

July 22nd (Thursday)

Opening Address and Announcements

Marine Theater

09:15 – 09:30 *K. Ohnishi (Keio University, Japan)

Keynote Lecture

Marine Theater

Chairperson: K. Ohnishi
(Keio University, Japan)

09:30 – 10:20 Engineering review of biological evolution of motion control
*M. Kumamoto (Kyoto University, Japan)

10:20 – 10:30 **Discussions**

10:30 – 10:40 **Break**

Session Program

Biological Evolution in terms of Motion Control I

Marine Theater

Chairperson: T. Yamada
(National Museum of Nature and Science, Japan)

10:40 – 11:10 **From ciliary to muscular locomotion in lancelets**
*K. Yasui⁽¹⁾, T. Kaji⁽¹⁾ and S. Tabata⁽²⁾ (Hiroshima University, Japan⁽¹⁾; Kyushu University, Japan⁽²⁾)

11:10 – 11:40 **Numerical investigation of hydrodynamics of rainbow trout swimming**
*K. Kamemoto (Yokohama National University, Japan) and A. Ojima (College Master Hands Inc., Japan)

11:40 – 12:10 **Analyses of swimming motion of lancelet, blacktip reef shark and yellowfin**
*R. Sato⁽¹⁾, K. Fujii⁽²⁾, M. Iwata⁽²⁾, K. Yoshimura⁽²⁾, S. Yamauchi⁽²⁾, K. Matsuzaki⁽²⁾, Kosuke Yoshida⁽²⁾, C. Nakamura⁽²⁾, Y. Sato⁽³⁾ and Y. Abe⁽²⁾
(Kanazawa Institute of Technology, Japan⁽¹⁾; Aquamarine Fukushima, Japan⁽²⁾; Ministry of Defense, Japan⁽³⁾)

12:10 – 12:30 **Discussion**

12:30 – 14:30 **Lunch Break**

Biological Evolution in terms of Motion Control II

Marine Theater

Chairperson: M. Okabe

(The Jikei University School of Medicine, Japan)

- 14: 30 – 15: 00 **Muscular characteristics of aquatic mammals**
*T. Yamada (National Museum of Nature and Science, Japan) and M. Koizumi (Tokyo Ariake University of Medical and Health Sciences)
- 15: 00 – 15: 30 **Genomics and the evolution of chordates**
*C. T. Amemiya (Benaroya Research Institute and University of Washington, USA) and T. Miyake (The Jikei University School of Medicine, Japan)
- 15: 30 – 16: 00 **Evolution of locomotor adaptation in primates**
*M. Nakatsukasa (Kyoto University, Japan)
- 16: 00 – 16: 20 **Discussions**

July 23rd (Friday)

Biological and Engineering Reviews of Motion Control through Landing I

Marine Theater

Chairperson: T. Miyake

(The Jikei University School of Medicine, Japan)

- 09: 30 – 10: 00 **Transition from aquatic to terrestrial life and evolution of the vertebrate pharynx**
*M. Okabe (The Jikei University School of Medicine, Japan)
- 10: 00 – 10: 30 **Evolutionary developmental perspective of limbs and fins in gnathostomes**
*T. Yano⁽¹⁾⁽²⁾, H. Yokoyama⁽¹⁾, S. Yonei-Tamura⁽¹⁾ and K. Tamura⁽¹⁾ (Tohoku University, Japan⁽¹⁾; Research Fellow of the Japan Society for the Promotion of Science, Japan⁽²⁾)
- 10: 30 – 10: 40 **Discussions**
- 10: 40 – 10: 45 **Break**
- 10: 45 – 11: 15 **Fins to limb: evolution of the appendage skeleton and musculature across the fish-tetrapod transition**
*Per Erik Ahlberg (Uppsala University, Sweden)
- 11: 15 – 11: 45 **Link parameters as analysis tool for animal movements**
*S. Oh and N. Inuzuka (The University of Tokyo, Japan)

- 11: 45 – 12: 15 **The interplay of leg dynamics and multi-articular muscle function in stabilising locomotion in uneven terrain**
 *M. A. Daley (Royal Veterinary College, UK)
- 12: 15 – 12: 25 **Discussions**
- 12: 25 – 14: 00 **Lunch Break**
- 12: 45 – 13: 45 **Dialogue Session I (Odd-numbered presentations)**

Biological and Engineering Reviews of Motion Control through Landing II

Marine Theater

Chairperson: M. Kumamoto

(Kyoto University, Japan)

- 14: 00 – 14: 30 **The pectoral fin musculature of the coelacanth: an implication for evolution of mono- and multi-articular muscles in tetrapod limbs**
 * T. Miyake⁽¹⁾, M. Kumamoto⁽²⁾, M. Iwata⁽³⁾, M. Okabe⁽¹⁾, H. Koie⁽⁴⁾, K. Fujii⁽³⁾, K. Matsuzaki⁽³⁾, C. Nakamura⁽³⁾, S. Yamauchi⁽³⁾, Kosuke Yoshida⁽³⁾, K. Yoshimura⁽³⁾, A. Komada⁽³⁾, S. Matsunaga⁽⁵⁾, N. Kumai⁽⁵⁾, Y. Yabumoto⁽⁶⁾, K. Fujita⁽⁷⁾, T. Uyeno⁽⁸⁾ and Y. Abe⁽³⁾ (The Jikei University School of Medicine, Japan⁽¹⁾; Kyoto University, Japan⁽²⁾; Aquamarine Fukushima, Japan⁽³⁾; Nihon University, Japan⁽⁴⁾; Research Center of Computational Mechanics, Inc., Japan⁽⁵⁾; Kitakyushu Museum of Natural History & Human History, Japan⁽⁶⁾; Tokyo University of Marine Science and Technology, Japan⁽⁷⁾; National Museum of Nature and Science, Japan⁽⁸⁾)
- 14: 30 – 15: 00 **Investigation of a lancelet robot with triarticular muscle mechanism**
 *T. Tsuji (Saitama University, Japan)
- 15: 00 – 15: 30 **Robotics application using bi-articular muscle provided coordination control model (BiCOOM)**
 *T. Oda (OKI Electric Industry Co., Ltd., Japan)
- 15: 30 – 15: 50 **Discussions**
- 15: 50 – 16: 00 **Break**
- 16: 00 – 16: 30 **Torque transfer function of the bi-articular muscle in engineer's view**
 *T. Oshima⁽¹⁾, K. Koyanagi⁽¹⁾, T. Fujikawa⁽²⁾ and N. Momose⁽³⁾ (Toyama Prefectural University, Japan⁽¹⁾; Osaka Electro-Communication University, Japan⁽²⁾; Toyama National College of Technology, Japan⁽³⁾)
- 16: 30 – 17: 00 **Quadruped walking for rough terrain**
 *K. Ohnishi (Keio University, Japan)
- 17: 00 – 17: 20 **Discussions**

July 24th (Saturday)

Physiological and Engineering Aspects of Neuro-Muscular Characteristics in Motion Control

Marine Theater

Chairperson: K. Ohnishi

(Keio University, Japan)

- 09: 30 – 10: 00 **The monkey primary motor cortex may generate motor commands and estimated arm states during reaching movements**
*E. Miyashita, H. Ueda and Y. Ueyama (Tokyo Institute of Technology, Japan)
- 10: 00 – 10: 30 **Useful signals from motor cortex**
*A. B. Schwartz (University of Pittsburgh, USA)
- 10: 30 – 10: 40 **Discussions**
- 10: 40 – 10: 50 **Break**
- 10: 50 – 11: 20 **Forward dynamics simulation of human locomotion**
*N. Hata (OKI Electric Industry Co., Ltd., Japan)
- 11: 20 – 11: 50 **A muscle-like actuator named “Twist Drive”**
*I. Godler (University of Kitakyushu, Japan) and T. Sonoda (Fukuoka Industry, Science & Technology Foundation, Japan)
- 11: 50 – 12: 20 **Biarticular muscle structure robotics**
*S. Oh⁽¹⁾, Kengo Yoshida⁽²⁾ and Y. Hori⁽¹⁾ (The University of Tokyo, Japan⁽¹⁾; Intelligent Infrastructure Development, Japan⁽²⁾)
- 12: 20 – 12: 35 **Discussions**
- 12: 35 – 14: 00 **Lunch Break**
- 12: 45 – 13: 45 **Dialogue Session II (Even-numbered presentations)**

Mechatronics and Motion Control

Marine Theater

Chairperson: I. Godler

(University of Kitakyushu, Japan)

- 14: 00 – 14: 30 **Actuator design for human machine interaction**
*K. Kong, J. Bae and M. Tomizuka (University of California, Berkeley, USA)
- 14: 30 – 15: 00 **Motion control – a SMC approach**
*Asif Sabanovic (Sabanci University, Turkey)

- 15: 00 – 15: 30 **Remote evaluation of muscular capabilities in patients with neurological impairments**
 *R. Oboe⁽¹⁾, O. A. Daud⁽²⁾, S. Masiero⁽¹⁾, F. Oscari⁽¹⁾ and G. Rosati⁽¹⁾ (University of Padova, Italy⁽¹⁾; University of Trento, Italy⁽²⁾)
- 15: 30 – 15: 50 **Discussions**
- 15: 50 – 16: 00 **Break**
- 16: 00 – 16: 30 **Electromagnetic actuators as artificial muscles for a robotic motion – advantages and limitations**
 *T. Koseki (The University of Tokyo, Japan) and H.-J. Kim (Sungjin Royal Motion Co., Ltd., Korea)
- 16: 30 – 17: 00 **A consideration for push-pull motion**
 *K. Ohnishi (Keio University, Japan)
- 17: 00 – 17: 10 **Discussions**
- 17: 10 – 17: 20 **Break**

General Discussions and Concluding Remarks

Marine Theater
 Chairperson: M. Kumamoto
 (Kyoto University, Japan)
 Chairperson: K. Ohnishi
 (Keio University, Japan)

- 17: 20 – 18: 20 **General Discussions and Concluding Remarks**
Banquet

The Oceans at the Current Rip
 Aquamarine Fukushima

- 19: 30 **Banquet begins**

Dialogue Program

Aqua-room I (1F) of Aquamarine Fukushima

Session I July 23rd 12: 45 – 13: 45	Odd-numbered presentations chaired by T. Tsuji (Saitama University)
Session II July 24th 12: 45 – 13: 45	Even-numbered presentations chaired by S. Oh (The University of Tokyo)

A list of Presentations

- 1. Relationship of between elbow joint angle and moment arms of antigravity muscles during the stance phase of tetrapods: case studies of upright and inverted quadrupedal limb postures.** *S. Fujiwara (The University of Tokyo, Japan) (Note: This dialogue presentation is one of session program presentations attended by M. Manabe, National Museum of Nature and Science)
- 2. Estimation of muscle strength during rising motion considering mechanical characteristics of three pairs of muscle.** *T. Abe (Seijoh University, Japan), A. Kanai (Toyohashi SOZO University, Japan), K. Furukawa (Seijoh University, Japan) and T. Fujikawa (Osaka Electro-Communication University, Japan)
- 3. Proposal of error convergence-type predictor using 2nd-order Volterra neuron networks with input-delay.** *S. Kobayakawa and H. Yokoi (Kyushu Institute of Technology, Japan)
- 4. Development of haptic data acquisition robot hand.** *T. Nozaki and Kouhei Ohnishi (Keio University, Japan)
- 5. Wire tension control for a PE line with modal transformation.** *Yusuke Suzuki and Kouhei Ohnishi (Keio University, Japan)
- 6. Imitated bi-articular arm by motor drive with planetary gear.** *A. Umemura, T. Haneyoshi and Y. Saito (Tokyo Denki University, Japan)
- 7. Biped walking pattern generation with clothoid curve.** *S. Shimmyo and Kouhei Ohnishi (Keio University, Japan)
- 8. Study on power assisting rehabilitation robotic arm utilized hydraulic bilateral servo actuators (HBSA).** *T. Higashihara (Takamatsu Prosthetic & Orthotic Mfg, Ltd., Japan), Y. Saito (Tokyo Denki University, Japan), Kengo Ohnishi (Tokyo Denki University, Japan) and T. Oshima (Toyama Prefectural University, Japan)

9. **An experimental validation of walking stabilization control for biped robot on uneven terrain.** *Tomoya Sato, S. Sakaino and Kouhei Ohnishi (Keio University, Japan)
10. **Control system of an exoskeleton robot for aged people's transportation.** *J. Monnet, Y. Saito and M. Noguchi (Tokyo Denki University, Japan)
11. **Forceps robot with 2-DOF of roll-rotation and open-close.** *M. Kawamoto, Yusuke Suzuki and Kouhei Ohnishi (Keio University, Japan)
12. **Haptic Communication between Japan and Italy through Internet.** *D. Yashiro, R. Oboe and Kouhei Ohnishi (Keio University, Japan)
13. **A new approach for torque sharing of robotic arms equipped with biarticular actuators.** *V. Salvucci, S. Oh and Y. Hori (The University of Tokyo, Japan)
14. **Muscle motion actuator for humanoid robots.** *S. Obata, Y. Saito and H. Matsui (Tokyo Denki University, Japan)
15. **Control of a straight line motion for a humanoid robot using characteristics of bi-articular simultaneous drive and machine learning control.** *H. Fukusho, T. Sugimoto and T. Koseki (The University of Tokyo, Japan)
16. **Component analysis of contact motion based on modal power.** *Y. Kasahara and Kouhei Ohnishi (Keio University, Japan)
17. **Force corresponding velocity bilateral control using gyrator principal.** *T. Mizoguchi, H. Kuwahara and Kouhei Ohnishi (Keio University, Japan)
18. **Verification of flexible actuator with thrust-rotational wire.** *K. Okuda, K. Sugawara, F. Mitome and Kouhei Ohnishi (Keio University, Japan)
19. **Knee stretch walking of biped robot utilizing toe and heel joints.** *Takahiko Sato, S. Shimmyo, Tomoya Sato and Kouhei Ohnishi (Keio University, Japan)
20. **Proposal of a muscle activation level control method for limbs during motion and its application to strength training.** *S. Komada, Y. Murakami and J. Hirai (Mie University, Japan)
21. **Improvement of operability for redundant MDOF bilateral system in workspace.** *R. Horie and T. Murakami (Keio University, Japan)
22. **Flexible interactive force control in human-system interaction.** *T. Shimono (Yokohama National University, Japan) and Kouhei Ohnishi (Keio University, Japan)
23. **Modeling of nonlinear factor in thrust wires and application to motion control system.** *K. Sugawara, A. Suzuki, H. Kuwahara and Kouhei Ohnishi (Keio University, Japan)
24. **Realization of efficient motions by information and energy transmission management based on system connection theory.** *K. Natori (Aoyama Gakuin University, Japan)
25. **Fracture prediction system using 2DOF haptic forceps robot.** *W. Motooka, Yusuke Suzuki, D. Yashiro, Kouhei Ohnishi (Keio University, Japan)
26. **Development and verification of POF flexible actuator.** *F. Mitome, Y. Kasahara, K. Okuda,

K. Sugawara and Kouhei Ohnishi (Keio University, Japan)

- 27. Realization of bi-articular driven robotic arm with planetary gear based on disturbance observer.** *Y. Kimura, S. Oh and Y. Hori (The University of Tokyo, Japan)
- 28. Articulated multilateral control for adaptation to increase of system connection.** *T. Ishii and S. Katsura (Keio University, Japan)
- 29. Calculation of the maximum force distribution of an index finger by using linear programming method.** *T. Sugimoto, H. Fukusho and T. Koseki (The University of Tokyo, Japan)
- 30. A synthesis method of motion using haptic devices.** *M. Miyagaki, H. Kuwahara and Kouhei Ohnishi (Keio University, Japan)
- 31. High thrust force direct-drive linear actuator and its application to musculoskeletal robots.** *Y. Fujimoto, I. A. Smadi, H. Ohmori and Y. Wakayama (Yokohama National University, Japan)
- 32. Thermal bilateral control without heat flux sensor.** *H. Morimitsu and S. Katsura (Keio University, Japan)
- 33. A study on quantitative evaluation of extent of crying and laughing based on brain blood flow measured by near infrared spectroscopy (NIRS).** *K. Noguchi, Yukihiro Suzuki, J. Ishikawa, T. Shiotsuki, N. Kamamichi, M. Izutsu, K. Furuta (Tokyo Denki University, Japan) and S. Yoshino (Tokyo Denki University and Nippon Medical School, Japan)
- 34. Trial manufacture of a mechanical model of coelacanth lobe-fin.** *T. Okada, S. Kawano and R. Sato (Kanazawa Institute of Technology, Japan)
- 35. Trial manufacture of a robot with flagellar wave propulsor.** *T. Mizouchi, H. Niimi and R. Sato (Kanazawa Institute of Technology, Japan)
- 36. Realization of motion distributor based on real-world haptics.** *Y. Yokokura and S. Katsura (Keio University, Japan)
- 37. Construction of real-world environmental model considering frictions.** *T. Shimoichi and S. Katsura (Keio University, Japan)