



The 9th International Symposium on Swarm Behavior and Bio-Inspired Robotics 2025

September 23-25, 2025

Göttingen, Germany

Program and General Information

A note of caution (travel): Sadly, the German railway system is **notoriously unpunctual!**

If you travel to the airport(s) you really need to build in at least one more additional hour allowing for train delays and/or cancellations.

The picture shows the old town of Göttingen (middle) flanked by the famous Gänseliesel (Goose Girl) who is a 1m tall statue placed about 2m above a water fountain in the central square. More than 100 years ago students have decided that you have to kiss the Gänseliesel on matriculation. This has by now shifted and it is the PhD students that do this, after receiving their certificate, and they also provide her with a nice bunch of flowers each. This has by now become long-standing tradition at Göttingen and at every PhD ceremony all PhD students climb across the fountain and up the metal adornments to kiss the girl, before they start partying. Thus, Gänseliesel is without doubt the most kissed girl in the world.

Left and right: from <https://flic.kr/p/4zuZSG> under license CC BY-NC 2.0

Middle: modified from <https://flic.kr/p/sN7PWJ> under license CC BY 2.0

Welcome Note

It is our pleasure to welcome you to SWARM 2025 in September in Göttingen, which is the 9th international symposium on swarm behavior and bio inspired robotics. The history of SWARM started in 2015 and it has been held in several years consecutively until autumn 2024 maintaining its success also during the troubling times of Covid 19. Several of the SWARM symposia were held in a joint format. However, this SWARM 2025 is the second in 6 years that is being held independently.

The goal of SWARM is to build a bridge between biologists and engineers interested in the intelligence of living things and to create a new academic field by integrating biology with engineering. This conference covers, thus, a broad spectrum of topics trying to help our understanding of swarm behavior and bio-inspired robotics.

One important feature of this symposium is that we welcome not only well polished results but also immature research reports as long as they are expected to stimulate our intellectual curiosity. You will, thus, find at our symposium the seeds of research that can be expected to grow in the future.

In this SWARM we have about 80 general talks and posters, 10 special (plenary) lectures, and 2 workshops, which cover specific sub-aspects introducing advanced topics.

We are sure that these presentations will be inspiring to all involved.

Finally, we'd like to thank our invited speakers, we especially thank the authors and participants for their valuable contributions, and we are also grateful to the members of the advisory organization and program committees and as well as the reviewers who generously contributed their valuable time and effort in preparing and organizing this symposium. Furthermore, we like to thank the students and support staff from the 3rd Inst. of Physics in Göttingen for their hard work for setting up this symposium.

We sincerely hope that this symposium will be an opportunity to share interdisciplinary knowledge a build a network of friends and we hope that you will be able to enjoy the inspiring old town of Göttingen, too.



(General Chair)
Florentin Wörgötter
University of Göttingen,
Germany



(Co-Chair)
Fumitoshi Matsuno,
Osaka Institute of Technology,
Japan



(Co-Chair)
Poramate Manoonpong,
Vidyasirimedhi Institute of
Science and Technology,
Thailand

Venue, Food and Drink (Banquet) and Local Transport

Central Lecture Hall Building, ZHG, University of Göttingen

Address: Platz der Göttingen Sieben 5, 37073 Göttingen

The **blue dot** in the left image marks the venue and the floor plan with the three lecture halls we use is shown in the right image. The **Registration Desk** will be in front of lecture hall 7

There are many stops of busses nearby. Use <https://lageplan.uni-goettingen.de?piz=5257>

and click on this:  to see the stops. Pay at the driver with cash!



Food and Drink

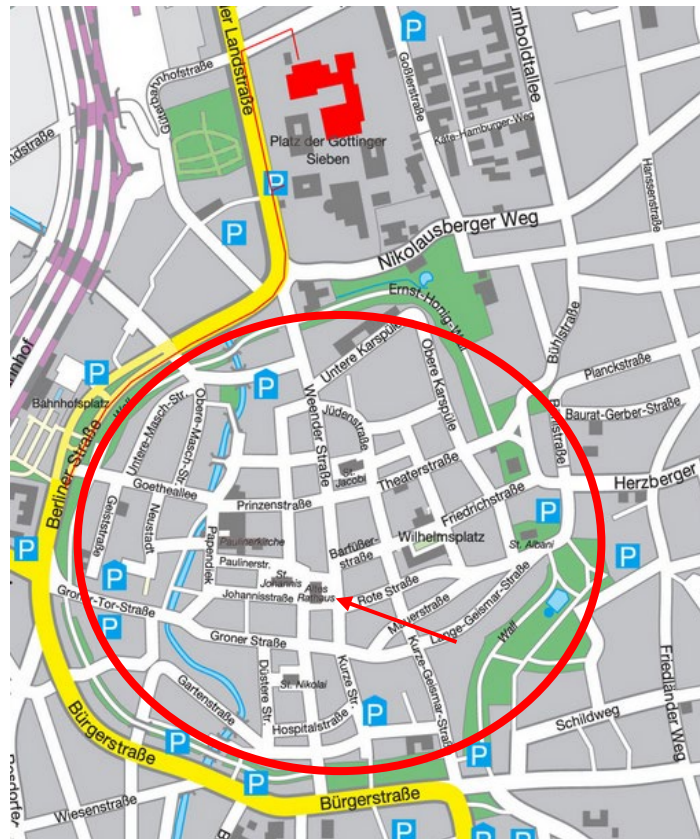
The most convenient place for lunch is right next to the ZHG in the “Zentralmensa” (red dot above). You can pay with credit card as well as by some electronic services. They serve a large variety of dishes including vegetarian and vegan options.

As an alternative you can walk (7 min, ~500m) to the town center where there are very many food places (street food and other).

The red building (right) is the ZHG, town center is marked by the circle.

Location of the Banquet on the 24th:

Restaurant Bullerjahn, Markt 9 in the very center of Göttingen. Marked with a red arrow in the right picture. It's in the basement of the old city hall (Altes Rathaus) near the famous Gänselesel Fountain.



Program at a Glance

Note that the registration desk will open on Tuesday by 8:30am

Date	Times	ZHG 2	ZHG 3	ZHG 7
23rd (Tue.)	09:00-12:00	Workshop 1	Workshop 2	
	13:00-13:10			Opening Remarks
	13:15-14:00			Plenary Talk 1 : Heiko Hamann
	14:00-14:10	Coffee Break		
	14:10-15:00			Poster Spotlight
	15:00-16:30	Poster Session (Lobby)		
	16:30-17:15			Plenary Talk 2: Kenzo Nonami
	17:30-18:15			Plenary Talk 3: Antonio Bicchi
24th (Wed.)	9:00-9:45			Plenary Talk 4: Cecilia Laschi
	9:45-10:00	Coffee Break		
	10:00-10:45			Plenary Talk 5: Dongheui Lee
	10:45-11:00	Coffee Break		
	11:00-13:00	Session Swarm Behavior 1	Session Bio Robotics 1	
	13:00-14:00	Lunch Break		
	14:00-14:45			Plenary Talk 6: Nicholas Gravish
	14:45-15:15	Coffee Break		
	15:15-17:15	Session Swarm Behavior 2	Session Bio Robotics 2	
	17:15-18:00			Plenary Talk 7: Saravana Prashanth Murali Babu
	19:00-open end	Social Event - Conference Dinner (at Bullerjahn)		
25th (Thu.)	9:30-10:15			Plenary Talk 8: Deborah Gordon
	10:15-10:30	Coffee Break		
	10:30-13:10	Session Swarm Behavior 3	Session Bio Robotics 3	
	13:10-14:00	Lunch Break		
	14:00-14:45			Plenary Talk 9: Sabine Hauert
	14:45-15:00	Coffee Break		
	15:00-15:45			Award Ceremony & Closing Remarks
	15:45-open end	Farewell Event (Lobby)		

Plenary Speakers (in order of program)

Intelligent, Autonomous and Swarm Control of Robots in Harsh Environment (see Workshop 1)

Masayoshi Tomizuka

University of California, Berkeley, CA 94720-1740 and
Fukushima Institute for Research, Education and Innovation (F-REI)



Biography

Masayoshi Tomizuka received his Ph. D. degree in Mechanical Engineering from the Massachusetts Institute of Technology in February 1974. In 1974, he joined the faculty of the Department of Mechanical Engineering at the University of California at Berkeley, where he currently holds the Cheryl and John Neerhout, Jr., Distinguished Professorship Chair and serves as Associate Dean for the Faculty in the College of Engineering. His current research interests are control theory, merging model-based control and machine learning, mechatronic systems such as intelligent robots and autonomous vehicles. He served as Program Director of the Dynamic Systems and Control Program of the National Science Foundation (2002-2004). He has supervised about 150 Ph. D. students to completion. He is the recipient of the Charles Russ Richards Memorial Award (ASME, 1997), the Rufus Oldenburger Medal (ASME, 2002), the John R. Ragazzini Award (AACC, 2006), the Richard Bellman Control Heritage Award (AACC, 2018) and the Nichols Medal (IFAC, 2020). He is an honorary member of ASME, Life Fellow of IEEE and is a member of the United State National Academy of Engineering.

Human-Swarm Interaction and Time: Subjective Time-Perception as a Plastic Feature

Heiko Hamann

University of Konstanz, Germany



Biography

Heiko Hamann is professor for cyber-physical systems at the University of Konstanz, Germany. He was a professor of swarm robotics at the University of Lübeck, Germany from 2017 until 2022. His main research interests are swarm robotics, bio-hybrid systems, evolutionary robotics, and modeling of complex systems. In his research projects, he studies bio-hybrid systems, such as using natural plants as sensors by doing phytosensing (EU-funded project WatchPlant) and forming symbiotic relationships between robots and natural plants to produce architectural artifacts and living spaces (EU-funded project flora robotica).

Heterogeneous Swarm Flight by Cerebral AI Drones

Kenzo Nonami

Fukushima Institute for Research, Education and Innovation (F-REI)



Biography

Dr. Kenzo Nonami has been a full professor in the Department of Mechanical Engineering at Chiba University since 1994. He was in charge of Vice President of Chiba University from 2008 to 2013. Right now, Dr. Nonami is an emeritus professor at Chiba University, in 2013 he founded the Company “Autonomous Control Systems Laboratory, Ltd.” and was Chairman from 2018 to 2021. He currently holds the position of Chairman at Advanced Robotics Foundation since 2019, and a

Chairman at Japan Drone Consortium which includes more than 300 companies since 2012. And is Independent Outside Director at Sodick Co., Ltd. since 2020. Dr. Nonami received a doctorate degree in Mechanical Engineering from the University of Tokyo in 1979. He worked as an Associate Professor at Chiba University from 1988 to 1994 and as full professor in the Department of Mechanical Engineering and Electronics from 2004. He won the NRC research fellowship at NASA (USA) in 1985 and did research on various fields like robots, unmanned small scale helicopter, Micro Air Vehicle to name a few. He is a member of Japan Society of Mechanical Engineers, Robotics Society of Japan, IEEE, ASME, etc. He has published more than 300 journal papers and seven textbooks. He has guided 36 Ph.D students. He will be taking over as Vice-President of Chiba University in April 2008. He has many awards to his credit from Japan and American Society of Mechanical Engineers.

On some abstract lessons learnt from nature, and concrete applications thereof

Antonio Bicchi

University of Pisa, Italy



Biography

Antonio Bicchi is Senior Scientist at the Italian Institute of Technology in Genoa and the Chair of Robotics at the University of Pisa. He graduated from the University of Bologna in 1988 and was a postdoc scholar at M.I.T. Artificial Intelligence lab. He teaches Robotics and Control Systems in the Department of Information Engineering (DII) of the University of Pisa. He leads the Robotics Group at the Research Center “E. Piaggio” of the University of Pisa since 1990. He is the head of the SoftRobotics Lab for Human Cooperation and Rehabilitation at IIT in Genoa. Since 2013 he serves as Adjunct Professor at the School of Biological and Health Systems Engineering of Arizona State University. From January, 2023, he is the Editor in Chief of the International Journal of Robotics Research (IJRR), the first scientific journal in Robotics. He has been the founding Editor-in-Chief of the IEEE Robotics and Automation Letters (2015-2019), which rapidly became the top Robotics journal by number of submissions. He has organized the first WorldHaptics Conference (2005), today the premier conference in the field. He is a co-founder and President of the Italian Institute of Robotics and Intelligent Machines (I-RIM). His main research interests are in Robotics, Haptics, and Control Systems. He has published more than 500 papers on international journals, books, and refereed conferences. His research on human and robot hands has been generously supported by the European Research Council with an Advanced Grant in 2012, a Synergy Grant in 2019, and three Proof-of-Concept grants. He originated and is today the scientific coordinator of the JOiNT Lab, an advanced tech transfer lab with leading-edge industries in the Kilometro Rosso Innovation District in Bergamo, Italy. Among his students, five were finalists of the “G. Giralt Award” for Best Ph.D. thesis in Robotics. The award went to Manuel G. Catalano in 2013, to Cosimo Della Santina in 2019, and to Giuseppe B. Averta in 2020. Alessandro Altobelli and Federica Barontini won the EuroHaptics Best Ph.D. Thesis award in 2015 and 2023, respectively. The prestigious IEEE RAS Early Career Award was awarded to Arash Ajoudani in 2021 and to and Cosimo Della Santina in 2023.

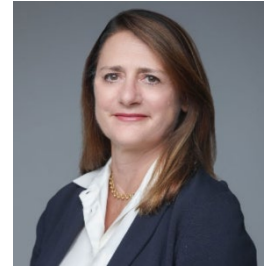
Lessons from nature for soft robotics

Cecilia Laschi

National University of Singapore, Singapore

Biography

Cecilia Laschi is best-known for her research in soft robotics, an area that she pioneered internationally. She investigates how to build robots with soft materials, studying the octopus as a model for robotics. She explores marine applications of soft robots and their use in the biomedical field, with a focus on eldercare. She has worked in humanoid and neuro-robotics, applying brain models to humanoid robots. Cecilia Laschi is Provost's Chair Professor at the National University of Singapore and the Director of the Advanced Robotics Centre. She is a Professor on leave from the BioRobotics Institute of Scuola Superiore Sant'Anna, Pisa, Italy. She is IEEE Fellow and AAAS member. She is Editor-in-Chief of *Bioinspiration & Biomimetics* and Specialty Chief Editor of Soft Robotics in *Frontiers in Robotics & AI*. She is Editorial Board member of *Science Robotics*, *IEEE Robotics & Automation Letters*, *International Journal of Robotics Research*, and the Intelligent Robotics and Autonomous Agents (IRAA) Series of MIT Press. She founded the *IEEE-RAS International Conference on Soft Robotics (RoboSoft)* in 2018. She co-founded the start-up company RoboTech, in edutainment robotics.



Human-Centric Approaches for Robot Learning and Interaction with Human

Dongheui Lee

University of Technology in Vienna, Austria

Biography

Dongheui Lee is Full Professor of Autonomous Systems at Institute of Computer Technology, Faculty of Electrical Engineering and Information Technology, TU Wien. She has been also leading a Human-centered assistive robotics group at the German Aerospace Center (DLR), since 2017. Prior, she was Associate Professor of Human-centered Assistive Robotics at the TUM Department of Electrical and Computer Engineering, Assistant Professor of Dynamic Human Robot Interaction at TUM, Project Assistant Professor at the University of Tokyo (2007-2009), and a research scientist at the Korea Institute of Science and Technology (KIST) (2001-2004). She obtained a PhD degree from the department of Mechano-Informatics, University of Tokyo, Japan in 2007. She was awarded a Carl von Linde Fellowship at the TUM Institute for Advanced Study (2011) and a Helmholtz professorship prize (2015). She has served as Senior Editor and a founding member of *IEEE Robotics and Automation Letters (RA-L)* and Associate Editor for the *IEEE Transactions on Robotics*. Her research interests include human motion understanding, human robot interaction, machine learning in robotics, and assistive robotics.



The symbiotic mutualism of robotics and biology

Nicholas Gravish

University of California, USA

Biography

Nick Gravish is an associate professor in the Mechanical & Aerospace Engineering department and a faculty member in the Contextual Robotics Institute. Dr. Gravish received his PhD from Georgia Tech in 2013, and was postdoctoral fellow at Harvard from 2013-2016 supported by a James S. McDonnell fellowship in complex systems science. His research focuses on bio-inspiration, biomechanics, and robotics, towards the development of new locomotion systems. Gravish's research focuses on better understanding the challenges of movement and manipulation in micro-scale robotic and biological systems. Current understanding of locomotion and manipulation in micro-scale systems lags behind our ability to create devices at these scales (i.e. microrobots). We also lack an intuitive understanding of the strategies animals use for movement and manipulation at these scales. To bridge this knowledge gap between manufacturing and movement, Gravish studies high-speed, robust, and agile locomotion in microscale biological systems such as flying and running insects and looks for the principles of dynamic locomotion at the micro-scale. In addition, Gravish manufactures at-scale microrobots to test locomotion and manipulation hypotheses. His research takes an integrative approach, through quantitative biology experiments and robotics manufacturing and experiments, based on the mechanics driving the interaction between the animals and their environment when they move. He aims to discover principles for robust movement in complex environments with limited sensing and control. Gravish's overarching goal is to expand our knowledge of movement and manipulation capabilities in micro-scale biological and robotic systems through novel manufacturing and experiments.



From Nature to Robots: Exploring Modular Locomotion and Evolution

Saravana Prashanth Murali Babu

The Maersk Mc-Kinney Møller Institute, Univ. of Southern Denmark

Biography

Saravana Prashanth Murali Babu is an Assistant Professor at the University of Southern Denmark (SDU), where he leads his "Sustainable Soft Robotics" research at SDU Soft Robotics. His work focuses on developing sustainable, bioinspired soft robots to tackle environmental challenges through accessible and innovative approaches in design, fabrication, control, and learning. He holds a PhD in BioRobotics (cum laude) from the BioRobotics Institute, Scuola Superiore Sant'Anna, Italy under the supervision of Dr. Barbara Mazzolai and Prof. Cecilia Laschi. Saravana's contributions in advancing soft robotics, particularly in bioinspired locomotion, modular design, and the development of eco-friendly, biodegradable robots for multi-terrain exploration. His previous works on integrated actuator-sensor solution with intrinsic proprioception and tunable stiffness, enabling soft robots to perform dynamic and adaptive tasks. His research draws inspiration from the dynamic movements of small animals, particularly invertebrates, using them as models for soft robotics. To explore these biological motions, he develops robots that mimic similar behaviors, offering insights into unresolved biological questions and hypotheses. This approach aims to advance biological studies without harming animals, using soft robots as experimental models. From an engineering perspective, Saravana adopts modular design as his robot platform, enabling the



integration of multiple locomotion principles into a single robot. Along with this perspective, he aims to contribute to the broader goals of sustainable development and climate action. By bridging biological inspiration with engineering innovation, his work drives robotics toward sustainability and the creation of eco-conscious technologies. Saravana envisions establishing a high-standard platform for biodegradable robotics, advancing technologies that align with and support planetary health.

The ecology of collective behavior

Deborah Gordon

Stanford University, California, USA

Biography

Deborah M. Gordon is a Professor in the Department of Biology at Stanford University. She studies how ant colonies work without central control using networks of simple interactions, and how these networks evolve in relation to changing environments. She received her PhD from Duke University, then joined the Harvard Society of Fellows, and did postdoctoral research at Oxford and the University of London before joining the Stanford faculty in 1991. Projects include a long-term study of a population of harvester ant colonies in Arizona, studies of the invasive Argentine ant in northern California, arboreal ant trail networks and ant-plant mutualisms in Central America.



From Nano to Macro: Building Trustworthy Swarms for People

Sabine Hauert

University of Bristol, UK

Biography

Sabine Hauert is Professor of Swarm Engineering at University of Bristol. She leads a team of 20 researchers working on making swarms for people, and across scales, from nanorobots for cancer treatment, to larger robots for environmental monitoring, or logistics (<https://hauertlab.com/>). Before joining the University of Bristol, Sabine engineered swarms of nanoparticles for cancer treatment at MIT, and deployed swarms of flying robots at EPFL. She's PI or Co-I on more than 40M GBP in grant funding and has served on national and international committees, including the UK Robotics Growth Partnership, the Royal Society Working Group on Machine Learning, and several IEEE boards. She is on the board of directors of the Open Source Robotics Foundation and is Executive Trustee of non-profits robohub.org and aihub.org, which connect the robotics and AI communities to the public.



Technical Program - WEB

See: <https://www25.swarm-systems.org/event-schedule/>

Note: if you click on the paper number you will see the abstract

Technical Program – INSTRUCTIONS

For Oral Sessions

- Each speaker is allocated a total of 20 minutes.
- Organizers do not provide PCs in session rooms; please bring your own laptop PC that can be connected to HDMI for your presentation.

For Poster Sessions

The poster sessions (poster spotlight and interactive sessions) will be held on 23th September in the foyer of the Central Lecture Hall building, the spotlight will take place in Lecture Hall 7.

Poster Spotlight Session (14:10-15:10)

- You have two minutes to introduce the topic of your poster.
- Spotlights will use the same PC, which we will provide. Presenters must upload their spotlight presentation (PDF or PPTX) before the Spotlight session using a memory stick.

Poster Interactive Session (15:10-16:45)

- You are responsible for printing, setting up, and taking down your poster. Organizers do NOT provide a printer; please print your own poster in advance and bring it with you. Place the poster on the panel labeled with your submission ID before the spotlight session (14:00-14:10), and remove it before you leave.
- Posters will be displayed on poster display boards that are distributed in the foyer.
- The poster should follow the International Standards Organization (ISO) size A0. The dimensions for the A0 format are 84 cm x 119 cm. The orientation of the poster should be portrait.

FOR THE POSTER SESSION AUDIENCE

Vote for the 1st, 2nd and 3rd best presentations **by 18:00 on September 23rd using the provided voting sheets.**

You can vote only once.

The Best Poster Awards will be announced at the Award Ceremony.

Technical Program – WS

Workshops – September 23, 2025 – 9:00-12:00

Workshop 1

ZHG 2

Harsh environment robotics

- 9:00 – 9:05 Introduction
- 9:05 – 9:35 Paper 1
Title: Fuel cell system development for harsh environment at F-REI
Authors: Akihiro Iiyama, Goh Matsuo, Tetsuya Kamihara, Keiji Okada, Atsuko Fukaya, Satoru Imazu, and Masanari Yanagisawa
- 9:35 – 10:05 Paper 2
Title: Fluid powered robots for harsh environments
Authors: Koichi Suzumori
- 10:05 – 10:35 Paper 3
Title: Aerial Interception of Multiple Drones by Multiple Distributed Chasers with Batch Deployments
Authors: Nontaphat Charuvajana, Panithan Rithburi, Sutthiphong Srigrarom, Boo Cheong Khoo, and Florian Holzapfel
- 10:35 – 11:20 Paper 4
Title: Tele-operated Robot Having Real Haptics Capability in Harsh Environment
Authors: Kouhei Ohnishi, Yuki Saito, Hiroshi Asai, Kasun Prasanga
- 11:20 – 12:05 Keynote Talk – Masayoshi Tomizuka
Topic: Intelligent, Autonomous and Swarm Control of Robots in Harsh Environment

Workshop 2

ZHG 3

Muscle to Mobility (M2): Crafting Soft Robots with Bioinspired Design Principles

- 9:00 – 9:15 Welcome and Opening Remarks
Saravana, Henrik and Etienne
- 9:15 – 9:40 Neuroscience Control Strategies
Prof. Dr. Henrik Jörintell
- 9:40 – 10:05 Simulating Movement Science
Dr. Hari Teja
- 10:05 – 10:30 Control of Bioinspired Robots
Prof. Poramate Manoopong
- 10:30 – 10:55 Human Robotics
Prof. Dr. Etienne Burdet
- 10:55 – 11:20 Soft Robotics
Prof. Dr. Cecilia Laschi
- 11:20 – 11:45 Bioinspired Design Process
Dr. Junior Rojas and Assistant Prof. Dr. Saravana
- 11:45 – 12:05 Panel discussion
Panelist (all speakers)
- 12:05 Goodbye Notes

Technical Program – Main Conference

23rd, Tuesday

From 11am onwards conference registration

- 9:00h – 12:00 Workshop 1 and Workshop 2 (parallel) See page 11,
Workshop 1 – Harsh environment robotics
11:15 — 12:00 Keynote Talk: Masayoshi Tomizuka
Topic: Intelligent, Autonomous and Swarm Control of Robots in Harsh Environment
Workshop 2 – Muscle to Mobility (M2): Crafting Soft Robots with Bioinspired Design Principles
- 13:00 – 13:10 Opening Remarks
- 13:15 – 14:00 **Plenary Talk 1: Heiko Hamann** (Chair: Florentin Wörgötter) ZHG 7
Human-Swarm Interaction and Time: Subjective Time-Perception as a Plastic Feature
- Coffee Break
- 14:10 — 15:00 Poster Spotlight ZHG 7
- 15:00 – 16:30 Poster Session / Coffee parallel Foyer in front of the lect. halls

Poster Session

- [05] Yuto Fukao, Yuya Shimizu, Ryohei Michikawa, Kiona Hosotani, Ryusuke Fujisawa, Tetsushi Kamegawa, and Fumitoshi Matsuno. *Development of Wheels and a Tail for a Two-Wheeled Lunar Rover*
- [22] Claudio Feliciani, Zeynep Yacel, Hisashi Murakami, Yuto Uesugi, Takenori Tomaru, Tamao Maeda and Sakurako Tanida. *Quantifying swarm reorganization in soldier crabs under external threats*
- [24] Tomohiro Hayakawa, Ryusuke Fujisawa, Yuki Tanigaki and Fumitoshi Matsuno. *Task allocation strategy for reconfigurable modular robots based on trophallaxis and cannibalism*
- [25] Ryohei Michikawa, Kiona Hosotani, Xixun Wang, Yuki Takagi, Haruho Mitsunaga, Mihiro Nakabayashi, Guang Yang, Ryusuke Fujisawa, Akio Noda, Tomohiro Hayakawa, Hiroshi Oku and Fumitoshi Matsuno. *Development of Robot Module Connectors with Dustproof and Passive Error Compensation Functions Using Metal Sheets*
- [27] Mau Adachi, Tomoya Kamimura, Yuichi Ambe, Yasuo Higurashi, Naomi Wada, Fumitoshi Matsuno and Shinya Aoi. *Asymmetrical body structures producing symmetrical running in quadrupedal mammals*
- [31] Guang Yang, Xixun Wang, Ryohei Michikawa, Kiona Hosotani, Yuya Shimizu, Tetsushi Kamegawa, Ryusuke Fujisawa and Fumitoshi Matsuno. *Vision-Based Docking of Limited-DoF Modules for Reconfigurable Modular Robots*
- [32] Xixun Wang, Tomohiro Shimomura, Ryo Ariizumi and Fumitoshi Matsuno. *Simultaneous optimization of structure and control of modular robots on rough terrain considering leg and wheel modules*
- [34] Yongdong Wang, Runze Xiao, Jun Younes Louhi Kasahara, Shota Chikushi, Keiji Nagatani, Atsushi Yamashita and Hajime Asama. *A Human-in-the-Loop DAG Refinement Framework for LLM-Driven Multi-Robot Construction Task Planning*
- [37] Tomoki Tokiwa, Shun-ichi Azuma and Ikumi Banno. *Feasible Learning Problems for Networks of Conditioning Logical Devices: Characterization by Output Controllability with Periodic State Preservation*
- [41] Yuki Takagi, Kazuki Shibata, Hiroshi Oku, Yuki Tanigaki, Guang Yang, Xixun Wang, Ryohei Michikawa and Fumitoshi Matsuno. *Development of a Health Monitoring Scheme on Mechanical Connection Motion of Modular Robots*
- [43] Giuseppe Antonio Patarino, Volker Strobel and, Marco Dorigo. *Modeling information propagation in robot swarms through epidemiological models*
- [48] Hun Jang and Liang Li. *Effects of Tail Stiffness on Swimming Performance in Individual and Schooling Conditions*
- [57] Ryohei Michikawa, Hiroshi Yokoi and Fumitoshi Matsuno. *A Neuro-musculoskeletal Model-based Algorithm for Virtual Weight Presentation via Electrical Muscle Stimulation*

Continued

- [59] Ryuusei Nishii, Kenichiro Satonaka, Ryota Kinjo, Hiroshi Oku, Yuki Tanigaki, Tomohiro Shimomura, Guang Yang, Xixun Wang, Fumitoshi Matsuno and Ryo Ariizumi. *Isomorphism Determination Method for Modular Robots Using Graph Neural Networks*
- [63] Aki Matsutaka, Shun-ichi Azuma and Ikumi Banno. *Diffusion-model-based Coordination of Multi-agent Systems: Achieving Formations Similar to—but Distinct from—References*
- [64] Takatoshi Hashimoto, Tomoya Kamimura, Sota Tsuchida, Tomoki Nakagawa, Yuichi Ambe, Mau Adachi and Shinya Aoi. *Stability change in a quadruped robot by stride frequency via neuromechanical resonance*
- [65] Sota Tsuchida, Tomoya Kamimura, Takatoshi Hashimoto, Tomoki Nakagawa, Yuichi Ambe, Mau Adachi, and Shinya Aoi. *Gait stability landscape of a quadruped robot governed by neuromechanical resonance*
- [67] Momiji Yoshikawa and Ikkyu Aihara. *Wavy synchronization in locomotion of train millipedes : From automatic tracking to a phase oscillator model*
- [69] Thirawat Chuthong and Poramate Manoonpong. *A Differential Steering Mechanism for Directional Adaptation and Self-Organized Locomotion under Decentralized Control in Legged Robots*
- [04] Luna Rusteberg, Minija Tamosiunaite and Florentin Wörgötter. *Recurrent neural network trained unsupervised to discover feature combinations*
- [03] Konstantin Möller, Minija Tamosiunaite, Florentin Wörgötter. *Unsupervised learning to forage following feature combinations*
- [70] Tenta Suzuki, Yuta Tobe, Tomohiro Harada, Johei Matsuoka and Kiyohiko Hattori. *Pheromone-Reward Reinforcement Learning for Trajectory Design of Multi-Agent: Evaluation Using Lane-less Self Driving as a Case Study*
- [71] Masashi Shiraishi and Hiraku Nishimori. *Effects of An Interaction Network Structure on the Task Allocation Dynamics Generated by the Response-Threshold Model*

- 16:30 – 17:15 **Plenary Talk 2 : Kenzo Nonami** (Chair: Fumitoshi Matsuno)
Heterogeneous Swarm Flight by a Cerebral AI Drones
- 17:30 – 18:15 **Plenary Talk 3: Antonio Bicchi** (Chair: Tomas Kulvicius)
On some abstract lessons learnt from nature, and concrete applications thereof

24th, Wednesday

- 9:00 – 9:45 **Plenary Talk 4: Cecilia Laschi** (Chair: Koichi Suzumori)
Lessons from nature for soft robotics
- Coffee Break
- 10:00 – 10:45 **Plenary Talk 5: Dongheui Lee** (Chair: Tommy Gravdahl)
Human-Centric Approaches for Robot Learning and Interaction with Human
- Coffee Break
- 11:00 – 13:00 Specific Sessions (2 Parallel Sessions)
Swarm Behavior 1 (Chair: Minija Tamosiunaite)

[07] Yigal Koifman , Erez Koifman, Eran Iceland, Ariel Barel, and Alfred M. Bruckstein. *VariAntNet: Learning Decentralized Control of Multi-Agent Systems*

[10] Tomoki Umezaki , Masaki Ogura, Takayuki Nakamura, Shodai Suzuki, Tsutomu Takagi, Tomonori Yoshikawa, Shunsuke Torisawa, Keitaro Kato, Youhei Washio, Shukei Masuma, Naoki Wakamiya . *Modeling Fish Schooling Behavior for Selective Fishing in Set Net Fisheries*

[11] Glenn R. Varhaug , Jarle Dorum, Jan Tommy Gravdahl, Elias Prytz, and Henrik Vasbotten . *Agricultural weed control by a swarm of robots*

[12] Aymeric Vellinger, Nemanja Antonic and Elio Tuci. *From Pheromones to Policies: Reinforcement Learning for Engineered Biological Swarms*

[14] Wei Wang and Qi Wang . *Robust UAV Formation Control via Improved ESO and SMC: From Wind-Disturbed Simulations to Real-World Flights*

[15] Makoto Eguchi and Kazuaki Yamada. *Autonomous Role Allocation in Multi-Agent Systems: Inspired by Ant Division of Labor*

Bio Robotics 1 (Chair: Tomoya Kamimura)

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[19] Fumitoshi Matsuno, Xixun Wang, Guang Yang, Kiona Hosotani, Ryohei Michikawa, Tetsushi Kamegawa, Yuya Shimizu, Motoyasu Tanaka, Ching Wen Chin, Ryusuke Fujisawa, Ryo Ariizumi, Koki Harada, Tomohiro Hayakawa, Yuichi Ambe, Akio Noda, Hiroshi Oku, Takashi Takuma, Ryota Kinjo, Yuki Tanigaki, Noritaka Sato, and Kotaro Kanazawa. *Self-Reconfigurable Modular Robots for Lunar Exploration and Base Construction " Overview and Interim Results of a Research Theme within the Moonshot Project*

[09] Shingo Onizuka , Ryohei Michikawa, Yuto Fukao, Xixun Wang, Haruho Mitsunaga, Soshi Yoneda, Yuki Takagi, Yousuke Izuno, Mihiro Nakabayashi, Reo Nishino, Yuya Shimizu, Ryosuke Inoue, Syota Uryu, Akio Noda, Takashi Takuma, Hiroshi Oku, Tomohiro Hayakawa, Tetsushi Kamegawa, Fumitoshi Matsuno and Ryusuke Fujisawa. *Enhancing Morphological Diversity and Demonstrating Control Robustness of Polyhedral Modular Rovers*

[30] Mayu Kikuchi , Yasumasa Tamura and Masahito Yamamoto . *Building a Motion Embedding Space for Annotation-Free Animal Behavior Recognition*

[21] Haruhiro Sato, Ku Esaki and Kazuyuki Ito . *Bio-Inspired Spiral Soft Arm Based on an Animal Tongue*

[23] Xixun Wang and Ryohei Michikawa and Fumitoshi Matsuno . *Autonomous Exploration of Mobile Robots in Unknown Uneven Terrain Inspired by Insect Locomotion Strategies*

[26] Haruki Aoyama , Kotaro Kanazawa, Ching Wen Chin, Guang Yang, Xixun Wang, Ryohei Michikawa, Noritaka Sato, Motoyasu Tanaka, Akio Noda, Fumitoshi Matsuno . *Development of a Remote Monitoring User Interface for Self-organized Modular Robots for Lunar Exploration*

- Lunch Break

- 14:00 – 14:45 **Plenary Talk 6: Nicholas Gravish** (Chair: Minija Tamosiunaite)

The symbiotic mutualism of robotics and biology

- Coffee Break

- 15:15 – 17:15 Specific Sessions (2 Parallel Sessions)

Swarm Behavior 2 (Chair: Simon Blaue)

[16] Taiki Watanabe, Yuki Tanigaki, Tomohiro Hayakawa, Fumitoshi Matsuno, and Ryusuke Fujisawa . *Enhancing Swarm Foraging Efficiency via Dynamic Task Switching and Threshold Diversity*

[17] Haruto Maeda and Masaki Ogura . *Modeling and Analysis of Locust Swarms with OR35-Deficient Individuals*

[29] Jie Song , Yang Bai, Mikhail Svinin and Naoki Wakamiya . *Autonomous Detection and Coverage of Unknown Target Areas by Multi-Agent Systems*

[50] Alexander Puzicha . *Modular Cross-Platform Software Design for the Autonomy Core of Decentralized Heterogeneous Mobile Robot Swarms*

[38] Asad Razzaq , Senshu Wakayama, Mazhar Manzoor, and Toshiyuki Yasuda . *Evolutionary Approach for Optimization of Perceptual Abilities and Group Composition in Heterogeneous Robotic Swarms*

[45] Ruiheng Wu, Oliver Deussen, Iain D. Couzin and Liang Li. *AutoPercep: A Pipeline for Onboard Neighbor Position Estimation Toward Scalable Swarm Robotics*

Bio Robotics 2 (Chair: Poramate Manoopong)

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[33] Gantogoo Oyunbat, Sven Lange, Zhenshan Bing and Florian Röhrbein . *Position Estimation Experiment on Bio-inspired Robotic Mouse with Inertial Measurement Unit*

[35] Yongxu Ren, Felix Deichsel, Jürgen Seiler, Andr'e Kaup, Philipp Beckerle. *Enhancing LLM Inference with Human Expert Knowledge: A Case Study on Mobile Robotics Fault Diagnosis and Prediction*

[46] Mohamed Aziz Zouita, Ahmad Hammad and Sophie F. Armanini . *Development of a Bio-Inspired Takeoff Mechanism for Flapping-Wing Micro Aerial Vehicles*

[47] Kenichiro Satonaka , Ryusei Nishii, Ryota Kinjo, Seiichi Ohashi, Tomoya Negoro, Yuki Takagi, Hiroshi Oku, Yuki Tanigaki, Koki Harada, Ryo Ariizumi, Tomohiro Simomoura, Guang Yang, Xixun Wang, and Fumitoshi Matsuno,. *Optimization of Autonomous Transformation Paths in Modular Robots via Structure Graph Encoding and Isomorphism Determination*

[53] Mao Tobisawa, Tenta Suzuki, Clive Jancen Kawaoto, Yuki Itoh, Kaito Kumagae, Tomohiro Harada, Johei Matsuoka, and Kiyohiko Hattori . *Efficient and Safe Bidirectional Traffic Control in Lane-less Environments Using Global Reward and Curriculum Learning*

[54] Clive Jancen Kawaoto, Tenta Suzuki, Mao Tobisawa, Yuki Itoh, Kaito Kumagae, Johei Matsuoka, and Kiyohiko Hattori. *Probabilistic Path Selection Method in Planetary Exploration: Improving Terrain Adaptability through Tethered Cooperative Rover Systems*

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- 17:15 – 18:00 **Plenary Talk 7: Saravana Prashanth Murali Babu** (Chair: Poramate Manoonpong)

From Nature to Robots: Exploring Modular Locomotion and Evolution

- 19:00 – Social Event (Dinner)

Restaurant Bullerjahn,
see bottom of page 3

25th, Thursday

ZHG 7

- 9:30 – 10:15 **Plenary Talk 8: Deborah Gordon** (Chair: Fumitoshi Matsuno)
The ecology of collective behavior
- Coffee Break

- 10:30 – 13:10 Specific Sessions (2 Parallel Sessions)

Swarm Behavior 3 (Chair: Tomas Kulvicius)

ZHG 2

[36] Yinan Shi, Georgios Tzoumas, Thomas Richardson and Sabine Hauert. *Validating the Potential of Multi-UAV Systems to Mitigate Large-scale Wildfires Based on Historical Data and Fire Modeling*

[51] Pranav Rajbhandari, Abhi Veda, Matthew Garratt, Mandayam Srinivasan and Sridhar Ravi . *Understanding visual attention behind bee-inspired UAV navigation*

[58] N. Charuvajana, X.Y. Tan, P. Rithburi, S. Srigrarom , B.C. Khoo and F. Holzapfel . *Aerial Interception of Multiple Drones by Multiple Distributed Chasers with Batch Deployments*

[60] Shenbagaraj Kannapiran, Elena Oikonomou, Albert Chu , Spring Berman, and Theodore P. Pavlic,. *Ant-inspired Walling Strategies for Scalable Swarm Separation: Reinforcement Learning Approaches Based on Finite State Machines*

[62] Kristina Wogatai and Wilfried Elmenreich . *Utilization of Cohesion and Adhesion Forces in Plasmodial Slime Molds for Network Information Transfer*

[39] Kohei Ohashi, Rei Hiraoka, Syoma Kamata, Raj Rajeshwar Malinda. Hiroaki Kawashima, Hitoshi Habe and Takayuki Niizato. *Visual manipulation of group behavior in *Plecoglossus altivelis* via projected dot patterns*

[20] Hossein B. Jond . *Position-Based Flocking for Robust Alignment*

Bio Robotics 3 (Chair: Florentin Wörgötter)

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[56] Yuki Tanigaki and Yano Mikito. *Multi-Objective Optimization of Module Configuration and Task Allocation for Modular Robots of the Lunar Exploration Project*

[68] Simon Blaue, Minija Tamosiunaite and Florentin Wörgötter. *Recording and Analysis of Interactive Human Reaching Motions with Cooperative Collision Avoidance*

[06] Pasut Suriyasomboon, Rene M. Suarez Flores, Sajid Nisar. *Design and Development of A Bio-Inspired Anthropomorphic Finger for Dexterous Robotic Hands*

[08] Koki Harada, , Ryo Ariizumi, Xixun Wang, Ryota Kinjo and Fumitoshi Matsuno . *Graph Grammar Definition Language GGDL and its application*

[13] Kenta Okumura , Motoaki Hiraga, Kazuhiro Ohkura, Arata Masuda . *Improving Topological Diversity in Mutation-Based Evolving Artificial Neural Network via Multi-Objective Optimization*

[55] Tenta Suzuki, Mao Tobisawa, Clive Jancen Kawaoto, Kaito Kumagae, Yuki Itoh, Kenji Matsuda, Junya Hoshino, Tomohiro Harada, Jyouhei Matsuoka and Kiyohiko Hattori. *Improving DRL Policies via Explainable Action Correction Based on Accident Cause Analysis*

[42] Yuichi Ambe, Takashi Takuma, Tomohiro Hayakawa and Fumitoshi Matsuno. *Static Pose Optimization to Reduce Connector and Joint Loads in a Modular-Limbed Quadruped with Position-Controlled Joints*

[28] Tomoya Kamimura, Yuya Oshita, Mau Adachi, Yuichi Ambe, Akihito Sano, Naomi Wada, Shinya Aoi and Fumitoshi Matsuno. *Dynamical Effects of Asymmetry Body Flexibility on Cheetah Running Gait*

- Lunch Break
- 14:00 – 14:45 **Plenary Talk 9: Sabine Hauert** (Chair: Shinya Aoi)
From Nano to Macro: Building Trustworthy Swarms for People
- Short Break
- 15:00 – 15:45 Poster and Paper Award Ceremony and Closing Remarks
- 15:45 – Farewell Event

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We thank our Program and Advisory Committee.

Please see: <https://www25.swarm-systems.org/committee/>

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