

Toshihiko FUKUSHIMA

Robotics Researcher & Automotive Engineer

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HARD SKILLS

Robotics	Soft robot, Bio-inspired robot, Legged robot, Musculoskeletal robot, Biomechanics, Biomimetics, Control system, Statics, Machine learning, Embodied intelligence, Locomotion, Aerial righting, Soft actuator, Pneumatic actuator, Electrostatic actuator, Artificial muscle, HASEL, Data processing, Lidar, Sensor fusion
Mechatronics	Mechanical modeling, CAE, Circuit design, PCB, Electrical modeling, BLDC motor, Field Oriented (vector) Control, T-Motor, DYNAMIXEL, Embedded system, Arduino, ESP32, STM32, SPI, I2C, SSI
Sim. & CAD	Matlab, Simulink, Simscape, OpenHRP3, MuJoCo, Genesis, DeepLabCut, Solidworks, CATIA, ADAMS
Automobile	Chassis system, Steering system, Suspension system, Vehicle dynamics, By-wire system, Engine, EV-motor, Transmission system, NVH, HiL, SiL, System bench, Vehicle test, MBD, Rapid-ECU, System stability, Battery management, Heat management, Lifetime management, Functional safety, ISO26262
Auto. soft.	dSPACE, MicroAutobox, ControlDesk, ModelDesk, RTI, ASM, CarSim, ATLAS, Romax, SharcNT
IT	Illustrator, Premiere Pro, UNIX, Ubuntu, CentOS, DNS, Apache, Samba, OpenSSH, HTML5, CSS, Bootstrap

SOFT SKILLS

Communication	worked in international teams (6yrs) and coordinated global companies and institutions (6yrs)
Management	experienced global coordination (6yrs), project management (10yrs), team management (3yrs)
Innovation	have interdisciplinary background and created the first legged robot with HASEL technology. was selected in MPG research highlights 2024 (12 selected papers among 15,000+ publications)
Productivity	published 12x papers (Nat. Commun., ICRA, Humanoids), received Young Investigation Excellence Award
Presentation	received a presentation award. conducted 6x robotic demonstrations and automotive demos individually to 2x Exec. Vice Presidents of Toyota. presented in 5x TV shows, 3x radios, 4x magazines, 200+ news articles

LANGUAGES

Native:	Japanese	●●●●●
Professional:	English	●●●●○
Beginner:	German	●○○○○
	Chinese	●○○○○

SOFTWARE LANGUAGES

matlab, TeX	●●●●●
Python, Simulink, Arduino	●●●●○
HTML5, CSS, CAPL, Processing	●●●○○
C, OpenCV, Shell script	●●○○○
C++, PHP, Go	●○○○○

WORKING EXPERIENCE



Mar. 2023 – Present

Associated fellow

Max Planck ETH Center for Learning Systems (CLS), Stuttgart, Germany

Research embodied intelligence in soft robotics

- > collaborate with international institutions and universities
- > supervise master and bachelor students and guide junior PhD students
- > reach out to the media and public domains to share the research outcomes with society

Robotics Soft robotics Embodied intelligence Networking Team management Public relations Press release
Media reaching Media interview Public speech Outreach Export control Event management Web development



Sep. 2020 – Present

Doctoral Researcher

Max Planck Institute for Intelligent Systems, Stuttgart, Germany

Research soft robotics with soft electrohydraulic actuators (HASELs)

- > develop musculoskeletal robotic legs and proved their agile, adaptive, yet energy-efficient locomotion
- > develop compact sensing & control devices for high voltage robots (10kV) to optimize the system efficiencies
- > develop optimized controllers for electrostatic-based systems using electro-mechanical coupling

Robotics Bio-inspired robot Soft robot Musculoskeletal robot Embodied intelligence Dynamic locomotion Legged robot
Soft actuator Electrostatic actuator Electrohydraulic actuator HASEL BLDC motor Field Oriented (vector) Control T-Motor
DYNAMIXEL Mechanical modeling Electrical modeling Solidworks Robot experiment Sensor fusion Data processing
Circuit design PCB Matlab Simulink Simscape MuJoCo Genesis DeepLabCut Python Arduino STM32 ESP32
SPI I2C SSI HTML5 Modern CSS Hugo Blox Bootstrap



Sep. 2020 –
Mar. 2021

Research Engineer

Max Planck Institute for Intelligent Systems, Stuttgart, Germany

Research morphological intelligence of animals and deploy them to robotic systems

- > developed bio-inspired robots (squirrel, gecko, fish) and tested them to understand their locomotion
- > built dynamic robotic models and explored optimized controls in simulation studies
- > published 3 journal papers and presented a poster in an international conference

Robotics Mechatronics Mechanics Control system Electronics Electrostatics Biomechanics Bio-inspired robot
 Soft robot Dynamic locomotion Soft actuator Morphological intelligence Climbing Perching Swimming Aero-righting
 Dynamics modeling Robot experiment Data visualization Sensor fusion Matlab Simulink Simscape Python Arduino



Oct. 2019 –
Sep. 2021

Application Engineer

NTN Wälzlager (Europa) GmbH, Stuttgart & Erkrath, Germany

Develop bearing systems for automotive customers

- > developed the bearing systems through model studies, prototyping, testing and quality control
- > developed software for NVH analysis and data visualization
- > coordinate worldwide development teams and managed customer requirements and their deliveries

Automobile Bearing Steering system Transmission system EV motor Project management Requirements management
 Quality management Heat management Lifetime management System testing NVH CAE Romax SharcNT Python



Feb. 2017 –
Jan. 2018

Control System Engineer

Toyota Motorsport GmbH (TOYOTA GAZOO Racing GmbH), Cologne, Germany

Develop an Active Suspension System and coordinate international branches (Feb. 2017 – Jan. 2018)

- > modeled vehicles and suspension systems via dSPACE ASM, and test tracks via integrating GPS & LIDAR data
- > tested and validated vehicles and systems using HiL
- > developed vehicle simulation environment together with suspension in the loop system
- > Coordinate international branches and teams, and integrate multi-located systems

Automobile Suspension system Vehicle dynamics MBD HiL SiL Lidar Linear actuator Vehicle test System test
 Sensor fusion CAN communication dSPACE ModelDesk ControlDesk RTI MATLAB Simulink CarSim ATLAS



Apr. 2014 –
Oct. 2018

Chassis System Engineer

Toyota Motor Corporation, Susono & Toyota, Japan

Develop a steering-by-wire system for concept cars (Feb. 2018 – Oct. 2018)

- > developed test benches and HiLs integrated with rapid ECU systems for fail injection
- > developed a driving simulator to evaluate human-machine system during system fails
- > defined fail modes and functional safety concept of the system (ISO26262)

Develop a steering and leaning by-wire system for a 3-wheeled ultra compact EV (Jan. 2016 – Jan. 2017)

- > developed system-vehicle simulations by integrating ADAMS and Simulink to evaluate vehicle stability
- > developed test benches and HiLs systems and their operations for heat, NVH and battery management

Develop Electric Power Steering Systems (EPS) for mass production cars (Jun. 2014 – Dec. 2015)

- > developed steering system models (Mech. and E/E) and analyzed their system stability
- > analyzed NVH transfer paths by integrating ECU, accelerometer and microphone data
- > tested systems and vehicles for debugging and evaluating newly developed mechanisms and controllers

Automobile Chassis system Steering system By-wire system Vehicle dynamics Vehicle simulation Vehicle test System test
 NVH MBD BLDC-motor Battery management Heat management System stability Functional Safety ISO26262 ECU
 HiL SiL rapid ECU CAN communication MATLAB Simulink dSPACE MicroAutoBox CANoe CarSim CATIA ADAMS



Apr. 2012 –
Mar. 2013

Technical Assistant

The University of Tokyo, Tokyo, Japan

Manage UNIX servers and renewed a website in the laboratory

- > installed physical servers and maintained DNS, mail, HTTP and Samba servers
- > designed and developed the website via Twitter Bootstrap and PHP

IT DNS Apache Samba OpenSSH Shell script UNIX Ubuntu CentOS HTML CSS PHP Twitter Bootstrap



Feb. 2011 –
Mar. 2011

Internship

Toyota Boshoku Corporation, Kariya, Japan

develop a charging and discharging system for a small electric vehicle

- > built a simulation system and developed a prototype for the system

Simulink Electrical engineering Ladder Control Logic gate



Mar. 2021 – Present

PhD (Robotics)

Max Planck Institute for Intelligent Systems, Stuttgart, Germany

Robotic Materials Department | Prof. Christoph Keplinger | Major: Robotics

- > research **soft robotics** with **soft electrohydraulic actuators** (HASELs)
- > develop **musculoskeletal robotic legs** and prove their agile, adaptive, yet energy-efficient locomotion
- > develop sensing and controlling devices for **high voltage systems** (10kV) to optimize system efficiencies
- > develop optimized controllers for electrostatic-based systems using **electro-mechanical coupling**
- > published **1 Journal paper**, took **5 robotic demos**, **10 media interviews**, and shown in **over 200 news articles** in **over 12 languages**

Robotics Soft robotics Mechatronics Mechanics Electronics Electrical engineering Computer science Statics Physics
Material science Control system Biomechanics Biomimetics Locomotion Musculoskeletal robot Electrostatic actuator
Electrohydraulic actuator HASEL



Apr. 2012 – Mar. 2014

Master of Arts and Sciences (Interdisciplinary Information Studies)

The University of Tokyo, Tokyo, Japan

Intelligent Systems and Informatics Laboratory | Prof. Yasuo Kuniyoshi | Major: Robotics

thesis: “Active bending motion of pole vault robot to improve vaulting height”

- > developed a hypothesis in **pole vaulting** and automated simulation system for a robot with an **elastic pole**
- > developed a pole vaulting robot from **scratch** using **pneumatic actuators** (SH board + C)
- > developed **2 human interaction robots** and exhibit in events (Arduino + processing, OpenCV)
- > performed robot experiments for **2 pole vaulting**, **1 humanoid** and **2 animal robot** with **pneumatic muscle**
- > published **2 Journal papers**, **4 International conference papers**, **6 domestic conference papers**, **2 exhibitions** and took **3 awards**

Robotics Mechatronics Computer science Mechanics Electronics Control system Biomechanics Bio-inspired robot
Pneumatic muscle Locomotion Musculoskeletal robot Sport biomechanics Dynamics Sensor fusion Embedded system
Arduino motion capture Statics Machine learning MATLAB C C++



Apr. 2007 – Mar. 2012

Bachelor of Engineering

Toyota Technological Institute, Nagoya, Japan

Control System Laboratory, | Prof. Tatsuo Narikiyo | Major: Control system

thesis: “Gait stabilization of passive dynamic walker by foot shape optimization”

- > developed cross-functional simulation system for shape optimization in a **passive dynamic walker**
- > developed a **prototype** of the passive dynamic walker
- > published **1 Journal paper**, **1 domestic conference paper** and took **1 award**

Mechatronics Mechanics Control system Robotics Computer science Electronics Production system
Passive dynamic walking Optimization Genetic algorithm MATLAB C BASIC OpenHRP3

MEDIA EXPOSURE

- > 7x TV shows: *BBC News* , *3sat*   , *SWR* , *YTN* , *WKYT* , *TNN* , *KBS* 
- > 3x Radio programs: *NDR* , *rbb24* , *Radio Eins* 
- > 4x Magazines: *National Geographic Deutschland*, *Wirtschafts Woche*, *Stuttgarter Maschinenbau*, *Max Planck Society Year book*
- > 200+ News articles in **12+ languages**: *REUTERS*, *AFP*, *heise*, *EL Economista*, *The National Tribune*, *THE HINDU*, *人民日报*, etc.

HONORS

- > **Research highlights 2024**, *Max Planck Society*, selected 12 research articles out of 15,000+ publications in the year.
- > **Editors’ Highlights**, *nature communications*, 2024.
- > **Video Friday**, *IEEE Spectrum*, 2024.
- > **Young Investigation Excellence Award**, *The Robotics Society of Japan*, 2014.
- > **Scholarship for Students with Outstanding Achievements**, *Japan Student Services Organization (JASSO)*, 2014.
- > **Student travel grant**, *6th International Symposium on Adaptive Motion of Animals and Machines (AMAM)*, 2013.
- > **Presentation award**, *The 13th SICE System Integration Division Annual Conference (SICE SI)*, 2012.

PUBLICATIONS

- > 7 journal papers
- > 5 international conference papers (ICRA, Humanoids)
- > 7 domestic conference papers

Details are shown in another document.