

Antonio Frisoli
Curriculum Vitae
Updated to February 2012

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INTRODUCTORY NOTES

General data

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Current position

Antonio Frisoli is Associate Professor of Mechanics for Machines and Mechanical Systems and Head of the scientific research area of Human Robot Interaction (HRI) of PERCRO Laboratory at the TeCIP Institute (Institute for Communication, Information and Perception Technologies at Scuola Superiore Sant'Anna)

Antonio Frisoli authored about 150 publications in peer-reviewed scientific journals, international conferences and books.

Antonio Frisoli is associated member of IEEE (the Institute of Electric and Electronics Engineers) since 2000, chair of the IEEE Technical Committee on Haptics and member of the Technical-Scientific Committee of the Italian Association of Hydrothermal Technique.

He is actively involved in the scientific community of haptics, robotics and applied mechanics, with involvement in international scientific cooperation projects and editorial activities.

He is also in charge of the following roles as Associate Editor of international scientific journals and conferences:

Scientific journals

- Associate Editor of MIT Press Presence: Teloperators and Virtual Environments (2007-now)

International Conferences

- IEEE CEB (Conference Editorial Board) Associate Editor (2009-now)
 - Associate Editor of IEEE ICRA International Conference of Robotics & Automation (2012)
- Member of the Programme Committee of the IEEE Haptic Symposium (2011-now)
- Member of the Programme Committee of IEEE VR (2012)

University service

- September 2010: winner of the national selection for one position of Associate Professor in the scientific domain of "Applied Mechanics" (ING-IND/13) at Scuola Superiore Sant'Anna;
- Period since August 2003- July 2009: Antonio Frisoli holds the position Assistant Professor in Applied Mechanics (ING-IND/13) (6 years temporary position) at Scuola Superiore Sant'Anna, after resulting winner of the national selection for the same position opened at Scuola Superiore Sant'Anna.

- Period 1999-2003: Antonio Frisoli carried out scientific research and teaching activity at the PERCRO laboratory of Scuola Superiore Sant'Anna, within which is involved in numerous research projects both at national and international level (EU projects), with collaborations established with industrial partners, universities, worldwide and European research institutes.

Education and studies

- In 2002 Antonio Frisoli receives the PhD *summa cum laude* (diploma di perfezionamento) in Industrial and Computer Science Engineering, area of "Theoretical analysis and Experimental activities for the development of teleoperations systems in Virtual Environments", from Scuola Superiore Sant'Anna, discussing a thesis entitled "titolo Design and Modeling of Haptic Interfaces: an integrated approach" with advisors prof. Massimo Bergamasco, Prof. Paolo Ancilotti, Prof. Paolo Dario, and invited members in the evaluation jury Prof. Vincent Hayward (McGill University), prof. Vincenzo Parenti-Castelli (University of Bologna).
- In 1998 Antonio Frisoli receives the graduate degree (equivalent to Master of Science) *Summa cum Laude* in Mechanical Engineering from the Engineering Faculty of the University of Pisa with a thesis on "Design and Optimization of a haptic Interface with six degrees of freedom for high dexterity operations in Virtual Environments", advisors Prof. Massimo Bergamasco, Prof. Marino Marini, Eng. Fabio Salsedo.
- In 1998 he receives the diploma of graduate studies in Engineering from Scuola Superiore Sant'Anna, discussing a thesis on "*Kinematic analysis and design of the haptic interface subsystem of the TREMOR project*", advisor prof. Massimo Bergamasco
- In 1998 Antonio Frisoli obtained the national professional qualification as Engineer
- In 1994 Antonio Frisoli won the national selection by examination for 5 places at undergraduate level at the Scuola Superiore Sant'Anna (ranking 2nd over 400 participants) and he is admitted at courses in the Class of Experimental Science)
- In 1993 Antonio Frisoli received the diploma from high school specialized in scientific studies (Scientific Lyceum A. Volta, Foggia Italy) with the maximum vote of 60/60.

SCIENTIFIC ACTIVITY

Research Interests

The research activity of Antonio Frisoli has been mainly developed at the Perceptual Robotics laboratory of TeCIP Institute, Scuola Superiore Sant'Anna. Antonio Frisoli is the head of the research area of Human-Robot Interaction.

His research interests deal with the design and control of spatial robots with high performance, the study and development of new advanced human-machine interfaces - including exoskeletons systems, haptic interfaces, Brain-Computer interfaces-, issues of theoretical kinematics and applied to the study of new mechanisms, design and development of novel robotic systems for the neuro-motor rehabilitation in virtual environments, the investigation of sense of presence and multisensory interaction in virtual environments, biorobotics and cognitive robotics.

In the following, a detailed description of main research themes is reported.

Force feedback exoskeletons

In the course of the last ten years at PERCRO laboratory different versions of arm and hand force feedback exoskeletons have been designed, characterized with incremental improvements of performance in terms of force fidelity, mechanical impedance, in terms of weight and bulk.

Antonio Frisoli significantly contributed to the development of the force-feedback exoskeleton L-Exos and of its parts, and to the development and definition of model-based and model-free controllers for its application in Virtual Environments and teleoperation.

Two prototypes of the system were built and the system has been significantly acknowledged in the scientific literature for the design and for its successful application in rehabilitation [R13].

In a second configuration, an hand exoskeleton was developed on purpose for a museum application, that can exert forces on the two fingers of the hand can be mounted as final interface on the end-effector [L9].

The combination of the hand and arm exoskeleton make a system with 10 DoF, with high performance in terms of dynamics, obtained through the coupling of a micro-system for the hand and a macro-system for the arm [R19]. The system was successfully employed in an itinerant exhibition in several well-recognized European museums, demonstrating high levels of reliability and robustness, in the context of the EU project Pure-Form, of which Antonio Frisoli was the responsible for technical and application development [74].

Recently Antonio Frisoli has completed the design and construction of a new exoskeleton for the arm targeting neuromotor rehabilitation, the Rehab-Exos (2009) [43]. The core of the system was the development of an innovative actuated joint, composed of one brushless torque motor, integrated with a custom design 1-dof torques sensor, one Harmonic-Drive speed-reducer and two redundant position sensors, so that both irreversibility of motion can be guaranteed in case power is off, for increasing safety, while high back-drivability of motion can be achieved when the power and control is on, thanks to joint-located torques sensors, with at the same time high safety standards for the patient.

Moreover the system is based on a modular actuation, so that the exoskeleton can be easily configured for left and right patients, with only a kinematic change.

Within the BRAVO project, Antonio Frisoli is also coordinating the development of an integrated system that includes an hand active orthosis implemented by the hand for the performance of tasks of grasping [10].

Robotic systems for rehabilitation

Antonio Frisoli investigates how robotic interfaces used in combination with technologies of virtual environments can be used to improve motor learning in patients with motor disorders [L2,L3].

Antonio Frisoli is coordinating an interdisciplinary group for the development and application of novel robotic technologies to the neuromotor rehabilitation of upper limb in patients with motor disorders after stroke. He has a consolidated collaboration with the Department of Neurorehabilitation of Pisa University Hospital, and he had conducted several clinical trials leading to significant results at clinical level [R6,R13,1].

In the context of clinical rehabilitation, applications of Virtual Reality have been on purpose developed to allow patients to do a specific motor training over a period of 6 weeks, and several clinical evaluation protocols have been conducted to test the efficacy. Different specific controllers for exoskeleton robots have been specifically developed, in order to allow different “assistance as needed” paradigms in neurological robotic-assisted rehabilitation: from impedance control, to passive movement with high backdrivability, up to active assistance guided with an triggered gain impedance control, or constrained movement on pre-defined or on-line computed trajectories. Antonio Frisoli has also worked on motion analysis of upper limb function, associated to dynamic EMG recordings, to assess quantitatively the effects of therapy. This has led to significant results in terms of assessment of the effects of robotic therapy, in terms of quantitative indexes of muscle co-contraction ratios, smoothness of motion and interjoint coordination [R6,45].

Antonio Frisoli is currently testing the efficacy in a group of stroke patients of motor imagery techniques for the rehabilitation of movement, based on the combination of VR and robotic technologies with Brain Computer Interfaces, through the development of dedicated algorithms for signal classification and extraction, such as Common Spatial Patterns; Sub-band algorithms, frequency weighted methods, Support Vector Machines [R4,2, 6].

Effects of robotic rehabilitation training for understanding motion synergies

Antonio Frisoli has investigated the effects of robot aided training on the recovery of spatial reaching movements, with a focus on point-to-point reaching movements performed in different directions, analyzing how muscle imbalance in stroke influences the process of motor recovery in terms of regain of smooth movement, interjoint coordination and agonistic/antagonistic muscle recruitment.

The observed functional changes were found to be associated to an improvement in the co-contraction index of proximal joints, in particular for shoulder extension and flexion (Co-contraction ratio for Anterior Deltoid/Posterior Deltoid), while no changes were observed in the co-contraction ratio of distal joints, i.e. elbow (Co-contraction ratio Triceps Brachiali/ Biceps Brachiali), and to a better interjoint coordination, related to a recovery of movements performed out of motor synergies [R6].

Evaluation of consciousness in patients in Vegetative State

Recently, in collaboration with the Department of Neuroscience, Antonio Frisoli has developed with his team an EEG method for localization of ERPs (event related potentials) associated to blink in the delta rythm (Delta-Related BRO Blink Oscillation).

These ERPs can be found only in healthy subjects in the awake state, but are absent in patients in vegetative state, allowing a clinical classification in patients with minimally conscious state [R5].

New control techniques for exoskeletons

Antonio Frisoli has developed and proposed several innovative approaches in the control of upper limb exoskeletons, with a particular focus on rehabilitation issues. In particular his main contributions have been:

- Several schemes of model-free control based on sliding mode control: the controller exhibits high robustness to change in parameters and can guarantee finite time properties of convergence of error [26,28,29,32]
- Triggered gain position control: control gains are adjusted on the basis of the force exchanged in real time between the patient and the exoskeleton, developing a control paradigm "assistance as needed", in which the patient is more involved in movement tasks [12]
- Impedance control of exoskeleton with model-based compensation of friction of tendon transmissions [73]
- Joint torque control based on a state-space techniques with dynamics modeling [22,57]
- EEG/EMG driven control of robots: this innovative approach uses techniques developed in recent years of motor imagery and Brain Computer Interfaces to detect the intention of movement or neural networks for mapping patterns of surface EMG to force directions and movements of the upper limb [R4, 10].
- Intention driven control: in this framework a novel algorithm for bounded-jerk control of movement has been proposed and developed. The algorithm performs an on-line planning for reaching an object in the space, fulfilling biological constraints of human movement of minimum jerk, in order to provide active on-line assistance in rehabilitation paradigms that exploit gaze tracking [9,14].

New systems of haptic interfaces and advance man-machine interfaces for the interaction in virtual environments

Antonio Frisoli has extensively worked on the design, modelling, implementation and control of new haptic interface systems.

Recently he had developed new systems of haptic interfaces based not only on kinaesthetic stimulation, but that rely also or alternatively are based only on cutaneous stimulation applied at the level of the fingerpad. Antonio Frisoli proposed a new method for the stimulation of the fingerpad, that is based on a small parallel manipulator, with one rotational and one translational stage, which can exert a controlled pressure on the fingerpad through a small plate, that can approach the finger with a given orientation, coincident with the one of the contact surface [R9,R15].

The miniaturization represents a crucial aspects for the realization of haptic interfaces that can be used in highly immersive virtual environments. Antonio Frisoli has dealt with the study and analysis of new actuators of piezoelectric type or based on electroactive

polymers or SMA [7,13], that can allow to overcome the traditional limits of electrical actuation in terms of payload/power ratio.

He had also performed research on multi-contact point simulation in haptic exploration of shape, by designing specific systems suitable for multi-point haptic feedback. He had built a system for the haptic exploration of shapes with up to four contact points.

Passivity and absolute stability during haptic interaction with virtual environments and time-delayed teleoperation

Antonio Frisoli has dealt with the study and performance of advanced man-machine interfaces, with particular attention to the study of passivity and absolute stability under conditions of teleoperation with time delay.

In teleoperation, stability can be severely compromised by delays and uncertainty on the explored environment. Antonio Frisoli developed the techniques of robust control and optimal control, to study how the effect of parameters, such as the inertia or stiffness presented by the remote environment, can affect absolute stability and system performance. An application of these algorithms has been the synthesis of optimal control systems for the human power augmentation [22, 57, 87].

He has also developed algorithms for bilateral teleoperation using schemes of passivation of the active communication channel, through an encoding in terms of wave variables of the transmitted force-position information, enabling bilateral stable interaction between master and slave systems even in conditions of communication delays [27].

Modeling, simulation, design and control of robotics and mechatronics systems

Antonio Frisoli has dealt with the mechanical design, construction and control of several robotic systems: haptic interface for multiple points contact interaction [R21], motion and rowing simulators [R11], development of robotic active vision heads [R14], biomedical systems for positioning of an ultrasound probe [56], for laparoscopy and for rehabilitation, exoskeleton robotic systems for arm and hands, desktop haptic interfaces with different degrees of freedom [R24], force sensors and many other electromechanical system with high mechatronic integration.

Specific methodologies have been developed by Antonio Frisoli for the CAD simulation of kineto-static and dynamic performance of devices, the implementation of models for the simulation and design of control systems, the experimental identification of dynamic system parameters and the experimental validation of the control law on robotic systems [R21, 82].

Design of parallel mechanisms with reduced number of degrees of freedom

Antonio Frisoli has conducted the study of innovative mechanisms with parallel kinematics presenting features of high kinematic isotropy and high static and dynamic performance. During his research activity, several tools of analysis have been designed based on the theory of screws, that has allows him to evaluated in a direct manner the kineto-statics and dynamics performance of different mechanisms and to generate the analytical conditions for the synthesis of parallel manipulators with purely translational or rotational motion, and with reduced number of degrees of freedom [L16].

These activities has led in 2000 to the publication of one of the first studies on this topic [L16], where it was introduced a general methodology for the type synthesis of translational parallel mechanisms with theory of screws. More in detail, Antonio Frisoli has investigated the synthesis of innovative parallel manipulators with reduced number of degrees of freedom. He was one of the first to propose the derivation with an analytical methodology of all admissible parallel kinematics that can lead to pure translation motion of the upper platform. In the following, he had further developed these concepts to design and implement innovative concepts of haptic interfaces, with high dynamic performance and high position accuracy, that can be used for bilateral remote teleoperation control architectures. The developed methods led to the ideation and construction of two haptic interfaces with parallel kinematics and pure translational motion, based on a new parallel kinematic architecture that was selected on the basis of its high performance in terms of stiffness and dynamic bandwidth. More recently an interface for fMRI studies has been designed and built based on a 3RUR kinematics.

Antonio Frisoli has also been working on performance analysis of parallel mechanisms with purely translational motion, studying the conditions of isotropy and force transmission, and developing an innovative method for exact calculation of maximum accuracy under joint clearances in purely translational parallel manipulators.

Antonio Frisoli has further investigated the performance analysis of parallel mechanism with purely rotational mechanisms, by studying the conditions for kinematic isotropy and force transmissions. These concepts have been then extended to the synthesis of parallel manipulators with spherical motion, leading to the introduction of a new kinematics that making use of crossed-linked parallelograms allowed to extend significantly the angular range of motion of the end effector, with a significant application in the synthesis of surgical tools for laparoscopic surgery [68].

Robot kinematics by means of screws theory

Theory of screws and analysis of kinematic law in the framework of differential geometry (Lie groups, Lie algebras) represent a powerful tool form the analytical and geometric point of view for the resolution of spatial kinematic problem, such as in the case of robot design. Antonio Frisoli has investigated and extended the tools of screws theory to study the acceleration properties of robots, deriving a new method for the analysis of parallel manipulators [L15].

He has made use of the developed techniques for different kind of applications, such as type-synthesis of new kinematics, analysis of parallel manipulators and gravity compensation laws.

Extension of screw theory methods to dynamic analysis of parallel manipulators

The developed methods were further extended to the movement and dynamic analysis of parallel manipulators, such as Gough-Stewart platforms, used in inertial motion simulators, MORIS (motorbike simulator) and INDICA (forklift simulator), developed at PERCRO laboratory in the associated research projects [L11, 103, R25].

The methodology of analysis based on screw theory was extended to the Hamiltonian formulation in the dynamics of robotic systems [L15], that can be directly used for the synthesis of control systems, exhibiting robustness to time delay in the signal transmission or computation eventually present in the system.

In collaboration with Prof. Rico [R25], Antonio Frisoli has also developed a generalized method based on the extension of the theory of the screws to higher order motion analysis, with the introduction of accelerators for the dynamic analysis of parallel systems. Their fundamental work on the subject has shown the application of the methodology for modeling the dynamics of a Stewart platform and a parallel wrist with two degrees of freedom.

Analysis of position accuracy of parallel manipulators under joint clearances

Antonio Frisoli and colleagues developed and proposed a new method for the analytical characterization of position accuracy of parallel manipulators. In particular with reference to purely translating and purely rotational parallel manipulators an exact analytical methodology was derived to identify the poses corresponding to the worst case accuracy in terms respectively of rotations and translations of the upper platform [R8].

Robotic systems with elastic transmissions and multiple degrees of freedom

Antonio Frisoli has dealt in detail the analysis and design of cable-actuated systems, both with non-redundant and redundant implementations. In particular Antonio Frisoli has introduced a new system of transmission cables for the implementation of parallel manipulators, optimizing some geometric solutions to obtain the best conditions of isotropy and force transmission ratio, which has led to the realization of an innovative haptic interface with two degrees of freedom with high kinematic isotropy properties [106,107]. In addition he was responsible for the experimental characterization of the performance of cable-driven robots, particularly in the case of complex transmissions as those required by exoskeleton systems, deriving methods for the dynamic identification of natural modes and of the characteristic frequencies of the systems with lumped models [R17,R24].

Antonio Frisoli has developed non-linear friction of the observers that can capture the complex nature of the friction generated by long cable transmissions and estimate the distribution of the torque on the joints in the case transmission joint coupling. The dynamic models of friction, thus developed, used in a feedforward control loop in the base, have been shown to greatly increase robot performance [73,L15].

Multimodal interaction in virtual environments and applications

Antonio Frisoli has been responsible for numerous projects in virtual reality applications based on the above the technologies [R20]. He has worked the University Pompeu Fabra in Barcelona as part of a clinical protocol for testing the use of bimanual haptic interfaces for rehabilitation [R3].

He was involved in the development of a complete application for the simulation of a virtual museum, the Museum of Pure Form, within which you can touch the statues of digital systems using an haptic interface [R26].

Antonio Frisoli has investigated presence and multimodal interaction in virtual environments. Within the European project Presenccia, he studied how the perception of the virtual environment is affected by the perception of one's body and the specific role of touch with simulated haptic interfaces on the sense of presence and immersion [R2,R10,R16].

Advanced interfaces for training

He developed a first prototype of virtual reality simulator for simulating operations of medical assistance in case of cardiac arrest. The system was successfully demonstrated in the Italian national congress of the association IRC (Italian Resurrection Council). In collaboration with the Maggiore Hospital of Bologna is developing a virtual reality simulator for the simulation of resuscitation procedures [R7].

A second system based on 3D Kinect motion sensor has been developed, capable of providing feedback in real time on the frequency and depth of performed chest compressions. The system was successfully validated in an experimental study with 80 subjects involved in medical and lay personnel specialist at the Maggiore Hospital in Bologna and the SSSA [R1].

Antonio Frisoli has also dealt with the development of a mechanical simulator of rowing within the European project SKILLS, for the simulation of in-door rowing. The system consists of a kinematic structure that can reproduce the movements of both the sculling both of the rowing of the tip. The resistance of water is simulated through the use of passive dissipative air-fans, while equipping the system with "embedded" sensors for force and position allowed to estimate in real time the gesture made by the athlete [R11,36].

Other interfaces for training include applications of haptic interface for learning new skills, such as Japanese handwriting [R18].

Haptic rendering algorithms with force feedback

At the laboratory PERCRO, Antonio Frisoli promoted the development of a complete software library for rendering haptic, called H-Lib, able to calculate in real time the magnitude of the forces of interaction and contact between an operator connected by a ' haptic interface and objects in a virtual environment. This library was developed in particular for the computation of the geometric interaction forces exchanged during the exploration of digital models very complex, with a high number of polygons, as in the case of geometries acquired by means of laser scanning, e.g sculptures acquired in the digitalization campaign of the project Pure Form [83,96].

Further he developed physical simulation models, such as deformation of elastic bodies, models of linear friction and rotation for 1 or 2 points of contact, multibody dynamics, as well as analytical algorithms that can calculate the value of the forces of interaction on the basis of the geometrical conditions of the contacts [L13].

In the field of haptic rendering, in collaboration with the Robotics Lab at the University of Stanford, Antonio Frisoli has developed an original model for the simulation rotational friction during two fingers grasping of objects extending an approach derived from the robotic manipulation based on limit curves, and conducted experimental activities conducted to validate the model [69-79].

Antonio Frisoli was responsible for the development of control systems for more realistic simulation in car simulators. In particular he developed models that allow the simulation of primary command of car, resulting in the definition of a new approach for the simulation of a manual car gearshift [93,97,98].

It dealt with the simulation of deformable bodies based on linear models that approximate the behavior of nonlinear elastic bodies to large deformations [R23].

He is currently working on grasping of virtual objects with physical simulation of interaction in virtual environments using datagloves equipped with goniometric sensors. He developed a prototype of data glove sensorized equipped with vibratory pads, able to that can stimulate the fingertips only in the proximity of contact with a virtual object [28,59,62].

Mobile and cognitive robotics applications

Antonio Frisoli has been involved in developing systems of neuromorphic control for autonomous navigation of robots. He has developed an active vision head with 5 degrees of freedom, independent movement of the eyes and a size comparable to a human head. Using the active vision head developed at the laboratory were conducted PERCRO task of autonomous navigation of robots to achieve functional goals, avoiding obstacles on the path, simulating the activity of brain areas involved in the human navigation and perception of optic flow. The system has also enabled us to experimentally verify the performance of algorithms for navigation based on optical flow balance, inspired by models of animal behavior [R14,25].

Antonio Frisoli was involved in the study of control architectures for robot types that include neuromorphics support for memory and learning.

Editorial activity

Organization of conferences and special issues

- Antonio Frisoli has organized the 2010 edition of the national workshop of "Medicine meets Virtual Reality" of MIMOS Italian association, held at SSSA in October 2010, as part of both the Scientific Committee and Organization Committee of the workshop
- Antonio Frisoli was general chair of the 2nd International Conference on Enactive Interfaces, ENACTIVE05 (www.enactive2005.org) which was held in Genoa on 17-18 November 2005
- Co-editor with Professor. Antonio Camurri of the special issue on "Multisensory Interaction in Virtual Environments", published in the journal Virtual Reality, Springer, Volume 10, Number 1 / May, 2006, ISSN 1359-4338

Participation to Scientific Committees of Scientific journals and conferences

Scientific journals

- Associate Editor of MIT Press Presence: Teloperators and Virtual Environments (2007-now)
- Associate Editor of IEEE Transactions on Haptics (2007-2010)
- Member of International Scientific Committee of the International Journal on Interactive Design and Manufacturing, Springer (2007)

International Conferences

- IEEE CEB (Conference Editorial Board) Associate Editor (2009-now)
 - Associate Editor of IEEE IROS International Conference on Intelligent Robots & Systems (2007-2011)
 - Associate Editor of IEEE ICRA International Conference of Robotics & Automation (2008-2012)
- Associate Editor of IEEE ROMAN International Conference on Human Robot Interaction (2010-2011)
- Member of the Programme Committee of the IEEE Haptic Symposium (2011-now)
- Associate Editor of IEEE Worldhaptics (2009-2011), Eurohaptics (2010) conference
- Member of the Programme Committee of IEEE VR (2007-2008, 2012)

Antonio Frisoli is member of the Technical-Scientific Committee of the Italian Association of Hydro-Thermal Technique (since 2011) as expert in the application of ICT technologies in the framework of thermal medicine.

He has also covered the following positions at international conferences

- Member of the Scientific Committee of MIMOS (Italian Society for modeling and simulation) "Medicine meets Virtual Reality: Applications in Italy of Virtual Reality to Medicine and Surgery" in years 2010, 2011, 2012
- Member of Program Committee of:
 1. Eurohaptics Conference for 2007
 2. Virtual Concept
 - 2006 Edition
 - 2007 Edition
 3. Science & Robotic Systems
 - 2006 Edition
 - 2007 Edition
 4. ENACTIVE conference
 - 2008 Edition
 5. 6th IEEE International Workshop on Haptic Audio Visual Environments and Their Application IEEE HAVE 2007
 6. Haptic and Audio Interaction Design Haid
 - 2006 Edition
 - 2007 Edition
- Awards Committee Member for IEEE Haptic Symposium 2012
- Publicity Chair of the conference Worldhaptics
 1. 2007 edition
 2. 2009 edition
- Member of organizing committee
 1. "First Joint Eurohaptics Conference and IEEE Symposium on Haptic Interfaces for Virtual Environment and Teleoperator Systems" Worldhaptics 2005, 18-20 March 2005, Pisa
 2. "8th IEEE International Workshop on Robot and Human Interaction - ROMAN'99" Roman IEEE, 27-29 September 1999, Pisa
 3. ENACTIVE International Workshop, March 2005, Pisa
 4. IEEE Conference on Robot Human Interaction Ro-man 2012

He has worked actively in the foundation of the IEEE Technical Committee on Haptics which currently lists more than 400 members (www.worldhaptics.org) and was a member of the committee chair for the election of TCH in the years 2007 and 2009.

He is member of the Executive Committee of the IEEE Technical Committee on Haptics, where he served as vice-chair for the dissemination and now holds the post of vice-chair for Educational Activities.

Antonio Frisoli is an associate member of IEEE (the Institute of Electric and Electronics Engineers). (2000-present) and formed of ASME (the American Society of Mechanical Engineers) for the period 1999-2010.

Peer-review activities

Antonio Frisoli performs regularly and had done in the past activities of peer-review in the major scientific journals in robotics, mechanical engineering and virtual environments, including:

- IEEE Transactions on Robotics & Automation
- IEEE Transactions on Man, System and Cybernetics, Part C, Applications
- IEEE Transactions on Control Systems Technologies
- IEEE Transactions on Neural Systems and Rehabilitation Engineering
- IEEE Transaction on Haptics
- IEEE Transactions on Mechatronics

- IEEE Transactions on Biomedical Engineering
- Robotica
- International Journal of Robotic Research
- Advanced Robotics
- Behavior Research Methods
- Computer Graphics
- Journal of Acoustic Society
- Journal of Robotic Systems
- ROBOTICS AND COMPUTER-INTEGRATED MANUFACTURING
- ASME Journal of Mechanical Design
- ASME Transactions on Robotics
- Mechanism and Machine Theory
- Meccanica
- Interacting with Computers (Elsevier)
- International Journal of Computer Studies
- Springer Journal of Virtual Reality
- MIT Press Presence- Teleoperators and Virtual Environments
- ACM Transactions on Applied Perception

Antonio Frisoli performed regularly peer-review activity for several international conferences, among which:

1. IEEE ICRA International Conference on Robotics & Automation
2. IEEE IROS International Conference on Intelligent Robots and Systems
3. IEEE BioRob
4. Robotics Science and Systems
5. IEEE Worldhaptics conference
6. Haptic Symposium
7. Eurohaptics
8. IEEE ROMAN International Symposium on Robot Human Interaction
9. ASME IMECE, DETC Asme 2002,
10. Virtual Concept
11. IEEE ICORR International Conference on Rehabilitation Robotics

Awards, invited talks and keynote lectures

- Invited as a expert at the Workshop on Strategic Exoskeleton-orientation at Otto Bock HealthCare GmbH, Febr 17, 2008
- Plenary Lecture on "Robotics in Rehabilitation" entitled "Robotics and Virtual Reality for Rehabilitation: Implementation and Results", XXXVI National Congress SIMFER 2008,
- As "Vice-Chair for Information and Dissemination" of the IEEE Technical Committee on Haptics won the "Most Active Technical Committee of the IEEE Robotics and Automation Society Year for 2006" presented in Rome at ICRA 2007.
- Keynote speaker session on "Haptic Systems in Interactive Design" at the conference Virtual Concept 2006 held in Biarritz, France.
- Key-note invited lecturer at the International Workshop VIA "Virtual Reality for Industrial Applications", held in Compiègne, November 2004, at the Technical University of Compiègne, 2006
- Lecture ARISER invited at the Summer School with a presentation on "Haptic technologies for interactive simulations in VR" (Santa Cesarea Terme, 2006).

- Honorary mention as innovative idea in the competition "Start Cup Pisa" with the project Museum of Pure Form, for the development of processes and systems and three-dimensional virtual reality for the protection and enjoyment of cultural heritage (2004)
- Winner of a selection opened by the National Institute of Nuclear Physics in Pisa for qualified researchers to conduct a period of specialist training at the Fermi National Accelerator Laboratory in Batavia (Chicago), IL-USA
- Winner of the national selection (ranking II over more than 400) with exams for five seats of undergraduate students at the Scuola Sant'Anna (SSSA) in Pisa

Research activities

Participation to research projects

Antonio Frisoli has participated either as owner, technical coordinator and research collaborator in numerous research projects at national and international level.

European projects

Progetto EU-IP BEAMING, Being in Augmented Multi-Modal Naturally-Networked Gatherings

This project bring today's networking, computer vision, computer graphics, virtual reality, haptics, robotics and user interface technology together to produce a new kind of virtual transportation, where the person can be physically embodied interacting with life-sized people who may be thousands of kilometres away.

Antonio Frisoli is implementing a teleoperation system for remote teleoperation and realizing novel portable haptic interfaces for simulation of grasping.

EU IP Project VERE Virtual Embodiment and Robotic Re-embodiment

The Integrated Project aims at dissolving the boundary between the human body and surrogate representations in immersive virtual reality and physical reality. Dissolving the boundary means that people have the illusion that their surrogate representation is their own body, and act and have thoughts that correspond to this. The work in VERE may be thought of as applied presence research and applied cognitive neuroscience, and it would also significantly add to scientific knowledge in these areas.

Antonio Frisoli is developing new technologies for the Embodiment Station, and in particular new actuators for proprioceptive stimulation inducing illusory movement via tendon vibration, new algorithms of BCI that make use of Error Related Negativity, new technologies for immersive visual feedback.

Project EU IP IST-027731-PRESENCIA

Antonio Frisoli has been the principal investigator for the Sant'Anna School of the project "Presencia: Presence Research Encompassing Sensory Enhancement, Neuroscience, Cerebral-Computer Interfaces and Application" www.presencia.org, lasting four years, funded in January 2006 for an amount of € 350.000. The purpose of the research of Dr. Frisoli in the research project was to develop innovative systems for the kinematics of the fingertip haptic stimulation of new systems and haptic interfaces for multimodal interaction in a highly immersive virtual environments.

EU StreP Project IST-027198 DECISION-IN-MOTION

Antonio Frisoli was responsible for the Scuola Superiore Sant'Anna of the European project STREP DECISION-IN-MOTION "Neural Decision-making in Motion" <http://www.decisionsinmotion.org>, funded for three years starting from January 2006 for an amount of € 250.000 -. The purpose of the project was the realization of a robotic autonomous platform, equipped with a robotic head with active vision capable of simulating the movements of both eyes of both the head, for the experimental study and implementation of new neuromorphic algorithms for autonomous navigation. The prototype developed at the laboratory PERCRO implemented a behavioral model based on neuromorphic algorithms that simulate the visual areas V1, V2, MT, which allows him to perform tasks of achieving goals with simultaneous avoidance of obstacles, by modulating the trajectory followed as a function of the actual speed navigation. The project was successfully completed in February 2009. The results of the project have also had extensive media exposure, with a video project published online on New Scientist.

EU IP SKILLS Project

Antonio Frisoli was responsible for the platform Demonstration on "Upper Limb Rehabilitation" in the European IP project SKILLS n (<http://www.skills-ip.eu/>), coordinated by the Scuola Superiore Sant'Anna prof. Bergamasco, funded for four years since October 2006. In this framework he conducted a controlled clinical trial evaluating the effects of a robotic treatment against physical therapy.

He also contributed to the technical development of a simulator in-door rowing. The simulator reproduces the kinematics of in-door rowing a boat, allowing both the sculling is leading. The resistance of water was simulated using appropriately sized mechanical fans, and force sensors and position allow you to record the athlete's performance during the execution of the movement.

VIGONI Bilateral Cooperation project between Italy and Germany

Antonio Frisoli was the technical manager the project, where in collaboration with prof. Mark Greenlee, University of Regensburg he developed a haptic interface fMRI-compatible for neuroscientific studies. The project led to the construction and test of one single dof prototype and the realization of a 3-dof prototype.

NoE Enactive Network of Excellence (2003-2005).

The Network of Excellence ENACTIVE was composed of 20 partners in Europe with expertise in robotics, ecological psychology, neuroscience, and HCI.

Antonio Frisoli has directed the working group which dealt with the simulation in virtual environments of manual tasks and has been a permanent member of the NEB Network Executive Board.

He also participated in numerous other workpackages, including the Research Directorate RD3.1 "Basic technologies for enactive interfaces", in which coordinated the activities of the laboratory PERCRO.

Progetto IST-2000-29580 PURE-FORM (The Museum of Pure Form) (2001-2004)

During 2002-2004 Antonio Frisoli was technical manager of the PURE project EU-IST Project FORM-2000-29580 (The Museum of Pure Form, www.pureform.org), coordinating and supervising the technical activities for the realization of an integrated virtual reality applications for museums, which led to the creation of a force-feedback exoskeleton with 10 degrees of freedom and the creation of the Museum of Pure Form, conceived as a

system of virtual reality where the user can interact through the use of touch and sight with three-dimensional digital models of sculptures and works of art.

A selection of sculptures belonging to different collections of European museums was made using a laser scanning system by creating a database of digital works of art, which formed the nucleus of a new store on the Internet shared among the partners and other museum European cultural institutions. Two haptic interface systems, including an exoskeleton innovative force feedback and a desktop interface to 2 points of contact, were the first to be validated in a CAVE immersive display system at the University College London (UCL - UK), and then in 3 exhibitions held in the National Museum of Fine Arts (Stockholm - Sweden), Centro Gallego de Arte Contemporanea (Santiago de Compostela-Spain), the Museum Opera del Duomo of Pisa (Italy).

The project in November 2004 received an honorable mention for the originality of the idea of Business Plan and of the proposed idea of business model in the national selection for the prize PNI (National Award for Innovation).

In June 2005, it was instead won a competition organized by the Greek Ministry of Culture in 2008 that led to the preparation of a multimedia room with a system of "Museum of Pure Form" in the Museum of Olympia.

Intuition Network of Excellence (2005)

Antonio Frisoli participated to the Network, as a member dell'Haptic Working Group. The Intuition Network of Excellence was the European network for research on virtual reality technologies.

IST-2001-34231-CREATE Project

The CREATE project aimed at the development of an environment based on Mixed Reality techniques that allows the construction and handling of a virtual temple with a high degree of interactivity.

Antonio Frisoli was involved in the design and development of the haptic interface.

EU IST-2000.26151-GRAB Project

The main objective of the project was the design of haptic interfaces for blind people to access a Virtual Environment through the sense of touch and with audio support.

Antonio Frisoli dealt with the kinematic analysis and mechanical design of the micromanipulator of the haptic interface system.

1999-R.D.11030 VIRTUAL Project (2002)

He participated to the project EU Project Virtual (Virtual reality systems for Perceived ergonomic quality testing of driving task and design).

The main objective of the project was the development of an integrated platform, based on Virtual Reality technologies, including systems for testing and related experimental procedures to obtain a tool to improve the analysis and the ergonomic design of vehicles . Antonio Frisoli was involved in the development of a control system for replication of the primary controls of a car in Virtual Environments. He was involved in the kinematic analysis and optimization of a parallel kinematics for the simulation of a car manual gearshift, interacting predominantly with the Fiat Research Centre in Turin.

ESPRIT N.20145 MORIS Project (2000).

He contributed to the project MORIS (Motorcycle Rider Simulator) The objective of the project MORIS (Motorcycle Rider Simulator) was the realization of an inertial system simulator of a 2-wheeled vehicle capable of providing the user with the same feelings of riding a motorbike in real conditions.

Antonio Frisoli was involved in the CAD simulation of the kinematics of a motorcycle simulator.

TIDE N.4527 TREMOR Project (1999)

In 1999 Collaboration to the EU project TREMOR (October 1997 - April 2000). The TREMOR project aimed at developing technological devices to support those affected by tremor in the upper limbs in order to restore and/or supplement their ability to handle daily activities. Antonio Frisoli was involved in the design and implementation of haptic interface with two degrees of freedom for the functional recovery of patients with writing tremor (multiple sclerosis, parkinsonian).

Nationally funded projects

ASI Crusoe (CRUSOE "CRUising in Space with Out-of-body Experiences")

Catching experiments are an interesting application in evaluating how the knowledge of gravity acceleration affects the human sensorimotor control. The study of the human reaction and adaptation to altered gravity conditions is important for the feasibility analysis of long term spatial missions, where the capabilities of the crew to operate in unfamiliar conditions and to readapt to standard environment after landing are fundamentals. A system capable of realistically simulating the catching of objects in altered gravity conditions can be applied to the study of possible neurocognitive problems of subjects in critical situations.

In this project Antonio Frisoli is developing an integrated VR system for the simulation of altered gravity conditions. A passive device is used (track-hold) to reduce the gravitational weight of the arm, while an encountered haptic device is used to simulate the behavior of objects in conditions of reduced gravity (example catching of flying balls).

Industria 2015 DOC project (Device for the navigation of blinds)

In this project Antonio Frisoli is responsible for the development of novel wearable devices that providing haptic cues might allow guidance of blinds during autonomous navigation in in-door environments.

BRAVO project "Brain computer interfaces for Robotic enhanced Action in Visuo-motOr tasks" (2010-2012)

Antonio Frisoli is the responsible under the BRAVO project, funded by the IIT, of the implementation of a robotic system for robotic assistance in performing manual tasks, guided by the command derived from gaze captured with eye tracking devices and the control of opening / closing of the hand through Brain Computer Interface.

The project is also evaluating the clinical efficacy of motor imagery techniques by BCI for the rehabilitation of patients after stroke.

Project funded by Monte Paschi Siena Foundation (2007-2009)

Antonio Frisoli was the technical manager of the research project funded by the Fondazione Monte Paschi Siena, for two years from January 2007, for a funding of € 250,000, managing the design and construction of new robotic systems for rehabilitation of neuromotor function in adult or pediatric patients. In this project, Antonio Frisoli supervised the design of an innovative exoskeleton system, specifically designed for safety and functional requirements in rehabilitation and developed a new actuated joint including Harmonic Drive gear type speed reduction and direct torque sensor.

In collaboration with the Unit of Neurorehabilitation of University of Pisa, Santa Chiara Hospital, he worked on the development, design, construction and development of new robotic technologies for neuromotor rehabilitation of the upper limb in patients with post-stroke disabilities and their clinical validation.

"Advanced applications in military technology robotic teleoperation" Ministry of Defence (2003-2005)

The research project concerned the design and implementation of a teleoperation system called "body extenders", to amplify the capabilities of a human operator to be used in tasks of handling loads, assembly room. Antonio Frisoli was involved in the preliminary design of the control system.

CNR Funded project

CNR Project for Young Researchers Ricercatori EnGrave (2002-2004).

In 2002-2004 Antonio Frisoli was the winner and holder of the research project CNR Young Researchers Engrave Engrave interactive 3D graphics, with the aim of creating a system for modeling artifacts in virtual environments. In particular, under this project it was designed a second version of the desktop haptic interface table, based on a prototype already made as a result of a previous research project, with parallel kinematics. Also in the course of the project numerical algorithms were developed to support interactive deformation of objects with haptic feedback in virtual environments.

University and MIUR project

PRIN project on new actuators (2009-2010)

Antonio Frisoli participated to the design, implementation and construction of new actuator technologies based on piezoelectric and electroactive materials.

PRIN AIDA Project (2007-2008)

Antonio Frisoli as part of research unit SSSA, developed innovative haptic systems and applications for physical interaction with virtual objects in real time using gloves with sensors in virtual environments.

MIUR Project RIME (2002-2004).

Since 2002 until 2004 Antonio Frisoli worked on the project RIME (2001-2003) "Design and realization of haptic interface with 5 degrees of freedom for teleoperation in surgery" It was carried out the design and study static-kinematic performance of an haptic Interface with 5 degrees of freedom to be used for teleoperation in orthopedic surgery of the spinal cor. As part of the continuation of the same project it was implemented a master-slave teleoperation system for performing drilling operations in orthopedic surgery.

MIUR Project METAFORE (2000-2002).

Since 1999 until 2003 Antonio Frisoli collaborated to the project METAPHORS MURST (1999-2001) "Methods and tools applied to a family of robots for medical environment" (National Co-ordinator Prof. Aldo Rossi).

In the project, having as its objective the study of the interaction robot-surgeon for the planning of implant surgery and neurology, Antonio Frisoli worked on the development of an optimal haptic interfaces with parallel kinematics and associated control algorithms,

Young Researchers MURST Project (1999-2000).

In 2002 Antonio Frisoli was the scientific responsible of a Young Scientists Scientific Research University Project (Art.65 cc. Sperim Sc.) "HI2 Highly Isotropic Haptic Interface", with the goal of designing an planar haptic interface with 2 degrees of freedom for interaction in virtual Environments. The project led to the realization and control of an Interface haptic innovative for the implementation principles, able to substantially increase the kinetic-static performance of the mechanism used.

University SSSA projects

Antonio Frisoli was also appointed as the Sant'Anna School of the University the following research projects:

- I6004AF - parallel manipulators for assembly and teleoperation (2004-2005) project
- I6005AF Study and preliminary evaluation of algorithms for power amplification (2005-2006)
- I6006AF System for robotic applications in ultrasound medical examinations (2006-2007)
- I6007AF Design of robots with fMRI compatibility (2007-2008)
- I6008AF University neuromotor rehabilitation assisted by robots in Virtual Environments (2007-2008)

Research project with industrial partners

Contract with Dida Network srl (2011)

Antonio Frisoli is technical responsible of a project for the development of wearable technologies for the localization and tracking of blinds in out-door environments. The approach will make use of the integration of available GPS technologies with inertial measurements.

Contract with Villa Serena (2010)

Antonio Frisoli was the responsible for the realization of a passive device (Track Hold) for the rehabilitation of patients post-stroke for upper limb tracking and lift reduction during the execution of exercises in virtual environments . The device was developed for the Villa Serena Clinics of Pescara.

Contract with (Whitehead Alenia Sistemi Subacquei) (2008-2009)

The project, of which Antonio Frisoli was the coordinator of activities for the SSSA, between the SSSA and WASS Whitehead Alenia Underwater Systems, is aimed at the development of a testbed for numerical simulation and the study of the controllability of torpedoes and technical support to the WASS for the development of new algorithms for controlling and piloting of torpedoes.

EchoDev (2005)

The project stems out from a collaboration of the laboratory PERCRO with the CNR in Pisa, Bracco Inc. and the Department of Internal Medicine, University of Pisa. Antonio Frisoli was involved in the design and implementation of a robotic system for moving an

ultrasound probe during monitoring of the brachial artery for cardiovascular risk assessment.

Contract with PEC Italia S.r.l (2004-2005)

Antonio Frisoli was technical manager of the project in conjunction with PEC Ltd and Agusta that led to the development of a robotic cell with two anthropomorphic robots operating on a testbed, for simulating the handling of the door of an helicopter. The testbed has been subjected to a fatigue cycle of 10,000 iterations, consisting in the simulation of opening and closing of the door of aircraft. Two robots COMAU NH-1 equipped with a gripper and a force sensor innovative parallel kinematic were used for experimentation.

Research period abroad

In 1998 he won a selection opened by the National Institute of Nuclear Physics in Pisa for qualified researchers to conduct a period of specialist training, of 2 months training, at the Fermi National Accelerator Laboratory in Batavia (Chicago), IL-USA, a Federal research in the U.S. high energy physics, research in the area of high energy physics - elementary particles. During this period he dealt with the design, testing and analysis of the mechanics of superconducting magnets with high field strengths, including LHC quadrupoles and / or new designs, designing equipment for the construction of superconducting magnets in an inert atmosphere.

Post-graduate courses

Antonio Frisoli participated in the following post-graduate training courses:

- 17-21 September 2001: PhD Summer School at the Laboratoire d'Automatique de Grenoble, "Modélisation et Commande des Systemes géométrique Automatiques"
- 24-27 June 2002: "Theories of discrete controls " Prof. Hisato Kobayashi (Hosei University, Tokyo)
- 3-6 July 2001: "Basic Models of the Robotic Systems, control and planning algorithms for mobile robotic systems" Prof. Steven Dubowsky Massachusetts Institute of Technology (USA)
- March 1998, "Special Lectures on Biorobotics" Prof. B. Hannaford, University of Washington

Visits at laboratories and research center

Antonio Frisoli has visited several foreign research laboratories. In particular, some of the most relevant are reported below:

- 2012 Tour of Human Motor Control Laboratories, Weizmann Institute, Prof. Tamara Flesh
- 2012: Visit to IIT laboratories, Dr. Paolo Medini, group of Cellular NeuroPhysiology
- 2011: Visit the Virtual Reality Laboratory, University of Barcelona, prof. Mel Slater
- 2011: Visit of robotics labs and ICT ETH, Zurich, Switzerland, prof. Robert Reiner
- 2009, Visit of robotics laboratory at University of Utah, Prof. J Hollerbach, Prof. W Provancher
- 2009: Visit of VRLAB, EPFL, Lausanne, Director Prof. Daniel Thalmann

- 2008: Visit of the laboratory Specs, Synthetic, Perceptive, Emotive and Cognitive Systems Group, UPF, Barcelona, Director Prof. Paul Verschure
- 2007: Visit of the psychology laboratory and brain imaging, University of Regensburg, prof. Mark Greenlee
- 2007: Visit of the workshop "Vision and Perception Lab Science" University of Ulm, prof. Heiko Neumann.
- 2006: Visit to MIRALab Laboratory, University of Geneva, prof. Nadia Thalmann
- 2005: Visit of laboratories dell'ACROE ICA-directed by Dr. Annie Luciani, at the INPG, Grenoble, France
- 2004: Visit of the Laboratory Uppsala University - Department of Psychology, Professor. Gunnar Jansson
- 2005 Visit of the Applied Mechanics Laboratory, San Sebastian, Dr. Emilio Sanchez
- 2005: Visit to the laboratories Labein Tecnalia, Bilbao (Spain)
- 2005: Oil press Visit Commissariat à l'Energie Atomique - Laboratoire des Systèmes d'Intégration et des Technologies (CEA LIST), Paris, Director Mustafa Hafez
- 2003: Grenoble, France: Visit to the laboratory of prof. Troccaz at the Institut Albert Bonniot, Université de Grenoble
- 2002: Montreal-Quebec: Visit the "Center for Intelligent Machines," directed by prof. V. Hayward
- 2001: Grenoble, France: Laboratoire d'Automatique of the Tour de Grenoble led by prof. Brogliato
- 2000: Boston, MA: MIT Laboratory, visited the laboratory of prof. Ian Hunter, Department of Mechanical Engineering
- 1999: Stanford, CA Stanford University: visit to the laboratory of Prof. Oussama Kathib the laboratory of rehabilitation "Veterans Administration" by Prof. Leifer, and "Dextrous Manipulation Lab" by prof. Cutkosky
- 1997 Berkeley / Stanford University, CA: Visit several laboratories in the field of robotics.

Participation to international conferences

Antonio Frisoli has constantly participated as a speaker at numerous international conferences presenting work on his research, since the start of his scientific career, among which IEEE ICRA; IEEE ICORR, IEEE Haptic Symposium, Eurohaptics, IEEE Worldhaptics, RoMansy, Advances in Robots Kinematics ARK, IEEE BioRob.

Activities with the European Union

Antonio Frisoli acted as evaluator of proposals in ICT CALL 5 at the European Commission, Directorate "General Information Society and Media" in the period from 16/10/2005 to 23/10/2005

National and international collaborations

Through the activities within the laboratory PERCRO, Antonio Frisoli has established continuous research collaborations and international exchanges with different national and international institutions, such as:

- Fondazione Santa Lucia, Prof. Lacquaniti e Dr. D'Avella
- Stanford University: Robotics Laboratory directed by Professor Ken Salisbury
- McGill University, Montreal, Canada: Haptics Laboratory directed by Prof. Vincent Hayward, now at Université Pierre et Marie Curie, Paris France,

- DLR Institute of Robotics and Mechatronics, Telerobotics Laboratory, directed by Prof. Gerd Hirzinger, Dr. Carsten Preusche
- University of Utah, Dept. of Mechanical Engineering, Mechatronics & Embedded Haptics Laboratory, Dr. William Provancher,
- University of Regensburg, Department of Psychology Prof. Mark Greenlee
- University of Ulm, Institute of Neural Information Processing Vision and Perception Lab Science, Prof. Heiko Neumann
- Faculty of Psychology. Universitat de Barcelona, Campus de Mundet, Prof. Mel Slater, founder of Virtual Environments and Computer Graphics group in the Department of Computer Science, University College London
- Event Lab, Neuroscience and Experimental Technologies in Virtual Environments, Barcelona IDIBAPS, Mavi Sanchez-Vives
- University of Montpellier I, Dept. of Sport and Movement Science, Director Prof. Benoit Bardy
- Hospital Bologna, Department of Intensive Care, Director Dr. Elga Cerchiari
- Department of Neurorehabilitation, University of Pisa, Director Professor Bruno Rossi
- CEIT, Applied Mechanics Department, Spain, Dr. Emilio Sanchez.

Patents and trademarks

1. Brevetto Europeo EP1629949; Frisoli Antonio, Salsedo Fabio, Bergamasco Massimo, Simoncini Francesco, "Haptic Interface Device", 2006-03-01
2. Brevetto mondiale WO2004058458 (registrato negli Stati Uniti US7409882, Europa EP1581368, Australia AU2002368501) Salsedo Fabio, Dettori Andrea, Bergamasco Massimo, Franceschini Marco, Frisoli Antonio, Rocchi Fabrizio, "Exoskeleton Interface Apparatus", 2006-07-13
3. Brevetto mondiale WO2006054163 (registrato in Europa come EP1828873 ed in Italia come ITPI20040084), Salsedo Fabio; Bergamasco Massimo; Frisoli Antonio; Cini Guido, "Portable Haptic Interface", 2007-09-05
4. Brevetto Italiano ITPI20070020, Avizzano Carlo Alberto, Bergamasco Massimo, Frisoli Antonio, Ruffaldi Emanuele, Vanni Federico, "Simulatore Multimodale di Canottaggio", 2007-06-02
5. Brevetto Italiano ITPI20080054, AVIZZANO CARLO ALBERTO; BAGNOLI LEONARDO; BERGAMASCO MASSIMO; FILIPPESCHI ALESSANDRO; FRISOLI ANTONIO; RUFFALDI EMANUELE "SPRINT", 2008-09-30
6. Marchio registrato, individuale figurativo, N. 003105129 Pure Form, Antonio Frisoli, Massimo Bergamasco., 27/05/2004

INSTRUCTION AND COURSE DEVELOPMENT

Courses at University of Pisa

Antonio Frisoli has held and holds the following teaching positions at the University of Pisa

- Assignment of teaching as an adjunct professor for the course of "Applied Mechanics" (ING-IND/13, 5 CFU) of the course Fundamentals of mechanics and technical physics during MSc (LM) in Computer Engineering (first year) in Faculty of Engineering
 - a.a. 2008-2009 (LS), a.a. 2009-2010 (LS), a.a. 2010-2011 (LM), a.a. 2011-12 (LM)
- Assignment of teaching as an adjunct professor for the course "Mechanics of Robots" (ING-IND/13, 6 CFU) MSc in Mechanical Engineering (second year) in the Faculty of Mechanical Engineering, University of Pisa
 - .a.a. 2004-2005, , a.a. 2005-2006, a.a. 2006-2007
- Assignment of teaching as an adjunct professor at the Faculty of Medicine, Physical Therapy Bachelor program within the course of "General methodology of Motor rehabilitation" - second year:
 - "Robotics and Virtual Environments in Rehabilitation" (ING-INF/06, 1 CFU) for the year 2005-2006 - 2010/2011
 - 'Rehabilitation Bioengineering "(ING-INF/06, 1 CFU) for the year yy 2010/2011

Antonio Frisoli acted as a teaching assistant for the course of Mechanics of Robots, held by prof. Massimo Bergamasco for the degree course in Mechanical Engineering from the University of Pisa in the academic years 1999-2003.

Courses at University of Udine

Assignment of teaching as an adjunct professor at the Faculty of Medicine, University of Udine teaching of "Biomaterials" (BIO-10, 1 CFU) in the MSc in Biotechnologies, for the academic years 2005-2006 (LS), a.a. 2006-2007 (LS), a.a. 2008-2009 (LS), a.a. 2009/2010 (LS), a.a. 2011/2012 (LM).

Courses at Scuola Superiore Sant'Anna

Antonio Frisoli has given the following courses to undergraduate students of the Engineering Sector of the Class of Experimental Sciences:

- • a.a. 2006-2007: teaching module of "Dynamical Systems II" (1 CFU) during integrated Prof. Bergamasco
- • a.a. 2005-2006: Training Module "Elements of CAD and FEM for the synthesis of robotic manipulators" (2CFU) in the integrated course of Prof. Bergamasco
- • a.a. 2004-2005: course "Principles of non-linear theory for the modeling of deformable bodies" (2CFU)

In years 2001-2002 and 2002-2003 he was teaching assistant in the course of Prof. Massimo Bergamasco addressed to undergraduate students of "Computer Aided Design."

He was lecturer of the course in "Perception and design of experiments" for students of the ICT PhD students in Engineering (2010-2011) and in the International Master on Virtual Environments (2008/2009).

In the academic year 2010-2011 he was appointed as academic tutor for the organization and management of teaching activities within the International Master in Virtual Environments International for Industrial Applications at the Scuola Superiore Sant'Anna.

For academic year 2011/2012, he has been appointed as lecturer for parts of the teaching of "Mechanics of Robots - Part II" addressed to PhD students and parts of the course in "Advances in Robot and Interface Design" (4CFU) addressed to PhD students.

Orientation meeting

Antonio Frisoli has participated actively in the creation and implementation of the first two editions of the School of Engineering for high Schools nationally selected Students, of San Miniato (2-5 February 2012, with a talk on "From robotics to reality virtuale: technologies for advanced interaction man-machine ") and Pisa (2011).

Antonio Frisoli has also actively participated in the organization of orientation meetings with the schools organized by the Institute TeCIP (2011, January 23, 2012).

Lectures at other institutions

- Lessons in the PhD course of Engineering, University of Siena, built-in "Virtual Reality Haptics in Design and Applications", year 2008
- Teaching of course "Design dell'Interfacce" by Pont-Tech srl under the project "Technical design and industrial design" for a number of hours equal to 12, year 2006
- Course "New interaction paradigms for cultural heritage" in the PhD program in Technology and Management of Cultural Heritage "for a total of 3 hours performed in the years 2005.2006
- Lessons in "MASTER IN COMMUNICATION AND PUBLIC POLICY" in the module "Introduction to multimedia languages", aa 2003/2004

Seminars and invited participation to international workshops/summer schools

- Participation by invitation to the workshop "Haptic Hardware Evaluation Practices," Haptics in 2012 in Vancouver organized by Evren Samur / Curt Salisbury with a presentation entitled "A comparative assessment of performance of active exoskeletons for haptic feedback: tendon driven vs. harmonic drives based designs "
- Lecturer at the Summer School 2011 held at the castle of Gargonza, July 25-30, 2011, on "Motor Learning and Rehabilitation Robotics"
- Control of robotic exoskeletons and their application in upper limb rehabilitation, Phd School of SIDRA; Bertinoro, Italy (2010)
- Invited talk on "In-door skill training in rowing practice with a VR based simulator", 10th european workshop on ecological psychology, Organized Jointly with the 2nd international congress of complex systems in sport, Madeira, 2008
- Workshop "PRESENCE and the Science of Virtual Reality ", "Enhanced Perception through Haptic Technologies" 0.2-3 November 2008, Technion, Haifa
- "Robotic technologies for rehabilitation in VE" in The 3rd and XVR BCI Workshop, Antonio Frisoli (PERCRO, Italy), 14-15 May 2008, Pisa

- "A limit-curves based soft finger god-object algorithm for two fingers manipulation of virtual objects" in Workshop of "Contact Models for Manipulation and Locomotion" in ICRA organized by Todd Murphey, Vijay Kumar in ICRA 2008,
- Invited talk on The Virtual Reality for the treatment of psychophysiological disorders induced by stress., SIFP XV CONGRESS COMPANY 'ITALIAN Psychophysiology, 30 November 2007, Pisa
- Robotic Technologies for Neuro-Rehabilitation in Virtual Environments, University of Siena, March 8, 2007
- •"L-Exos: A Light Exoskeleton System for Functional Rehabilitation of the Arm" in Workshop on "Robotic Technologies for Rehabilitation" organized by Carlo Alberto Avizzano and Craig Carignan, ICRA 2007, April 14 2007
- •"Foundations of Perceptual Robotics", in the graduate seminar on "Augmented Cognition / Cognitive Systems" University of Regensburg, June 28, 2007
- •"Multimodal perception and engineering" Workshop November 21, 2006, UCL London
- •"Evaluation of multipoint contact interfaces in haptic perception of shapes" in "Multi-point Interaction with Real and Virtual Objects", Workshop on "multipoint interaction with real and virtual objects", in IEEE ICRA 2004, New Orleans
- •Tutorial on "Real-time Interaction and Inhabited Virtual Worlds" at Eurographics, September 5, 2006
- •"The human-robot sensorimotor coupling: an engineering perspective" in the Enactive Virtual Workshop, available <http://www.interdisciplines.org/enaction> edited by Roberto Casati, Sarah Bendaoud, July 23, 2004
- • Antonio Frisoli, Gunnar Jansson, Massimo Bergamasco, Emanuele Ruffaldi, Pure-Form: Perception and exploration of digital shapes, International Conference on Applied Perception ICPA 13, 5-10 July 2005
- •The Museum of Pure Form in the workshop "Novel Technological interfaces for the perception of art and Fruition", January 22, 2004, CGAC, Santiago de Compostela
- •Report on "The perceizione of virtual sculptures: The Museum of Pure Form" in the workshop on "High technology management in the Square of Miracles", Museum Opera del Duomo of Pisa, September 26, 2003
- • "Haptic Interfaces for rehabilitation and assistance of disabled people", I-Learning and Strategic Scientific Meeting, 23-24 October 2003, Milan (Italy)
- "Haptic Interfaces for rehabilitation and assistance of disabled people", I-Learning Scientific and Strategic Meeting, 23-24 Ottobre 2003, Milano (Italy)

Advising in doctoral program

Antonio Frisoli was also a member of PhD committees for the degree of Doctor of Philosophy of the following candidates.

At SSSA

With underlined the candidate for which he acted as thesis supervisor (tutor)

1. Umberto Olcese(2010) "Neuromorphic computational models for robotics" (Tutor)
2. Alessandro Filippeschi (2011) "Skill acquisition and transfer of rowing" (Tutor)
3. Nicola Lucchesi (2009): "Design of novel robotic devices for human power augmentation", (Tutor)
4. Silvia Pabon (2010): "Study and experimental evaluation of innovative portable devices for touch-mediated social interaction in virtual environments" (Tutor)
5. Siqiao Li (2010) "Design and development of a new fMRI compatible haptic interface" (Tutor)

6. Massimiliano Solazzi (2010): “Nuovi concetti di interfaccia aptica portabili”, Scuola Superiore Sant’Anna ([Tutor](#))
7. Luis Ivan Villeda (2010) “Control of Upper Limb Exoskeletons for Rehabilitation” Scuola Superiore Sant’Anna ([Tutor](#))
8. Luigi Borelli (2010) “Applicazioni di robotica in realtà virtuale per il trattamento delle disabilità motorie dell’arto superiore”, Scuola Superiore Sant’Anna ([Tutor](#))
9. Federico Tarri(2009): “Theoretic/experimental analysis of actuation systems for portable robotic devices”, Scuola Superiore Sant’Anna ([Tutor](#))
10. Walter Aprile (2008): “Cognitive aspects during haptic interaction”, Scuola Superiore Sant’Anna ([Tutor](#))
11. Damaso Checacci (2006): “Parallel kinematics and mechanical response to force cues on locomotion interfaces”, Scuola Superiore Sant’Anna ([Tutor](#))
12. Emanuele Ruffaldi (2006): “Multirate and Perceptual Techniques for Haptic Rendering in Virtual Environments”, Scuola Superiore Sant’Anna
13. Rossi Fabio (2006): “High Quality Modeling of 3D objects in Virtual Environments, Optimized Single Chart Parameterizations”, Scuola Superiore Sant’Anna
14. Marcello Carrozzino (2006): “Efficient management and authoring of complex virtual environments”, Scuola Superiore Sant’Anna
15. Marco Fontana (2008): “Exoskeleton haptic interface for the human hand”, Scuola Superiore Sant’Anna

At foreign institutions:

1. Renaud Ott (2009), “Two-handed Haptic Feedback in Generic Virtual Environments”, Ecole Polytechnique Federal De Lausanne
2. Nivedita Gadhopy (2006) “The Sensorimotor Theories of Visual Consciousness” Institut Nicod, Paris, France,
3. Guillaume Drieux, (2006) France “De la maquette numérique produit vers ses applications aval: propositions de modèles et procedes associés”, INPG Grenoble,

Advisor in undergraduate dissertations

Antonio Frisoli also followed as a speaker in the preparation of numerous dissertations, for the Faculty of Engineering of Pisa and Scuola Superiore Sant’Anna.

In particular, Antonio Frisoli has been supervisor of the following theses:

- 19 theses for the degree in Mechanical Engineering, Faculty of Engineering University of Pisa (three years, specialist, five VO)
- 1 theses for the degree course in Biomedical Engineering, University of Pisa
- 1 theses for the degree in Computer Engineering, University of Pisa
- 5 theses in the graduate program in Engineering, Faculty of Engineering University of Pisa
- 3 theses for a license with the SSSA
- 1 graduated licensing at the University Institute of Advanced Studies (IUSS) of Pavia
- 3 thesis during Degree in Computer Science, University of Pisa
- 1 Degree Thesis in Media Engineering, Technical University of Ilmenau, Germany

It follows a detailed list of dissertations for which he as acted as advisor at undergraduate level:

1. Dettori Stefano (in corso) "Tecniche di machine learning per il controllo via EMG di superficie di un esoscheletro robotico" INGEGNERIA DELLA AUTOMAZIONE, Università di Pisa, (2012)
2. BARTALUCCI, RICCARDO A new robotic exoskeleton system for upper limb rehabilitation by gaze tracking INGEGNERIA DELLA AUTOMAZIONE, Università di Pisa (2011)
3. GIANNETTI, DANIELE Studio e Realizzazione di una Libreria Software per la Visualizzazione Interattiva di Ambienti Virtuali Complessi INGEGNERIA INFORMATICA, Università di Pisa (2009)
4. BARSOTTI, MICHELE Metodi di analisi di segnali EEG in applicazioni di Brain Computer Interfaces INGEGNERIA BIOMEDICA, Università di Pisa (2012)
5. NATALI, SIMONE Sviluppo e implementazione di un sistema multimodale per la riabilitazione INGEGNERIA DELLA AUTOMAZIONE INGEGNERIA BIOMEDICA, Università di Pisa (2009)
6. Laura Buti, Tesi di Laurea triennale in Ingegneria Meccanica "Studio di un freno magnetoreologico per un simulatore di canottaggio" 2010
7. Andrea Giovannini, Tesi di laurea di specialistica in Ingegneria Meccanica Progettazione di un esoscheletro per la riabilitazione, 2008
8. Lorenzo Bertini, Tesi di laurea di primo livello in Ingegneria Meccanica " Studio e progettazione di un sensore di coppia per un giunto integrato attuato per applicazioni di robotica riabilitativa ",2008
9. Giovanni Greco, Tesi di licenza specialistica presso l'Istituto Universitario di Studi Superiori (IUSS) di Pavia dal titolo "Analisi di casi clinici nella riabilitazione dell'arto superiore",2007
10. Umberto Olcese, Diploma di Licenza Specialistica, Scuola Superiore Sant'Anna, Settore di Ingegneria Industriale e dell'Informazione, "Sleep and learning: repetition of spike sequences in cortical circuits",2008
11. Tommaso Giuntini, Tesi specialistica in Ingegneria Meccanica in collaborazione con CEA-Paris "Skills. Design of a vibrating handle for the next Virtuose 6D medical simulator",2008
12. Frauke Fritz, Tesi di laurea in Media Engineering "Dextrous Manipulation of Virtual Objects in VR through data gloves" (tesi all'estero),2008
13. Gaetano Mancini, Tesi di laurea di primo livello in Informatica "Modeling and visualization of a Virtual Environment for rowing",2008
14. Giacomo Bosio, Tesi di laurea di primo livello in Informatica "Development of 3D graphics application for VR-based rehabilitation in children",2008
15. Simone Natali, Tesi specialistica in Ingegneria dell'Automazione "Development and implementation of a multimodal system for rehabilitation",2008
16. Alessandro Maffei, Tesi di laurea di primo livello in Informatica "VR simulator for healthcare management",In corso
17. Massimo Satler, Tesi specialistica in Ingegneria dell'Automazione "Bilateral teleoperation under time-varying delay using wave variables.",2008
18. Alessandro Filippeschi, Leonardo Bagnoli, Tesi di laurea specialistica in Ingegneria Meccanica "Studio e progettazione di un simulatore meccanico per la voga indoor",2007
19. Damiano Lombardi, Diploma di licenza in ingegneria "Study and development of novel configuration of piezoelectric actuators",2007
20. Alberto Montagner, Tesi specialistica in Ingegneria dell'Automazione "Control and clinical evaluation of an arm exoskeleton system for rehabilitation using Virtual Reality",2007
21. Cardellicchio Andrea, Tesi specialistica in Ingegneria Meccanica "Progettazione e sviluppo di una mano robotica con caratteristiche biomeccaniche",2007
22. Marco Danuso, Tesi di laurea triennale in Ingegneria Meccanica "A non-linear model for the buckling of an electroactived membrane",2006

23. Giovanni Molino, Tesi di laurea in Ingegneria Meccanica in collaborazione con Università di Delft: "Multi-body dynamic simulation: identification of impact parameters for a knee prostheses",2006
24. Michelangelo di Palo, Diploma di Licenza in Ingegneria "Compliance analysis with FEM methods in parallel manipulators",2006
25. Tommaso Borraccini, Laurea in Ingegneria Meccanica "ANALISI E PROGETTAZIONE DI UN ORGANO DI PRESA PER AFFERRAGGIO DI POTENZA, AD ELEVATA FLESSIBILITA' D'USO, BASATO SU DI UN MECCANISMO SOTTOATTUATO E SERVOASSISTITO",2005
26. Lorenzo Noferi, Massimiliano Solazzi, Laurea Specialistica in Ingegneria Meccanica "Progettazione e sviluppo di un innovativo sistema robotico per il posizionamento fine di una sonda ecografica per la valutazione della funzione endoteliale sull'arteria brachiale e radiale",2005
27. Guido Cini, Laurea in Ingegneria Meccanica "Analisi, progettazione e realizzazione di un innovativo dispositivo portatile per la simulazione del contatto in ambienti virtuali",2004
28. Luigi Borelli, Laurea in Ingegneria Meccanica "Studio ed implementazione di un modello physically-based per la simulazione in ambiente virtuale di un corpo deformabile per l'apprendimento chirurgico con dispositivi a ritorno di forza",2004
29. Lucchesi Nicola, Tesi di laurea in Ingegneria Meccanica "Analisi e progettazione di un nuovo sistema d'attuazione per interfacce aptiche a più gradi di libertà",2004
30. Pajno Felice, Tesi di laurea in Ingegneria Meccanica "Studio e progettazione preliminare di un sistema di retroazione di forza innovativo per interfacce di locomozione in ambienti virtuali",2004
31. Guarini Ciro, Tesi di laurea in Ingegneria Meccanica "Analisi e progettazione di un'attrezzatura per la misura di prestazioni di interfacce aptiche,2003
32. Tarri Federico, Tesi di laurea specialistica in Ingegneria Meccanica "Analisi e progettazione di un innovativo sistema per l'attuazione di una testina millirobotica da utilizzarsi in operazioni chirurgiche mininvasive",2004
33. Massimiliano Solazzi, Tesi di laurea triennale in Ingegneria Meccanica "Design of a gravity compensated haptic interface",2003
34. Sauro Fracassi e Tiziano Fracassi, "Analisi e progetto di un'interfaccia aptica per la simulazione dell'afferraggio, manipolazione ed esplorazione di oggetti tramite due punti di contatto",2002
35. Simoncini Francesco, "Analisi e progetto di un'Interfaccia Aptica portatile a due punti di contatto per la simulazione della manipolazione ed esplorazione di oggetti.",2001
36. Checcacci Damaso, "Studio di un sistema di interfaccia aptica con struttura cinematica parallela innovativa", 2000

UNIVERSITY SERVICE

Antonio Frisoli was appointed Head of Scientific Research of the Human Robot Interaction Laboratory at the Institute PERCRO TeCIP (Institute of Information Technology, Communication and Perception), Scuola Superiore Sant'Anna, where he directs the 'area of Human-Robot Interaction (HRI), composed by a group of about 20 people, including 4 senior researchers, 6 PhD students, 1 post-doc researcher, 3 graduate research assistants, 2 technicians and students in different thesis.

Currently Antonio Frisoli is academic tutor of 10 undergraduate students, and 5 PhD students at the Sant'Anna School of Advanced International PhD "ICT and Robotics Engineering", on the following topics:

PhD Students:

1. Padilla Castaneda Miguel Angel (4th year) "Study of body awareness through the virtual hand illusion within immersive Virtual Environments"
2. Claudio Loconsole (3rd year) "Rehabilitation robotics and new human-robot interaction paradigms for rehabilitation"
3. Daniele Leonardis (2nd year) "Innovative actuators and BCI interfaces for virtual and robotic embodiment"
4. Banitalebi Dehkordi Maryam (2nd year) "3 UPU parallel manipulator fMRI Compatible Haptic Interface"
5. Basilio Lenzo (2nd year) "Design and control of active orthoses for rehabilitation and assistance to the elderly"

Undergraduate students (year of admission at scuola):

1. Antonello leave, Aerospace Engineering (2011)
2. Mark Graffiedi, mechanical engineering (2011)
3. Erica Pezzica, Aerospace Engineering, (2010)
4. Stephen Calderini, Nuclear Engineering, (2010)
5. Henry Beghini, mechanical engineering (2008)
6. Federico Bucciarelli, mechanical engineering (2008)
7. Antonio di Giovanni, Aerospace Engineering (2007)
8. Valerio Varricchio, Aerospace Engineering (2007)
9. Ennio Barbaro, Aerospace Engineering (2007)
10. Alessandro Mosca Civil Engineering (2007)

He held the following positions in the past at the Sant'Anna School

- Representative of the Assistant Professors at the Faculty of Experimental Sciences and Applied
- Representative of the PhD students with the Class of Experimental and Applied Sciences
- Representative of the PhD students in the Library Commission of SSSA.

Participation to teaching boards

- Member of the Council of the PhD program of SSSA.
- Member of the PhD in Morphology and function of normal and pathological cells and tissues, in the Department of Human Morphology and Applied Biology, Faculty of Medicine, University of Pisa.
- Member of the Master of Science in Mechanical Engineering for the academic years from 2003-2004 to 2007-2008, Faculty of Engineering, University of Pisa
- Member of the Master of Science in Computer Science Engineering in the academic years from 2008-2009 to 2011-2012, Faculty of Engineering, University of Pisa
- Member of the Master of Science of Biotechnologies from 2008-2009 to 2011-2012, Faculty of Medicine, University of Udine

- Member of the Council of Bachelor Degree in Physiotherapy for the academic years 2008-2009 to 2011-2012, Faculty of Medicine, University of Pisa

Participation to evaluation committees

- Member of jury for admission to the first level of undergraduate courses in Engineering at Scuola Superiore Sant'Anna (since 2007-2008). The committee is charge to prepare the oral and written tests on the basis of which the candidate will be evaluated and selected (national competition)
- Member of jury for admission to the second level of undergraduate courses in Engineering at Scuola Superiore Sant'Anna
- Member of jury for admission to the PhD Program in engineering at Scuola Superiore Sant'Anna
- Member of the internal Boards of profit assessment for undergraduate students of the Scuola Superiore Sant'Anna.

LIST OF PUBLICATIONS

Antonio Frisoli has been author or co-author of the following scientific publications, including articles published in scientific journals, papers in national and international conference proceedings.

Journal publications

- R0. C. Loconsole, A. Frisoli., R. Bartalucci, M. Bergamasco, A new control strategy for on-line active assistance of human arm movement with an active robotic exoskeleton in neurorehabilitation, *Robot and Autonomous Systems, Special Issue on Models and Technologies for Multi-Modal Skill Training* (2012)
- R1. Federico Semeraro, Antonio Frisoli, Claudio Loconsole, Filippo Bannò, Gaetano Tammaro, Guglielmo Imbriaco, Luca Marchetti, Erga L. Cerchiari, Motion detection technology as a tool for cardiopulmonary resuscitation (CPR) quality training, *Resuscitation* (IF 4.17) (2012)
- R2. Antonio Frisoli, Miguel A. Padilla-Castaneda, Silvia Pabon and Massimo Bergamasco, Improving the experience of virtual environments through visuo-tactile-proprioceptive stimulation: a study on virtual body ownership and agency, submitted to *Presence* (IF 1.097) (2012)
- R3. Mónica da Silva Cameirão, Sergi Bermúdez i Badia, Esther Duarte, Antonio Frisoli, and Paul FMJ Verschure, "Neurorehabilitation in chronic stroke patients using the Rehabilitation Gaming System augmented with haptic feedback and orthosis", *Stroke* (IF 5.75) (2012)
- R4. Frisoli, Antonio; Loconsole, Claudio; Leonardis, Daniele; Bannó, Filippo; Fontana, Marco; Bergamasco, Massimo, "A new BCI, gaze and Kinect-based active guidance mode for upper limb robot-aided neurorehabilitation in real world tasks", *Transactions on Systems, Man, and Cybernetics--Part C: Applications and Reviews*(IF 2.105) (2012)
- R5. Rocco Vertechy, Antonio Frisoli, Massimo Bergamasco, Federico Carpi, Gabriele Frediani, Danilo de Rossi, Modelling and experimental validation of buckling dielectric elastomer actuators, *Smart Mater. Struct* (2012),
- R6. Luca Bonfiglio, Umberto Olcese, Bruno Rossi, Antonio Frisoli°, Pieranna Arrighi, Giovanni Greco°, Simone Carozzo, Paolo Andre^, Massimo Bergamasco°, Maria Chiara Carboncini., Cortical source of blink-related delta oscillations and their correlation with levels of consciousness, in *Human Brain Mapping* (IF 5.107) (2012)
- R7. Antonio Frisoli, Caterina Procopio, Carmelo Chisari, Ilaria Creatini, Luca Bonfiglio, Massimo Bergamasco, Bruno Rossi, Maria Chiara Carboncini, "Positive effects of robotic exoskeleton training of upper limb reaching movements after stroke", *Journal of Neuroengineering and Rehabilitation* (IF 2.638) (May 2012)
- R8. Federico Semeraro, Luca marchetti, Antonio Frisoli, Erga L. Cerchiari, Gavin D. perkins, Motion detection technology as a tool for cardiopulmonary resuscitation (CPR) quality improvement, *Resuscitation* 83 (e11-e12) (letter to editor) (IF 4.17) (2012)
- R9. Antonio Frisoli, Massimiliano Solazzi, Dario Pellegrinetti, Massimo Bergamasco, A new screw theory method for the estimation of position accuracy in spatial parallel manipulators with joint clearances, *Mechanism and Machine Theory* 46, 1929–1949 (IF 1.210) (2011)
- R10. Antonio Frisoli, Massimiliano Solazzi, Miriam Reiner, Massimo Bergamasco, The contribution of cutaneous and proprioceptive sensory modalities in haptic perception of orientation, on-line available *Brain Research Bulletin* (IF 2.498) 85(5), 2011
- R11. Sanchez-Vives MV, Spanlang B, Frisoli A, Bergamasco M, Slater M, 2010 Virtual Hand Illusion Induced by Visuomotor Correlations. *PLoS ONE* (IF 4.411) 5(4):

- R12. Filippeschi, A.; Ruffaldi, E.; Frisoli, A.; Avizzano, C.A.; Varlet, M.; Marin, L.; Lagarde, J.; Bardy, B. & Bergamasco, M. "Dynamic models of team rowing for a virtual environment rowing training system, *The International Journal of Virtual Reality* Vol. 4 (8) , pp. 49-56 "(2009)
- R13. Semeraro, Federico - Frisoli, Antonio - Bergamasco, Massimo - Cerchiari, Erga L. Virtual reality enhanced mannequin (VREM) that is well received by resuscitation experts, *Resuscitation* - 80 : 489 - 492 (IF 4.17) (2009)
- R14. Frisoli, A. Montagner, L.i Borelli, F. Salsedo, M. Bergamasco, "A force-feedback exoskeleton for upper limb rehabilitation in Virtual Reality", *Applied Bionics and Biomechanics* 6(2), pp115-126, (2009)
- R15. Walter Aprile, Emanuele Ruffaldi, Edoardo Sotgiu, Antonio Frisoli, Massimo Bergamasco "A dynamically reconfigurable stereoscopic/panoramic vision mobile robot head controlled from a virtual environment" *Visual Computer* 24 (11), pp. 941-946 (IF 0.583) (2008)
- R16. A fingertip haptic display for improving curvature discrimination, Antonio Frisoli, Massimiliano Solazzi, Fabio Salsedo, Massimo Bergamasco, *Presence*, 17 (6) 2008
- R17. Understanding and realizing presence in the presencia project, Mel Slater, Antonio Frisoli, Franco Tecchia, Christopher Guger et al., *IEEE Computer Graphics and Applications*, July-August (IF 1.75) (2007)
- R18. M. Bergamasco, F. Salsedo, M. Fontana, F. Tarri, C.A. Avizzano, A. Frisoli, E. Ruffaldi, S. Marcheschi , "High performance haptic device for force rendering in textile exploration", *Visual Computer* 23 (4), pp. 247-256 (IF 0.583) (2007)
- R19. Carlo Alberto Avizzano, Massimo Bergamasco, Antonio Frisoli, Simone Marcheschi, Jorge Solis, Reactive robot system using a haptic interface: an active interaction to transfer skill from the robot to unskilled persons, *Advanced Robotics* 21(3), (IF 0.653) (2007)
- R20. Antonio Frisoli, Francesco Simoncini, Fabio Salsedo, Massimo Bergamasco, "Kinematic design of a two contact points haptic interface for the thumb and index fingers of the hand" *Journal of Mechanical Design, Transactions of the ASME* 129 (5), pp. 520-529 (IF 0.617) (2007)
- R21. Antonio Frisoli, Antonio Camurri, "Editorial: Special Issue on Multisensory Interaction in Virtual Environments" *Springer Journal of Virtual Reality*, May, 2006, 10(1).
- R22. Massimo Bergamasco Carlo Alberto Avizzano, Antonio Frisoli, Emananuele Ruffaldi Simone Marcheschi, "Design and validation of a complete haptic system for manipulative tasks" *Advanced Robotics* 21 (3-4), pp. 267-291 (IF 0.653) (2007)
- R23. Antonio Frisoli, Luigi Borelli, Massimo Bergamasco, "Modeling biologic soft tissues for haptic feedback with an hybrid multiresolution method", *Stud Health Technol Inform.* 2005;111:145-8.
- R24. A Frisoli, LF Borelli, C Bianchi, E Ruffaldi, G Di Pietro, M Bergamasco C Stasi, M Bellini "Simulation of real-time deformable soft tissues for computer assisted surgery", , *Int. J. Medical Robotics and Computer Assisted Surgery* ISSN: 1478-5951 (paper), 1478-596X (online)Volume: 01 Issue: 01 Pages: 107-113 (IF=1.257) (2004)
- R25. Force-based impedance control of a haptic master system for teleoperation Frisoli A.; Sotgiu E.; Avizzano C.A.; Checcacci D.; Bergamasco M. *Sensor Review*, 6 February, vol. 24, iss. 1, pp. 42-50(9) MCB University Press (IF 0.475) 2004
- R26. J. Gallardo, J. M. Rico, A. Frisoli, D. Checcacci and M. Bergamasco, Dynamics of parallel manipulators by means of screw theory, Pages 1113-1131 , *Mechanisms and Machine Theory*, 38 (11) (IF 1.210) (2003)
- R27. G. Jansson, M. Bergamasco, A. Frisoli, "A New Option for the Visually Impaired to Experience 3D Art at Museums: Manual Exploration of Virtual Copies" , "Visual Impairment Research", Swets & Zeitlinger Publishers (2003), 2(2).

Chapters in edited books

- L1. Massimo Bergamasco, Antonio Frisoli, Carlo Alberto Avizzano, Fabio Salsedo "Haptic devices for the simulation of upper limb in Virtual Reality" in Grasping the Future: Advances in Powered Upper Limb Prosthetics. V. Parenti Castelli & M. Troncossi Eds., Bentham Science Publishers - Open-Access e-book.(2012, in press)
- L2. Antonio Frisoli, "Skills Learning and Rehabilitation Robotics" in Skills Learning and Virtual Environments, edited by M. Bergamasco, B. Bardy, A.R. Carrillo, T. Gutierrez, Menmosyne ISBN 978-88-905767-0-6, July 2011
- L3. Antonio Frisoli, Denis Mottet, Isabelle Laffont, Massimo Bergamasco, "Training platforms for Upper Limb Rehabilitation", in M. Bergamasco, B. G. Bardy, & D. Gopher (Eds.), Skills training in multimodal virtual environments., Taylor & Francis (2012)
- L4. Lugo-Villeda, L., A. Frisoli, E. Sotgiu, G. Greco, and M. Bergamasco, Right-Arm Robotic-Aided-Therapy with the Light-Exoskeleton: A General Overview Emerging Trends in Technological Innovation, L. Camarinha-Matos, P. Pereira, and L. Ribeiro, Editors. 2010, Springer Boston. p. 205-214.
- L5. Robotic assisted rehabilitation in Virtual Reality with the L-EXOS Antonio Frisoli, , Massimo Bergamasco, Maria C. Carboncini, Bruno Rossi in "Advanced Technologies in Neurorehabilitation: Emerging Applications in Evaluation and Treatment" editors Gaggioli, A., Keshner, E., Riva, G, and Weiss, P.L. , IOS PRESS, pages 40-54 ISBN 978-1-60750-438-2
- L6. C.A. Avizzano, A. Frisoli, Bergamasco M.. (2008). Design guidelines for generating force feedback on fingertips using haptic interfaces. In: Human Haptic Perception, Edited by Martin Grunwald, Published by Birkhauser Verlag. ISBN: 978-3-7643-7611-6. June 2008
- L7. Antonio Frisoli, Massimo Bergamasco, Emanuele Ruffaldi, "Haptic Systems: Advanced Haptic Systems for Virtual Reality" in "Virtual Reality, Applications and Tools for Intelligent Manufacturing Systems" ed. By Doru Talaba and Angelos Admitis, Springer 2008
- L8. A.Frisoli, M.Carrozzino, L.Borelli, M.Bergamasco,Chapter 6: "Ambienti Virtuali: applicazioni in medicina e sviluppi tecnologici" (pp. 51-70), Federico Semeraro, "Simulazione, istruzioni per l'uso", IRC Editore, Bologna 2007, ISBN: 978-88-95517-02-5
- L9. Bergamasco M., Frisoli A., Avizzano C.A.. (2007). Exoskeletons as Man-Machine Interface Systems for Teleoperation and Interaction in Virtual Environments. In: Manuel Ferre, Martini Buss, Rafael Aracil, Claudio Melchiorri, Carlos Balaguer. Advances in Telerobotics. (pp. 61-76). ISBN: 978-3-540-71363-0. : Springer.
- L10. A. Frisoli, M. Carrozzino, S. Marcheschi, F. Salsedo, Bergamasco M. (2006). "Haptic systems for simulation of primary commands of cars",. In: "Research in Interactive Design - Proceedings of Virtual Concept 2005" di Xavier Fischer, Daniel Coutellier (vol. XV). ISBN: 2-287-28772-8. : Springer Editions.
- L11. Bergamasco M., S. Perotti, C.A.Avizzano, M. Angerilli M. Carrozzino, G.Facenza, A. Frisoli (2006). "Fork Lift truck simulator for training in industrial environments". In: "Research in Interactive Design Proceedings of Virtual Concept 2005" di X. Fischer, D. Coutellier. (vol. XV). ISBN: 2-287-28772-8. : Springer Editions, 2006.
- L12. Editor of the CD proceedings of the "2nd International Conference on Enactive Interfaces" ENACTIVE 2005 conference, Genoa, November 17-18,2005
- L13. Frisoli, S-L. Wu, E. Ruffaldi, M. Bergamasco "Evaluation of multipoint contact interfaces in haptic perception of shapes" in "Multi-point Interaction with Real and Virtual Objects", Series: Springer Tracts in Advanced Robotics, Vol. 18, Barbagli, Federico; Prattichizzo, Domenico; Salisbury, Kenneth (Eds.) 2005, Approx. 280 p., Hardcover, ISBN: 3-540-26036-6

- L14. Frisoli, M. Bergamasco, M. Radesca, "Il Museo delle Pure Forme" in "Arte trazione e contemplazione. L'interattività nelle ricerche artistiche." A cura di Silvana Vassallo, Andreina Di Brino, Edizioni ETS (2004)
- L15. Frisoli, M. Bergamasco, "Hamiltonian formulation of the constrained dynamics of a tendon driven parallel mechanism", ROMANSY 14 Theory and Practice of Robots and Manipulators: Proceedings of the Fourteenth Cism-IFTOMM Symposium, Bianchi, Giovanni; Guinot, Jean-Claude; Rzymkowski, Cezary (Eds.), XXI,, Hardcover, ISBN: 978-3-211-83691-0 (2002)
- L16. A. Frisoli, D. Checcacci, F. Salsedo, Bergamasco M. Synthesis of Translating in-parallel Actuated Mechanisms by Screw Algebra. In: J. Lenarcic AND M.M. Stanisic Recent Advances in Robot Kinematics. (pp. 433-440). LONDON: Kluwer Academic Publishers (UK), ISBN 0-7923-6426-0, (2000)

Abstracts in scientific journals

- Umberto Olcese, Luca Bonfiglio, Giovanni Greco, Simone Carozzo, Antonio Frisoli, Maria Chiara Carboncini, Pieranna Arrighi, Paolo Andre, Massimo Bergamasco and Bruno Rossi , "Source localization of blink-related delta activity in the resting-state EEG", Human Brain Mapping 2010
- Frisoli, A., Ruffaldi, E., Filippeschi, A., Avizzano, C.A., Vanni, F., Bergamasco, M. "Indoor skill training in rowing practice with a VR based simulator" International Journal of Sport Psychology 41 (4 SUPPL.) , pp. 14-16 (2010)
- "Virtual reality prototype in healthcare simulation training", Resuscitation, Volume 77, Supplement 1, May 2008, Pages S60-S61, F. Semeraro, M. Bergamasco, A. Frisoli, M. Holtzer, E.L. Cerchiari
- Stasi C., Frisoli A., Bellini M., Taddei S., Costa F., Biagi S., Mumolo M.G., Ricchiuti A., Marchi S. Increased levels of neuropeptide Y in patients with irritable bowel syndrome. Dig Liver Dis, 2006
- Stasi C, Bellini M, Taddei S, Favilla S, Frisoli A., Costa F, Biagi S, Mumolo MG, Ricchiuti A, Bruno RM, Orlandelli E, De Risio S, Marchi S. Uncoupling of the hypothalamic-pituitary-adrenal and hypothalamic autonomic nervous system axes in irritable bowel syndrome, Digestive and liver disease (2005)

Conference proceedings

0. R. Verthey, A. Frisoli, M. Bergamasco et al., An Interaction-Torque Controller for Robotic Exoskeletons with Flexible Joints: Preliminary Experimental Results, IROS 2012
1. C. Lo console, A. Frisoli, M. Bergamasco et al., A new Kinect-based guidance mode for upper limb robot-aided neurorehabilitation, IROS 2012
2. M. Solazzi, D. Pellegrinetti, P. Tripicchio, A. Frisoli, M. Bergamasco, Dynamical Modeling of an Encountered Haptic Interface for Impact and Catching Tasks Simulation, Eurohaptics (2012)
3. A. Frisoli, E. Sotgiu, C. Procopio, M. Bergamasco, C. Chisari, G. Lamola, B. Rossi, Training and assessment of upper limb motor function with a robotic exoskeleton after stroke, BioRob 2012
4. D. Leonardis, Antonio Frisoli, Michele Barsotti, Nicola Vanello, Massimo Bergamasco, A comparison of algorithms for motor imagery BCI under different sensory feedback conditions, BioRob 2012
5. M. Banitalebi Dehkordi , A. Frisoli , E. Sotgiu and M. Bergamasco, A New Algorithm for Gravity Compensation of a 3-UPU Parallel Manipulator, submitted to RoMansy 19th CISM-IFTOMM Symposium on Robot Design, Dynamics, and Control 2012

6. B. Lenzo, A. Frisoli, F. Salsedo and M. Bergamasco, An Innovative Actuation Concept for a New Hybrid Robotic System, submitted to RoMansy 19th CISM-IFTToMM Symposium on Robot Design, Dynamics, and Control 2012
7. A. Frisoli, C. Chisari, E. Sotgiu, C. Procopio, M. Fontana, B Rossi, M. Bergamasco, Rehabilitation training and evaluation with the L-EXOS in chronic stroke , submitted to ICOST 2012 10th International Conference On Smart homes and health Telematics, (2012)
8. D. Leonardis, A. Frisoli, M. Solazzi, M. Bergamasco, Illusory perception of arm movement induced by visuo-proprioceptive sensory stimulation and controlled by motor imagery, Haptic Symposium (2012)
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Dr. Anthony Frisoli declares under his sole responsibility that everything stated is true according to the rules of artt.46 DPR445/2000.

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Sincerely,

Pisa, March 1st , 2012

Dott. Antonio Frisoli