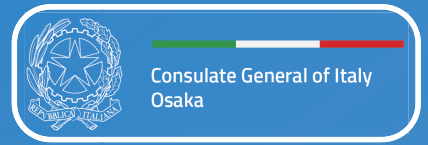


PROGRAM



International Symposium on Robotics Humanity and Healthcare: linking Italy and Japan in view of Expo2025 Osaka

June 21 (Fri) 2024 09:30-18:00

at Kansai Medical University (Katano Auditorium / KMU Tower)

The symposium provides the opportunity for sharing Italy and Japan's knowledge and latest research on robotics, with its expansion and extraordinary potential in the field of healthcare. Integrating innovative robotic technology into healthcare services provision can greatly boost healthcare system's performance and help catering the needs of elderly population, especially in countries like Italy and Japan which have to face the challenges of aging societies. Concurrently, service robotics can provide solution for mobility, automation and testing. The symposium also contributes to the overall goal of Expo 2025 Osaka "Designing future societies for our lives", thus providing a chance for Italy and Japan to actively foster international cooperation in academic research, in a joint effort to deliver innovative solutions to the challenges of the next decades.

本シンポジウムは、ヘルスケアの分野におけるロボット工学の広がりとその多大な可能性について日伊の知見と最新の研究を共有する機会を提供するものです。革新的なロボット技術をヘルスケアサービスの提供に取り入れることにより、ヘルスケアシステムのパフォーマンスを著しく向上させ、特に高齢化社会が抱える課題に直面するイタリアや日本のような国々における高齢者のニーズに応えることが可能となるでしょう。同時に、サービスロボティクスは、モビリティ、オートメーション、テストのためのソリューションを提供することができます本シンポジウムは、2025年大阪万博のテーマ「いのち輝く未来社会のデザイン」にも寄与するもので、イタリアと日本が今後数十年の間に立ち向かう課題への革新的な解決策を導き出すための共同研究を通し、学術研究上の国際協力を積極的に後押しする機会を提供します。



Consulate General of Italy
Osaka



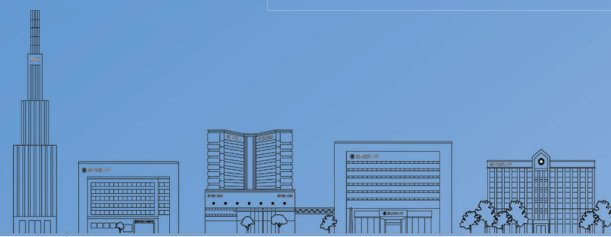
関西医科大学
KANSAI MEDICAL UNIVERSITY



Politecnico
di Torino



PoliTO
JapanHub



Timetable

9:00-
KMU Tower 1F

Reception Opens

9:30-11:00
KMU Tower 3F

Morning Session - Presentations from companies on robotics and healthcare

■ Moderators

Giuseppe QUAGLIA (Professor, Politecnico di Torino)

Masaharu KOMORI (Professor, Kyoto University)

Daisuke MATSUURA (Specially Appointed Associate Professor, Tokyo Institute of Technology)

■ Speakers

Fabio DALLA LIBERA (Robotics Promotion Office, Panasonic Holdings Corporation)

"Development of an Autonomous Mobile Robot Platform for Urban Environments"

Robert FUCHS (JTEKT Corporation)

"Pairdriver Steering Collaborative Control for Automated Driving"

Tetsuya KUBOTA (Kawasaki Heavy Industries, Ltd.)

"Battle Against the COVID-19 Pandemic With the Robotic PCR Testing System"

Tatsuya YOSHIMOTO (KOBELCO)

"Automatic Welding Technology Using Weld Pool Image Recognition"

Kenfa MATSUMOTO (Shimazu Corporation)

"Robots in the analytics industry"

Lorenzo SABAINI (ALBA Robot SRL)

"Personal Mobility Robots for All"

Hiroyuki ISHII (Waseda University)

"Robotics for sustainable well-being: from teeth brushing robot to balloon robot for performing arts"

Lunch Break

13:00-13:20
Katano Auditorium

Welcome Greetings

Koichi TOMODA (President Emeritus, Director of the Center for Global Engagement, Kansai Medical University)

Opening Remarks

H.E. Gianluigi BENEDETTI (Ambassador of Italy to Japan)

Stefano Paolo CORGNATI (Rector, Politecnico di Torino) -Video

Tatsuo KINASHI (President, Kansai Medical University)

Alberto SAPORA (Vice Rector, Politecnico di Torino)

Master of Ceremony: Giuseppe PEZZOTTI (Guest Professor, Kansai Medical University)

Photo Session

13:20-15:20
Katano Auditorium

Keynote Lectures

■ Moderators

Masaharu KOMORI (Professor, Kyoto University)

Kimitaka HASE (Professor, Kansai Medical University)

■ Speakers

Giuseppe QUAGLIA (Professor, Politecnico di Torino)

"Service Robots: global trends and prototypes for health care, rehabilitation, disability"

Marco CECCARELLI (Professor, University of Roma Tor Vergata)

"Experiences and challenges in medical devices for elderly people"

Kenjiro TAKEMURA (Professor, Keio University)

"Ultrasonic Actuation Enhances Cell/Tissue Engineering"

Tomoyuki NODA (Senior Researcher, Advanced Telecommunications Research Institute International)

"Enhancing Tailor-made Neurorehabilitation with Compliant AI-driven Exoskeletons"

Q&A

Closing Remarks

Marco PRENCIPE (Consul General of Italy in Osaka)

Coffee Break

Timetable

16:00-16:55

Katano Auditorium

Symposium 1

“New robotic technologies for health care, rehabilitation, disability and aging society

■ Moderators

Marco CECCARELLI (Professor, University of Roma Tor Vergata)

Koji OHATA (Professor, Hokuriku University)

■ Speakers

Koji OHATA (Professor, Hokuriku University)

Kimitaka HASE (Professor, Kansai Medical University)

Tomofumi YAMAGUCHI (Professor, Kyoto University)

Jun NAKAYAMA (Lecturer, Kansai Medical University)

Yuko ISHIZAKI (Professor, Kansai Medical University)

Kiyoshi HAYAKAWA (Professor, Osaka Metropolitan University College of Technology)

Break

17:00-18:00

Katano Auditorium

Symposium 2

“Challenging applications of service robotics for Humanity and Healthcare”

■ Moderators

Stefano PASTORELLI (Professor, Politecnico di Torino)

Daisuke MATSUURA (Specially Appointed Associate Professor, Tokyo Institute of Technology)

■ Speakers

Stefano PASTORELLI (Professor, Politecnico di Torino)

Masaharu KOMORI (Professor, Kyoto University)

Daisuke MATSUURA (Specially Appointed Associate Professor, Tokyo Institute of Technology)

Akio YAMAMOTO (Professor, University of Tokyo)

Luigi TAGLIAVINI (PhD, Politecnico di Torino)

Award Ceremony

18:10-19:30

Cafeteria 4F

Networking

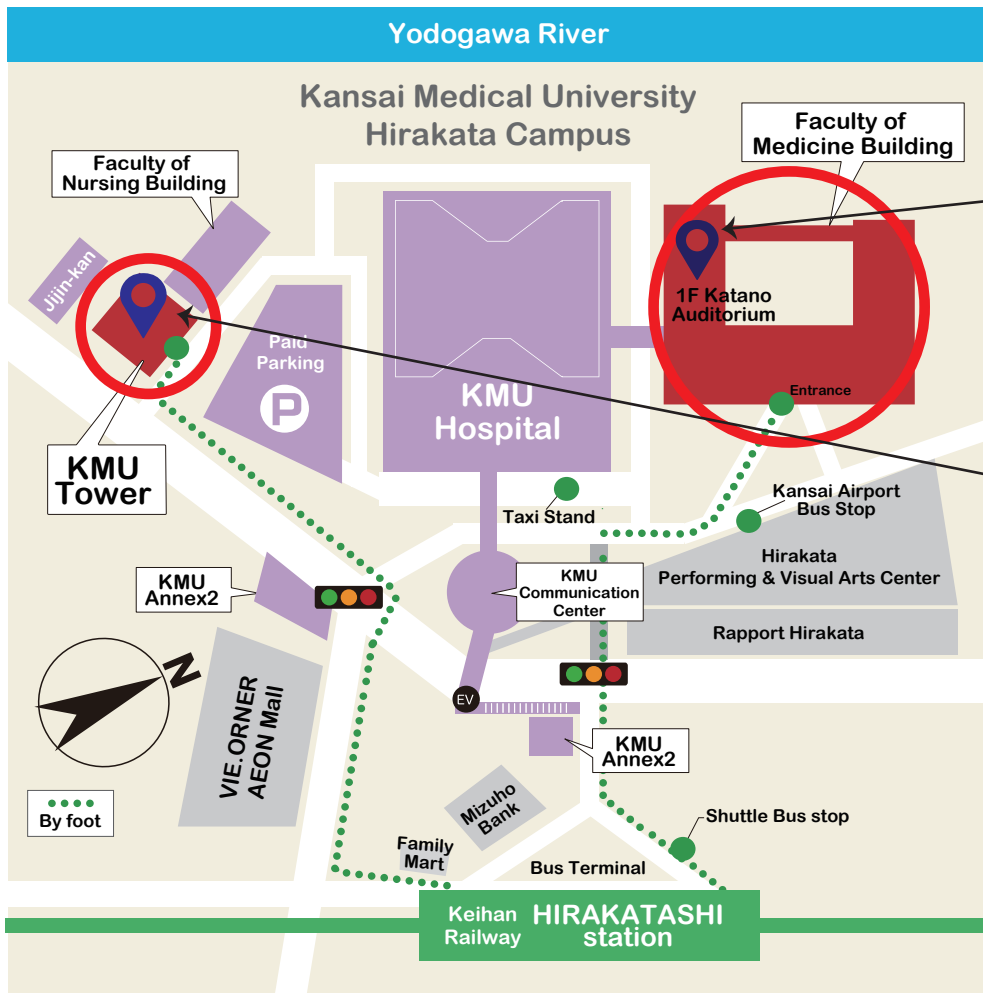
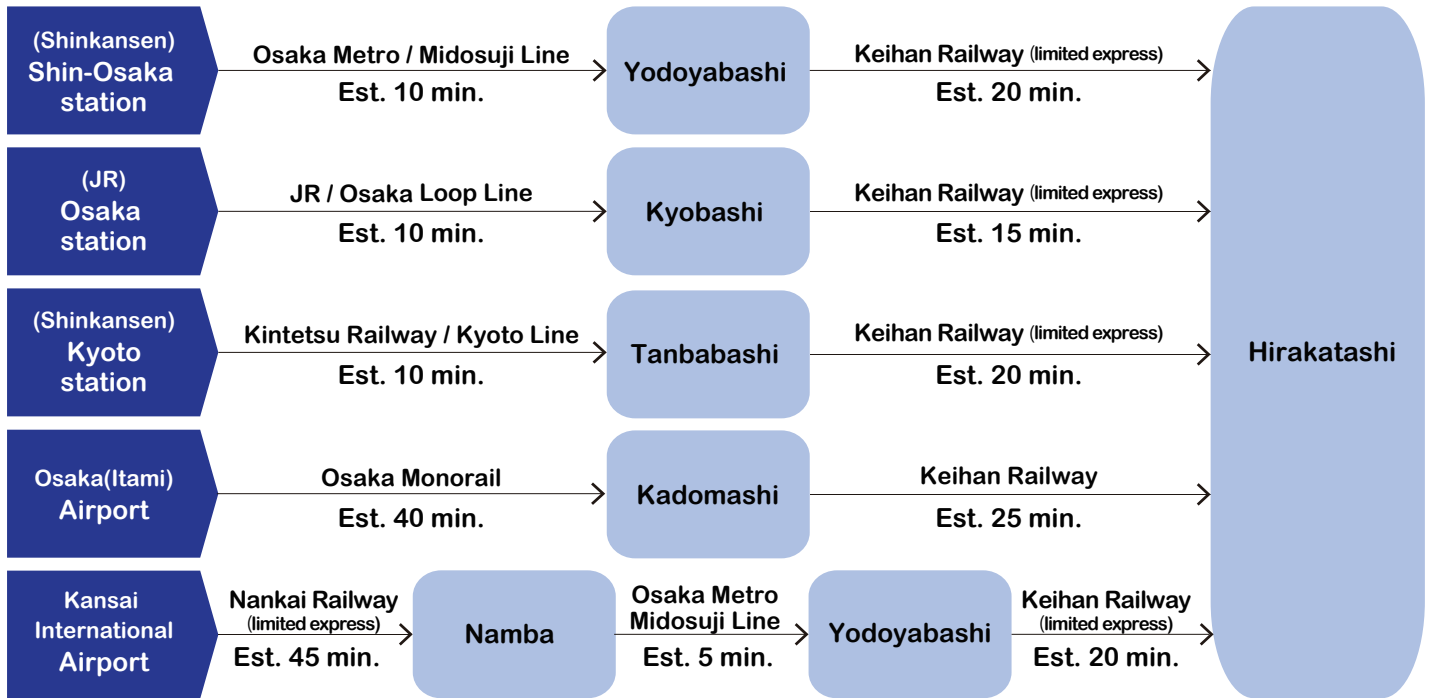
Access

Kansai Medical University Hirakata Campus

2-5-1 Shinmachi, Hirakata, Osaka 573-1191

5 mins walk from Hirakatashi station (Keihan Railway)

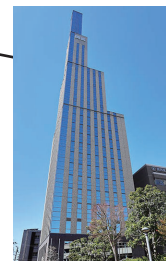
* The route is an example.



Katano Auditorium
Kansai Medical University
Faculty of Medicine Building 1F



KMU Tower (KMU Hotel)



google map
to KMU



Abstract collection of International Symposium on Robotics for Humanity and Healthcare: linking Italy and Japan in view of Expo2025 Osaka

Keynote lectures

Giuseppe QUAGLIA (Professor, Politecnico di Torino)	1~2
Marco CECCARELLI (Professor, University of Roma Tor Vergara)	3~4
Kenjiro TAKEMURA (Professor, Keio University)	5~6
Tomoyuki NODA (Senior Researcher, Advanced Telecommunications Research Institute International)	7~8

Symposium ① “New robotic technologies for healthcare, rehabilitation, disability and aging society

Koji OHATA (Professor, Hokuriku University)	9
Kimitaka HASE (Professor, Kansai Medical University)	10
Tomofumi YAMAGUCHI (Professor, Kyoto University)	11
Jun NAKAYAMA (Lecturer, Kansai Medical University)	12
Yuko ISHIZAKI (Professor, Kansai Medical University)	13
Kiyoshi HAYAKAWA (Professor, Osaka Metropolitan University College of Technology)	14

Symposium ② “Challenging applications of service robotics for Humanity and Healthcare”

Stefano PASTORELLI (Professor, Politecnico di Torino)	15
Masaharu KOMORI (Professor, Kyoto University)	16
Daisuke MATSUURA (Specially Appointed Associate Professor, Tokyo Institute of Technology)	17
Akio YAMAMOTO (Professor, University of Tokyo)	18
Luigi TAGLIAVINI (PhD, Politecnico di Torino)	19

Morning Session

Hiroyuki ISHII (Professor, Waseda University)	20
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Prof. Giuseppe Quaglia
CURRICULUM VITAE

**Affiliation**

Politecnico di Torino
Department of Mechanical and Aerospace Engineering
Corso Duca degli Abruzzi 24, 10129 Torino, Italy



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giuseppe.quaglia@polito.it

Giuseppe Quaglia, Master of Science's Degree in Mechanical Engineering, rating 110/110 cum Laude and PhD in Applied Mechanics, in 1994 entered the role of researcher, at the Department of Mechanics of the Politecnico di Torino, where he became Associate Professor in 2003 and Full Professor in 2018 (Academic Recruitment Field "09/A2 Meccanica Applicata alle Macchine", Academic Discipline "ING-IND/13 Meccanica Applicata alle Macchine")

1. Scientific Activity

The scientific activity of prof. Giuseppe Quaglia, is characterized by a significant number of topics, listed in the following:

Service robotics for healthcare, agriculture, search and rescue, Inspection; Mechatronics; automation, actuators and mechanisms; Device for disabled people and biomedical applications; Energy saving, renewable energy and sustainability; Vehicle dynamic and systems; Appropriate technologies and systems for sustainable human development.

2. Teaching activity

Prof. Quaglia had the formal responsibility of 59 Master of science and Bachelor of science courses related to Mechanics of machines, Mechanics of automatic machines, Mechatronics, Applied Mechanics, Mechanical system control. He is faculty advisor of ISAAC student Teams.

2. Coordination of research and technology transfer groups and projects

Prof. Quaglia coordinated many research activities of research groups "Robotic and automation", being a tutor of several PhD students. He is also member of the Management Board of "Politecnico Interdepartmental Center for Service Robotics" (PIC4SeR), Politecnico di Torino.

He was the winner of three "Proof of Concept" call, devoted to technology transfer projects related to disable people: an electric wheelchair named wheelchair.q for disable capable of overcoming architectural barriers; a manual wheelchair, named "handwheelchair.q", with innovative transmission system, to increase the mobility of the user and for sports practice; an electrical wheelchair, named Moviewe.q, with omnidirectional mobility.

Moreover he had the scientific responsibility of competitive National and International research projects, awarded through a peer-review process.

Prof. Quaglia was responsible for the following research projects between the Politecnico di Torino and the companies:

Texa automotive testing s.r.l., C.F. Gomma, SKF Industrie s.p.a., m.t.m. srl, Carmec s.r.l., Freudenberg Sealing Technologies sas, Corcos, EDISON S.p.A., Alba robot.

The results of applied research and technological transfer are evidenced by the presence of 16 patents, indicating the originality and innovative nature of the research activity. Some of them have been developed during research activities in collaboration with companies and/or extended internationally.

3. National and international reputation and professional activity for the scientific community

- Deputy chair of IFToMM Italy, Member Organization of IFToMM (International Federation for the Promotion of Mechanism and Machine Science)
- Chair of IFToMM Technical Committee for Sustainable Energy Systems
- Chair of CDG1 Securing our Future Environment – Air, Water, Energy
- Chair of working group Sustainability of I-RIM, Institute for Robotic and Intelligent Machines
- Member of SIRI council, (Italian Association of Robotics and Automation)
- Member of IFToMM Technical Committees for Robotics and Mechatronics, and for Linkages and Mechanical Controls
- Member of ASME

4. Prizes and awards:

- Best paper award, IFIT2016 international conference;
- IMECE 2016 Certificate of Appreciation
- First prize in the technical paper, IHTC 2017, International Humanitarian Technology Conference.
- 2017 Mechanism and machine theory award for outstanding contribution in peer review
- 2018 best application paper award RAAD 2018 (wheelchair_q)
- 2018 best student paper award IFIT 2018 (handwheelchair_q)
- 2019 best research paper award IFToMM World Conference 2019 (agri_q)
- 2019 SPRINGER best research paper award on the History of MMS, IFToMM World Conference
- 2019 finalist young investigator fund best paper award 2nd JC-IFToMM symposium
- 2020 Bronze Student Award IFIT 2020
- 2021 3rd International Jc-IFToMM symposium, Best Paper Award finalist
- 2021 I4SDG Gold Best Student Paper Award
- 2022 Best_Contribution_Award student RAAD 2022
- 2023 Silver Award_Student_I4SDG 2023
- 2023 Best paper award IFToMM World Conference
- 2024 Bronze research paper award ISRM 2024

5. Institutional offices and roles in Italian Universities

- Member of the Academic Senate of the Politecnico di Torino as a representative of the professors of the "II Fascia" for two mandates (2012-2015), (2015-2019), "I fascia" (2019-2020);
- Deputy Dean of the First Faculty of Engineering of the Politecnico di Torino, for System Logistics and Teaching Procedures (2006-2012);
- Delegate of the Rector of the Politecnico di Torino for the organizational and logistical aspects (2010-2012);
- Coordinator of Field Inclusion and Equal Opportunities (2020-)
- Deputy chair of the D.O.T. Foundation Donation of organs and transplants.
- Member of the PhD School of Mechanical Engineering of the Politecnico di Torino (2005-); Member of the Didactic Management Management Committee of the Politecnico di Torino (2005-2009); Member of the Teaching Committee of the Department of Mechanics of the Politecnico di Torino (2001-2012); Member of the Board of the Department of Mechanics of the Politecnico di Torino (2006-2008) Member of the interdepartmental council of CESAL (Politecnico di Torino, campus of Alessandria, 2003-2007).- Member of the Technical Committee of CESMO (Politecnico di Torino, campus of Mondovi, 2007-2009)

International Symposium
Robotics for Humanity and Healthcare in Italy and Japan
Friday 21 June 2024, Osaka, Japan



Abstract title: Service Robots: global trends and prototypes for health care, rehabilitation, disability

Name: Giuseppe Quaglia

Role:

- Coordinator of Field Inclusion and Equal Opportunities at Politecnico di Torino
- Member of Interdepartmental Center PIC4SeR - PoliTO Interdepartmental Centre for Service Robotics management board
- Member of SIRI board (Italian Association for Robotic and Automation)
- Member of I-RIM (National Institute for Robotics and Intelligent Machines)

Institution: Politecnico di Torino

Abstract:

Technology has always been at the service of human beings, and the keynote will show how robotics developed in Italy and Japan can be an extraordinary tool at the service of humanity. Italy and Japan are leading countries in the world of robotics, and they contribute from the born of this field is shown by the fact that SIRI (Italian Association of Robotics and Automation) was founded in Italy in 1975 and is the second association in the world after JARA (Japan Robot Association). A first part of the keynote will provide an overview of Service Robotics, presenting its application sectors and the data processed by the IFR, International Federation of Robotics, regarding current status and forecasts. Subsequently, a focus on the robotics for healthcare will be dedicated to illustrating some challenges and the results obtained in the research laboratories of the Politecnico di Torino. Devices for the rehabilitation of the hand, of the wrist, and for weight reduction of obese people will be presented. Solutions for the mobility of people with disabilities, aimed at guaranteeing full autonomy in daily life, both indoors and outdoors, and also at overcoming architectural barriers such as stairs and sidewalks will be described. Finally, there will be a focus on manual wheelchairs developed for people with disabilities, to guarantee them an active life and also the possibility of carrying out sporting activities.

BIOGRAPHICAL NOTES of MARCO CECCARELLI

Updated: February 2024



prof. Marco Ceccarelli
 LARM2: Laboratory of Robot Mechatronics
 Dept of Industrial Engineering
 University of Rome Tor Vergata,
 Via del Politecnico 1, 00133 Rome, Italy
 Phone +39-333-4479314 marco.ceccarelli@uniroma2.it

Marco Ceccarelli was born in Rome in 1958. He received the mechanical engineer degree cum laude in 1982 at the University “La Sapienza” of Rome. At the same University he received a Ph.D. degree in Applied Mechanics in 1987. In 1987 he was visiting scholar at Stanford University, U.S.A., and in 1990 he received a CNR-NATO annual grant as visiting professor at the Technical University of Valencia, Spain. Since 1990 he teaches courses on Mechanics of Machinery and Mechanisms, and Mechanics of Robots at Cassino University, and from September 2018 in University of Rome Tor Vergata. Since 1996 up to 2018 he was Director of LARM, the Laboratory of Robot Mechatronics at the University of Cassino and South Latium and since 2019 he is Director of LARM2, the Laboratory of Robotics and Mechatronics in University of Rome Tor Vergata. Since 2001 he is Full Professor of Mechanics of Machinery and Mechanisms at Cassino University. From 2003 to 2005 he has been Vice Director of DiMSAT Department. Since March 2019 he is full Professor in University of Rome Tor Vergata, Italy.

He is ASME fellow (The American Society of Mechanical Engineers) and member of AEIM (Spanish Society of Mechanical Engineers), IFToMM Italy (Italian Association of MMS), IEEE (the Institute of Electrical and Electronics Engineers), IFAC (International Federation of Automation and Control), FeIBIM (Iberoamerican Federation for Mechanical Engineering), AISI (Italian Society for the History of Engineering), GMA (Italian Group for Mechanics of Machinery).

From 1998 to 2004 he has been Chairman of the Permanent Commission for History of Machine and Mechanism Science of IFToMM, the International Federation for the Promotion of Machine and Mechanism Science, and currently he is still a member. Since 1999 he is also member of the IFToMM Technical Committee for Mechatronics and Robotics. He has been member of IFToMM TC for Computational Kinematics. He has been Chairman of the Commission for Mechatronics of FeIBIM, Federaciòn Iberoamericana de Ingenieria Mecànica until 2016. In 2008-09 and 2014-16 he has been Coordinator of the Scientific Committee for RAAD, International Workshops on Robotics in Alpe-Adria-Danube Region being member since 1995. From 2002 to 2018 he has been founder Chairman of the Scientific Committee of MUSME, IFToMM-FeIBIM International Conference on Mechatronics and Multibody Systems. Since 2010 is founder Chairman of the Scientific Committee of MEDER, IFToMM International Conference on Mechanism Design for Robots. He is member of scientific Committees for several other international conferences, like, Romansy, CK, SYROM, EUCOMES, ASIAN MMS, MetrApp, MESROB; in 2008-2015 he has been associate editor for the Journal Mechanics Based Design of Structures and Machines, he is associate editor for International Journal of Mechanics and Control, Chinese Journal of Mechanical Design (Europe editor), and Journal Advanced Robotic Systems (editor-in-chief for Service Robotics), Int. Journal of Mechanisms and Robotic Systems, Frontiers of Mechanical Engineering, MDPI Robotics (editor-in-chief), and many others; he has served as associated editor for Mechanism and Machine Theory; he has served and serves as reviewer for several international conferences and journals; he has served and serves as reviewer for national and international projects for Italian and foreign agencies. In 2015-16 he has been member of GEV the Italian commission for the research evaluation and since 2012 member AVA for University evaluation. He has been invited as visiting professor in institutions of several countries and has given invited lectures and short courses in many countries at conference events, celebration events, or within regular courses. He has carried out consulting activity for companies and in industrial plants on problems regarding with Automation and Robotics. He has been the founder and then Scientific Editor for all the Proceedings of HMM 2000-2024 International Symposium on History of Machines and Mechanisms. He has been Chairman for HMM 2000 and 2004 that have been held in Cassino. He has been the co-founder of MUSME, the IFToMM-FeIBIM Symposium on Multibody Systems and Mechatronics. He has been Co-Chairman for MUSME in 2002 in Mexico City, in 2005 in Uberlandia, Brazil, in 2008 in San Juan, Argentina, in 2011 in Valencia, Spain and in 2014 in Huatulco, Mexico. He has been Chairman for RAAD Workshops held in Cassino in 1997 and 2003. He has been Chairman for CK2005, IFToMM International Workshop on Computational Kinematics that has been held in Cassino in 2005. He has been co-founder of EUCOMES, the European conference on Mechanism Science and he has been Chairman for the second event held in Cassino in 2008. He is the Scientific Editor of a Book Series on History of Mechanism and Machine Science published by Springer since 2007. In 2007 he has edited ‘Distinguished Figures in MMS – Part 1’ published by Springer in the above-mentioned book series and he has also editor again for the Part 2, 3, 4, and 5. He is Scientific Editor of a Book Series on Mechanism and Machine Science published by Springer since 2010. He has co-authored the book ‘A short Illustrated History of Machines’ published at Technical University in Madrid in 2008 with a revised version published by Springer in 2010. In 2008 he edited the book ‘Robot Manipulators’ published by I-Tech Education Publishing KG in Wien. In 2012 he edited the book ‘Service Robots and Robotics’ published by IGI-Global. In 2015 he co-edited two ASME books on ‘Design and prototypes of Mobile Robots’. In 2018 he coedited the Elsevier book ‘Design and operation of human-like locomotion systems. He has written the book ‘Fundamentals of Mechanics of Robotic Manipulation’ published by Kluwer/Springer in 2004 with second extended edition in 2023. Together with prof Carlos Lopez-Cajùn he has written the book ‘Mecanismos – Fundamentos cinematicos para el diseno y optimizacion de maquinaria’ published by Trillas Publisher in Mexico in 2008 with second edition in 2014. He also edited or co-edited books as proceedings of several other conferences. With LARM team he has conceived and developed several algorithms and systems, like ring formula for workspace determination, design formulation for circular-arc cams, CAPAMAN manipulator, LARM Hand, CATRASYS, CALOWI, LARM Rickshaw robot, LARM Hexapod, LARM clutched arm, Cassino Hexapod, Surveybot, leg exoskeletons, CADEL, Space astronaut robot TORVEASTRO, Exoskeleton Finger, LARMbot humanoid, Heritagebot Platform, Medical devices as robotic wheelchair, RESPIRholter, sensed rib retractor, and rib fixator, with patent releases, experimental characterizations and prototype results. He has also worked out findings and interpretations in the History of Mechanical Engineering, like on Screw Theory by Giulio Mozzi, History of IFToMM, and on personalities like Lorenzo Allievi, Giuseppe Antonio Borgnis, Francesco di Giorgio, and Vitruvius.

In November 2003 he has received the Degree of Doctor Honoris Causa in Mechatronic Engineering from UNI, National University of Lima, Perú; in May 2009 he received Honoris Causa Degree in Engineering from Technical University of Kursk, Russia; in October 2009 he received Honoris Causa Doctor Degree in Engineering from Technical University of Brasov, Romania; in April 2010 he received Honoris Causa Doctor Degree in Engineering from University of Craiova, Romania, as recognizing his academic and scientific career, and his support to the activity. In 2021. He has also received the 2010 Engineer-Historian Award of the American Society of Mechanical Engineers (ASME) for his lifelong involvement in mechanical engineering, specifically the history of machines and mechanisms. He received Dedicated Service Award for his career from IFToMM Italy in September 2020 and from AEIM Spanish society in 2021. In 2023 he was granted of IFToMM Honorary Membership by the IFToMM General Assembly. He is 2017-2020 member of ASME committee National Inventors Hall of Fame and member 2019-2023 of ASME HHC History Heritage Committee. He has been Coordinator of the Commission for Research of GMA, Italian National Group for Mechanics of Machinery for the period 2002-2006. He has been elected Secretary-General of IFToMM for the term 2004-2007. He has been elected President of IFToMM for the term 2008-2011 and again in 2016-2019 since his IFToMM leadership with different positions since 1998.

His research interests cover aspects of Machine and Mechanism Science (MMS) and Mechanics of Robots. Specific subjects of his interest are Analysis and Design of Workspace and Manipulation; Mechanical Design of Manipulators, Legged Robots; Service Robotics, Medical Devices, Grippers and Hands; Mechanics of Grasp; History of MMS; and Mechanism Design. He is author or co-author of more than one thousand papers, which have been presented at Conferences or published in national and international journals. His publication impact is with Scopus H= 33.

More information at the web page: LARM2 webpage: <https://larm2.ing.uniroma2.it/marco-ceccarelli/>

International Symposium on Robotics

Friday 21 June 2024, Osaka, Japan



Abstract title: *Experiences and challenges in medical devices for elderly people*

Name: *Marco Ceccarelli*

Role: *professor, director of LARM2: Laboratory of Robot Mechatronics*

Institution: *University of Roma Tor Vergata, Rome, Italy*

Abstract:

Challenges in Mechanism Design for robotic systems as assisting medical devices can be considered from several viewpoints in technical, social, and financial ones as new emerging service field referring specifically to elderly people. In this keynote main issues are discussed in terms of Innovation aspects coming from Mechanism Design addressing needs and requirements for surgical assistance and motion assistance of elderly people. The discussed challenging aspects are related to the mechanical structure and operation of motion assistance when considering tasks in rehabilitating or helping elderly people in motion autonomy. The lecture presents aspects emphasizing the role of Mechanism Design in developments of medical devices since the action in performing tasks, either in coordination or not with nursery operators, is of mechanical nature due to motion and force transmission goals of motion assistance. The challenges are presented in terms of technical solutions and community activity, since they depend, impact, and generate on each other. Examples of solutions are presented from the experience of the speaker team to show how a mechanism design can be determinant for device conception and community developments. Activities at LARM2 in Rome are outlined on topics and systems as illustrative examples from direct experience of the speaker.

KENJIRO TAKEMURA, Ph.D.**Professor****Department of Mechanical Engineering****Keio University**

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Tel: +81 45 566 1826

takemura@mech.keio.ac.jpwww.takemura.mech.keio.ac.jp**Education**

09/2002 PhD (Integrated Design Engineering), Keio University, Japan

03/2000 MSc (Biomedical Engineering), Keio University, Japan

03/1998 Bachelor of Engineering (Mechanical Engineering), Keio University, Japan

Appointments Held

06/2019-03/2020 Visiting Scholar, Department of Mechanical and Aerospace Engineering, UC San Diego

04/2019-present Professor, Department of Mechanical Engineering, Keio University

04/2012-03/2019 Associate Professor, Department of Mechanical Engineering, Keio University

04/2008-03/2012 Assistant Professor, Department of Mechanical Engineering, Keio University

07/2006-08/2006 Visiting Research Scientist, Faculty of Engineering, Monash University

04/2003-03/2008 Assistant Professor, Precision and Intelligence Laboratory, Tokyo Institute of Technology

04/2002-03/2003 Research Associate, Department of Mechanical Engineering, Keio University

04/2001-02/2002 Research Fellow, Japan Society for the Promotion of Science

Research Leadership

K. Takemura is a director of the Micro/Nano-Mechatronics Laboratory at the Department of Mechanical Engineering, Keio University. He has supervised more than 75 graduate students and 4 postgraduate students in his laboratory since 2008, most of which have gone on to promising careers in industry worldwide. Currently, he supervises 5 undergraduate students and 11 graduate students. He is currently collaborating with 3 companies based on various [research outcomes](#) from his research.

International Symposium on Robotics

Friday 21 June 2024, Osaka, Japan



Abstract title: *Ultrasonic Actuation Enhances Cell/Tissue Engineering*

Name: Kenjiro Takemura, PhD

Role: Professor

Institution: Keio University

Abstract:

One of the common challenges in Japan and Italy is a rapidly growing aging society: Japan ranks 1st and Italy 2nd for the elderly ratio for 2023. Regenerative medicine, for instance, is one of the promising measures to tackle this challenge to make as many people live healthily as possible, just like in the *Blue Zones* as Sardinia and Okinawa. Given the possibility of not only regenerative medicine but also biotech products in the pharmaceutical industry, we aim to contribute to cell and tissue engineering by taking a robotic approach. This talk briefly introduces our contributions to *in-vitro* cell development (procuring components) and *in-vitro* tissue formation (assembly) using *ultrasonic actuation technology*.

A reliable *in-vitro* cell culture is conducted in a culture dish/flask to obtain a sufficient number of cells. One of the bottlenecks for the automation of the entire culture process is the cell detachment process. For this, we have introduced an enzyme-free ultrasonic cell detachment technique to obtain quality cells without requiring manual procedures. Tissue formation, such as spheroid fabrication, is also enhanced by using ultrasonic trapping technology. We can make a mm-scale cell aggregation floated in a culture medium in 10 min at the shortest.

Tomoyuki Noda, PhD

Senior Researcher

Advanced Telecommunications Research Institute International (ATR)
Brain Information Communication Research Laboratory Group
Department of Brain Robot Interface

t_noda@atr.jp

Biography

2009: Ph.D. in Engineering, Division of Intelligence and Function Creation
Engineering, Graduate School of Engineering, Osaka University
2008-2010: Japan Society for the Promotion of Science (JSPS) Research Fellow
(DC2) at Osaka University (2009-2010: Visiting Researcher, MPLAB, University of
California, San Diego)
2010-Present: Postdoc Researcher, Dept. of Brain Robot Interface, Brain
Information Communication Research Laboratory Group, ATR
2015-: Principal Researcher (Senior Researcher)
2021-Present: Chief Researcher (Senior Researcher)

Current research projects and interests:

Robotics interface for neurorehabilitation and integration of AI technologies with
robotic systems (Gait rehabilitation and shoulder rehabilitation)
Development of Artificial Muscle and Hybrid Actuators
Healthcare and assistive devices development

Professional Affiliations:

Member of IEEE (Robotics and Automation Society)
Member of the Robotics Society of Japan

Awards:

Best Video Nominate in the IEEE AAAI Conference on Artificial Intelligence 2008
Best Video in LAB-RS 2008 for the development of a whole-body humanoid robot
with tactile sensation and compliant joints
Best Paper Nominate Award at IEEE Humanoids 2012
BCI Research Award 2017 Top 12 Nominees for a BMI-controlled Exoskeleton

International Symposium on Robotics

Friday 21 June 2024, Osaka, Japan



Abstract title: Enhancing Tailor-made Neurorehabilitation with Compliant AI-driven Exoskeletons

Name: Tomoyuki Noda

Role: Senior Researcher

Institution:

ATR

Brain Information Communication Research Laboratory Group

Dept. of Brain Robot Interface

Abstract:

This talk explores the development of compliant exoskeleton robots and AI technologies for enhancing neurorehabilitation. These technologies help individuals recall their motor experiences and agency in control of their own bodies, rather than relying solely on robotic assistance. A crucial concept introduced is Gait-print, which is essential for providing tailored neurorehabilitation by adapting to each individual's unique motor patterns. To achieve optimal compatibility with the human body, it is essential to lower the impedance of the robots. This keynote will introduce the use of pneumatic artificial muscles and hybrid actuators, combining pneumatic and electric power, to enhance this compatibility. Additionally, it will cover how these technologies interface with the body both physically and through neural pathways. Approaches include Brain-Machine-Interface (BMI) rehabilitation, detecting and synchronizing motor patterns with individual movements, and improving dynamic transparency during assistive actions. Clinical validation examples will demonstrate how these concepts are being realized in practice. These innovations hold significant potential for applications in healthcare and daily support, providing personalized neurorehabilitation based on Gait-print, thus enhancing individuals' neuro connectivity to control over their bodies.

International Symposium on Robotics

Friday 21 June 2024, Osaka, Japan



Abstract title: ROBOT ASSIST GAIT TRAINING WITH WEARABLE ROBOTS

Name: Koji Ohata

Role: Professor

Institution: Innovation of Healthcare Center / Department of Physical Therapy, Faculty of Health and Medical Sciences, Hokuriku University

Abstract:

This study investigated the impact of short-term intervention with a rehabilitation robot on gait function improvement post-stroke. Participants were divided into a robot-assisted gait training group (RAGT) and a control group (Con). While both groups didn't show significant changes in gait speed immediately after intervention, RAGT exhibited notable improvements in hip and knee motion range during intervention, and increased gait speed during follow-up. Short-term robot intervention improved gait kinematics and subsequently boosted gait speed in the follow-up phase.

International Symposium on Robotics

Friday 21 June 2024, Osaka, Japan



Abstract title: Feature extraction from quantitative gait analysis data to maximize rehabilitation treatments

Name: Kimitaka Hase

Role: Professor

Institution:

Kansai Medical University

Department of Physical Medicine and Rehabilitation

Abstract:

Robotic assisted gait trainings have been widely used in stroke rehabilitation and developed to restore gait function by promoting neuroplasticity. In clinical situations, it needs to discriminate factors between responders and non-responders. Exploring the characteristics of gait pattern from instrumented gait analysis data has potential for improving rehabilitation outcomes. The importance sampling by the Mahalanobis distance and Markov Chain Monte Carlo method was used to extract a set of gait-related features influencing ankle function recovery after gait trainings with robotized ankle foot orthosis.

Determining who should receive what kind of therapy or combination of therapies is crucial to maximize clinical benefits. The use of importance sampling algorithm can support clinicians to assess the effectiveness of rehabilitation protocols as well as healthcare management.

International Symposium on Robotics

Friday 21 June 2024, Osaka, Japan



Abstract title: *Non-invasive Electrical Stimulation to Enhance Robotic Rehabilitation*

Name: Tomofumi Yamaguchi

Role: Professor

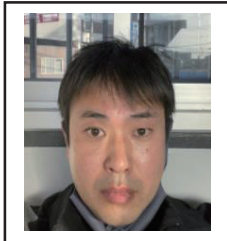
Institution: Department of Physical Therapy, Graduate School of Medicine, Kyoto University

Abstract:

Non-invasive electrical stimulation, such as transcranial direct current stimulation and transcranial alternating current stimulation, has the clinical therapeutic potential for improving motor function recovery in patients with central nervous system lesions. Recent studies reported that these brain stimulation techniques could enhance the effectiveness of robotic rehabilitation training for functional recovery. This presentation will provide our findings on a novel rehabilitation approach with a non-invasive electrical stimulation setting focusing on neurophysiological information to promote robotic rehabilitation training.

International Symposium on Robotics

Friday 21 June 2024, Osaka, Japan



Abstract title: *Dynamic Traction Splint by an Artificial Muscle (DTSaM)*

Name:

1. Jun Nakayama
2. Nobuyoshi Fukui

Role:

1. Lecturer
2. Professor

Institution:

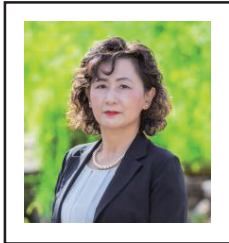
1. Kansai Medical University Faculty of Rehabilitation
2. Kansai Medical University Faculty of Rehabilitation

Abstract:

In recent years, the dart throw motion (DTM) from radial deviation to ulnar deviation has been gaining attention as a functional movement direction for wrist joints. We have devised a new dynamic splint called the Dynamic Traction Splint by an Artificial Muscle (DTSaM), which incorporates traction and DTM functions. When applied to patients with wrist joint contractures or distal radius fractures, we came across cases where the range of motion and grip strength improved. Moreover, this splint was also applicable to patients with severe pain such as Kienböck's disease. As a result, pain was alleviated and improvement in range of motion was achieved. Therefore, there is a possibility that this orthosis is effective not only for contracture but also for reducing pain.

International Symposium on Robotics

Friday 21 June 2024, Osaka, Japan



Abstract title: Development of equipment that promotes effective exercise training for children with orthostatic intolerance/dysregulation

Name: Yuko Ishizaki¹⁾, MD, PhD, & Kiyoshi Hayakawa²⁾, Eng, PhD,

Role: Professors

Institution: 1) Department of Pediatrics, Kansai Medical University, Osaka, Japan

2) Osaka Metropolitan University College of Technology, Osaka, Japan

Abstract:

The number of children with orthostatic intolerance/dysregulation (OD/OI) fail to attend school is increasing. Children with OD/OI have deteriorated physical function, neither drug nor counselling is sufficiently effective. There is a strong need for a development of training method and equipment with a high level of evidence.

We are developing an ergometer with a monitoring system using Arduino core microcontroller. An accelerometer is used to calculate speed while a piezoelectric sensor is used to measure pedal pressure. The Arduino core simultaneously receives these data and sends them to a computer via Bluetooth Low Energy wireless communication. On the computer, multiple sets of data are displayed on the screen in real-time. This project will contribute to the improvement of children's health.

International Symposium on Robotics

Friday 21 June 2024, Osaka, Japan



Abstract title: Monitoring IoT System and robotics application of the training equipment for orthostatic intolerance/dysregulation

Name: Kiyoshi Hayakawa¹, Eng, PhD, & Yuko Ishizaki², MD, PhD,

Role: Professors

Institution: 1) Osaka Metropolitan University College of Technology , Osaka, Japan

2) Department of Pediatrics, Kansai Medical University, Osaka, Japan

Abstract:

It is necessary to measure the rotation speed and pressure of the pedals to effective rehabilitation using an ergometer for OD/OI. The IoT system embedded in an Arduino core provides visualization of sensor data and assessment of movement.

To visualize and assess movement, The Arduino core simultaneously receives the sensor data and sends them to a computer via Bluetooth Low Energy wireless communication. We are able to check and save multiple data sets on the computer in real time, such as speed, pressure, and acceleration.

Furthermore, by utilizing the saved data, it is possible to assess the effectiveness of exercise in real-time using K-NN machine learning.

International Symposium on Robotics

Friday 21 June 2024, Osaka, Japan



Abstract title: *Assistive robotics and wearable mechatronics for human active wellbeing*

Name: Stefano Pastorelli

Role: Full Professor

Institution: Politecnico di Torino – Department of Mechanical and Aerospace Engineering

Abstract:

The lecture presents how robotics and mechatronics might help to deal with aging of the population, affecting human active wellbeing.

A first project is on the development of an active exoskeleton for trunk support during bend over gestures. An innovative sensorised joint, a state machine and a real-time movement recognition algorithms, let the identification of the motion pattern, and provide support customized to user's specific gesture and settings. The exo has been conceived to improve worker safety and performance, but has wider applications in different fields.

A second project concerns a novel read add-on assistance device based on an active propulsive and steering wheel for wheelchairs. Such as a caregiver, it provides longitudinal thrust and yaw torque consistent with the user motion request, detected by means of sensorised handrims, with reduction of user's effort in propulsion and maneuvering. Its design enables sharing use in healthcare and social contexts.

International Symposium on Robotics

Friday 21 June 2024, Osaka, Japan



Abstract title: *Riding robotics and intuitive operation for human life support*

Name: Masaharu KOMORI

Role: Professor

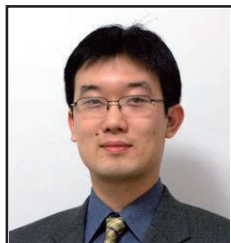
Institution: Kyoto University

Abstract:

Riding Robotics is a research field that focuses on small vehicles, which play a supporting role in people's lives. In my laboratory, we proposed an active omni wheel and developed a vehicle that can move in any direction. In addition, in future life support, robots may be operated by people who are not familiar with technology. It is thought that the robot arm can be easily operated if the operator operates the robot arm by moving his or her arm. In my laboratory, we have developed a robot manipulation system that takes into account the characteristics of the operator's intended and actual arm movements.

International Symposium on Robotics

Friday 21 June 2024, Osaka, Japan



Abstract title: *Technology Development Aiming for User-Friendly Mobility and Medical Applications*

Name: Daisuke Matsuura

Role: Specially appointed associate professor

Institution: School of Engineering, Tokyo Institute of Technology

Abstract:

In this talk, several developments of technologies aiming to achieve safe and user-friendly mechanical systems will be discussed, especially from the view point of view of a mechanical engineer. To give a minimally essential intelligence to a mechanical system, it can be said that dealing with visual and tactile sensation is crucial because they are the most common and natural approach to sense the circumstance environment and opposing object to accomplish a task for the system. Actual topics of this talk includes i) Integrated measurement of visual and tactile sensation, ii) Gently hierarchical and highly distributed processing of visual and haptic sensation, and iii) Several demonstrations of above technologies with experimental prototypes aiming for robotization of things.

International Symposium on Robotics

Friday 21 June 2024, Osaka, Japan



Abstract title: Linear electrostatic actuator for robotic applications

Name: Akio Yamamoto

Role: Professor

Institution: The University of Tokyo

Abstract:

In designing robots that coexist with humans, selecting actuators that balance performance and safety is crucial. Traditional geared motors can achieve high torque but have the drawback of increased inertia due to gear-induced inertia amplification, leading to greater impact during collisions. Additionally, systems with high gear reduction ratios suffer from low backdrivability, which is undesirable for safety. Consequently, there is growing interest in direct-drive, low-inertia actuators. This presentation introduces an electrostatic linear actuator made by stacking sheet-like materials, which serves as one such actuator. Excellent backdrivability is demonstrated with a prototype robotic arm driven by these actuators.

International Symposium on Robotics for Humanity and Healthcare

Friday 21 June 2024, Osaka, Japan



Abstract title: The omnidirectional wheelchair MoviWE.Q

Name: Luigi Tagliavini

Role: Post-Doc Research Fellow

Institution: Politecnico di Torino, Turin, Italy

Abstract:

According to the United Nations Report on Disability and Development around 1% of the global population needs a wheelchair for daily life. This non-negligible part of our society reports difficulties in accessing public and private facilities. According to the UN report, only 47% of education facilities and 69% of public toilets are accessible for persons using wheelchairs, and about 20% of hospitals and 32% of pharmacies are not wheelchair accessible. Against this context, the project MoviWE.Q aims to develop a motorized wheelchair with improved mobility to improve indoor navigation in environments full of obstacles and narrow passages. This wheelchair is conceived to be used in three modes: manual mode (the user drives), assisted mode (the caregiver drives), and autonomous mode (the wheelchair drives).

International Symposium on Robotics

Friday 21 June 2024, Osaka, Japan



Abstract title: Robotics for sustainable well-being; from teeth brushing robot to balloon robot for performing arts

Name: Hiroyuki Ishii

Role: Professor

Institution: Department of Modern Mechanical Engineering / Center for Entrepreneurship, Waseda University

Abstract:

In Ishii laboratory in Waseda University, we have been developing several robots for well-being. For example, we have developed a teeth brushing robot, which is designed to remove plaques on teeth by motion of brushes driven by DC motors. A user of this robot doesn't have to move his/her hand to remove plaques. A startup company is funded from the lab, and the company now starts providing teeth brushing robots to handicap people who have difficulties to move their hands. We have also developed balloon robots to support development of children through playing interaction between these robots and children. These balloon robots can be also used in inclusive performance arts to encourage the performers to express their emotions.

<Symposium lecture>