering); Applied Mechanics for Machines 1 (Naval Engineering); Industrial Technical Design 2 (Mechanical Engineering); Fundamentals of Industrial Design 1 (Materials Science and Engineering, Faculty of Science)
2008/2009: Fluid Automation 1 (Mechanical Engineering and Naval Engineering); Applied Mechanics for Machines 1 (Naval Engineering); Industrial Technical Design 2 (Mechanical Engineering); Fundamentals of Industrial Design 1 (Materials Science and Engineering, Faculty of Science)
2009/2010: Fluid Automation 1 (Mechanical Engineering and Naval Engineering); Applied Mechanics of Machines 1 (Naval Engineering); Fundamentals of Industrial Design 1 (Materials Science and Engineering, Faculty of Science); Fluid Power Drives (Mechatronics Engineering, La Spezia); Machine Mechanics (Mechanical Engineering - Energy and Aeronautics)
Mechatronics Engineering Laboratory (Mechatronics Engineering, La Spezia)
2010/2011: Fluid Automation (Mechanical Engineering and Naval Engineering); Applied Mechanics of Machines (Naval Engineering); Fundamentals of Industrial Design (Materials Science and Engineering, Faculty of Science); Fluid Power Drives (Mechatronics Engineering, La Spezia); Mechatronics Engineering Laboratory (Mechatronics Engineering, La Spezia); Machine Mechanics (Mechanical Engineering - Energy and Aeronautics)
2011/2012: Fluid Automation (Mechanical Engineering and Naval Engineering); Applied Mechanics of Machines (Naval Engineering); Fundamentals of Industrial Design (Materials Science and Engineering, Faculty of Science); Fluid Power Drives (Mechatronics Engineering, La Spezia); Mechatronics Engineering Laboratory (Mechatronics Engineering, La Spezia)
2012/2013: Fluid Automation (Mechanical Engineering and Naval Engineering); Applied Mechanics of Machines (Naval Engineering); Fundamentals of Industrial Design (Materials Science and Engineering, Faculty of Science).
2013/2014: Fluid Automation (Mechanical Engineering and Naval Engineering); Applied Mechanics of Machines (Naval Engineering); Fundamentals of Industrial Design (Materials Science and Engineering, School of Science).
2014/2015: Fluid Automation (Mechanical Engineering and Naval Engineering); Applied Mechanics of Machines (Naval Engineering); Fundamentals of Industrial Design (Materials Science and Engineering, School of Science).
2015/2016: Fluid Automation (Mechanical Engineering and Naval Engineering); Applied Mechanics of Machines (Naval Engineering); Fundamentals of Industrial Design (Materials Science and Engineering, School of Science).
2017/2018: Fluid Automation (Mechanical Engineering and Naval Engineering); Applied Mechanics of Machines (Naval Engineering); Fundamentals of Industrial Design (Materials Science and Engineering, School of Science).
2018/2019: Fluid Automation (Mechanical Engineering and Naval Engineering); Applied Mechanics of Machines (Naval Engineering); Fundamentals of Industrial Design (Materials Science and Engineering, School of Science).
2019/2020: Fluid Automation (Naval Engineering)
2020/2021: Fluid Automation (Naval Engineering)

The author proposed and activated courses that did not previously exist at the University of Genoa: Fluid Automation in 1990 (the second course of this type in Italy), Mechatronics in 1994 (the first course of this type in Italy), and Fundamentals of Industrial Design in 2011, specifically designed for the interschool degree program in Materials Science and Engineering.

In the 2019/2020 academic year, he taught the module "Fundamentals of Industrial Design" in the first semester until November 1, 2019, completing the module as a contract professor. He also taught the module "Fluid Automation" in the second year of the Master's Degree in Naval Engineering , as a contract professor.

In the 2020/2021 and 2021/2022 academic years, he taught the Fluid Automation module in the second year of the Master's Degree in Naval Engineering, as an adjunct professor. In the 2022/2023 academic year, he taught the same Fluid Automation module, again as an adjunct professor.
In the 2023/2024 academic year he held the same Fluid Automation module, again with the qualification of contract professor.
In the 2024/2025 academic year, he taught the same Fluid Automation module, again as an adjunct professor. He also taught the new course "Mechanics and Machine Construction for Naval Engineering" as part of the three-year Naval Engineering degree program, again as an adjunct professor. This course was entirely designed by the author, who compiled a large collection of teaching materials and wrote the book "Notes on Mechanics and Machine Construction for Naval Engineering," currently in press.

COURSES, SEMINARS AND OTHER EDUCATIONAL ACTIVITIES

In particular, the following are mentioned:

- computer-based exercise cycles in parallel with traditional exercises, with particular reference to the courses in Mechanics applied to machines, Fluid automation, Mechatronics;
- the courses organized by the SOGESTA company at the 'Permanent school of solar energy and other renewable energy sources' in Urbino, in 1979 and 1980 on the topics of “Small scale power generation”;
- the courses for designers and company managers organised by the Liguria Region with the patronage
- EEC in the years 1980 and 1981 in the solar energy sector;
- the training course for graduates organized by Finmeccanica in Rome in 1981 on
- “Renewable sources and rational use of energy”;
- the specialization courses organized by the University of Genoa in collaboration with Ansaldo in 1985 and 1986 in “Nuclear and Energy Plant Engineering”;
- the “CIM Deep Immersion” training courses organized by SEIAF (Genoa) in 1987 on the topics of “Computer Integrated Manufacturing”;
- the teaching qualification course for secondary schools, in technical disciplines in the mechanical area, in 1986;
- the multi-year refresher course (1988-1990) for secondary school teachers, held at the G. Capellini Technical Institute in La Spezia on the topic of “Experimental Mechanics”, for which the writer was also scientific director;
- the training courses for the use of solar energy aimed at the CEE mirror-populated power plant in Adrano (CT), organised by CRITA (Pisa) in 1985;
- the short course for company technicians held at the Institute's General Mechanics and Vibration Mechanics Laboratory on “Industrial Pneumatics Updates”, Genoa, September 1991;

- teaching within the Assofluid course “Specialists in maintenance of fluid automation systems”, held in Milan in 1992;

- teaching within the COMETT course “Applying new technology to products and systems” organized by the Dundee Institute of Technology (Dundee, Scotland), Dep. of Mechanical Engineering, in September 1992 with presentations on the topics of “Intelligent pneumatics and hydraulics”;

- teaching within the training course for Russian personnel of the Kamaz company, organized by ISVOR-FIAT in March 1994;

- seminars in the corporate and industrial fields on industrial pneumatics topics in 1997, 1998, 1999, 2000, 2002;

- the seminar on the topic “Evolution of control techniques in pneumatics”, held at the University of Cassino in 1998;

- the IFTS course “Management of automated production cycles – Mechanical automation” held in 2000-2001 at the ITISG Capellini in La Spezia, with participation as a teacher and member of the Technical-Scientific Committee;

- the interventions in the annual courses for seniors organized by the University of Genoa (UNITE), from 1994 to 2010;

- seminar activities for students of the Materials Science and Engineering Degree Course (interfaculty course) on industrial design topics.

- teaching activity within the 2nd level Master's in Industrial Plant Engineering, Genoa, July 2008, on the topics: “General problems on fluid systems in industrial plants” and “Pneumatic systems in industrial plants”.

- teaching activity from 2014 to 2018 within the 2nd level university master's degree in “Mechatronics and management”, organized by the LIUC University of Castellanza (VA).

Further teaching activities included:
or systematic assistance to students during the completion of degree theses for which it has been speaker;
or assistance to students during the completion of other degree theses followed
within the scope of the activities at the relevant laboratory;
or support activities for evening courses (outside of class hours);
or laboratory teaching activity, with full activation of exercise teaching modules
specific (Fluid Automation, Mechatronics);
or the teaching supports for projects proposed to individual students or groups of students in courses
address (Fluid automation, Mechatronics, Vehicle mechanics);
or educational visits organised at companies and/or research institutions throughout the country, as part of specific courses;
or the reception of groups of external researchers, students, and visiting professors at the laboratories (Genoa-S. Ilario Solar Station, General Mechanics and Vibration Mechanics, Fluid Automation and Mechatronics, Drives and Experimental Automation for Marine Systems).

The writer was also:

- supervisor of 92 degree theses;
- coordinator of the Quality and Self-Evaluation Commission (QAV) of the Mechanical Engineering Degree Course for 6 years;
- president of the exam commissions for the profit of the ownership modules;
- member of examination commissions for non-tenure modules;
- president and member of the degree examination commission in Mechanical Engineering and Naval Engineering;
- scientific contact for internal internships;
- coordinator and organizer of university internships for high school students. Coordinator for the transformation of degree programs pursuant to Ministerial Decree 270 for the Master's Degree in Mechanical Engineering (Genoa campus) and for the Master's Degree in Mechatronics Engineering (La Spezia campus);
- member of the working group for the transformation of the interfaculty specialist degree in Materials Science and Engineering into a master's degree;
- member of the commission for a semester of degree exams in Naval Engineering;
- vice-president of the Mechanical Engineering Course;
- member of the coordination group of the interfaculty course in Materials Science and Engineering (with the Faculty of MFN Sciences).
- member of the DITEN doctoral college in 2013 and 2014.

Seven of the theses supervised by the author have won awards: three received awards from Assofluid, one was awarded at the High-Performance Marine Vehicles Symposium in 2016, one received an award from the American Bureau of Shipping (ABS), and two were declared the best theses of their respective academic years for Naval Engineering (Genoa) and Nautical Engineering (La Spezia).

ACTIVITIES AND OTHER ACTIVITIES

The writer has been involved in multiple organizational activities of the Department, of Courses of
Study, Faculty, School, and University. In particular, it was or still is:
member and vice-president of the University Commission for Authorizations ;
vice-president of the Degree Course in Mechanical Engineering;
delegate of the Rector of the University of Genoa for the development of the University's Musical Activities for seven years;
director of the MUSICOS Research Center from 2007 to 2013 ;
Secretary of the Council of the Faculty of Engineering for three years ;
member of the Board of the Department of Mechanics and Machine Construction ;
scientific advisor of the Fluid Automation and Mechatronics Laboratory from 1990 to 2012;
scientific advisor of the DREAMS Laboratory from 2012 to 2019;
member of the coordination group of the interfaculty course in Materials Science and Engineering (with the Faculty of MFN Sciences);
coordinator of the Quality and Self-Evaluation Commission (QAV) of the Mechanical Engineering Degree Course;
member of the DITEN departmental working group for Debt Recovery;
DITEN associate representative at ASSOFLUID (Italian Association of Manufacturers and Operators in the Hydraulic and Pneumatic Sector;
member of the International Federation for the Promotion of Mechanisms and Machines Science (IFToMM) _ Italian section;
member of the Scientific Committee of the magazine “Oleodinamica Pneumatica” ;
member of the Scientific Committee of the magazine “Liuteria Musica Cultura” ;
member of the Board of Directors of the Italian Violin Making Association (ALI) ;
scientific representative of the ALI Scientific Community for Violin Making

The undersigned has directly overseen the organization of numerous other activities arising from his positions at the University, with particular reference to his role as the Rector's Delegate for University Musical Activities. He has also served as the scientific advisor for specific events. Among these are:

- scientific seminar with laboratory “Vibration and sound in the evolution of the violin”, at the Department of Physics of the University of Genoa, April 2008;
- participation in the European initiative proposed by IAU (International Association of Universities), contributions to the compilation of an “international music CD”, within the UNESCO framework, Brussels, June 2008;
- conception and development of the UNIGEZZ project at the Louisiana Jazz Club in Genoa with the inclusion of ensemble groups from the University and the organisation of a series of concerts “ *Laboratorio di Jazz e dintorni* ”, October 2008;
- scientific event “The hidden world of theatrical machines. Exhibition and “virtual and real” itinerary inside the scenic machinery of the Teatro Carlo Felice in Genoa”, Genoa, 9 October-15 November 2008;
- participation in the scientific seminar for the restoration of the organ of the Oratory of NS del Suffragio - S. Margherita Ligure (GE), August 2009;

- scientific seminar “The transition of stringed instruments in the Paganini era, between construction and science ” , 4th Festival of Early Music in the Italian Style, Genoa, December 2009;
- scientific event “Musical Essences” as part of the Hanburyana festival, Ventimiglia,
- December 2009;
- Scientific seminar “The Music of Trees”, N. Paganini Conservatory, Genoa, June
- 2010;
- scientific seminar “From plants to music”, University of Genoa, September 2010;
- periodic scientific conferences within the annual initiatives of the Festival of
- Science (years 2008, 2009, 2010, 2012);
- organization of concert events at the University of Genoa, December 2009, May 2010, July 2010, September 2010 and December 2010;
- creation, development and updating of the MUSICOS Research Centre website;
- creation, development and updating of the University Musical Activities website;
- organization of musical groups belonging to the University Musical Activities;
- participation in the II National Conference of University Choirs and Orchestras, Sassari, May 2010 .
- participation in the IV National Conference of University Choirs and Orchestras, Rome, October 2012.