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Personal

Date of Birth: 18/07/1994

Research Interests: Humanoid, Biomimetics, Machine Learning

Education

Ph.D. Candidate in Dept. of Mechano-Informatics, The University of University, Japan, with Prof. Masayuki Inaba (JSK Robotics Laboratory), 2019-current

M.S. in Dept. of Mechano-Informatics, Graduate School of Information Science and Technology, The University of Tokyo, Japan, 2017-2019

B.S. in Dept. of Mechano-Informatics, Faculty of Engineering, The University of Tokyo, Japan, 2013-2017

Experience

Internship at Preferred Networks, Robotics Engineer, Japan, 2018-2020

Internship at Works Applications Co. Ltd., Software Engineer, Japan, 2016

Internship at Future Standard, Software Engineer, Japan, 2016

Internship at HIOKI, E.E. CORPORATION, Software Engineer, Japan, 2015

Skills

Software Skills

Basic: Java, JavaScript, Android, Haskell

Intermediate: Ruby, Lisp, Statistics

Advanced: C, C++, Python, Machine Learning, Algorithms

Hardware Skills

Basic: Electorinics, Machining

Intermediate: 3D CAD, 3D Printer

Publications

Journal Articles (Peer Reviewed)

1. **K. Kawaharazuka**, M. Nishiura, Y. Toshimitsu, Y. Omura, Y. Koga, Y. Asano, K. Okada, K. Kawasaki, M. Inaba: "Robust Continuous Motion Strategy Against Muscle Rupture using Online Learning of Redundant Intersensory Networks for Musculoskeletal Humanoids (in press)", *Robotics and Autonomous Systems (RAS)*, 2022
2. **K. Kawaharazuka**, A. Miki, Y. Toshimitsu, K. Okada, M. Inaba: "Adaptive Body Schema Learning System Considering Additional Muscles for Musculoskeletal Humanoids", *IEEE Robotics and Automation Letters (RAL)*, vol. 7, no. 2, pp. 3459-3466, 2022, **(presented at ICRA2022)**
3. **K. Kawaharazuka**, K. Okada, M. Inaba: "Adaptive Robotic Tool-Tip Control Learning Considering Online Changes in Grasping State", *IEEE Robotics and Automation Letters (RAL)*, vol. 6, no. 3, pp. 5992-5999, 2021, **(presented at IROS2021)**
4. **K. Kawaharazuka**, Y. Kawamura, K. Okada, M. Inaba: "Imitation Learning with Additional Constraints on Motion Style using Parametric Bias", *IEEE Robotics and Automation Letters (RAL)*, vol. 6, no. 3, pp. 5897-5904, 2021, **(presented at IROS2021)**
5. Y. Koga, **K. Kawaharazuka**, Y. Toshimitsu, M. Nishiura, Y. Omura, Y. Asano, K. Okada, K. Kawasaki, M. Inaba: "Self-Body Image Acquisition and Posture Generation with Redundancy using Musculoskeletal Humanoid Shoulder Complex for Object Manipulation", *IEEE Robotics and Automation Letters (RAL)*, vol. 6, no. 4, pp. 6686-6692, 2021, **(presented at IROS2021)**
6. **K. Kawaharazuka**, M. Nishiura, Y. Koga, Y. Omura, Y. Toshimitsu, Y. Asano, K. Okada, K. Kawasaki, M. Inaba: "Automatic Grouping of Redundant Sensors and Actuators Using Functional and Spatial Connections: Application to Muscle Grouping for Musculoskeletal Humanoids", *IEEE Robotics and Automation Letters (RAL)*, vol. 6, no. 2, pp. 1981-1988, 2021, **(presented at ICRA2021)**
7. **K. Kawaharazuka**, K. Tsuzuki, Y. Koga, Y. Omura, T. Makabe, K. Shinjo, M. Onitsuka, Y. Nagamatsu, Y. Asano, K. Okada, K. Kawasaki, M. Inaba: "Toward Autonomous Driving by Musculoskeletal Humanoids: Study of Developed Hardware and Learning-Based Software", *IEEE Robotics and Automation Magazine (RAM)*, vol. 27, no. 3, pp. 84-96, 2020, **(presented at ICRA2021)**
8. **K. Kawaharazuka**, K. Tsuzuki, M. Onitsuka, Y. Asano, K. Okada, K. Kawasaki, M. Inaba: "Object Recognition, Dynamic Contact Simulation, Detection, and Control of the Flexible Musculoskeletal Hand Using a Recurrent Neural Network With Parametric Bias", *IEEE Robotics and Automation Letters (RAL)*, vol. 5, no. 3, pp. 4580-4587, 2020, **(presented at IROS2020)**
9. **K. Kawaharazuka**, N. Hiraoka, K. Tsuzuki, M. Onitsuka, Y. Asano, K. Okada, K. Kawasaki, M. Inaba: "Estimation and Control of Motor Core Temperature with Online Learning of Thermal Model Parameters: Application to Musculoskeletal Humanoids", *IEEE Robotics and Automation Letters (RAL)*, vol. 5, no. 3, pp. 4273-4280, 2020, **(presented at IROS2020)**
10. **K. Kawaharazuka**, K. Tsuzuki, M. Onitsuka, Y. Asano, K. Okada, K. Kawasaki, M. Inaba: "Musculoskeletal AutoEncoder: A Unified Online Acquisition Method of Intersensory Networks for State Estimation, Control, and Simulation of Musculoskeletal Humanoids", *IEEE Robotics and Automation Letters (RAL)*, vol. 5, no. 2, pp. 2411-2418, 2020, **(presented at ICRA2020)**
11. **K. Kawaharazuka**, S. Makino, M. Kawamura, S. Nakashima, Y. Asano, K. Okada, M. Inaba: "Human Mimetic Forearm and Hand Design with a Radioulnar Joint and Flexible Machined Spring Finger for Human Skillful Motions", *Journal of Robotics and Mechatronics (JRM)*, vol. 32, no. 2, pp. 445-458, 2020, **(The first two authors contributed equally to this work)**

12. **K. Kawaharazuka**, K. Tsuzuki, S. Makino, M. Onitsuka, Y. Asano, K. Okada, K. Kawasaki, M. Inaba: “Long-time Self-body Image Acquisition and its Application to the Control of Musculoskeletal Structures”, *IEEE Robotics and Automation Letters (RAL)*, vol. 4, no. 3, pp. 2965-2972, 2019, **(presented at IROS2019)**
13. **K. Kawaharazuka**, S. Makino, M. Kawamura, Y. Asano, K. Okada, M. Inaba: “Online Learning of Joint-Muscle Mapping using Vision in Tendon-driven Musculoskeletal Humanoids”, *IEEE Robotics and Automation Letters (RAL)*, vol. 3, no. 2, pp. 772-779, 2018, **(presented at ICRA2018)**
14. **K. Kawaharazuka**, M. Kawamura, S. Makino, Y. Asano, K. Okada, M. Inaba: “Antagonist Inhibition Control in Redundant Tendon-driven Structures Based on Human Reciprocal Innervation for Wide Range Limb Motion of Musculoskeletal Humanoids”, *IEEE Robotics and Automation Letters (RAL)*, vol. 2, no. 4, pp. 2119-2126, 2017, **(presented at IROS2017)**

International Conference Proceedings (Peer Reviewed)

1. **K. Kawaharazuka**, K. Shinjo, Y. Kawamura, K. Okada, M. Inaba: “Environmentally Adaptive Control Including Variance Minimization Using Stochastic Predictive Network with Parametric Bias: Application to Mobile Robots”, *Proceedings of the 2021 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS2021)*, pp. 8381-8387, 2021
2. **K. Kawaharazuka**, Y. Toshimitsu, M. Nishiura, Y. Koga, Y. Omura, Y. Asano, K. Okada, K. Kawasaki, M. Inaba: “Design Optimization of Musculoskeletal Humanoids with Maximization of Redundancy to Compensate for Muscle Rupture”, *Proceedings of the 2021 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS2021)*, pp. 3204-3210, 2021
3. **K. Kawaharazuka**, N. Hiraoka, Y. Koga, M. Nishiura, Y. Omura, Y. Asano, K. Okada, K. Kawasaki, M. Inaba: “Online Learning of Danger Avoidance for Complex Structures of Musculoskeletal Humanoids and Its Applications”, *Proceedings of the 2020 IEEE-RAS International Conference on Humanoid Robots (HUMANOIDS2020)*, pp. 349-355, 2021
4. **K. Kawaharazuka**, Y. Koga, M. Nishiura, Y. Omura, Y. Asano, K. Okada, K. Kawasaki, M. Inaba: “Motion Modification Method of Musculoskeletal Humanoids by Human Teaching Using Muscle-Based Compensation Control”, *Proceedings of the 2020 IEEE-RAS International Conference on Humanoid Robots (HUMANOIDS2020)*, pp. 83-89, 2021
5. M. Onitsuka, M. Nishiura, **K. Kawaharazuka**, K. Tsuzuki, Y. Toshimitsu, Y. Omura, Y. Asano, K. Okada, K. Kawasaki, M. Inaba: “Development of Musculoskeletal Legs with Planar Interskeletal Structures to Realize Human Comparable Moving Function”, *Proceedings of the 2020 IEEE-RAS International Conference on Humanoid Robots (HUMANOIDS2020)*, pp. 17-24, 2021, **Best Oral Paper Award, Finalists of Mike Stilman Paper Award**
6. Y. Toshimitsu, **K. Kawaharazuka**, M. Nishiura, Y. Koga, Y. Omura, Y. Asano, K. Okada, K. Kawasaki, M. Inaba: “Biomimetic Operational Space Control for Musculoskeletal Humanoid Optimizing across Muscle Activation and Joint Nullspace”, *Proceedings of the 2021 IEEE International Conference on Robotics and Automation (ICRA2021)*, pp. 1184-1190, 2021
7. S. Nakashima, **K. Kawaharazuka**, M. Nishiura, Y. Asano, Y. Kakiuchi, K. Okada, K. Kawasaki, M. Inaba: “Restoring Force Design of Active Self-Healing Tension Transmission System and Application to Tendon-Driven Legged Robot”, *Proceedings of the 2021 IEEE International Conference on Robotics and Automation (ICRA2021)*, pp. 7033-7038, 2021
8. **K. Kawaharazuka**, M. Nishiura, S. Nakashima, Y. Toshimitsu, Y. Omura, Y. Koga, Y. Asano, K. Okada, K. Kawasaki, M. Inaba: “Stability Recognition with Active Vibration for Bracing Behaviors

- and Motion Extensions Using Environment in Musculoskeletal Humanoids”, *Proceedings of the 2021 IEEE International Conference on Soft Robotics (ROBOSOFT2021)*, pp. 126-133, 2021
9. **K. Kawaharazuka**, Y. Koga, K. Tsuzuki, M. Onitsuka, Y. Asano, K. Okada, K. Kawasaki, M. Inaba: “Exceeding the Maximum Speed Limit of the Joint Angle for the Redundant Tendon-driven Structures of Musculoskeletal Humanoids”, *Proceedings of the 2020 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS2020)*, pp. 3585-3590, 2020
 10. **K. Kawaharazuka**, Y. Koga, K. Tsuzuki, M. Onitsuka, Y. Asano, K. Okada, K. Kawasaki, M. Inaba: “Applications of Stretch Reflex for the Upper Limb of Musculoskeletal Humanoids: Protective Behavior, Postural Stability, and Active Induction”, *Proceedings of the 2020 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS2020)*, pp. 3598-3603, 2020
 11. **K. Kawaharazuka**, T. Ogawa, C. Nabeshima: “Tool Shape Optimization through Backpropagation of Neural Network”, *Proceedings of the 2020 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS2020)*, pp. 8387-8393, 2020
 12. Y. Toshimitsu, **K. Kawaharazuka**, K. Tsuzuki, M. Onitsuka, M. Nishiura, Y. Koga, Y. Omura, M. Tomita, Y. Asano, K. Okada, K. Kawasaki, M. Inaba: “Biomimetic Control Scheme for Musculoskeletal Humanoids Based on Motor Directional Tuning in the Brain”, *Proceedings of the 2020 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS2020)*, pp. 7784-7791, 2020
 13. **K. Kawaharazuka**, K. Tsuzuki, M. Onitsuka, Y. Asano, K. Okada, K. Kawasaki, M. Inaba: “Stable Tool-Use with Flexible Musculoskeletal Hands by Learning the Predictive Model of Sensor State Transition”, *Proceedings of the 2020 IEEE International Conference on Robotics and Automation (ICRA2020)*, pp. 4572-4578, 2020
 14. T. Nishio, M. Zhao, F. Shi, T. Anzai, **K. Kawaharazuka**, K. Okada, M. Inaba: “Stable Control in Climbing and Descending Flight under Upper Walls using Ceiling Effect Model based on Aerodynamics”, *Proceedings of the 2020 IEEE International Conference on Robotics and Automation (ICRA2020)*, pp. 172-178, 2020
 15. **K. Kawaharazuka**, S. Makino, K. Tsuzuki, M. Onitsuka, Y. Nagamatsu, K. Shinjo, T. Makabe, Y. Asano, K. Okada, K. Kawasaki, M. Inaba: “Component Modularized Design of Musculoskeletal Humanoid Platform Musashi to Investigate Learning Control Systems”, *Proceedings of the 2019 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS2019)*, pp. 7294-7301, 2019
 16. **K. Kawaharazuka**, K. Tsuzuki, S. Makino, M. Onitsuka, K. Shinjo, Y. Asano, K. Okada, K. Kawasaki, M. Inaba: “Task-specific Self-body Controller Acquisition by Musculoskeletal Humanoids: Application to Pedal Control in Autonomous Driving”, *Proceedings of the 2019 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS2019)*, pp. 813-818, 2019
 17. **K. Kawaharazuka**, T. Ogawa, C. Nabeshima: “Dynamic Task Control Method of a Flexible Manipulator Using a Deep Recurrent Neural Network”, *Proceedings of the 2019 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS2019)*, pp. 7689-7695, 2019
 18. K. Shinjo, **K. Kawaharazuka**, Y. Asano, S. Nakashima, S. Makino, M. Onitsuka, K. Tsuzuki, K. Okada, K. Kawasaki, M. Inaba: “Foot with a Core-shell Structural Six-axis Force Sensor for Pedal Depressing and Recovering from Foot Slipping during Pedal Pushing Toward Autonomous Driving by Humanoids”, *Proceedings of the 2019 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS2019)*, pp. 3049-3054, 2019
 19. S. Nakashima, T. Shirai, **K. Kawaharazuka**, Y. Asano, Y. Kakiuchi, K. Okada, M. Inaba: “An Approach of Facilitated Investigation of Active Self-healing Tension Transmission System Oriented for Legged Robots”, *Proceedings of the 2019 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS2019)*, pp. 2567-2572, 2019, **SICE International Young Authors Award (2019)**

20. T. Makabe, T. Shirai, Y. Nagamatsu, **K. Kawaharazuka**, S. Fumihito, K. Okada, M. Inaba: “Development of Joint Module with Two-Speed Gear Transmission and Joint Lock Mechanism during Driving for Task Adaptable Robot”, *Proceedings of the 2019 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS2019)*, pp. 5123-5130, 2019
21. **K. Kawaharazuka**, K. Tsuzuki, M. Onitsuka, Y. Koga, Y. Omura, Y. Asano, K. Okada, K. Kawasaki, M. Inaba: “Reflex-based Motion Strategy of Musculoskeletal Humanoids under Environmental Contact Using Muscle Relaxation Control”, *Proceedings of the 2019 IEEE-RAS International Conference on Humanoid Robots (HUMANOIDS2019)*, pp. 114-119, 2019
22. Y. Koga, **K. Kawaharazuka**, M. Onitsuka, T. Makabe, K. Tsuzuki, Y. Omura, Y. Asano, K. Okada, M. Inaba: “Modification of Muscle Antagonistic Relations and Hand Trajectory on the Dynamic Motion of Musculoskeletal Humanoid”, *Proceedings of the 2019 IEEE-RAS International Conference on Humanoid Robots (HUMANOIDS2019)*, pp. 632-637, 2019
23. Y. Asano, S. Nakashima, I. Yanokura, M. Onitsuka, **K. Kawaharazuka**, K. Tsuzuki, Y. Koga, Y. Omura, K. Okada, M. Inaba: “Ankle-Hip-Stepping Stabilizer on Tendon-Driven Humanoid Kengoro by Integration of Muscle-Joint-Work Space Controllers for Knee-Stretched Humanoid Balance”, *Proceedings of the 2019 IEEE-RAS International Conference on Humanoid Robots (HUMANOIDS2019)*, pp. 397-402, 2019
24. **K. Kawaharazuka**, K. Tsuzuki, S. Makino, Y. Asano, K. Okada, M. Inaba: “Modeling and On-line Learning of Musculoskeletal Intersensory Networks for Static Controls of Tendon-driven Humanoids”, *Proceedings of 9th International Symposium on Adaptive Motion of Animals and Machines (AMAM2019)*, 2019, **Company of Biologists Early Career Researcher Grant (500 GBP)**
25. **K. Kawaharazuka**, T. Ogawa, J. Tamura, C. Nabeshima: “Dynamic Manipulation of Flexible Objects with Torque Sequence Using a Deep Neural Network”, *Proceedings of the 2019 IEEE International Conference on Robotics and Automation (ICRA2019)*, pp. 2139-2145, 2019
26. **K. Kawaharazuka**, T. Makabe, S. Makino, K. Tsuzuki, Y. Nagamatsu, Y. Asano, T. Shirai, F. Sugai, K. Okada, K. Kawasaki, M. Inaba: “TWIMP: Two-Wheel Inverted Musculoskeletal Pendulum as a Learning Control Platform in the Real World with Environmental Physical Contact”, *Proceedings of the 2018 IEEE-RAS International Conference on Humanoid Robots (HUMANOIDS2018)*, pp. 784-790, 2018, **(The first two authors contributed equally to this work)**
27. **K. Kawaharazuka**, S. Makino, M. Kawamura, Y. Asano, K. Okada, M. Inaba: “A Method of Joint Angle Estimation Using Only Relative Changes in Muscle Lengths for Tendon-driven Humanoids with Complex Musculoskeletal Structures”, *Proceedings of the 2018 IEEE-RAS International Conference on Humanoid Robots (HUMANOIDS2018)*, pp. 1128-1135, 2018
28. T. Makabe, **K. Kawaharazuka**, K. Tsuzuki, K. Wada, S. Makino, M. Kawamura, A. Fujii, M. Onitsuka, Y. Asano, K. Okada, K. Kawasaki, M. Inaba: “Development of Movable Binocular High-Resolution Eye-Camera Unit for Humanoid and the Evaluation of Looking Around Fixation Control and Object Recognition”, *Proceedings of the 2018 IEEE-RAS International Conference on Humanoid Robots (HUMANOIDS2018)*, pp. 840-845, 2018
29. **K. Kawaharazuka**, S. Makino, M. Kawamura, A. Fujii, Y. Asano, K. Okada, M. Inaba: “Online Self-body Image Acquisition Considering Changes in Muscle Routes Caused by Softness of Body Tissue for Tendon-driven Musculoskeletal Humanoids”, *Proceedings of the 2018 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS2018)*, pp. 1711-1717, 2018
30. S. Makino, **K. Kawaharazuka**, M. Kawamura, A. Fujii, T. Makabe, M. Onitsuka, Y. Asano, K. Okada, K. Kawasaki, M. Inaba: “Five-Fingered Hand with Wide Range of Thumb Using Combination of Machined Springs and Variable Stiffness Joints”, *Proceedings of the 2018 IEEE/RSJ International Conference*

- on *Intelligent Robots and Systems (IROS2018)*, pp. 4562-4567, 2018, **IEEE RAS Japan Joint Chapter Young Award (2018), IROS ICROS Best Application Paper Award 2018 Finalists**
31. A. Fujii, S. Nakashima, M. Kawamura, **K. Kawaharazuka**, S. Makino, Y. Asano, K. Okada, M. Inaba: "Development and Functional Evaluation of a Deformable Membrane Capsule for an Open Ball Glenohumeral Joint", *Proceedings of the 2018 IEEE RAS/EMBS International Conference on Biomedical Robotics and Biomechatronics (BIROB2018)*, pp. 853-858, 2018
 32. **K. Kawaharazuka**, S. Makino, M. Kawamura, Y. Asano, Y. Kakiuchi, K. Okada, M. Inaba: "Human Mimetic Forearm Design with Radioulnar Joint using Miniature Bone-muscle Modules and its Applications", *Proceedings of the 2017 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS2017)*, pp. 4956-4962, 2017, **IEEE RAS Japan Joint Chapter Young Award (2017)**
 33. S. Makino, **K. Kawaharazuka**, M. Kawamura, Y. Asano, K. Okada, M. Inaba: "High-power, flexible, robust hand: Development of musculoskeletal hand using machined springs and realization of self-weight supporting motion with humanoid", *Proceedings of the 2017 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS2017)*, pp. 1187-1192, 2017
 34. Y. Asano, T. Kozuki, S. Ookubo, M. Kawamura, S. Nakashima, T. Katayama, Y. Iori, H. Toshinori, **K. Kawaharazuka**, S. Makino, Y. Kakiuchi, K. Okada, M. Inaba: "Human Mimetic Musculoskeletal Humanoid Kengoro toward Real World Physically Interactive Actions", *Proceedings of the 2016 IEEE-RAS International Conference on Humanoid Robots (HUMANOIDS2016)*, pp. 876-883, 2016, **Best Interactive Paper Award Finalist**

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