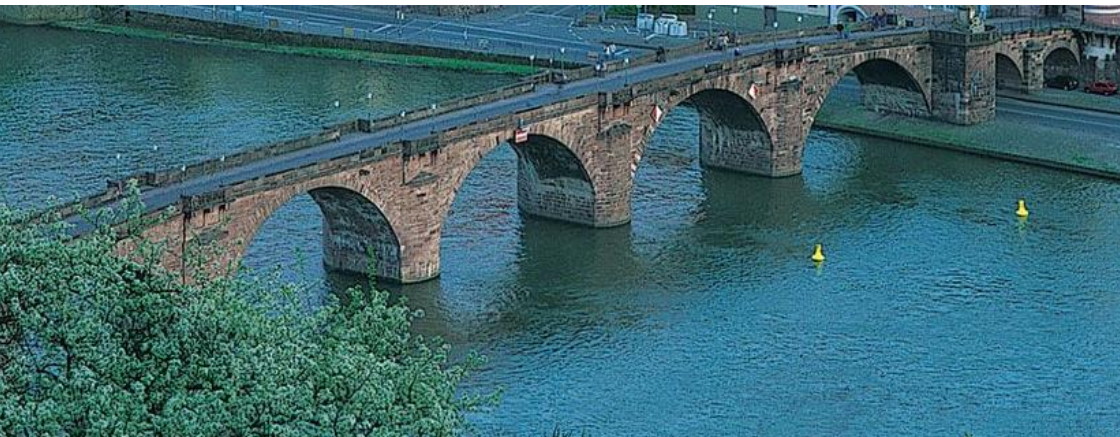
BIOROB2024

10th IEEE International Conference on Biomedical Robotics and Biomechatronics, SEPTEMBER 1-4, Heidelberg, Germany

www.biorob2024.org



Sponsors and Exhibitors

Thanks to our exhibitors:

Welcome

On behalf of the Organizing Committee, it is our great pleasure to welcome you to the 10th IEEE RAS/EMBS International Conference on Biomedical Robotics and Biomechatronics (BIOROB) in Heidelberg. BioRob 2024 is sponsored by the Institute of Electrical and Electronic Engineers (IEEE) Robotics and Automation Society (RAS) and Engineering in Medicine and Biology Society (EMBS).

Biorobotics research is highly interdisciplinary. It brings together researchers from many diverse fields to gain knowledge to tackle a range of clinically relevant applications. The IEEE societies (RAS and EMBS) share this belief and have enthusiastically joined together to co-sponsor the BIOROB conference. The first BIOROB conference was held in 2006 in Pisa (Italy), and since then BIOROB has travelled around the globe to Scottsdale, USA (2008), Tokyo, Japan (2010), Rome, Italy (2012), Sao Paulo, Brazil (2014), Singapore (2016), Twente (2018), New York (2020), Seoul (2022) and this year to Heidelberg.

BIOROB covers both theoretical and experimental challenges posed by the application of robotics and mechatronics in medicine and biology. The primary focus of biorobotics is to analyze biological systems from a “biomechatronic” point of view and try to understand the scientific and engineering principles underlying their extraordinary performance. This profound understanding of how biological systems work, behave and interact can be used for two main objectives: to guide the

design and fabrication of innovative, high-performance bio-inspired machines and systems for many different applications; and to develop novel nano-, micro-, and macro- devices that can act upon, substitute parts of, and assist human beings in prevention, diagnosis, surgery, prosthetics, rehabilitation and personal assistance.

An excellent conference has been planned for you. We are fortunate to have six outstanding plenary speakers: Dr. Aude Billard (EPFL), Dr. Sandra Hirche (TUM), Dr. Shoji Takeuchi (The University of Tokyo), Dr. Pietro Valdastri (University of Leeds), Dr. Helen Huang (North Carolina State University & University of North Carolina at Chapel Hill) and Dr. Hellen Roche (MIT). For the first time in the story of these conferences, we will have talks from 5 key innovators in Biorobotics: Dr. Hugh Herr (MIT), Dr. Robert Riener (ETH), Dr. Cecilia Laschi (NUS), Dr. Michael Goldfarb (Vanderbilt University) and Dr. Sami Haddadin (TUM). Additionally, we included two Forums from other top experts in the field and a Tutorial:

- Forum 1 – Afternoon session organized by Dr. Christian Cipriani (SSSA), entitled “Sensorimotor control of upper limb prostheses”.
- Forum 2 – Full day session organized by Dr. Barbara Mazzolai (IIT), entitled “Linking One Health to Environmental Intelligence and Ecorobotics”.
- Tutorial – Full day session organized by MathWorks entitled “MATLAB, Simulink & Co for Robotics: Simulation and Modeling of a Humanoid Robot”.

The conference venue will be at the Neue Universität in the heart of the Heidelberg old town. Within 1-1.5 km from the conference venue there two main touristic places of Heidelberg: the Castle

and the Philosophenweg (Philosopher's Path), both offering two fantastic panoramic views of the city center.

We would like to thank the outstanding and dedicated BIOROB 2024 Organizing Committee, our financial sponsors, the guidance and advice by the BIOROB Steering Committee, the Program Committee track chairs and members who handled the review process professionally and efficiently, and the student volunteers and IEEE staff who have helped in several logistics aspects of the conference.

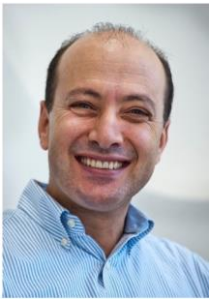
Welcome to Biorob; we hope you will have an enjoyable and productive conference in Heidelberg!

The Organizing Committee

Lorenzo Masia
General Chair
UNIVERSITÄT HEIDELBERG ZUKUNFT SEIT 1386

Franziska Mathis Ullrich
General coChair
FAU Friedrich-Alexander-Universität Erlangen-Nürnberg

Hermano Igo Krebs
General coChair
MIT Massachusetts Institute of Technology



Tamim Asfour
Awards Chair
KIT Karlsruher Institut für Technologie

Marcia O'Malley
Awards co-Chair America
RICE

Philipp Beckerle
Awards co-Chair Europe
FAU Friedrich-Alexander-Universität Erlangen-Nürnberg

Hyung-Soon Park
Awards co-Chair Asia-Pacific

KAIST

David Remy
Chairman
Workshops/Tutorials

University of Stuttgart
Germany

Cristina Piazza
Editor in Chief

Elliott Rouse
Program Chair

UNIVERSITY OF MICHIGAN

Leonardo Ricotti
Program Chair

Sant'Anna
School of Advanced Studies – Pisa

Enrica Tricomi
Program co-Chair

UNIVERSITÄT HEIDELBERG ZUKUNFT SEIT 1386

Francesco Missiroli
Local Arrangement Chair

UNIVERSITÄT HEIDELBERG ZUKUNFT SEIT 1386

Federico Masiero
Sponsor Chair

UNIVERSITÄT HEIDELBERG ZUKUNFT SEIT 1386

General Information

REGISTRATION AND INFORMATION DESK HOURS

All conference attendees must register, either by using online early registration (preferred option), or onsite. Details for registration are available here:

https://www.biorob2024.org/registration/

All registered participants must check in at the Registration Desk to pick up their registration package (including conference bag). Personal badges will be provided to identify registered participants.

The registration desk will be open during the following hours at the Neue Universität:

Sunday, September 1 – 08:00 – 17:30
Monday, September 2 – 08:00 – 17:30
Tuesday, September 3 – 08:00 – 12:00
Wednesday, September 4 – 08:00 – 12:00

Exact location of the registration desk can be found on the venue maps on pages 15-18.

PRESENTER PREPARATION ROOM OPENING HOURS

All conference attendees have the opportunity to check their presentation in the **Presenter Preparation Room** (HS 10), which will be open at the following hours:

Monday, September 2, 08:00 – 17:30
Tuesday, September 3, 08:00 – 17:30
Wednesday, September 4, 08:00 – 16:00

INTERNET ACCESS

The city of Heidelberg offers a free internet service for visitors:

https://www.heidelberg.de/HD/Rathaus/kostenloses+wlan.html

Select the WLAN network 'Heidelberg4you', open your browser and follow the indications to accept the conditions for the use of wireless internet.

Encrypted WiFi access via eduroam is also available to visitors from other educational and research institutions at Heidelberg University, provided that the home institution also participates in eduroam.

ELECTRICITY SUPPLY

Throughout Germany the standard supply is 220 V: F plugs and CEE 7/16 and CEE 7/4 sockets are supported.

CURRENCY

The currency in Germany is the Euro (€). Most banks offer a foreign exchange policy. Traveller's cheques are not generally accepted for everyday transactions.

SMOKING POLICY

Smoking is not permitted in the venue building. There are designated smoking areas outside buildings and delegates are requested not to litter these areas.

CODE OF CONDUCT

As a representative of your institution the professional standards and code of conduct of your institution are in effect while at the Biorob24 Conference and all social events. The organizing committee encourages open and honest intellectual debate within a welcoming and inclusive atmosphere at the Conference and through official Biorob24 social media channels. To help maintain an open and respectful community of scientists, the organizing committee of Biorob24 does not tolerate illegal or inappropriate behavior at any annual meeting, including violations of applicable laws of the country in which the meeting is taking place. The organizing committee of Biorob24 condemns inappropriate or suggestive acts or comments that demean or harass another person because of gender, gender identity or expression, sexual orientation, physical appearance, ethnicity/race, religion (or lack thereof), or that are generally unwelcome or offensive to other members of the community. Sexual language and imagery, unless related to specific scientific discussions, are not appropriate for any conference venue, including talks, workshops, parties, and online media platforms. As Biorob24 is attended by a wide spectrum of delegates, please be aware of the power dynamic between PIs, post-doctoral fellows and students and how that dynamic may affect interactions amongst delegates.

PUBLIC TRANSPORT

Five international Airports located in a range of 100 Km:

- **Frankfurt am Main** is the primary international airport in Germany and one of largest in Europe, with an internal train station that guarantees direct trains to Heidelberg.
- **Karlsruhe** and **Stuttgart** are also international airports advised for continental flights.
- **Saarbrücken** and **Frankfurt-Hahn** are served by low-cost companies all over Europe.

Train connections are provided by most of the airports to reach Heidelberg's central station (20-30 Euros).

By Train

Heidelberg's central station can be reached via the Deutsche Bahn intercity connection. For timetable inquiries see Deutsche Bahn. Tickets can be purchased via the DB Navigator App or the Deutsche Bahn website.

By Bus

From Heidelberg main station: Bus line 32 to Uniplatz, bus line 34 to Bismarckplatz and change to bus line 31, alternatively busses BRN 735 and BRN 755 to the congress centre and take six minutes' walk to the University Square (Uniplatz).

Further Information

https://int.bahn.de/en

https://www.uni-heidelberg.de/en/university/locations-and-how-to-get-there

SOCIAL EVENTS

OPENING CEREMONY – September 2, 2024

The opening banquet for the Conference will be held at the Courtyard of the Neue Universität (main conference venue), providing a picturesque backdrop for the evening. Attendees will enjoy a light dinner featuring finger food while being immersed in a vibrant yet relaxed atmosphere, fostering conversations among leading researchers, academics, and industry professionals. As the sun set, the elegant architecture of the Neue Universität, and the Neckar River scenario will add a touch of timeless charm to the event, setting a perfect tone for innovative discussions in the following days of the conference.

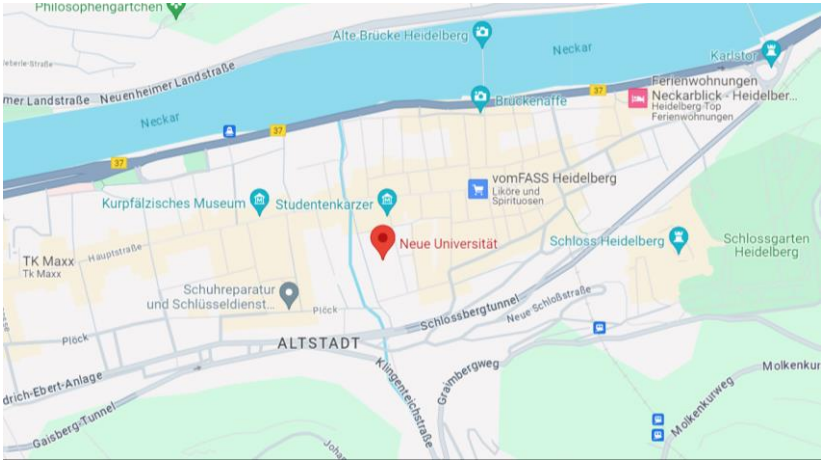
SOCIAL DINNER – September 3, 2024

The Conference Dinner will take place on the motor ship Queen Silvia on Tuesday, September 3, 2024. Queen Silvia is the newest ship of the White Fleet Heidelberg and named after Queen Silvia of Sweden, who was born in Heidelberg.

The river cruise starts at 19:00 in Heidelberg (**all the participants who reserved this event should embark within 18:30**) and takes you past castles and the charming banks of the Neckar Valley. Enjoy the marvellous view of the Heidelberg Castle and the Old Bridge during a champagne reception. During the dinner, you will pass along the banks of the Neckar River with a fantastic view on the lovely towns and castles on the shore until the ship reaches Neckarsteinach, the four-castle town. A finger food dessert buffet will conclude the evening and allow you to network with other participants in a pleasant atmosphere before the ship reaches Heidelberg again around 11 p.m.

VENUE MAPS

The Neue Universität building is located in Universitätsplatz 1, 69117 Heidelberg (click the map below).

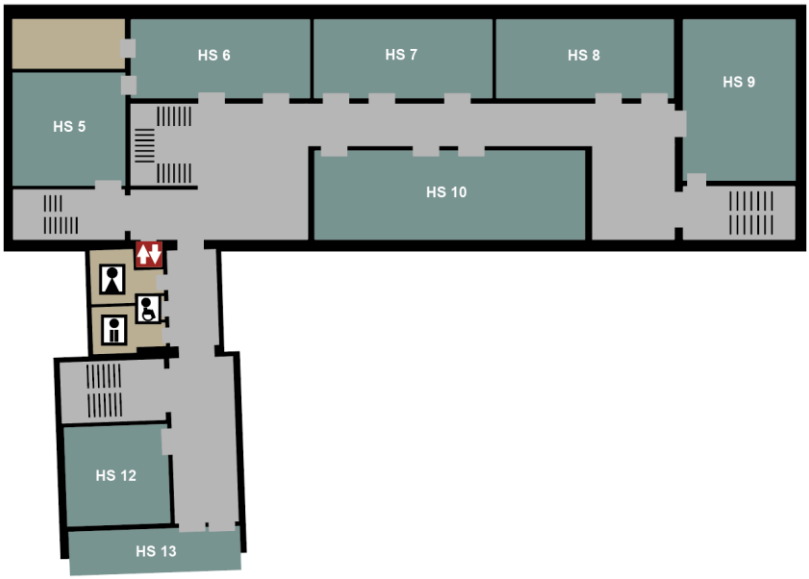


WORKSHOP/SESSION ROOMS

GROUND FLOOR VENUE

At the ground floor, five rooms are dedicated to conference workshops during the Workshop Day (September 1). These are: Hörsaal 1-4 (HS 1-4) and Hörsaal 4a (HS 4a). The Foyer and HS 3 will be populated by **Sponsor Booths** from September 2. On the ground floor, there is also the **Registration Desk** and the **Presenter Preparation Room** (HS 1). The Foyer will also host the **Poster sessions**. Moreover, the Courtyard will host the Conference Opening Ceremony.

FIRST FLOOR VENUE



On the first floor, seven rooms are dedicated to conference workshops during the Workshop Day (September 1). These are: Hörsaal 5-10 (HS 5-10) and Hörsaal 12 (HS 12). During the conference days, HS 5-10 are used for **parallel sessions** (Oral presentations and forums).

SECOND FLOOR VENUE

On the second floor, two rooms are dedicated to conference workshops during the Workshop Day (September 1). These are: Hörsaal 12a (Hs 12a) and Hörsaal 14 (HS 14).
Moreover, from this floor participants can access the **Neue Aula**, where all the **invited speakers** will present.

EXHIBITORS

Exhibitors are located on the ground floor, where you can find 10 booths and a room dedicated to events organized by The MathWorks inc.

1 MagnebotiX

2 iit RTECH ISTITUTO ITALIANO DI TECNOLOGIA REHAB TECHNOLOGIES

3 AUXIVO WEARABLE SUPPORT SYSTEMS

4 DELSYS® EUROPE


BIOROB 2024
HEIDELBERG

5 
ReWing

6 
IEEE
OPEN ACCESS
TNSRE
IEEE TRANSACTIONS ON NEURAL SYSTEMS
AND REHABILITATION ENGINEERING

7 
POWERED
ORTHOTICS

8 
NOKOV
Motion
Capture

9 
Resense
A Sense of Touch

10 
River Publishers

11 
MathWorks

CONFERENCE PROGRAM

Program at a glance

Sunday, September 1, 2024 (Workshops)	Monday, September 2, 2024 (Conference Day 1)	Tuesday, September 3, 2024 (Conference Day 2)	Wednesday, September 4, 2024 (Conference Day 3)
9:00 – 10:30: Conference Workshop	9:00 – 09:40: Conference opening - Paolo Dario	09:00 – 09:50: Plenary speaker 3 – Aude Billard	09:00 – 09:50: Plenary speaker 5 – Sandra Hirche
10:30 – 11:00: Coffee break	09:40 – 10:30: Plenary speaker 1 – Shoji Takeuchi	09:50 – 10:10: Keynote innovator 2 – Robert Riener	09:50 – 10:20: Keynote innovator 5 – Sami Haddadin
11:00 – 12:30: Conference Workshop	10:30 – 11:00: Coffee break	10:10 – 10:40: Coffee break	10:20 – 10:50: Coffee break

12:30 – 14:00: Lunch break	11:00 – 12:15: Parallel oral sessions	10:40 – 12:00: Parallel oral sessions + Best Paper Awards	10:50 – 12:05: Parallel oral sessions
14:00 – 15:30: Conference Workshop	12:15 – 14:00: Lunch break	12:00 – 13:30: Lunch break	12:05 – 13:30: Lunch break
15:30 - 16:00: Coffee break	14:00 - 14:50: Plenary speaker 2 – Helen Huang	13:30 – 14:45: Parallel oral sessions + Best Student Paper Awards	13:30 – 14:45: Parallel oral sessions
16:30 - 18:00: Conference Workshop	14:50 – 15:10: Keynote innovator 1 – Hugh Herr	14:45 – 15:15: Coffee break	14:45 – 15:15: Coffee break
	15:10 – 15:40: Coffee break	15:15 – 16:05: Plenary speaker 4 – Pietro Valdastri	15:15 – 16:05: Plenary speaker 6 – Ellen Roche
	15:40 – 17:00: Poster session 1	16:05 – 16:30: Keynote innovator 3 – Cecilia Laschi	16:05 – 17:30: Poster session 3
	17:00 – 18:15: Parallel oral sessions	16:30 – 16:50: Keynote innovator 4 – Michael Goldfarb	17:30 – 18:30: Awards, Closing Ceremony

	18:30: Opening Ceremony	16:50 – 18:10: Poster session 2
		18:30: Social Event

PROGRAM OVERVIEW

Sunday, **September 1,** 2024: **Workshops**.

Monday, **September 2,** 2024: **Plenary Speakers, Oral and Poster session, opening ceremony at the Conference Venue**.

Tuesday, **September 3,** 2024: **Plenary Speakers, Oral and Poster session, social dinner at the River**.

Wednesday, **September 4, 2024**: **Plenary Speakers, Oral and Poster session, awards and closing ceremony**.

Monday, September 2 (Conference Day 1)

9:00 – 09:40: Conference opening: Paolo Dario's intro talk	NEUE AULA
09:40 – 10:30: Plenary speaker 1 Shoji Takeuchi	NEUE AULA
10:30 – 11:00: Coffee break	
11:00 – 12:15: Parallel oral sessions	
• [Exoskeletons and exosuits] EE-MO2	HS 1
• [Neural control of movement and biomechanics] NC-MO2	HS 4
• [Surgical and medical robotics] SR-MO2	HS 7
• [Bionic prostheses] BP-MO2	HS 8
• [IEEE RAL Session 1 of 2] RAL1-MO2	HS 9
12:15 – 14:00: Lunch break	
14:00 – 14:50: Plenary speaker 2, Helen Huang	NEUE AULA
14:50 – 15:10: Keynote innovator 1, Hugh Herr	NEUE AULA
15:10 – 15:40: Coffee break	
15:40 – 17:00: Poster session 1	Foyer
17:00 – 18:15: Parallel oral sessions	
• [Forum Christian Cipriani] FO-AF2	HS 14
• [Exoskeletons and exosuits] EE-AF2	HS 1

- [Neural control of movement and biomechanics] NC-AF2 — HS 4
- [Soft robotics] SR-AF2 — HS 7
- [Haptics] HP-AF2 — HS 6

18:30: Opening Ceremony — Courtyard

Tuesday, September 3 (Conference Day 2)

09:00 – 09:50: Plenary speaker 3, Aude Billard	NEUE AULA
09:50 – 10:10: Keynote innovator 2, Robert Riener	NEUE AULA
10:10 – 10:40: Coffee break	
10:40 – 12:00: Parallel oral sessions	
• [Exoskeletons and exosuits] EE-MO3	HS 5
• [Neural control of movement and biomechanics] NC-MO3	HS 6
• [Micro/nano robotics] MN-MO3	HS 4
• [Human-machine interaction and assistive robotics] HM-MO3	HS 1
• [Neurorobotics and neural interfaces] NI-MO3	HS 7
• [IEEE RAL Session 2 of 2] RAL2-MO3	HS 9
• [Tutorial MathWorks]	HS 4a
• [Forum Barbara Mazzolai] FO-AF3	HS 14
• [IEEE RAS EMBS Best paper Awards] BP-MO3	HS 8
12:00 – 13:30: Lunch break	
13:30 – 14:45: Parallel oral sessions	
• [Forum Barbara Mazzolai] FO-AF3	HS 14

- [Exoskeletons and exosuits] EE-AF3 — HS 1
- [Neural control of movement and biomechanics] NC-AF3 — HS 4
- [Surgical and medical robotics] SR-AF3 — HS 5
- [Haptics] HP-AF3 — HS 6
- [IEEE RAS EMBS Best Student Paper Awards] BSP-AF3 — HS 8
- [Bionic prostheses] BP-AF3 — HS 7
- [Tutorial MathWorks] — HS 4a

14:45 – 15:15: Coffee break

15:15 – 16:05: Plenary speaker 4, Pietro Valdastri — NEUE AULA

16:05 – 16:50: Keynote innovator 3-4, Cecilia Laschi & Michael Goldfarb — NEUE AULA

16:50 – 18:10: Poster session 2 — Foyer

18:30: Social event Boat Trip on the Neckar

Wednesday, September 4 (Conference Day 3)

09:00 – 09:50: Plenary speaker 5, Sandra Hirche	NEUE AULA
09:50 – 10:20: Keynote innovator 5, Sami Haddadin	NEUE AULA
10:20 – 10:50: Coffee break	
10:50 – 12:05: Parallel oral sessions	
• [Exoskeletons and exosuits] EE-MO4	HS 4
• [Neural control of movement and biomechanics] NC-MO4	HS 1
• [Surgical and medical robotics] SR-MO4	HS 5
• [Rehabilitation robotics] RR-MO4	HS 6
• [Human-machine interaction and assistive robotics] HM-MO4	HS 7
• [IEEE TMRB Session] TMRB-MO4	HS 9
12:05 – 13:30: Lunch break	
13:30 – 14:45: Parallel oral sessions	
• [Exoskeletons and exosuits - 1] EE1-AF4	HS 4
• [Exoskeletons and exosuits - 2] EE2-AF4	HS 1
• [Neural control of movement and biomechanics] NC-AF4	HS 5
• [Surgical and medical robotics] SR-AF4	HS 6
• [Bionic prostheses] BP-AF4	HS 7

14:45 – 15:15: Coffee break	
15:15 - 16:05: Plenary speaker 6, Ellen Roche	NEUE AULA
16:05 – 17:30: Poster session 3	Foyer
17:30 – 18:30: Awards, Closing Ceremony and Biorob 2026 announcement.	NEUE AULA

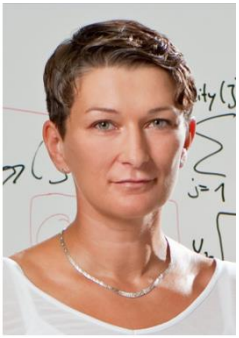
INVITED SPEAKERS

Sponsored by:

Plenary Speakers

Aude Billard

EPFL



Sandra Hirche

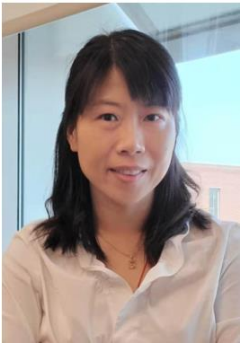
TUM

Shoji Takeuchi

東京大学 THE UNIVERSITY OF TOKYO

Pietro Valdastri

UNIVERSITY OF LEEDS



Helen Huang

THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL

NC STATE UNIVERSITY

Ellen Roche

MIT

Key Innovators in Biorobotics

Hugh Herr

Robert Riener

Cecilia Laschi

Michael Goldfarb

Sami Haddadin

Sponsored by:

DETAILED PROGRAM – Sunday 1 September

Full Day Workshops (9:00 – 18:00)

Conference Room	Workshop Title	More Information
HS 1	Bioinspired and Biohybrid Soft Robots: Advanced Materials and Enabling Technologies	https://www.santannapisa.it/it/biorob2024/bioinspired-and-biohybrid-soft-robots
HS 4a	A Multidisciplinary Overview of Upper Limb Prosthetics Development: Challenges and Opportunities	https://www.santannapisa.it/en/biorob2024/multidisciplinary-overview-upper-limb-prosthetics-development
HS 5	Nature unleashed: bio-inspired and bio-hybrid robotics tackling real-world challenges	https://sites.google.com/view/natureunleashed-ws-biorob2024/home
HS 9	Joint Discussions About Joint Actions and Interactions	https://rrlab.cs.rptu.de/en/conferences/biorob-2024
HS 12	Towards Meaningful User Experiences in Human-Technology Interactions through Interdisciplinary Co-Creation Methods	https://www.mlnlab.nl/biorob-2024-workshop
HS 13	Accelerating Wearable Robotics: Advancements in Mechatronic Prostheses and Exoskeletons and Rapid Control Prototyping	https://sites.google.com/view/ws30-34-biorob2024

HS 12a	Neuromusculoskeletal Twins - Lab vs. Clinical Reality	https://sites.google.com/view/clinical-msk-workshop/home

Half Day Workshops Morning (9:00-13:00)		
Conference Room	**Workshop Title**	**More Information**
HS 10	Incorporating motor learning principles to improve adaptation to lower-limb exoskeletons	http://www.utwente.nl/BR24motorlearning
HS 4	High-resolution myocontrol- Towards optimal intent detection via high-density spatial and temporal bio-signal detection	https://sites.google.com/view/hd-myocontrol-biorob2024
HS 6	ICORR Workshop: Translating Rehabilitation Robotics into Clinical Applications	https://sms.hest.ethz.ch/scientific_events/translating-rehabilitation.html
HS 7	AI-Based Estimation and Control of Wearable Robotic Systems for Enhancing Human Mobility	https://sites.google.com/view/biorob-wearable-robotics
HS 8	Revolutionizing Aging: The Role of Robotics and Wearable Tech for Older Adults	https://sites.google.com/view/revolutionizing-aging-biorob24
HS 14	Hybrid Robotic and Neuromodulation Control Methodologies for Rehabilitation and Assistive Devices	https://biorob2024hybridcontrolmethods.blogs.rice.edu/

Half Day Workshops Afternoon (14:00-18:00)		
Conference Room	**Workshop Title**	**More information**
HS 10	Efficient actuation principles and bi-directional energy exchange in human-centric and wearable robotics	https://www.ram.eemcs.utwente.nl/efficient-actuation-principles-and-bi-directional-energy-exchange-human-centric-and-wearable
HS 4	Building Responsive Body-Machine Interfaces with Biosignals and Robotic Exoskeletons	https://sites.google.com/view/biorob24-ws-responsive-bmi
HS 6	Human-robot embodiment: myths, principles, techniques, quantification, benefits, and more	https://www.santannapisa.it/it/istituto/dirpolis/etica-della-tecnologia
HS 7	Sensorimotor Representation: Advancements in Learning Models for Robots	https://www.santannapisa.it/en/institute/biorobotics/brair-lab/workshop-ieee-biorob-2024
HS 8	Ethical Issues Related to Bionic Organs: From Techne to Ethos	https://www.santannapisa.it/it/istituto/dirpolis/etica-della-tecnologia
HS 14	Robot-aided Somatosensory-based Approaches for the Neurorehabilitation of Sensorimotor Function	https://www.santannapisa.it/it/international-conference/robot-aided-somatosensory-based-approaches-neurorehabilitation-sensorimotor-function

DETAILED PROGRAM – Monday 2 September

PLENARY SPEAKER 1 – Shoji Takeuchi (Neue Aula, 9:40 – 10:30)

東京大学 THE UNIVERSITY OF TOKYO

***Title*: Innovating Biohybrid Robotics: Integration of Biological and Artificial Systems for Robotic Advancements**

Bio: Shoji Takeuchi received the B.E, M.E., and Dr. Eng. degrees in mechanical engineering from the University of Tokyo, Tokyo, Japan, in 1995, 1997, and 2000, respectively. He is currently a Professor in the Department of Mechano-Informatics, Graduate School of Information Science and Technology, University of Tokyo. He has authored more than 230 peer-reviewed publications and filed over 140 patents. He has been recognized with numerous honours including Young Scientists' Prize, the JSPS prize fromthe Japan Society for the Promotion of Science in 2010, ACS Analytical Chemistry Young Innovator Awards in 2015, and UNESCO Netexplo Award Winner 2019. JSME Micro-Nano Science & Technology Achievement Award in2022. His current research interests include cultivated meat, 3D tissue fabrication, bioMEMS, implantable devices, artificial lipid bilayer systems, and biohybrid machines.

PARALLEL ORAL SESSIONS MORNING

Morning ORAL Sessions (11:00 – 12:15): Parallel oral sessions (talks: 10 min + 2 min Q&A)

[Exoskeletons and exosuits] EE-MO2 – Room HS 1 ***Chair: Matteo Laffranchi, Co-Chair: Leonardo Cappello***		
7	Swaminathan, Krithika; Lee, Christina; Schmitz, Dylan; Baker, Teresa; Chin, Andrew; Wendel, Nicholas; Awad, Louis; Ellis, Terry; Thelen, Darryl; Walsh, Conor James	Propulsion Modulation Methods in People Post-stroke during Resistive Ankle Exosuit Use
79	Dezman, Miha; Marquardt, Charlotte Dorothea; Üğür, Adnan; Asfour, Tamim	Influence of Motion Restrictions in an Ankle Exoskeleton on Gait Kinematics and Stability in Straight Walking
121	HAFS, Abdelwaheb; Verdel, Dorian; burdet, etienne; BRUNEAU, Olivier; Berret, Bastien	A Finite-Horizon Inverse Differential Game Approach for Optimal Trajectory-Tracking Assistance with a Wrist Exoskeleton
128	Pruyn, Kai; Murray, Rosemarie; Gabert, Lukas; Lenzi, Tommaso	Autonomous Powered Ankle Exoskeleton Improves Foot Clearance and Knee Hyperextension After Stroke: A Case Study
136	Miskovic, Luka; Tricomi, Enrica; Zhang, Xiaohui; Missiroli, Francesco; Krstanovic; Kristina; Petric, Tadej; Masia, Lorenzo	Coupling Rigid Pneumatic Knee Exoskeleton with Soft Tendon-Driven Hip Exosuit: First Insights
157	Pericu, Valentina; Vassallo, Christian; Zinni, Gaia; Hinterlang, Wiebke; Lencioni, Tiziana; Ferrarin, Maurizio; Jonsdottir,	A novel assistive controller for gait rehabilitation through the TWIN lower-limb exoskeleton in individuals with residual motor functionalities

Johanna; De Michieli, Lorenzo; Semprini, Marianna; Maludrottu, Stefano; Laffranchi, Matteo

[Neural control of movement and biomechanics] NC-MO2 – Room HS 4
Chair: Tadej Petric, Co-Chair: Tomislav Bacek

161	Zhang, Jianxi; Zeng, Hong; Wang, Jiajin; Wang, Xin; Song, Aiguo	Human Movement Compensation Control for Supernumerary Limb in Overhead Support Task: A Non-cooperative Game Theory Approach
204	Anwar, Eisa; Abeywardena, Sajeeva; Miller, Stuart; Farkhatdinov, Ildar	Design and Validation of a Wearable Robotic Tail for Human Balance Support
81	Sun, Mingrui; Horst, Fabian; Slijepcevic, Djordje; Oetomo, Denny; Tan, Ying; Bacek, Tomislav	The Uniqueness of Gait Patterns Differs Across Data Modalities and Walking Conditions
84	Edraki, Mahdiar; Lokesh, Rakshith; Krotov, Aleksei; Ramezani, Alireza; Sternad, Dagmar	Human-Inspired Control of a Whip: Preparatory Movements Improve Hitting a Target
86	Yang, Qihan; Gloumakov, Yuri; Spiers, Adam	Multi-modal Compensatory Motion Analysis for Reaching Motions Over a Discretely Sampled Workspace
94	Lan, Bangyu; Stramigioli, Stefano; Niu, Kenan	Anatomical Region Perception and Real-time Bone Tracking Methods by Dynamically Decoding A-Mode Ultrasound Signals

[Surgical and medical robotics] SR-MO2 – Room HS 7 *Chair: Franziska Mathis Ulrich, Co-Chair: Nili Krausz*		
203	Alagi, Hosam; Fischer, Nikola; Behrends, Kai Lennart; Fürst-Walter, Iris; Becker, Juergen; Beigl, Michael; Mathis-Ullrich, Franziska; Hein, Björn	Enhancing Force Sensing Capabilities in Exoskeleton Interfaces Using Compliant Actuator-Sensor Units: A User Study
216	Beck, Adrian; Tomita, Yoshihide; Miyazaki, Tetsuro; Kawashima, Kenji	A Pneumatically Driven Arm Muscle Training System Realizing Wide Motion Range and Large Moment Arm
340	Jenkinson, George; Conn, Andrew; Tzemanaki, Antonia	Braille-tip: Structured Small-Footprint Tactile Sensor for High Acuity Dynamic Tactile Tasks
338	Ito, Jin; Murakami, Toshiyuki	Robust Position and Force Control in Series Elastic Actuator for Human Assistance Systems
348	Guachi, Lorena de los Angeles; Sorriento, Angela; Cafarelli, Andrea; Restaino, Francesco; Spinnato, Paolo; Ricotti, Leonardo	A Portable Ultrasound Procedure to Enable Remote Management of Tennis Leg Injuries

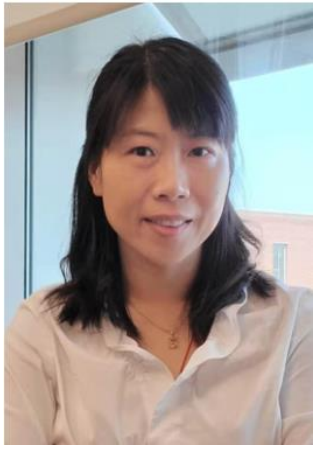
[Bionic prostheses] BP-MO2 – Room HS 8 ***Chair: Renaud Ronsse, Co-Chair: Enrica Tricomi***		
206	Wang, Fengyi; Fu, Xiangyu; Thakor, Nitish V.; Cheng, Gordon	Object Classification Utilizing Neuromorphic Proprioceptive Signals in Active Exploration: Validated on a Soft Anthropomorphic Hand
250	Grignaffini, Luca; Van der Kooij, Herman; Sadeghi, Ali	A New Approach for Multi-Material Additive Manufacturing of a Sensorized Hybrid Soft Robotic Hand
281	Spiegeler Castaneda, Theophil; Capsi Morales, Patricia; Zhang, Xiaoqian; Piazza, Cristina	Soft Artificial Hand with Configurable Stiffness through Bio-inspired Spherical Joints
71	Guiaux Brinon, Julien; Ronsse, Renaud	A novel concept of passive knee prosthesis with multiple stiffnesses to support overground walking and sit-to-stand
103	Boccardo, Nicolò; Canepa, Michele; Sacchi, Lorenzo; Marinelli, Andrea; Di Domenico, Dario; De Michieli, Lorenzo; Laffranchi, Matteo	Identification of the most significant tactile sensing pressure points towards biomimetic sensory prosthetic design

[IEEE RAL Session 1 of 2] RAL1-MO2 – Room HS 9

Chair: Francisco Valero-Cuevas, Co-Chair: Anne D. Koelewijn

3	Hu, Xuhui,Song, Aiguo*,Zeng, Hong,Wei, Zhikai,deng, hanjie,Chen, Dapeng	Bridging Human-Robot Co-adaptation via Biofeedback for Continuous Myoelectric Control
4	Habibollahi, Zahra,Zhou, Yue,Jenkins, Mary,Garland, S. Jayne,Naish, Michael D.,Trejos, Ana Luisa*	Multimodal Tremor Suppression of the Wrist Using FES and Electric motors—A Simulation Study
6	He, Shaoying,Sun, Langlang,Xu, Yunwen*,li, dewei	A Modeling and Data-driven Control Framework for Rigid-soft Hybrid Robot with Visual Servoing
11	Hadi Hosseinabadi, Amir Hossein*, Black, David Gregory,Salcudean, Septimiu E.	Multi-Axis Force Sensing in Laparoscopic Surgery
19	Luciani, Beatrice*, Roveda, Loris,Braghin, Francesco,Pedrocchi, Alessandra,Gandolla, Marta	Trajectory Learning by Therapists' Demonstrations for an Upper Limb Rehabilitation Exoskeleton
392	Wu, Man I*, Stirling, Leia	Emergent gait strategies defined by cluster analysis when using imperfect exoskeleton algorithms
393	Leestma, Jennifer*,Mathur, Snehil,Anderton, Maximillian,Sawicki, Gregory,Young, Aaron	Dynamic duo: Design and validation of an autonomous frontal and sagittal actuating hip exoskeleton for balance modulation during perturbed locomotion

PLENARY SPEAKER 2 – Helen Huang (Neue Aula, 14:00 – 14:50)



THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL

NC STATE UNIVERSITY

Title: **Towards Symbiotic Robotic Prostheses**

Bio: Dr. Helen Huang is the Jackson Family Distinguished Professor in the Joint Department of Biomedical Engineering at North Carolina State University (NC State) and the University of North Carolina at Chapel Hill (UNC) and the Director of the Closed-Loop Engineering for Advanced Rehabilitation (CLEAR) core. She is also the co-director of NIDILRR funded Rehabilitation Engineering Research Center. Her research interest lies in neural-machine interfaces, wearer-robot interaction and co-adaptation, robotic prosthetics and exoskeletons, and human motor control/biomechanics. She was awarded with many prices among which the Delsys Prize for Innovation in Electromyography, the NSF CAREER Award, and the NC State ALCOA Foundation Distinguished Engineering Research Award. She is a member of numerous scientific societies, and she is the incoming Editor-in-Chief for the IEEE Transactions on Neural Systems and Rehabilitation Engineering and an Editorial Board Member for IEEE Transactions on Biomedical Engineering.

KEY INNOVATOR 1 – Hugh Herr (Neue Aula, 14:50 – 15:10)

***Title*: On the Design of Bionic Limbs: The Science of Tissue-Synthetic Interface**

Bio: Hugh Herr is a pioneering scientist in the field of Biomechatronics, blending human physiology with electromechanics to create advanced bionic limbs. A double amputee himself, he has developed groundbreaking technologies, such as the EmPower Ankle-Foot Prosthesis, which allows amputees to walk with a natural gait. He is a Professor at MIT, where he directs the Biomechatronics Group and co-directs the K. Lisa Yang Center for Bionics. With over 350 publications and numerous patents, Herr's innovations include powered exoskeletons, neural interfacing technologies, and advanced prosthetic limbs. Herr's MIT group has also invented novel mechanoneural Interfaces to the peripheral nervous system, surgical amputation procedures combined with neural interfacing technologies that enable persons with limb loss to neurally control their synthetic limbs, as well as to experience natural proprioceptive and cutaneous sensations. He has received numerous awards for his contributions, and his story has been featured in various media, including National Geographic and CNN.

POSTER SESSION 1

Afternoon Poster Sessions (15:40 – 17:00)

Panel	ID	Authors	Title
1	62	Devillez, Louis; Herman, Benoît; Ronsse, Renaud	Design of a compact active hip prosthesis with human-like range of motion and torque
2	112	Heremans, François; Evrard, Jeanne; Langlois, David; Ronsse, Renaud	A lightweight and compact lockable parallel spring enhances the performance of a powered ankle-foot prosthesis
3	109	Fagioli, Ilaria; Mazzarini, Alessandro; Baldoni, Andrea; Dell'Agnello, Filippo; Gruppioni, Emanuele; Trigili, Emilio; Crea, Simona; Vitiello, Nicola	A Lightweight Robotic Knee Prosthesis with Torsional Series Elastic Actuation
4	337	Ceccarelli, Alessandro; Nini, Ludovica; Taffoni, Fabrizio; Zollo, Loredana; Tagliamonte, Nevio Luigi	Mechanical Design of a Bioinspired and Customized Prosthetic Hand Finger Based on Six-Bar Linkage
5	356	Borja Inga, Rolando; Mio, Renato Alonso; Narayan, Jyotindra	A Low-Cost Upper-Limb Prosthetic Tool for Handlebar-Driven Vehicles
6	43	Evrard, Jeanne; Heremans, François; Ronsse, Renaud	Validation of a heuristic intention detection algorithm for a powered ankle prosthesis across various ambulation tasks
7	163	Mariani, Giulia; Dominici, Chiara; Tessari, Federico; Freddolini, Marco; Traverso, Simone; De Giuseppe, Samuele; Cherubini, Andrea; Gruppioni, Emanuele; De	Social Tasks in a Spatial Augmented Training for the Embodiment of Prosthetic Lower Limbs

		Michieli, Lorenzo; Ferraresi, Carlo; Laffranchi, Matteo; Barresi, Giacinto	
8	241	Arfaie, Omid; Unal, Ramazan	Comparison of Different Actuation Concepts for the Knee Joint During Stair-Climbing
9	354	Pirritano, Marissa; Neuman, Ross Michael; Molitor, Stephanie; Klute, Glenn; Neptune, Richard R.; Fey, Nicholas	Ability of a Robotic Ankle Prosthesis to Augment Effective Foot-Ankle Stiffness relative to Standalone Prosthetic Feet
10	390	Chengxiang, Liu; Tagliabue, Gregorio; Raveendranathan, Vishal; Houdijk, Han; Carloni, Raffaella	Control Architecture of a Variable Stiffness Prosthetic Knee for Energy Absorption and Restoration
11	51	Reginaldi, Irene; Puliti, Marco; Bunt, Alessandro; Franconi, Benedetta; Martulli, Luca Michele; Bernasconi, Andrea; Frigo, Carlo Albino; De Michieli, Lorenzo; Laffranchi, Matteo	Effect of Prosthetic Mass Reduction on Metabolic Cost and Walking Symmetry: a Case Study on Lower Limbs
12	284	Nini, Ludovica; Ceccarelli, Alessandro; Tagliamonte, Nevio Luigi; Zollo, Loredana; Taffoni, Fabrizio	Parametric 3D Modeling of a Customized Prosthetic Hand Finger for Additive Manufacturing
13	233	Stefanelli, Enrica; Lapresa, Martina; Cordella, Francesca; D'Accolti, Daniele; Cipriani, Christian; Zollo, Loredana	A hand-wrist control strategy based on human upper limb kinematics
14	80	Marquardt, Charlotte Dorothea; Dezman, Miha; Asfour, Tamim	Influence of Motion Restrictions in an Ankle Exoskeleton on Force Myography in Straight and Curve Walking
15	166	Moreira, Luís; Figueiredo, Joana; Cerqueira, João; Santos, Cristina P.	Assist-As-Needed Electromyography-based Control for a Wearable Ankle Robotic Orthosis

16	199	Bottin-Noonan, Joel; Alici, Gursel; Sreenivasa, Manish	Characterization of stiffness and damping properties of a Soft Torque Assistive Bio-inspired Lower Limb Exosuit (STABLE)
17	175	Bodo, Giulia; Giannattasio, Raffaele; Ramadoss, Vishal; Tessari, Federico; Laffranchi, Matteo	A Modular, Time-Independent, Path-Based Controller for Assist-As-Needed Rehabilitative Exoskeletons
18	212	Gantenbein, Jessica; Dittli, Jan; Meyer, Jan Thomas; Linke, Anita Dorothea; Curt, Armin; Lambercy, Olivier; Gassert, Roger	A helping hand at home: a case study on the unsupervised use of a robotic hand orthosis in people with tetraplegia
19	246	Vinzenz, Gerhard; Miskovic, Luka; Nanni, Alex; Tricomi, Enrica; Missiroli, Francesco; Palmerini, Luca; Chiari, Lorenzo; Masia, Lorenzo	Design of a High Bandwidth Wearable Actuation for seamless Assistance in Walking and Running
20	106	Ingraham, Kimberly; Feldner, Heather; Steele, Katherine	An Instrumented 'Explorer Mini' for Quantitative Analysis of Toddlers Using Powered Mobility for Exploratory, Mobile, and Digital Play
21	343	Arciniegas-Mayag, Luis; Ranjan Das, Adip; CASAS, DIEGO; Otalora, Sophia; Jiménez Hernández, Mario Fernando; Segatto, Marcelo; Diaz, Camilo; Munera, Marcela; Cifuentes, Carlos A.	Cable-Driven Exosuit to Assist Affected Upper-Limb Users with Hemiparesis
22	360	Dragusanu, Mihai; Troisi, Danilo; Suthar, Bhivraj; Prattichizzo, Domenico; Malvezzi, Monica	Development of a soft actuated glove based on twisted string actuators for hand rehabilitation
23	389	Durfee, William; Gustafson, Kimberly	A Muscle-Powered Exoskeleton for Weight-Bearing Exercise after a Spinal Cord Injury

24	139	Hjorth, Sebastian; Mobedi, Emir; Ajoudani, Arash	A Power-Based Load Decoupling Method for Wearable Assistive Systems
25	144	Sampaio Pinheiro, Cristiana Filipa; Figueiredo, Joana; Cerqueira, João; Santos, Cristina	A pilot study on wearable multimodal robotic biofeedback for personalized physical training
26	155	Bodo, Giulia; De Angelis, Agnese; Taglione, Elisa; Capitta, Gianluca; De Guglielmo, Luca; Buccelli, Stefano; Laffranchi, Matteo	Human Exoskeleton Interfaces and Precision Robotic-Human Joint Alignment for Enhanced Upper Limb Rehabilitation
27	237	Baselli, Camilla; Missiroli, Francesco; Buatier de Mongeot, Lucia; Rominger, Julius; Krzywinski, Jens; Altinsoy, Ercan; Fitzek, Frank; Cappello, Leonardo; Controzzi, Marco; Masia, Lorenzo	Tendon-Driven Haptic Glove for Force Feedback Telemanipulation
28	306	Pitzalis, Roberto Francesco; Cartocci, Nicholas; Di Natali, Christian; Caldwell, Darwin G.; Berselli, Giovanni; Ortiz, Jesus	Development of a ML-Control Strategy for a Wrist Exoskeleton based on EMG and Force measurements with Sensor Strategy Optimisation
29	332	Fanti, Vasco; Leggieri, Sergio; Caldwell, Darwin G.; Di Natali, Christian	Proprioceptive-Based Control Strategy to Assist Walking and Carrying Tasks in Back-Support Exoskeletons
30	45	Mosconi, Denis; Moreno, Yecid; Moreira, Melkzedekue; Siqueira, Adriano	HUMAN-EXOSKELETON INTERACTION DURING KNEE FLEXION-EXTENSION WITH ROBOT SETUP IN RESISTIVE MODE
31	100	Liu, Yali; Zhou, Xingjian; Liu, Yue; Zhang, Jingyi; Song, Qiuzhi	The kinetics modeling of a 3 powered joint exoskeleton for lifting and transferring heavy loads
32	129	Hofmann, Veronika; Bölke, Nico; Maufroy, Christophe; Schneider, Urs; Pott, Peter	Development and evaluation of a passive lower body exoskeleton for agriculture

33	310	Khatiwada, Denish; Sanders, Quentin	Design, Characterization, and Testing of Rigid Chain Actuator for an Under-Actuated, Tendon Driven Hand Exoskeleton
34	232	Garzás-Villar, Alberto; Boersma, Caspar; Derumigny, Alexis; Zgonnikov, Arkady; Marchal-Crespo, Laura	Personality Traits Modulate the Effect of Haptic Guidance during Robotic-assisted Motor Training
35	150	Poignant, Alexis; Morel, Guillaume; Jarrassé, Nathanael	Hands-free teleoperation of a nearby manipulator through a virtual body-to-robot link
36	217	Pierella, Camilla; Freccero, Aurora; Biasotti, Giulia; Traverso, Nicolò; Bellitto, Amy; Ricci, Serena; Sante, Filippo; Carlini, Giorgio; Canessa, Andrea; Massone, Antonino; Casadio, Maura	Driving Skills Assessment in Individuals with Spinal Cord Injuries: A Pilot test of ADRIS 3.0 Simulator
37	219	Bellitto, Amy; Girardo, Ermanno; Casadio, Maura; Mastrogiovanni, Fulvio; Moro, Matteo; Pierella, Camilla; Carfì, Alessandro	TIAGo Robot Teleoperation via Body-Machine Interface: Enhancing Assistance for Cervical Spinal Cord Injured Individuals
38	299	Buscaglione, Silvia; Noccaro, Alessia; Provenzale, Cecilia; Chiara, Bonsignori; Ivanova, Ekaterina; Sparaci, Laura; Taffoni, Fabrizio; burdet, etienne; Formica, Domenico	A Human-Human Physical Interaction System for Training Handwriting
39	167	Higashikawa, Kouki; Hong, Jing-Chen; Tsuruta, Chihiro; Nagashima, Ryo; Takeuchi, Ryohei; Gunbe, Tsubasa; Iwata, Hiroyasu	Development of a Foot Center of Pressure Biofeedback System for the Prevention of Bowleg Redeformation: A Feasibility Study in Patients after Tibial Osteotomy
40	165	Hoefflin, Niklas; Spulak, Tim; Jeworutzki, André; Schwarzer, Jan	Real-time Lateral Sitting Posture Detection using YOLOv5

PARALLEL ORAL SESSIONS AFTERNOON

Afternoon ORAL Sessions (17:00 – 18:15): Parallel oral sessions (talks: 10 min + 2 min Q&A)

[Exoskeletons and exosuits] EE-AF2 – Room HS 1 ***Chair: Edwin van Asseldonk, Co-Chair: Carlos A. Cifuentes***		
184	Chen, Chih-Yu; Martins Frejat, Julia; Vaidyanathan, Ravi; Drechsler, Klaus	Biomechanical Joint Design of Patient-Specific Rehabilitative Knee Exoskeletons for Misalignment Correction
197	Tomc, Matej; Olenšek Andrej; Matjaz Zadravec; Matjacic, Zlatko	Inherent Synchrony Between an Ankle Exoskeleton and its Wearer Achieved Through Mechanical Design
230	Su, Huimin; Missiroli, Francesco; Zhang, Xiaohui; Becchio, Cristina; Park, Hyung-Soon; Masia, Lorenzo	Advanced Soft Wearable Robotics for Rehabilitation: Incorporating Forearm Rotation in a Glove Exosuit to Augment Grasping Capabilities and Improve Therapeutic Outcomes
249	Missiroli, Francesco; Ferrazzi, Francesco; Tricomi, Enrica; Casadio, Maura; Masia, Lorenzo	Assistive Force Myography Controlled Exoglove
256	Capitani, Stefano Laszlo; Peperoni, Emanuele; Kuang, Lisheng; Fiumalbi, Tommaso; Baldoni, Andrea; Dell'Agnello, Filippo; Creatini, Ilaria; Taglione, Elisa; Vitiello, Nicola; Trigili, Emilio; Crea, Simona	H-PhlEx α: a compact SEA-based hand exoskeleton with active methacarpophalangeal joints

154	Sugino, Tomotaka; Shimoda, Yusuke; Okui, Manabu; Nishihama, Rie; Nakamura, Taro	Exoskeleton-type Assist Device Focusing on the Variable Viscosity Characteristics of the Knee Joint During Stair Descent

[Neural control of movement and biomechanics] NC-AF2 – Room HS 4 *Chair: Lorenzo Masia, Co-Chair: Guillaume Durandau*		
105	McArthur, Daniel; Branyan, Callie; Tansel, Derya; Eric Vincent, Liu, Eric; Mazumdar, Anirban; Miera, Alexandria; Rittikaidachar, Michal; Spencer, Steven J.; Wood, David; Wheeler, Jason	Dynamic Shear and Normal Force Detection in a Soft Insole Using Hybrid Optical & Piezoresistive Sensors
126	Bunz, Elsa Katharina; Pawusch, Louisa Helen; Schmitt, Syn	Optimizing reflex-based neuromusculoskeletal walking model on rough terrain reveals increased robustness and key stabilizing reflexes
132	Sapounaki, Maria; Schumacher, Pierre; Ilg, Winfried; Giese, Martin; Maufroy, Christophe; Bulling, Andreas; Schmitt, Syn; Haeufle, Daniel Florian Benedict; Wochner, Isabell	Quantifying human upper limb stiffness responses based on a computationally efficient neuromusculoskeletal arm model
191	berjis, mahshad; LeBel, Marie-Eve; Lizotte, Daniel; Trejos, Ana Luisa	Selecting Muscles for Detection of Upper-limb Compensatory Motions Using s-EMG Sensors
193	Jaberi Miandoab, Mahan; Rogers-Bradley, Emily	Passive Dynamic Walking with Arms: Sagittal Plane Bifurcation and Stability
200	Terada, Ryohei; Hirai, Hiroaki; Sasaki, Kosei; Kuga, Hirokazu; Furukawa, Keisuke; Matsui, Kazuhiro; Nishikawa, Atsushi; Krebs, Hermano Igo	Transverse Pelvic/Saddle Rotation Characterizing Push-off Initiation during Saddle-seat-type Body-weight-supported Treadmill Walking

[Soft robotics] SR-AF2 – Room HS 7 *Chair: Edoardo Milana, Co-Chair: Federico Masiero*		
268	Tosi, Beatrice; Nazeer, Muhammad Sunny; Falotico, Egidio	Behavior Cloning from Observations with Domain Mapping for the Control of Soft Robots
384	Osawa, Keisuke; Nakamura, Seishiro; Duan, Kaiwen; Ueda, Akio; Tanaka, Eiichiro	Modeling of Gummy Gears for Self-Propelled Edible Robots
228	Kalpathy Venkiteswaran, Venkatasubramanian; Bos, Jurrien; Dannana, Dimple; Sadeghi, Ali	An LMPA-based Magnetically-Actuated Growing Robot for Medical Applications
357	Nassour, John; Pei, Guanran; Menzel, Nicholas Daniel; Berberich, Nicolas; Gigl, Sandra; Wilke, Manuel; Koch, Kathrin; Cheng, Gordon	MRI Compatible Valve Enables Fast Actuation of Soft Hand Exoskeleton in Medical Imaging
331	Donato, Enrico; George Thuruthel, Thomas; Falotico, Egidio	Towards Interpretable Visuo-Tactile Predictive Models for Soft Robot Interactions
50	Lizotte, Alex; Daemi, Parisa; DiFabio, Brendan; Trejos, Ana Luisa	Improving the Cooling Time of Twisted Coiled Actuators in Soft Robotics
95	Nagase, Jun-ya; Unno, Yo	Cylindrical Elastic Crawler with Active Steering Using Sliders for Pipe Inspection

[Haptics] HP-AF2 – Room HS 6 ***Chair: Yeongmi Kim, Co-Chair: Domenico Formica***		
8	van Riessen, Huibert A. J.; Vardar, Yasemin	Relocating thermal stimuli to the proximal phalanx may not affect vibrotactile sensitivity on the fingertip
15	Tiseo, Carlo; Rouxel, Quentin; Asenov, Martin; Kouhkiloui Babarahmati, Keyhan; Ramamoorthy, Subramanian; Li, Zhibin (Alex); Mistry, Michael	Achieving Dexterous Bidirectional Interaction in Uncertain Conditions for Medical Robotics
77	Cheng, Ching Hei; Eden, Jonathan; Oetomo, Denny; Tan, Ying	Exploring the Influence of Displacement, Velocity and Actuation Duration on Skin Stretch Perception
311	Eder, Jasmin; Mauracher, Dorothea; Freiherr von Stein-Liebenstein zu Barchfeld, Ruben; Zamarian, Laura; Kim, Yeongmi	Enhancing sensory memory through multi-modal stimulation on a finger training and assessment device
339	Way, Joel; Buscaglione, Silvia; Giovannetti, Giorgia; Formica, Domenico	Design and Testing of a Planar Device for haptic interactions during handwriting teaching and learning.

Forum 1 – Sensorimotor control of upper limb prostheses

Christian Cipriani

Room HS 14

Afternoon Session:
17:00 – 18:15

Abstract

This Forum aims to discuss the emerging, current, and historical trends and challenges in the field of sensorimotor control of upper limb prostheses from an interdisciplinary perspective. Over the past 20 years, advancements in bionic hand reconstruction have significantly improved motor and sensory functions for individuals with upper limb amputations. Combining advanced surgical procedures with complex prosthetic technologies, experts are striving for more intuitive and biomimetic control of artificial limbs, including the restoration of proprioceptive and exteroceptive sensations. These recent developments have opened up new perspectives for all stakeholders involved in the field of upper limb prostheses and have offered researchers valuable insights for compelling discussion.

This Forum is an opportunity for young researchers to learn from leaders in the field and for senior researchers to inspire new projects and collaborations. We will explore the latest advances in invasive and non-invasive technologies and strategies for probing control signals and restoring sensation, their integration with state-of-the-art surgical interventions, and discuss hardware modifications needed to adapt current prosthetic solutions to these new scenarios.

The format is highly interactive: we will present a series of provocative research statements or questions, and the audience will be invited to discuss the topic and engage in open discussion, fostering effective and critical opinion exchanges on key topics in the field.

Contributors

Strahinja Dosen, Dario Farina, Levi Hargrove, Helen Huang, Nathanaël Jarrassé, Max Ortiz-Catalan, Patrick Pilarski, Jonathon Schofield, Jon Sensinger.

Forum Chair

Christian Cipriani, Scuola Superiore Sant'Anna (Christian.cipriani@santannapisa.it).

Acknowledgment

This Forum is supported by the Italian Ministry of Research, under the complementary actions to the NRRP "Fit4MedRob - Fit for Medical Robotics" Grant (number PNC0000007), and by INAIL, in the framework of the BioARMnext (grant number: PR23-RR-P3), NoProblem (grant number: PR23-CR-P3), and OsteoAMI (grant number: PR23-CR-P5) projects.

DETAILED PROGRAM – Tuesday 3 September

PLENARY SPEAKER 3 – Aude Billard (Neue Aula, 9:00 – 9:50)

Title: **Toward Human-Like Dexterity for Robots**

Bio: Aude Billard is full professor and head of the LASA laboratory at the School of Engineering at the Swiss Institute of Technology Lausanne (EPFL). Dr. Billard acts as the President of the IEEE Robotics and Automation Society (RAS), after serving in several roles in the administrative and executive committees of IEEE RAS. She also serves as Associate Dean for Education at the EPFL School of Engineering and lead of Swiss Innovation Booster on Robotics. Aude Billard holds a B.Sc and M.Sc. in Physics from EPFL and a Ph.D. in Artificial Intelligence from the University of Edinburgh. A. B. is an IEEE Fellow and the recipient of numerous recognitions, among which the Intel Corporation Teaching award, the Swiss National Science Foundation career award, the Outstanding Young Person in Science and Innovation from the Swiss Chamber of Commerce, the IEEE RAS Distinguished Award, and the IEEE-RAS Best Reviewer Award.

KEY INNOVATOR 2 – Robert Riener (Neue Aula, 9:50 – 10:10)

ETH zürich

***Title*: Rock and Treat during Sleep**

Bio: Robert Riener studied Mechanical Engineering at TU München, Germany, and University of Maryland, USA. He received a Dr.-Ing. degree in Engineering from the TU München in 1997. After postdoctoral work from 1998-1999 at Politecnico di Milano and TU München, he became assistant professor at ETH Zurich and the medical faculty of the University of Zurich ("double-professorship") in 2003. Since 2010 he has been full professor for Sensory-Motor Systems, ETH Zurich. In 2016 Riener became also full professor of medicine at the University of Zurich. Riener's research focuses on the investigation of the sensory-motor interactions between humans and machines. He is the initiator and organizer of the Cybathlon Championship, which was honored with the European Excellence Award and the Yahoo Sports Technology Award. In 2018 Riener obtained the honorary doctoral degree from the University of Basel. Since 2022 Riener is president of the ICORR.

PARALLEL ORAL SESSIONS MORNING

Morning ORAL Sessions (10:40 – 12:00): Parallel oral sessions (talks: 10 min + 2 min Q&A)

[Exoskeletons and exosuits] EE-MO3 – Room HS 5 ***Chair: Sabine Thuerauf, Co-Chair: Satoshi Endo***		
267	Meier, Tess; Nycz, Christopher J; Daudelin, Andrew; Fischer, Gregory Scott	The PneuHOPE Hand Exoskeleton: A Platform for Studying Brain Activation during Robot-facilitated Hand Movement using fMRI
274	Arcobelli, Valerio Antonio; Bruschi, Agnese; Vassallo, Christian; Zauli, Matteo; De Marchi, Luca; Maludrottu, Stefano; Laffranchi, Matteo; Chiari, Lorenzo; Mellone, Sabato	Enhancing TWIN Lower-Limb Exoskeleton Functionalities through Sensorized Crutches and a Trunk Inertial Measurement Unit
288	Kavianirad, Hossein; Missiroli, Francesco; Endo, Satoshi; Masia, Lorenzo; Hirche, Sandra	Toward Dexterous Hand Functional Movement: Wearable Hybrid Soft Exoglove-FES Study
314	Scott, Isaiah; Rose, Chad; Deshpande, Ashish	A Novel Velocity-Based Controller That Targets Unwanted Joint Coordination
352	Palacios, Joaquin; Deli-Ivanov, Alexandra; Chen, Ava; Winterbottom, Lauren; Nilsen, Dawn; Stein, Joel; Ciocarlie, Matei	Grasping Force Modulation with a Wrist Motion-Controlled Hand Orthosis for C6-C7 Spinal Cord Injury

[Neural control of movement and biomechanics] NC-MO3 – Room HS 6
Chair: Massimo Sartori, Co-Chair: Friedl De Groote

127	Lokesh, Rakshith; Sternad, Dagmar	Human control of underactuated objects: Adaptation to uncertain nonlinear dynamics ensures stability
266	D'Hondt, Lars; Falisse, Antoine; Gupta, Dhruv; Van Den Bosch, Bram; Buurke, Tom; Febrer Nafría, Míriam; Vandekerckhove, Ines; Afschrift, Maarten; De Groote, Friedl	PredSim: A Framework for Rapid Predictive Simulations of Locomotion
292	Rook, Jan Willem A; Sartori, Massimo; Mohamed Refai, Mohamed Irfan	Towards Wearable Electromyography for Personalized Musculoskeletal Trunk Models using an Inverse Synergy-based Approach
303	Gogeascoechea, Antonio; Mohamed Refai, Mohamed Irfan; Yavuz, Utku S.; Sartori, Massimo	Towards Real-time Decoding of Motor Unit Firing Events and Resulting Muscle Activation during Human Locomotion and High-force Contractions
309	ye, tian; Manzoori, Ali Reza; Ijspeert, Auke; Bouri, Mohamed	Human-in-the-Loop Optimization for Terrain- and User-Adaptive Gait Phase Estimation in Phase-Portrait-Based Methods
312	Helm, Cody; Sergi, Fabrizio	Model-Based Estimation of Active and Passive Muscle Forces Using MRE in Forearm Muscles During 2-DOF Wrist Tasks
149	Marjaninejad, Ali; Valero-Cuevas, Francisco, J.	Model-agnostic Bio-inspired Autonomous Lifelong-learning of Kinematic Control in Tendon-driven Quadruped Robots

[Micro/nano robotics] MN-MO3 – Room HS 4 *Chair: Egidio Falotico, Co-Chair: Islam S. M. Khalil*		
259	De Remigis, Eugenia; Dikbas, Fehmi Mustafa; Ibrahimi, Michele; Bianciardi, Francesco; Petrocelli, Elisa Linda; Roberti, Elisa; Iacovacci, Veronica; Palagi, Stefano	Infiltration of cell-inspired ultra-deformable magnetic microrobots in restrictive environments
195	Kim, Min Sung; Park, Chan Young; Lee, Doo Yong	Magnetorheological-elastomer-based and Hydraulically Steerable Actuator for Micro Guidewire and Catheter
223	Srymbetov, Tamerlan; De Angelis, Giordano; Menciassi, Arianna; Iacovacci, Veronica	Millimeter-scale Magnetic Carrier for On-demand Delivery of Magnetic and Non-magnetic Microparticles Suspensions
134	Ligtenberg, Leendert-Jan Wouter; Jongh, de, Luuc; Liefers, Herman Remco; Wasserberg, Dorothee; Klein Rot, Emily A. M.; Ben Ami, Doron; Sadeh, Udi; Lomme, Roger MLM; Tuijthof, Gabrielle; Shoseyov, Oded; Jonkheijm, Pascal; Warle, Michiel; Khalil, Islam S.M.	X-Ray-Guided Robotic Platform for Remote Control of Untethered Magnetic Robots Targeting Blood Clots in the Iliac Artery
173	Manikandan, Aiswarya Lakshmi; Gurboga, Berfin; Munzenrieder, Niko; Raman, Akash; Gardeniers, Han J.G.E.; Susarrey-Arce, Arturo; Abelmann, Leon; Khalil, Islam S.M.	Exploring PEMFCs for Powering Untethered Small-Scale Robots

[Human-machine interaction and assistive robotics] HM-MO3 – Room HS 1 *Chair: Alessia Noccaro, Co-Chair: Sebastian Hjorth*		
162	Du, Mingtian; Kager, Simone; Alexandre Pinto Sales de Noronha, Bernardo; Campolo, Domenico	The effect of haptic delay on robot-mediated dyadic cooperation
269	Kim, GilHwan; Sergi, Fabrizio	Modeling Neuromotor Adaptation to Pulsed Torque Assistance During Walking
300	Wu, Mengnan; Ting, Lena	Novel physical human-robot interactions at the hands alter walking coordination without relying on mechanical effects
41	Rossos, Daniel; Mihailidis, Alex; Laschowski, Brokoslaw	AI-Powered Smart Glasses for Sensing and Recognition of Human-Robot Walking Environments
98	Guachi, Robinson; Napoleoni, Flavio; Kabashi, Burim; Controzzi, Marco	Mechanical Integration of a Sensorized Skin in an Anthropomorphic Hand: Design pipeline and tests
122	Raei, Hamidreza; Gandarias, Juan M.; De Momi, Elena; Balatti, Pietro; Ajoudani, Arash	A Multipurpose Interface for Close- and Far-Proximity Control of Mobile Collaborative Robots

[Neurorobotics and neural interfaces] NN-MO3 – Room HS 7 *Chair: Emilia Ambrosini, Co-Chair: Lorenzo Masia*		
78	Mahmoudi Khomami, Asghar; Khosrotabar, Morteza; Kuhmann, Jannis; Grimmer, Martin; Rinderknecht, Stephan; Ahmad Sharbafi, Maziar	Feasibility of utilizing passive BCI for assistance evaluation: a case study on a knee exoskeleton
372	Kanetis, Jake; Gonzalez, Michael; Vaskov, Alex; Cederna, Paul; Chestek, Cynthia; Gates, Deanna	Assessing the utility of Regenerative Peripheral Nerve Interfaces (RPNIs) in providing referred sensations in functional tasks in a virtual environment
277	Nikonowicz, Rebecca; Sergi, Fabrizio	Development of an MRI-compatible robotic perturbation system for studying the task-dependent contribution of the brainstem to long-latency responses
285	Schmidt, Kristin; Berret, Bastien; Sergi, Fabrizio	Development of an Experimental Protocol to Study the Neural Control of Force and Impedance in Wrist Movements with Robotics and fMRI
341	Lambeth, Krysten; Iyer, Ashwin; Sharma, Nitin	Quantifying Functional Electrical Stimulation-Induced Fatigue Via Ultrasound for Hybrid Neuroprosthesis-Based Walking
242	Savona, Davide; Zanco, Camilla; Sanna, Nicole; Pedrocchi, Alessandra; Ambrosini, Emilia	A Functional Electrical Stimulation and motor-assisted trike for sport rehabilitation therapy

[IEEE RAL Session 2 of 2] RAL2-MO3 – Room HS 9

Chair: Francisco Valero-Cuevas, Co-Chair: Wesley Roozing

394	Lang, Guodong,Gao, Yongsheng*,Luo, Zhewen,Liang, Guanlin,Zhu, Yanhe,Zhao, Jie	Kinematic analysis for the spatial interlocking 3-UU mechanism with the wide range of motion
395	Nuesslein, Christoph*,Young, Aaron	A Deep Learning Framework for End-To-End Control of Powered Prostheses
396	Chathuranga, Damith Suresh*,Lloyd, Peter Robert,Chandler, James Henry,Harris, Russell,Valdastri, Pietro	Assisted Magnetic Soft Continuum Robot Navigation via Rotating Magnetic Fields
399	Kaito Mizuno*,Mitsuru Higashimori	Internal Pressure Pattern Design for Variable Surface Shapes of Tongue-type Pneumatic Soft Actuator
400	Fraai, Tristan,Wen, Jian,Taghavi, Majid*	Electrically Zipping Bending Actuators for Prosthetic Fingers
401	Panzirsch, Michael*,Singh, Harsimran,Sierotowicz, Marek,Dietrich, Alexander	Extension of the Deflection-Domain Passivity Approach for Variable Stiffnesses to SO(3)

[IEEE RAS EMBS Best paper Awards] BP-MO3 – Room HS 8

Chair: Tamim Asfour, Co-Chair: Philipp Beckerle

185	Schumacher, Pierre; Krause, Lorenz; Schneider, Jan; Büchler, Dieter; Martius, Georg; Haeufle, Daniel Florian Benedict	Learning to Control Emulated Muscles in Real Robots: Towards Exploiting Bio-Inspired Actuator Morphology
326	Eveld, Maura; Van Asseldonk, Edwin; Van der Kooij, Herman	A disturbance-cancelling approach for exoskeleton balance assistance
118	De Vicariis, Cecilia; Ivanova, Ekaterina; Sanguineti, Vittorio; Burdet, Etienne	Haptic Communication in a Redundant Sensorimotor Interactive Task
261	Abdulali, Arsen; Costa Cornella, Aliex; Sirithunge, Chapa; Iida, Fumiya	Effect of Material Viscosity on Tactile Compliance Discrimination
48	Smyrnakis, Nikolaos; Karakostas, Tasos; Cotton, R. James	Advancing Monocular Video-Based Gait Analysis Using Motion Imitation with Physics-Based Simulation
187	Marx, Lennard; Groenhuis, Vincent; Stramigioli, Stefano; Niu, Kenan	Augmented-Reality based digital twin to control an MR safe robot for breast biopsy: A benchmark study

PARALLEL ORAL SESSIONS AFTERNOON

Afternoon ORAL Sessions (13:30 – 14:45): Parallel oral sessions (talks: 10 min + 2 min Q&A)

[Exoskeletons and exosuits] EE-AF3 – Room HS 1 ***Chair: Robert D. Gregg, Co-Chair: Aaron Young***		
353	Ophaswongse, Chawin; Puma, Patrick; Daley, Ian; Santamaria, Victor; Agrawal, Sunil	Training Seated Postural Coordination in a Virtual Reality Reaching Game by Active Pelvic Guidance from a Robotic Exoskeleton
355	Chen, Ava; Lee, Katelyn S.; Winterbottom, Lauren; Xu, Jingxi; Lee, Connor; Munger, Grace; Deli-Ivanov, Alexandra; Nilsen, Dawn; Stein, Joel; Ciocarlie, Matei	Volitional Control of the Paretic Hand Post-Stroke Increases Finger Stiffness and Resistance to Robot-Assisted Movement
363	Eraky, Mohamed; Rocha, Mariana; Hernandez-Rocha, Mariana; Teker, Aytac; Gebre, Biruk; Nolan J., Karen; Pochiraju, Kishore; Zanotto, Damiano	A Novel Personalized Ankle Exoskeleton with Co-Located SEA for Gait Training
380	Mahdian, Zahra S.; Van der Kooij, Herman; MacLean, Mhairi	Iterative Learning Compensation Control for Torque Tracking of Short Pulses throughout Gait Cycle with an Ankle Exoskeleton
387	Bywater, Emily A.; Van Crey, Nikko; Rouse, Elliott	Optimizing the Mechanics of a Variable-Stiffness Orthosis with Energy Recycling to Mitigate Foot Drop
63	Ciaramella, Alessandro; Bagneschi, Tommaso; Tricomi, Enrica; Missiroli, Francesco; Zhang, Xiaohui; Frisoli, Antonio; Masia, Lorenzo	Design and Control of a Hip Exosuit for Assistance in Running

[Neural control of movement and biomechanics] NC-AF3 – Room HS 4 *Chair: Adriano Siqueira, Co-Chair: Fabrizio Sergi*		
334	Ornelas Kobayashi, Rafael; Mooiweer, Rienke; Sartori, Massimo	Towards personalized neurorehabilitation technologies: neural data-driven models of person-specific alpha-motoneuron pools
362	Ton, Vincent; Solav, Dana; Song, Seungmoon	Impact of sole designs of offloading AFO on gait dynamics: a predictive neuromechanical simulation study
368	Yoshihara, Masahiro; Ishii, Yuta; Itami, Taku; Yoneyama, Jun; Aoki, Takaaki	Effects of Insole-Type Device with Controllable Ankle Joint Angle on the Peroneus Longus Muscle During Foot Stomping Motion
47	Buchmann, Alexandra; Renjewski, Daniel	An open-source framework for sensitivity analysis of predictive neuromuscular simulations: how muscle-tendon stiffness and tendon slack length affect push-off
56	Eddy, Ethan; Campbell, Evan; Bateman, Scott; Scheme, Erik	Human-Machine Interaction Using Discrete Myoelectric Control: Contrastive Learning Reduces False Activations During Activities of Daily Living
60	Sabbah, Maxime; Dumas, Raphaël; Pomarat, Zoe; Robinet, Lucas; Adjel, Mohamed; Watier, Bruno; Bonnet, Vincent	Ground Reaction Forces and Moments Estimation from Embedded Insoles using Machine Learning Regression Models

[Surgical and medical robotics] SR-AF3 – Room HS 5 *Chair: Ting Zhang, Co-Chair: Daniel Häufle*		
102	Wochner, Isabell; Nadler, Tobias; Stollenmaier, Katrin; Pley, Christina; Ilg, Winfried; Wolfen, Simon; Schmitt, Syn; Haeufle, Daniel Florian Benedict	ATARO: a muscle-driven biorobotic arm to investigate healthy and impaired motor control
130	Bauer, Christian Johannes Eugen; Schäfer, Max Bert; Riepe, Sarah; Parenzan, Matthias; Weiland, Sophie; Pott, Peter	Achieving High-Quality Haptic Feedback in Robot-Assisted Surgery With a Model-Based Approach
327	Kenanoglu, Celal Umut; Le Mesle, Valentin; Luarasi, Gjergji; Sadeghian, Hamid; Haddadin, Sami	Design and Evaluation of a Surgical Tool Drive Unit for Sustainable Training in Robot-Assisted Minimally Invasive Surgery
83	Zhu, Guangpu; Gao, Zheng; Gong, Zhenhua; Zhang, Ting	Bionic Super Redundant Robot with Variable Stiffness and Telescopic Based on Origami Theory for Medical Applications
123	Rota, Alberto; Sun, Xianyi Federica; De Momi, Elena	Performance-driven tasks with adaptive difficulty for enhanced surgical robotics training

[Haptics] HP-AF3 – Room HS 6

Chair: Matthias Harders, Co-Chair: Marta Gherardini

182	Noccaro, Alessia; Boljanic, Tanja; Strbac, Matija; Di Pino, Giovanni; Formica, Domenico	Closed-loop Platform for Human Movement Augmentation with Electrotactile Feedback
258	Blanco-Diaz, Cristian Felipe; Degl'Innocenti, Gianmarco; Vendrame, Eleonora; Uliano, Manuela; Controzzi, Marco; Cappello, Leonardo	Design and characterization of a low-profile haptic system for telemanipulation
275	Arink, Wouter; Poggensee, Katherine; Beckers, Niek; Abbink, David A.; Marchal-Crespo, Laura	Indirect Haptic Disturbances Enhance Motor Variability, with Divergent Effects on Skill Transfer
280	Cecamore, Matteo; Gaponov, Igor; Miller, Stuart; Farkhatdinov, Ildar	Design and Validation of a Haptic Ankle Platform for Physical Human-Machine Interaction
87	Ratschat, Alexandre Lionel; Martin-Rodriguez, Ruben; Vardar, Yasemin; Ribbers, Gerard M.; Marchal-Crespo, Laura	Design and evaluation of a multi-finger skin-stretch tactile interface for hand rehabilitation robots

[Bionic prostheses] BP-AF3 – Room HS 7 *Chair: Herman van der Kooji, Co-Chair: Elliott Rouse*		
178	Pett, Nicholas; Rawal, Nundini; Shetty, Varun Satyadev; Wontorcik, Leslie; Rouse, Elliott	Preferred Ankle Stiffness of a Variable-Stiffness Prosthesis Across Five Activities
273	Patwardhan, Shriniwas; Bashatah, Ahmed; Joiner, Wilsaan; Schofield, Jonathon; Sikdar, Siddhartha	Closed-loop Shared Proportional Position Control of a Prosthetic Hand using Sonomyography
388	Mituniewicz, Austin; Hong, Woolim; Huang, He (Helen)	Continuous Gait Phase Estimation from Translational Kinematics: Towards Implementation in Powered Ankle Prostheses
40	Bendfeld, Robin; Remy, C. David	Squatting with Prostheses-inspired Compliant Robotic Legs
42	Happold, Johanna; Morais, Diogo; Capsi Morales, Patricia; Piazza, Cristina	Preliminary validation of an immersive virtual reality framework for prosthetic embodiment quantification
69	Shepherd, Max; Rouse, Elliott	Rethinking Energy Storage and Return in Prosthetic Feet: User Preferences Challenge Conventional Wisdom

[IEEE RAS EMBS Best Student Paper Awards] BSP-AF3 – Room HS 8 *Chair: Marcia O'Malley, Co-Chair: Hyung-soon Park*		
57	Marsh, David Michael; Puliti, Marco; Goldfarb, Michael	A Novel Swing Assistance Control Approach for a Powered Transfemoral Prosthesis
113	Polizzotto, Maria Grazia; Zaidi, Ahmed Zohaib; Paterno, Linda; Menciassi, Arianna	Self-adaptive upper limb prosthetic socket
201	van der Mijle Meijer, Joep Kobus; Mulder, Iris; Ligtenberg, Leendert-Jan Wouter; Liefers, Herman Remco; Magdanz, Veronika; Khalil, Islam S.M.	Controlled Locomotion of IRONSperm Clusters: Evaluating Maneuverability with X-Ray-Guided Magnetic Fields
75	Gonzalez cely, aura ximena; blanco-diaz, cristian felipe; delisle rodriguez, denis; bastos filho, teodiano freire	EEG-Based Multiclass Classification for Recognizing Pedaling Velocities: A Promising Approach for Brain-Computer Interface-Enhanced Lower-Limb Robotic Rehabilitation
169	Tamai, Hayato; Sankai, Yoshiyuki; Uehara, Akira; Kawamoto, Hiroaki	The Development of Anorectal and Core Activation Method with Wearable Cyborg HAL for Defecation Disorder Treatment
279	Deng, Yuanzhe; Roshanfar, Majid; Mayer, Haley; He, Changyan; Drake, James; Looi, Thomas; Diller, Eric D.	Towards Bimanual Operation of Magnetically Actuated Surgical Instruments

PLENARY SPEAKER 4 – Pietro Valdastri (Neue Aula, 15:15 – 16:05)

UNIVERSITY OF LEEDS

***Title*: Lifesaving Soft Magnetic Surgical Robots**

Bio: Pietro Valdastri is Full Professor and Chair in Robotics and Autonomous Systems at the University of Leeds. He directs the Science and Technologies Of Robotics in Medicine (STORM) Lab, focusing on intelligent robots to fight cancer, the Institute of Robotics, Autonomous System and Sensing (IRASS), and the Robotics at Leeds network. He graduated in Electronic Engineering from the University of Pisa in 2001 and received his PhD in Biomedical Engineering from Scuola Superiore Sant'Anna in 2006. He has published more than 150 peer reviewed journal papers in the field of medical robotics and has been principal investigator on grants in excess of $24M. STORM Lab's research has been featured by several news outlets, including the BBC, The Times, The Washington Post, to cite a few. Prof Valdastri also completed a successful entrepreneurial cycle with WinMedical s.r.l., a company he co-founded in 2009 and that was acquired by a larger enterprise in 2017. He recently started a new company, Atlas Endoscopy Limited, to bring his robotic colonoscopy platform to patients.

KEY INNOVATOR 3 – Cecilia Laschi (Neue Aula, 16:05 – 16:30)

***Title*: Robotics goes soft: from nature to robotics … and back**

Bio: Cecilia Laschi is Provost's Chair Professor of robotics at the National University of Singapore, leading the Soft Robotics Lab. She is Co-Director of CARTIN – Centre for Advanced Robotics Technology and Innovation. She graduated in Computer Science at the University of Pisa and received a Ph.D. in Robotics from the University of Genoa. Cecilia Laschi is a pioneer of soft robotics, exploring marine applications of soft robots and their use in the biomedical field. She investigates fundamental challenges for building robots with soft materials, with a bioinspired approach which started with a study of the octopus as a model for robotics. She has worked in humanoid and neuro-robotics, applying brain models in humanoid robots. She serves in the Editorial Boards of many scientific journals, including Science Robotics and IEEE Robotics & Automation Letters. She is IEEE Fellow and member of other scientific societies, like AAAS (American Association for the Advancement of Science), and the IEEE Robotics & Automation Society (RAS).

KEY INNOVATOR 4 – Michael Goldfarb (Neue Aula, 16:30 – 16:50)

VANDERBILT UNIVERSITY

***Title*: An appreciation of passive dynamics in the context of powered leg prostheses**

Bio: Michael Goldfarb is the H. Fort Flowers Professor of Mechanical Engineering at Vanderbilt University, with secondary appointments as a professor in Electrical Engineering and Physical Medicine and Rehabilitation. Dr. Goldfarb has authored over 250 publications on topics related to wearable robotics, has been awarded over 50 US patents, was inducted into the US National Academy of Inventors in 2020, and was recognized in 2021 by Stanford University as among the Top 2% of most cited scientists. Among his papers are ones awarded best-paper awards in 1997, 1998, 2003, 2007, 2009, 2013, 2020, and 2022 and others that were finalists for best paper awards in 2015, 2017, and 2020. Research interests include the development of robotic limbs for upper and lower extremity amputees, and the development of exoskeletons for individuals with spinal cord injury and stroke, including the development of a lower limb exoskeleton now sold as the Indego exoskeleton.

POSTER SESSION 2

Afternoon Poster Sessions (16:50 – 18:10)

Panel	ID	Authors	Title
1	218	Santos, André; Ferreira Duarte, Nuno; Dehban, Atabak; Santos-Victor, José	Learning the Sequence of Packing Irregular Objects from Human Demonstrations: Towards Autonomous Packing Robots
2	38	Ivanyuk-Skulskiy, Bogdan; Kurbis, Andrew Garrett; Mihailidis, Alex; Laschowski, Brokoslaw	Sequential Image Classification of Human-Robot Walking Environments using Temporal Neural Networks
3	88	Moreau, Emile; Herman, Benoît; Chatelain, Philippe; Ronsse, Renaud	Design and Characterization of a Robotic Cyber-Physical System for Real-Time Flow-Device Experiments
4	252	Cittadini, Roberto; Buonocore, Luca Rosario; Di Castro, Mario; Zollo, Loredana	Contactless Respiration Rate Monitoring and Human Body Pose Detection for Search and Rescue Robots
5	270	Brilli, Dionysia Danai; Georgaras, Evangelos; Tsilivaki, Stefania; Melanitis, Nikos; Nikita, Konstantina	AIris: An AI-powered Wearable Assistive Device for the Visually Impaired
6	297	Xygonakis, Ioannis; Seganfreddo, Riccardo; Hamad, Mazin; Schneider, Samuel; Schroeder, Axel; Krieg, Sandro; Meyer, Bernhard; Chiari, Lorenzo; Zavaglia, Melissa; Haddadin, Sami	Transcranial Magnetic Stimulation Robotic Assistant: towards a fully automated stimulation session
7	342	Cavaglià, Maria Sole; Sierra M., Sergio D.; Palmerini, Luca; Orlandi, Silvia; Munera, Marcela; Cifuentes, Carlos A.	Towards Safer Mobility: Developing and Evaluating a Fall Detection System for a Smart Walker

8	58	Sasaki, Tomoya; Ayusawa, Ko; Yoshida, Eiichi	Optimizing and Predicting Human-Symbiotic Robot Trajectory
9	124	Lee, I-Chieh; liu, ming; Huang, He (Helen)	Enhancing User-Prosthesis Integration through Intelligent Transparency
10	114	Loureiro, Matheus; Santos, Fabiana; Mello, Ricardo; Frizera, Anselmo	Ensuring Proper Interaction: VR-based Visual Feedback Interface For Smart Walker Training
11	146	Vonwirth, Patrick; Sivak, Olekasndr; Berns, Karsten	Foundations of Probabilistic Behavior Networks for Distributed, Dynamic Control of Legged Robots
12	180	Bamorovat Abadi, Mohammad Hossein; Shahabian Alashti, Mohamad Reza; Menon, Catherine; Holthaus, Patrick; Amirabdollahian, Farshid	Robotic Vision and Multi-View Synergy: Action and activity recognition in assisted living scenarios
13	10	Saeedi-Givi, Christine; Schwaab, Lennard; Bohné, Thomas; Tadeja, Slawomir Konrad	Exergame-Like Feedback for Passive Upper Limbs Exoskeleton Fitting: A Feasibility Study with Augmented Reality
14	231	Charaja, Jhon Paul Feliciano; Schelhaas, Booker; Campo, Jonathan; Moreno, Yecid; Siqueira, Adriano	Controlling Human Elbow Movements Using Electrical Stimuli and Deep Reinforcement Learning
15	115	Shen, Junyi; Ghosh, Swaninda; Miyazaki, Tetsuro; Kawashima, Kenji	Walking Condition Estimation Using Physical Reservoir Computing with External Echo State Network
16	116	Zhao, Peijun; Alencastre-Miranda, Moises; Whiteman, David; Gervas-Arruga, Javier; Krebs, Hermano Igo	Modeling Uncertainty in Computer Vision based Gross Motor Function Assessment of Children with Cerebral Palsy

17	189	Zhao, Peijun; Shen, Zhan; Alencastre-Miranda, Moises; Whiteman, David; Gervas-Arruga, Javier; Krebs, Hermano Igo	Distilling Knowledge in Vision-based Human Motor Assessment for Improved Accuracy and Running Efficiency
18	196	Tsuruta, Chihiro; Toriya, Shutaro; Nishimura, Kiichi; Iwata, Hiroyasu	Construction of a Sensory Feedback-Agnostic Transitional Tuning Method to Maintain Volitionality during Continuous Supine Walking
19	276	Peiffer, J.D.; Shah, Kunal; Anarwala, Shawana; Abdou, Kayan; Cotton, R. James	Fusing uncalibrated IMUs and handheld smartphone video to reconstruct knee kinematics
20	325	Frias-Miranda, Eugenio; Nguyen, Hong-Anh; Hampton, Jeremy; Jones, Trenner; Spotts, Benjamin; Cochran, Matthew; Chan, Deva; Blumenschein, Laura	A Wearable Resistance Device's Motor Learning Effects in Exercise
21	365	Riggio, Domenico; Breschi, Sofia; Peloso, Angela; Spadea, Maria Francesca; De Momi, Elena	Augmented Reality in Microinvasive Cardiac Surgery: Towards a Training Simulator for Mitral Valve Repair Intervention
22	25	Dashkovets, Andrii; Laschowski, Brokoslaw	Reinforcement Learning for Control of Human Locomotion in Simulation
23	46	Zhang, Shen; Zhou, Hao; Tchantchane, Rayane; Alici, Gursel	Enhancing Hand Gesture Recognition for Varied Arm Positions through the Integration of Co-located sEMG-pFMG Armband
24	67	firouzi, vahid; Mohseni, Omid; von Stryk, Oskar; Seyfarth, Andre; Ahmad Sharbafi, Maziar	Sensory modulation of gait balance in human locomotion: A neuromusculoskeletal modeling study
25	89	Le, Hongquan; in het Panhuis, Marc; Spinks, Geoffrey M.; Alici, Gursel	The effect of dataset size on EMG gesture recognition under diverse limb positions

26	138	Wang, Junyi; Xiong, Xiaofeng	A Learning-based Control Framework for Human-like Whip Targeting
27	140	Charaja, Jhon Paul Feliciano; Wochner, Isabell; Schumacher, Pierre; Ilg, Winfried; Giese, Martin; Maufroy, Christophe; Bulling, Andreas; Schmitt, Syn; Haeufle, Daniel Florian Benedict	Generating Realistic Arm Movements in Reinforcement Learning: A Quantitative Comparison of Reward Terms and Task Requirements
28	142	Damonte, Federica; Khanapuri, Vineeta; Durandau, Guillaume; Sartori, Massimo	Optimization of a Synergy-driven musculoskeletal model to estimates estimates muscle excitations and joint moments of the ankle joint at different walking speeds
29	159	Chen, Chen; Zhu, Xiangyang	Tracking motor unit discharges across days based on the pre-trained separation vectors
30	198	Lin, Hao-Ping; Kager, Simone; Cheng, Hsiao-ju; Woolley, Daniel Graham; Zhang, Xue; Wenderoth, Nicole	Implementing Markerless Body Tracking and Multi-Modal Feedback for Trunk Flexion Reduction in Post-Stroke Rehabilitation Robotic Training
31	209	Mohammadi Nejad Rashty, Aida; Ahmad Sharbafi, Maziar; Seyfarth, Andre	Variability in hopping is largely individual and reduced by a metronome
32	238	Salinas, Sergio Alexander; Grolinger, Katarina; LeBel, Marie-Eve; Trejos, Ana Luisa	Evaluating Mixed Reality Technology for Tracking Hand Motion for Shoulder Rehabilitation Assessment
33	257	Cravero, Grazia; Siri, Debora; Moro, Matteo; Ricci, Serena; Pierella, Camilla; Canessa, Andrea; Preiti, Deborah; De Grandis, Elisa; Nobili, Lino; Casadio, Maura	A personalized driving simulator for the assessment of adolescents with attention deficit hyperactivity disorder

34	265	Sperduti, Marika; Tagliamonte, Nevio Luigi; Cordella, Francesca; Zollo, Loredana	Accurate and Repeatable Identification of Mechanical Innocuous and Pain Thresholds Using a New Mechatronic Testbed
35	313	Iverson, Juliana; Rabe, Kaitlin G.; Fey, Nicholas	Task Dependent Sonomyography Signal Features Extracted with Task Independent Non-Negative Matrix Factorization Decomposition are Sensitive to Ambulation Mode
36	349	Firouzabadi, Pouyan; Murray, Wendy; Sobinov, Anton; Peiffer, J.D.; Shah, Kunal; Miller, Lab; Cotton, R. James	Biomechanical Arm and Hand Tracking with Multiview Markerless Motion Capture
37	221	Massardi, Stefano; Rodriguez-Cianca, David; Moreno, Juan C.; Lancini, Matteo; Torricelli, Diego	Effects of knee joint misalignments on human-exoskeleton interaction dynamics
38	278	Josse, Eva; Gaultier, Pierre-Louis; Kager, Simone; Cheng, Hsiao-ju; Gassert, Roger; Lambercy, Olivier	Optimizing digital health metrics to quantify functional upper limb movements with inertial measurement units
39	107	Liu, Juncheng; Xiaoran, Yang; Hong, Jing-Chen; Iwata, Hiroyasu	Analysis of Lifting Posture by Two Inertial Measurement Units and a Classification Model Based on a Convolutional Neural Network
40	111	Adjel, Mohamed; Sabbah, Maxime; Dumas, Raphaël; Mirkov, Marta; Mansard, Nicolas; Mohammed, Samer; Bonnet, Vincent	Lower Limbs Human Motion Estimation From Sparse Multi-Modal Measurements
41	133	Santos, Laura; Carvalho, Bernardo; Barata, Catarina; Santos-Victor, José	Extending 3D body pose estimation for robotic-assistive therapies of autistic children

Forum 2 – Linking One Health to Environmental Intelligence and Ecorobotics

Barbara Mazzolai

Room HS 14

Morning Session:
10:40 – 12:00

Afternoon Session:
13:30 – 14:45

Abstract

The “One Health” approach recognizes the interdependence of human health with ecological changes. Protecting and improving air, water, and soil quality, safeguarding biodiversity, and effectively managing natural resources are fundamental for healthy ecosystems and, consequently, human welfare.

This vision is shared by “Environmental Intelligence” (EI), a relatively recent field that synergizes environmental science, advanced sensor research, data science, robotics, and Artificial Intelligence to better understand the natural environment and coordinate responses to associated challenges.

Research in EI explores new materials, processes, and systems—incorporating bio-inspired, nature-based, chemical, biological, and physical technologies to reduce environmental pollution through sustainable methods. Robotics also play a crucial role by providing reliable data on ecosystems through continuous or periodic measurements of physical and chemical parameters, and by being deployed for remediation actions or emergency responses.

An emerging trend in robotics envisions environmentally responsible, bio-inspired systems that can adapt to unstructured urban or natural environments, include sensing capabilities, and are built with recyclable, biodegradable, or biohybrid materials. We refer to these as ‘EcoRobots’. They are designed to imitate the adaptability of living organisms, allowing them

to navigate and function effectively in complex and unpredictable environments, and to be seamlessly integrated into natural ecosystems. EcoRobots can be employed in a wide range of applications, including the exploration and monitoring of natural environments and infrastructures, precision agriculture, medicine, archaeological research, space missions, and search-and-rescue operations.

By incorporating an ecological approach to robot design, the use of EcoRobots aligns with the mission of Environmental Intelligence, as well as the model of One Health. The forum will discuss the themes of Environmental Intelligence and One Health, highlighting the contribution of healthy ecosystems to human well-being and the use of EcoRobotics as a tool for these fields: What are the current scientific and technological advancements driving the EcoRobotics revolution? What are the main challenges and opportunities in integrating EcoRobotics into existing ecological and industrial systems? How can EcoRobotics contribute to sustainable development and environmental conservation efforts? What are the key advantages of utilizing bio-inspired systems in EcoRobotics?

Forum Co-Chairs

Barbara Mazzolai, Italian Institute of Technology (barbara.mazzolai@iit.it)
Liqian Wang, Springer Nature (liqian.wang@cn.nature.com)
Sadra Bakhshandeh, Springer Nature (sadra.bakhshandeh@nature.com)
Paolo Dario, Scuola Superiore Sant'Anna (paolo.dario@santannapisa.it)

Forum Manager

Laura Margheri, Italian Institute of Technology (laura.margheri@iit.it)

Tutorial from MathWorks (Room HS 4a)

Morning Session (10:40-12:00)

MATLAB, Simulink & Co for Robotics: Simulation and Modeling of a Humanoid Robot

Speakers: Daniele Sportillo, Kathi Kugler

Join us for a special session at BioRob 2024, where Daniele Sportillo and Kathi Kugler from MathWorks will delve into the intricacies of simulating and modeling humanoid robots. Tailored for engineers and scientists, the objective of this session is to enhance your usage of MathWorks tools for advanced robotics applications.

Session Highlights:

Experience a blend of theory and hands-on coding examples to gain a comprehensive understanding of robot simulation and modeling with MATLAB, Simulink and Simscape. Gain a better understanding of the workflow with our example of a humanoid robot. As code, models and workshop licenses will be provided, you will be able to get hands-on experience during the session and tailor the materials to your own projects afterwards.

This session is ideal for engineers, scientists, and robotics enthusiasts who are looking to master the workflow of simulating and modeling robotic systems. Do not miss this opportunity to learn from MathWorks engineers and elevate your robotics projects to new heights!

Afternoon Session (13:30-14:45)

MathWorks & Partners Session: Community Research Toolbox for pHRC and Hardware Integration Examples with MATLAB, Simulink & Co

Speakers: Junnan Li, Haowen Yao, Janosch Marquart, Kathi Kugler, Luis Figueredo

Discover the cutting-edge advancements in robotics through the lens of MATLAB and Simulink at our special session at BioRob 2024. This presentation will highlight community contributions and hardware integration examples, providing valuable insights into cutting-edge research and inspiration for attendees. This comprehensive session aims to motivate and inspire you to elevate your own research by showcasing the practical and innovative applications of MATLAB and Simulink in the field of robotics.

Part 1: RhuMAn - Rapid Human Manipulability Assessment Toolbox

Recent advances in robotics have narrowed the gap between humans and robots, yet physical engagement remains rare. Physical collaboration requires mutual understanding of capabilities and a shared sense of embodiment. For better physical human-robot interaction (pHRI) and decision-making, it's crucial to quantitatively assess human biomechanics and physical modeling both in real-time, for reactive response, and globally, for predictive planning, akin to human-human interaction.

This session will introduce the RHuMAn (Rapid Human-Manipulability Assessment) Toolbox, a powerful MATLAB-based tool for collaborative AI applications. RHuMAn creates human manipulation quality distribution metrics within the human workspace, customizable for specific tasks and filtered for design purposes. It integrates force generation, acceleration capabilities, self-collision, joint-limits, nullspace, and ergonomics, simplifying human manipulability assessment for general and task-specific applications in real-time and resource-limited scenarios. The tool supports non-experts, enhancing the use of musculoskeletal model-based methods in robotics and industry. Demonstrations

will show RHuMAn's ability to minimize muscular effort and predict human-robot interaction, extending its concepts to designing human-like tendon-driven structures, such as robotic fingers and hands.

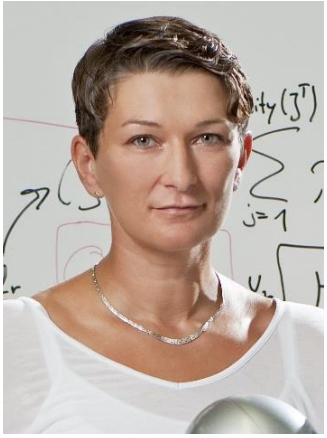
Part 2: From Desktop to Real-Time Simulation – Modeling and Hardware Integration for Robotic Applications

This segment covers modelling concepts for robotic applications with a focus on bringing MATLAB and Simulink models into real-time testing hardware. Its focus is on fundamental control applications, the concept of Digital Twin and Data-Driven Modeling (Reduced Order Modeling)

You will gain practical insights through use-case examples and live demonstrations, showcasing how MathWorks software can be used with Speedgoat real-time testing hardware. The session will include an overview of general applications with specific examples in biorobotics, including an exploration of exoskeleton robots and their requirements. The transition from desktop to real-time using Simulink and Simscape will be illustrated, along with motor control examples related to exoskeletons.

DETAILED PROGRAM – Wednesday 4 September

PLENARY SPEAKER 5 – Sandra Hirche (Neue Aula, 9:00 – 9:50)



***Title*: Personalized control for neurorehabilitation**

Bio: Sandra Hirche holds the TUM Liesel Beckmann Distinguished Professorship and heads the Chair of Information-oriented Control in the Department of Electrical and Computer Engineering at Technical University of Munich (TUM), Germany (since 2013). She graduated in Aeronautical and Aerospace Engineering in 2002 from the Technical University Berlin, Germany, and obtained her PhD in Electrical and Computer Engineering in 2005 from TUM. From 2005-2007 she has been a PostDoc Fellow of the Japanese Society for the Promotion of Science at the Fujita Laboratory at Tokyo Institute of Technology, Japan. Her main research interests include learning, cooperative, and networked control with applications in human-robot interaction, multi-robot systems, and general robotics. She has published more than 200 papers and received multiple awards such as the Rohde & Schwarz Award for her PhD thesis, the IFAC World Congress Best Poster Award in 2005, an ERC Starting Grant and an ERC Consolidator Grant. Sandra Hirche is Fellow of the IEEE and received the IEEE Control System Society Distinguished Member Award.

KEY INNOVATOR 5 – Sami Haddadin (Neue Aula, 9:50 – 10:20)

Title: **Human-aware robots and prosthetics**

Bio: Sami Haddadin is founder and Executive Director of the Munich Institute of Robotics and Machine Intelligence (MIRMI) at TUM. His research deals with the fundamentals of robotics and AI for creating intelligent machines. He received degrees in EE, CS and Technology Management from TUM and LMU and a doctorate from RWTH Aachen. He was a research scientist at the DLR and Professor at Leibniz University Hannover. He is chairman of the Bavarian AI Council and recipient of the German President's Award for Innovation and Leibniz Prize.

PARALLEL ORAL SESSIONS MORNING

Morning ORAL Sessions (10:50 – 12:05): Parallel oral sessions (talks: 10 min + 2 min Q&A)

[Exoskeletons and exosuits] EE-MO4 – Room HS 4 ***Chair: David Remy, Co-Chair: Lorenzo Masia***		
131	Afschrift, Maarten; Van Asseldonk, Edwin; van Mierlo, Michelle; Van der Kooij, Herman; De Groote, Friedl	Assisting global balance recovery responses during perturbed walking with ankle exoskeletons
152	Moreno Franco, Olmo Alonso; Parameswari Neelakandan, Raajshekhar; Di Natali, Christian; Caldwell, Darwin G.; Ortiz, Jesus	Task Assessment of XoNLI: A Natural Language Interface for Occupational Exoskeletons
260	Zhao, Qingya; Deepak, Rohan; Gebre, Biruk; Nolan J., Karen; Pochiraju, Kishore; Zanotto, Damiano	Gaussian Process Regression Models for On-line Ankle Moment Estimation in Exoskeleton-Assisted Walking
272	Eken, Huseyin; Livolsi, Chiara; Pergolini, Andrea; Penna, Michele Francesco; Hamoui, Giovanni; Gruppioni, Emanuele; Trigili, Emilio; Crea, Simona; Vitiello, Nicola	Continuous Gait Phase Estimation and Torque Profile Generation using adaptive Dynamic Movement Primitives for Able-Bodied Individuals and Stroke Survivors
295	Kuperus, Hannah; Tian, Yucheng; Burke, Katherine; Gillespie, Lincoln; Kemp, Stephen; Gillespie, Brent	Design and Implementation of a Triggered Response Experiment and Backdrivable Rodent Exoskeleton
308	Zhao, Susan; Walters, Katharine; Montes-Perez, Jose; Gregg, Robert D.	Design and Validation of a Modular, Backdrivable Ankle Exoskeleton

[Neural control of movement and biomechanics] NC-MO4 – Room HS 1
Chair: Laura Marchal-Crespo, Co-Chair: Tom Verstraten

70	Zhang, Haocheng; Kizyte, Asta; Wang, Ruoli	Ankle Torque Estimation Using HD-EMG Driven CNN-LSTM Model and Data Augmentation
156	Denayer, Menthy; Onal, Pinar; Turcksin, Tom; Verstraten, Tom	Comparison of OpenSim and BoB Musculoskeletal Simulation Engines for Overhead and Lifting Task
168	Alizadehsaravi, Leila; Draukšas, Simonas; K. Moore, Jason; Happee, Riender; Marchal-Crespo, Laura	Enhancing Motor Learning in Cycling Tasks: The Role of Model Predictive Control and Training Sequence
251	Gionfrida, Letizia; Kim, Daekyum; Jin, Yichu; Walsh, Conor James; Howe, Robert D.	Muscle architecture parameters inferred from simulated single element ultrasound traces
271	Jakubowski, Kristen; Sawicki, Gregory; Ting, Lena	Center of mass kinematics robustly predict multidirectional reactive joint torques during perturbed standing
290	Giovannetti, Giorgia; Noccaro, Alessia; Buscaglione, Silvia; Formica, Domenico	Estimation of passive wrist stiffness across two coupled degrees of freedom using a kinematic model of the human wrist

[Surgical and medical robotics] SR-MO4 – Room HS 5

Chair: Leonardo Ricotti, Co-Chair: Patricia Capsi Morales

264	Neidhardt, Maximilian; Mieling, Robin; Latus, Sarah; Fischer, Martin; Maurer, Tobias; Schlaefer, Alexander	A Modified da Vinci Surgical Instrument for OCE based Elasticity Estimation with Deep Learning
286	Kim, Sooyeon; Yu, Sujin; Lim, Yuri; Lee, Suhyun; Ryu, Seok Chang	Feasibility Study of a Teleoperation System with Haptics for Tip-force Sensing Active Needles
301	Oh, Ki-Hwan; Borgioli, Leonardo; Zefran, Milos; Chen, Liaohai; Giulianotti, Pier Cristoforo	A Framework For Automated Dissection Along Tissue Boundary
335	Guarnera, Daniele; Restaino, Francesco; Vannozzi, Lorenzo; Trucco, Diego; Mazzocchi, Tommaso; Lisignoli, Gina; Zaffagnini, Stefano; Russo, Alessandro; Ricotti, Leonardo	In situ extrusion of biomaterials through an arthroscopic tool: characterization and numerical analyses
358	Dimas, George; Kalozoumis, Panagiotis; Vartholomeos, Panagiotis; Iakovidis, Dimitris	Image-Based Path-Planning for Navigation of Soft-Growing Robots in the Spinal Sub-Arachnoid Space

[Rehabilitation robotics] RR-MO4 – Room HS 6 *Chair: Hermano Igo Krebs, Co-Chair: Juan C Moreno*		
137	Rominger, Julius; Buatier de Mongeot, Lucia; Boehm, Jacob; Lieb, Anne; Baur, David; Ziemann, Ulf; Masia, Lorenzo; Haeufle, Daniel Florian Benedict	Supporting functional tasks in bi-manual robotic mirror therapy by coupling upper limb movements based on virtual reality
208	Cherubini, Agnese; Sánchez del Valle, Clara; Sanz-Morère, Clara Beatriz; Herranz-Calero, Eloisa; De Eusebio Rubio, Elena; Gonzalez, Sara; HERRERA VALENZUELA, DIANA SOFIA; del-Ama, Antonio J.; Borromeo, Susana; Soto León, Vanesa; Oliviero, Antonio; Gil-Agudo, Angel; León, Natacha; Torricelli, Diego; Tornero, Jesús; Moreno, Juan C.	Multi-level characterization of the recovery process of a stroke survivor after 2 months of robotic therapy with the Walkbot robot
117	Zhao, Peijun; Krebs, Hermano Igo	Enabling Home Rehabilitation with Smartphone-Powered Upper Limb Training
316	Waters, Erica; Mendonca, Rochelle; Cacchione, Pamela; Johnson, Michelle J.	Towards Multi-User Robot-Based Stroke Rehabilitation: The Influence of Relative Partner Skill on Motor Learning
164	Lee, Seong-Hoon; Song, Won-Kyung	Bilateral Arm Movement Enhancement: Robotic Error Augmentation Insights from Stroke and Able-Bodied Participants

[Human-machine interaction and assistive robotics] HM-MO4 – Room HS 7 *Chair: Arash Arami, Co-Chair: Brokoslaw Laschowski*		
151	Wu, Rui; Gholami, Soheil; Bonato, Tristan; Munier, Louis; Billard, Aude	Transferring Shotcrete Skills to Robots
283	Das, Neha; Endo, Satoshi; Kavianirad, Hossein; Hirche, Sandra	Framework for Learning a Hand Intent Recognition Model from sEMG for FES-based control
370	Lu, zhijing; Ashok, Ashita; Berns, Karsten	RoboReID: Audio-Visual Person Re-Identification by Social Robot
5	Shushtari, Mohammad; Arami, Arash	Human-Exoskeleton Disagreement Resolution Through Interaction Torque Minimization: Experimental Results
65	Hobbs, Bradley; Artemiadis, Panagiotis	Intentional Increases in Push-off Force Coupled With Visual Feedback: Towards New Strategies in Robot-Assisted Gait Rehabilitation
254	Seiler, Julian; Schäfer, Niklas; Latsch, Bastian; Zhao, Guoping; Grimmer, Martin; Beckerle, Philipp; Kupnik, Mario	Human-Exoskeleton Interaction Force Estimation Based on Quasi-Direct Drive Actuators

[IEEE TMRB Session] TMRB-MO4 – Room HS 9 ***Chair: Leonardo Cappello, Co-Chair: Daniele Guarnera***	
Zimmermann, Yves Dominic; Georgarakis, Anna-Maria; Wolf, Peter; Hutter, Marco; Riener, Robert	Supporting and Stabilizing the Scapulohumeral Rhythm with a Body- or Robot-Powered Orthosis
Nuesslein, Christoph; Bhakta, Krishan; Fernandez, Joshua; Davenport, Felicia; Leestma, Jennifer; Kim, Raymond; Lee, Dawit; Mazumdar, Anirban; Sawicki, Gregory; Young, Aaron	Comparing Metabolic Cost and Muscle Activation for Lower-Body Exoskeletons Across Lifting Tasks
Laschowski, Brokoslaw; Kurbis, Andrew; Mihailidis, Alex	Development and Mobile Deployment of a Vision-Based Automated Stair Recognition System
Tamantini, Christian; Cordella, Francesca; Tagliamonte, Nevio Luigi; Pecoraro, Ilenia; Pisotta, Iolanda; Bigioni, Alessandra; Tamburella, Federica; Lorusso, Matteo; Molinari, Marco; Zollo, Loredana	A Data-Driven Fuzzy Logic Method for Psychophysiological Assessment: an Application to Exoskeleton-Assisted Walking
Paternò, Linda; Filosa, Mariangela; Anselmino, Eugenio; Cecere, Alessio; Dell'Agnello, Filippo; Gruppioni, Emanuele; Mazzoni, Alberto; Micera, Silvestro; Oddo, Calogero; Menciassi, Arianna	Soft transfemoral prosthetic socket with EMG sensing and augmenting feedback: a case study
Trejos, Ana Luisa; Zhou, Yue; Daemi, Parisa; Jenkins, Mary; Naish, Michael	Assessment of a Fault-Tolerant Control-based Wearable Tremor Suppression Glove under Faults and Disturbances
Mastinu, Enzo; Coletti, Anna; van den Berg, Jasper; Cipriani, Christian	Explorations of autonomous prosthetic grasping via proximity vision and deep learning

PARALLEL ORAL SESSIONS AFTERNOON

Afternoon ORAL Sessions (13:30 – 14:45): Parallel oral sessions (talks: 10 min + 2 min Q&A)

[Exoskeletons and exosuits - 1] EE1-AF4 – Room HS 4 ***Chair: Tommaso Lenzi, Co-Chair: Letizia Gionfrida***		
317	Anchivilca Baltazar, Alex; Hannol von Snarski, Benjamin; Amin, Nilp; Lai, Joshua; Fong, Justin; Shirota, Camila; Melendez-Calderon, Alejandro	Trajectory-based assist-as-needed control on an overground robotic exoskeleton: a preliminary study
324	Grilo Gouveia, João Pedro; Carvalho, Manuel Herculano; Kooij, H van der; Martins, Jorge	Control Strategy With Intra-Step Adaptation for Functional Electrical Stimulation Based Ankle-Foot Orthosis for Drop Foot
328	Dragusanu, Mihai; Troisi, Danilo; Prattichizzo, Domenico; Malvezzi, Monica	Assessing adaptability properties of a compact wearable hand exoskeleton
253	Archangeli, Dante; Ortolano, Brendon; Murray, Rosemarie; Gabert, Lukas; Lenzi, Tommaso	Design and Evaluation of a Powered Hip Exoskeleton for Frontal and Sagittal Plane Assistance
383	Lhoste, Clément; Kucuktabak, Emek Baris; Vianello, Lorenzo; Amato, Lorenzo; Short, Matthew; Lynch, Kevin; Pons, Jose L.	Deep-Learning Estimation of Weight Distribution Using Joint Kinematics for Lower-Limb Exoskeleton Control
369	Shukla, Manish; Franco, Leonardo; Prattichizzo, Domenico; Salvietti, Gionata	Enhancing Grasping Capabilities in Stroke Patients through a Novel Mechanical Design of the Robotic SixthFinger

[Exoskeletons and exosuits - 2] EE2-AF4 – Room HS 1 ***Chair: Claudio Castellini, Co-Chair: Enzo Mastinu***		
263	Blanco-Diaz, Cristian Felipe; Cappello, Leonardo	Identifying Key Hand Joints in Grasping Tasks for Wearable Applications
135	Olenšek, Andrej; Zadravec, Matjaz; Tomc, Matej; Matjacic, Zlatko	A Novel Mechanism and Method for Application of Force Impulses in Cable-based Rehabilitation Systems
255	Weber, Nico; Walter, Jonas; Braun, Dominik; Del Vecchio, Alessandro; Franke, Jörg	Compact and Lightweight Cable Decoupling Unit for Bio-Inspired Tendon Drives in Wearable Robots
85	Masiero, Federico; Ianniciello, Valerio; Raeli, Roberto; Sinibaldi, Edoardo; Masia, Lorenzo; Cipriani, Christian	Accurate Motion Detection via Magnetic Tracking for Wearable Technologies
59	Angelidou, Charikleia; Artemiadis, Panagiotis	Reducing Complexity, Enhancing Precision: Predicting Compliant Surface Transitions in Walking via Neighborhood Component Analysis
367	Verburg, Tim; Joshi, Sagar; Seth, Ajay; Della Santina, Cosimo	Development of a Variable Stiffness Mechanism with a Linear Output for Exosuit Integration

[Neural control of movement and biomechanics] NC-AF4 – Room HS 5 *Chair: Damiano Zanotto, Co-Chair: Linda Patternò*		
291	Boehm, Jacob; Rominger, Julius; Buatier de Mongeot, Lucia; Masia, Lorenzo	Simulation of an Online Estimation Algorithm for Time-Dependent Kinematic Synergies: Towards Synergy Shaping
293	Cohen, Hannah; Vásquez, Miguel; Sergi, Fabrizio	Estimating Propulsion Kinetics in Absence of a Direct Measurement of the Anterior Component of Ground Reaction Force
320	Arens, Philipp; Quirk, David; Walsh, Conor James	Deep-Learning Based Lumbar Moment Estimation during Exosuit Augmented Lifting with Variable Loading Conditions
179	West Jr., A. Michael; Tessari, Federico; Wang, Margaret; Hogan, Neville	The Study of Dexterous Hand Manipulation: A Synergy-Based Complexity Index
188	Moura Coelho, Rui; Oliveira, João P.; Krebs, Hermano Igo; Martins, Jorge	Ankle Impedance in Healthy subjects at different walking speeds
190	Forenzo, Dylan; He, Bin	Online Robotic Arm Control with a Deep Learning-based EEG BCI

[Surgical and medical robotics] SR-AF4 – Room HS 6
Chair: Fabien Vérité, Co-Chair: Francesco Missiroli

381	Mazidi, Aiden; C. Ramos, Andres; Sayadi, Amir; Dargahi, Javad; Barralet, Jake; Feldman, Liane; Hooshiar, Amir	Nonlinear Impedance Matching Approach (NIMA) for Robust Haptic Rendering during Robotic Laparoscopy Surgery
220	Saudrais, Charlélie; da Silva, Doris; Bayle, Bernard; Vitrani, Marie-Aude; Vérité, Fabien	Performance of Skin Stretch Haptic Feedback Augmentation for Laparoscopic Surgery in a Realistic Palpation Task
229	Morfino, Rosaura; Lauretti, Clemente; Cordella, Francesca; Zollo, Loredana	A hybrid position/force control for robot-aided pedicle tapping in spinal surgery
322	Bamoriya, Shailesh; gedam, vidit; Kumar, Cheruvu Siva	3D Manipulation of 6DOF Tendon Driven Continuum Robot for Surgical Applications
366	Katragadda, Sandeep; de Souza, Kevin	Machine learning-based automatic implant size prediction from CT images in total knee arthroplasty
321	Marahrens, Nils; Jones, Dominic; Stevenson, Jack; McLaughlan, James; Biyani, Chandra Shekhar; Lucas, Margaret; Valdastri, Pietro	Enabling Autonomous Ultrasound-Guided Tumor Ablation during Robotic Surgery

[Bionic prostheses] BP-AF4 – Room HS 7 *Chair: Jarrassé, Nathanael, Co-Chair: Cristina Piazza*		
74	Campanelli, Andrea; Saudrais, Charlélie; Mick, Sébastien; Tiboni, Monica; Vérité, Fabien; Jarrassé, Nathanael	Assessment of Multi Vibrotactile-Skin Stretch (MuViSS) Haptic Device to restore sensory feedback in upper limb amputees using prosthetics
90	Xie, Anran; Zhang, Zhuozhi; Zhang, Jie; Li, Tie; Patton, James; Lan, Ning	Slip Sensor Driven Closed-Loop Control of Grip Force with a Neuromorphic Prosthetic Hand
92	Fang, Yun; Wu, Yujun; Guo, Weichao; Sheng, Xinjun	Bionic Vibrotactile Feedback for Stiffness Recognition Towards the Pinch of a Prosthetic Hand
110	Mazzarini, Alessandro; Fagioli, Ilaria; Baldoni, Andrea; Dell'Agnello, Filippo; Gruppioni, Emanuele; Trigili, Emilio; Crea, Simona; Vitiello, Nicola	A Robotic Ankle-Foot Prosthesis Based on Torsional Series and Parallel Elasticity
148	Dawson, Michael R.; Parker, Adam; Williams, Heather E.; Shehata, Ahmed W.; Hebert, Jacqueline; Chapman, Craig; Pilarski, Patrick M.	Joint Action is a Framework for Understanding Partnerships Between Humans and Upper Limb Prostheses
377	Simon, Ann; Anarwala, Shawana; Abdou, Kayan; Hargrove, Levi	Improving Device Testing Efficiency in Prosthetic Research: The Impact of an Automated Robustness Testing Protocol

PLENARY SPEAKER 6 – Ellen Roche (Neue Aula, 15:15 – 16:05)

***Title*: Using soft robotics to augment and replicate cardiac mechanics**

Bio: Ellen Roche is the Latham Family Career Development Professor at the Department of Mechanical Engineering and the Institute for Medical Engineering and Science at MIT. She directs the Therapeutic Technology Design and Development Lab. Her research focuses on applying innovative technologies to the development of cardiac devices. Her research includes development of novel devices to repair or augment cardiac function using disruptive approaches such as soft robotics. Her work has been published in Nature Biomedical Engineering, Science Translational Medicine, Science Robotics, Advanced Materials among others. She is the recipient of multiple awards including the Wellcome Trust Seed Award in Science, a National Science Foundation CAREER Award, an NIH Trailblazer Award, a Hood Award for Excellence in Child Health Research, the LabCentral Ignite Golden Ticket and the inaugural Future Founders Grand Prize.

POSTER SESSION 3

Afternoon Poster Sessions (16:05 – 17:30)

Panel	ID	Authors	Title
1	211	Weiss, Alexander; Chen, Anthony; Janischowsky, Daniel; Shih, Isabella; Phillips, Gillian; Selinger, Jessica; Koelewijn, Anne	Pairing Predictive Simulations and Human Experiments in Ankle Exoskeleton Walking
2	240	Legrand-Lestoille, Mathilde; Magrini, Céline; Branscheidt, Meret; Luft, Andreas; Gassert, Roger; Lambercy, Olivier; Awai Easthope, Chris	Augmented feedback to influence gait symmetry: a feasibility study to quantify effects on the global gait pattern
3	248	Alizadeh Noghani, Mohsen; Bolívar-Nieto, Edgar	Prediction of Whole-Body Center of Mass using Joint Angles and Ground Reaction Forces: A Framework for Human Intent Prediction
4	298	Kurshakov, Georgii; Maffia, Andrea; Cosso, Tiziano; Chiostri, Renzo; Sanguineti, Vittorio; Delzanno, Giorgio	Loosely-Coupled GNSS/INS Integration for Foot Trajectory Reconstruction in Outdoor Environments
5	364	Sierotowicz, Marek	Empirical time complexity analysis of tractrix-based inverse kinematics algorithms
6	371	Orhan, Aymeric; Verdel, Dorian; Bruneau, Olivier; Geffard, Franck; Berret, Bastien	Combining Model-based and Data-based approaches for online predictions of human trajectories
7	373	Nabipour, Mahdi; Sawicki, Gregory; Sartori, Massimo	Predictive closed-loop control of muscle tendon force: towards a framework for human locomotion

8	72	Angie, Pino; Barria, Patricio; Baleta, Karim; Aguilar, Rolando; Azorin, Jose M.; Munera, Marcela; Cifuentes, Carlos A.	Transcranial Direct Current Stimulation Associated with Visual and Auditory Cueing during Gait Training: A Case Study with a Parkinson' s Disease Patient
9	172	Lu, Junyu; Modan, Amir; Lin, Zhenyu; Hughes, Charmayne; Zhang, Xiaorong; Qin, Zhuwei	mMyoHMI: Real-time EMG-based Pattern Recognition with On-device Learning Adaptation
10	379	Nguyen, Anh; Anand, Ajay; Johnson, Michelle J.	Exploring EEG Responses during Observation of Actions Performed by Human Actor and Humanoid Robot
11	97	Otalora, Sophia; Moreno, Hector Alonso; Munera, Marcela; Cifuentes, Carlos A.	Variable Stiffness Hip Joint for Lower-limb Exoskeletons
12	239	Massone, Valentina; Mannella, Kailynn; Albanese, Giulia Aurora; Casadio, Maura; Zenzeri, Jacopo; Holmes, Michael	Feasibility of an Adaptive Upper Limb Robotic Training Protocol for Persons with Multiple Sclerosis
13	91	Mukherjee, Ankita; Alvarez, Helena; Zhang, Xiaorong; Qin, Zhuwei; Hughes, Charmayne	DRome: A Deep Learning-based Mobile Vision System for Real-time Range of Motion Evaluation
14	244	Jonna, Prashanth; Madurwar, Anshul; B K, Aamod; Rao, Madhav	Effective Limb Rehabilitation: A Cost-Efficient Holonomic Drive-Based Robotic System for Optimal Joint Mobilization
15	294	Moon, James Hyungsup; Hwang, Yeji; Kim, Jonghyun	A Simulation Study on Individualized Reaching Training Framework using Model-based Evaluation for Stroke
16	158	Murali, Barathwaj; Weir, Richard	Towards a minimal-delay myoelectric control signal using thresholded surface EMG

17	222	Shahabian Alashti, Mohamad Reza; Bamorovat Abadi, Mohammad Hossein; Holthaus, Patrick; Menon, Catherine; Amirabdollahian, Farshid	Efficient Skeleton-based Human Activity Recognition in Ambient Assisted Living Scenarios with Multi-view CNN
18	382	Bharadwaj, Varun; Miller, Benjamin; Novak, Vesna; Jiang, Chao	Learning Skill Training Schedules from Domain Experts in a Rehabilitation Gym using Inverse Reinforcement Learning
19	304	Chishty, Haider; Sergi, Fabrizio	A Multi-objective Simulation-Optimization Framework for the Design of a Compliant Gravity Balancing Orthosis
20	141	Devittori, Giada; Akeddar, Mehdi; Retevoi, Alexandra; Schneider, Fabian; Cvetkova, Viktoria; Dinacci, Daria; Califfi, Antonella; Rossi, Paolo; Petrillo, Claudio; Kowatsch, Tobias; Lambercy, Olivier	Towards RehabCoach: Design and Preliminary Evaluation of a Conversational Agent Supporting Unsupervised Therapy after Stroke
21	147	Hailey, Rhet Osborne; Commander, Jon; Denney, Thomas; Zabala, Michael; Burch, Thomas; Rose, Chad	Tri-Modal Intervention for Diabetic Peripheral Neuropathy: Pilot Study
22	207	Privitera, Luigi; Lassi, Michael; Dalise, Stefania; Azzollini, Valentina; Vercillo, Fulvio; Maggiani, Luca; Mazzoni, Alberto; Chisari, Carmelo; Micera, Silvestro; Bandini, Andrea	Automatic prediction of upper limb motor recovery in stroke patients undergoing robotic therapy
23	236	Shi, Shuyang; Gassert, Roger	Development and Evaluation of A 3D-Printed Pneumatic Light Massage Device to Relieve Neuropathic Foot Pain

24	296	Nagiller, Marco; Winkler, Simon; Kim, Yeongmi	Portable hand rehabilitation device for patients with neurological disorders
25	375	Díaz Pinilla, María Alejandra; De Bock, Sander; Ali Mohamadi, Parham Haji; Langlois, Kevin; De Winter, Joris; Verstraten, Tom; De Pauw, Kevin	Assessing the Influence of Robot-Assisted Rehabilitation through Muscle Synergies Similarities
26	55	Luciani, Beatrice; Costante, Simone; Braghin, Francesco; Pedrocchi, Alessandra; Gandolla, Marta	Imitation learning using Gaussian mixture models and Dynamic Movement Primitives for rehabilitation exoskeletons: a comparison
27	323	Wannawas, Nat; Diaz-Pintado, Clara; Narayan, Jyotindra; Faisal, Aldo	Accessible FES Cycling: Leveraging Cost-Effective Crank Angle Measurement and Reinforcement Learning for Stimulation Optimization
28	351	Ting, Jonathan; Basyal, Sujata; Mishra, Kislaya; Rose, Chad; Allen, Brendon	Essential Tremor Severity Classification using a Multi-layer Perceptron and the TETRAS Scale
29	64	Hobbs, Bradley; Artemiadis, Panagiotis	Virtual Reality-based Robot-Assisted Method for Gait Training Showing Retention of Anticipatory Motor Responses
30	226	Siciliano, André; Dib, Ana Emília Hernandes; Luna, Felipe Drebtchinsky Lima; Moura, Rafael T; Forner-Cordero, Arturo	Design, manufacturing and testing of ARMS: a modular and portable upper limb rehabilitation robot

31	359	ChoeEunbin, Eunbin; Moon, Junyoung; Ryu, Jae Wook; Yang, Seung Tae; Lee, Giuk	Active Variable Compression Shoes: Design and Evaluation of External Ankle Support to Prevent Ankle Sprain via Active Compression Mechanism
32	176	Allen, Ben; Garrad, Martin; Cifuentes, Carlos A.	SOFT Glove
33	282	Koike, Amy; Lin, Keng-Yu; Mutlu, Bilge; Wehner, Michael	Sprout: Fiber Patterns in Soft Actuators Create Expressions in Social Robots
34	153	Davoodi, Ayoob; Li, Ruixuan; Van Assche, Kaat; Timmermans, Maikel; Tummers, Matthias; Borghesan, Gianni; Denis, Kathleen; Vander Poorten, Emmanuel B	All-UltraSound-Guided Path Planning for Robotic Pedicle Screw Placement
35	143	Carlini, Luca; Bicchi, Anna; Fu, Junling; De Momi, Elena	Towards Robotic Transseptal Puncture: A Preliminary Study Investigating the Influence of Puncture Velocity in Minimally Invasive Cardiovascular Surgery
36	289	Cordon, Ana; Selim, Mostafa; Abayazid, Momen	Integration of Respiratory Motion Compensation and Haptic Feedback for CT-Guided Teleoperated Robotic Needle Insertion
37	170	De Groot, Antonius Gerardus; Welleweerd, Marcel Klaas; Cornel, Erik Bastiaan; Stramigioli, Stefano; Siepel, Françoise J	Computational Design Optimization of Concentric Tube Robots for Patient-Specific Volumes and End Effector Tasks

38	262	Ouyang, Jingyu; Egle, Fabio Andre; Igney, Claudia; Mutzke, Thomas; Dahmani, Chiheb; Castellini, Claudio; Thuerauf, Sabine	C-arm unleashed: Intuitive inter-operative positioning of C-arms using wearable gesture detection
39	391	Kasman, Michael; Cui, Eric; Majewicz Fey, Ann	A Bio-Inspired Tendon-Driven Continuum Robot for Treatment of Twin-to-Twin Transfusion Syndrome

DELSYS®

Empowering Engineering

Unleash the Potential of EMG

30
YEARS
of Innovation

12K+
VALUED
Customers

96
SUPPORTED
Countries

ISTITUTO ITALIANO DI TECNOLOGIA
REHAB TECHNOLOGIES

https://rehab.iit.it/

INAIL Centro Protesi

twin

Lower Limb exoskeleton for motor impaired patients

Easy to use
Modular
Portable

Provides assessment on patient's level of impairment

ADI DESIGN INDEX 2021
CHICAGO ATHENAEUM 2021
IF DESIGN AWARD 2022

Hannes

Sizes: 7 3/4 L/R
8 1/4 L/R
Grip Strength 120N
Grasp Time 1.1s
Weight 480g (7 3/4)
Autonomy 1day

Easy to use
Versatile
Biomimetic

Adaptive grasp

Active wrist rotation

Active wrist flexion

ADI DESIGN INDEX 2018
GOOD DESIGN
CHICAGO ATHENAEUM 2018
ADI
PREMIO INNOVAZIONE
ADI DESIGN 2018

COMPASSO D'ORO 2020

FLOAT

Upper Limb exoskeleton for shoulder rehabilitation

Device close to patients and **therapists needs.** Can be used both in **seated** and **standing position**

Exoskeleton full weight compensation, allowing for **freedom** during **occupational therapy** movements

RTECH story: objectives and philosophy

Rehab Technologies Lab was born from an agreement between **IIT** and **INAIL** and since **2013** has been active in the **development of high-tech prosthetic, orthotic and rehabilitative medical devices**, ready for immediate use in therapeutic rehabilitation and treatments.

Our laboratory follows an **innovative user centred design approach** where **technicians, clinicians and patients work together** to develop new and innovative devices.

Rehab Technologies Lab team is made up of **reearchers** specialized in **mechatronics, computer science, bioengineering and neuroscience.**

We take care of every phase of the innovative **development process:** from the **design** and **prototyping** phase, to the **assembly** and **testing** of the devices.

The characteristics of the Rehab researchers are unique: **competence, passion, ambition** and **continuous research**.

armonico

Exploiting the **integrated sensors, Armonico adapts** to the gait **cushioning** the step during **ground contact**

unico

Lower limb prosthetic knee

Unico innovative mechatronic and **sensorization** systems, **lightens** the **patient's load** and allows for a more **physiological use** of the device

REHAB TECHNOLOGIES INAIL-IIT LAB

MADE IN ITALY

Contacts
Via Morego, 30 16163 Genova - Italy
Tel: +39 010 28961 - C.F.: 97329350587 - P.Iva: 09198791007

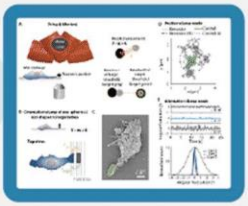
Educational Exoskeletons

With a strong academic foundation, the Auxivo team brings decades of expertise in exoskeleton research and education. We use this extensive experience to create high-performance occupational exoskeletons and are committed to sharing our knowledge with the next generation of developers and users through our educational exoskeletons.

Our educational EduExo kits are designed to make learning about exoskeleton technology more accessible and efficient.

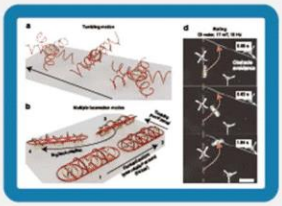
Visit us at our booth in the foyer.

auxivo.com



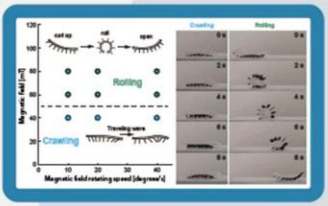
BIOLOGY & MEDICINE

A micromagnet is coated to resemble a bacterium and used to probe the mechanism of interaction with an immune cell[1]



MATERIALS SCIENCE

A fabricated interlocked micromachine with multiple magnetic domains shows diverse modes of field-induced locomotion[2]



ROBOTICS

A magnetic cilia carpet shows field-dependent geometry and multimodal robotic locomotion from metachronal waves to rolling[3]

Magnetic Field Generators for your needs

www.magnebotix.com

MINIMAG

NAVION

OCTOMAG

Visit our booth and see the M A G I C*!

*Magnetic Actuation Gives Incredible Control

MagnebotiX – *Leading the Way in Magnetic Manipulation*

Contact us

Ruetistrasse 14
8952 Schlieren
Zurich, Switzerland
info@magnebotix.com
www.magnebotix.com

MagnebotiX

Spin-off | ETH zürich