Salman Faraji

Robotic Systems Lab
LEE H301
Leonhardstrasse 21
CH-8092 Zurich, Switzerland

Email: sfaraji@ethz.ch
Website: https://salmanfaraji.github.io/
Linkedin: https://ch.linkedin.com/in/salman-faraji-9b841964

Education

Post-Doctoral Researcher, Robotic Systems laboratory, Prof. Marco Hutter, ETHZ, Switzerland 2020

Post-Doctoral Researcher, Learning Algorithms and Systems laboratory, Prof. Aude billard, EPFL, Switzerland 2018 - 2019

Ph.D. degree in Robotics and Control, Biorob laboratory, Advisor: Prof. Auke Ijspeert, EPFL, Switzerland 2013 - 2018

Dissertation: Towards Robust Bipedal Locomotion: From Simple Models To Full-Body Compliance

M.Sc. degree in Micro-Engineering, Robotics and Autonomous Systems, EPFL, Switzerland 2011 - 2013

Thesis: A Model-Based Control Approach for Locomotion of Biped Robots

Supervisor: Prof. Christopher Atkeson (from CMU, US)

B.Sc. degree in Electrical Engineering, Digital Systems and Control, Sharif University of Technology, Iran 2007 - 2011

Thesis: Design and Simulation of a Novel Self-Locomoting Structure for Modular Robots

Research Interests

Control, Optimization, Dynamics, Robot and Human Locomotion

Career Interests

Innovator, Research Team-Leader, Problem Solver

Awards & Honors

2021: Received 10k Venture Kick Grant, ETHZ.

2020: Received 130k SNF BRIDGE Grant, ETHZ.

2019: Received 100k SNF Spark Grant, ETHZ.

2019: Best PhD Thesis Award in Robotics, EPFL.

2013: Best Master Thesis Award in Robotics, Commune d'Ecublens, EPFL, Switzerland

2011: Best Bachelor Thesis Award in Electrical engineering, Sharif University of Technology, Iran

2011: Ranked 1st out of 190 bachelor graduates, Sharif University of Technology, Iran

2007: Member of the National Iranian **Elites Foundation**

2007: Ranked 3rd out of 400,000**, nationwide university entrance exam**, Iran

Professional Experience

Suspended Manipulator Project, 2019-2021: Invented and built the hardware and software

European CogIMon Project, 2018-2019: Developed collaborative walking controllers

European Walk-Man Project, 2013-2017: Developed walking and balancing controllers for humanoids

Internship at ABB, Summer and Fall 2012: Developed a thin inspection robot for large gearless mill drives

Internship at Festo Pneumatics, Summer 2010: Courses in Pneumatics, Hydraulics, Industrial Sensors, PLC programming

Robocup small-size soccer league, 2005-2009: Developed highly agile wheeled robots for soccer

Languages skills

English (Professional Fluency), German (B1-B2), French (A2), Persian (Native)

Publications (find full texts and a visual summary here)

JOURNAL ARTICLES

H. Razavi, **S. Faraji** and A. Ijspeert. From Standing Balance to Walking: A Single Control Structure for a Continuum of Gaits, in The International Journal of Robotics Research (**IJRR**), vol. 38, num. 14, p. 1695-1716, 2019.

S. Faraji, H. Razavi and A. Ijspeert. Push recovery with stepping strategy based on time-projection control, in The International Journal of Robotics Research (**IJRR**), vol. 38, num. 5, p. 587-611, 2019.

N. Kashiri, A. Abate, S. J. Abram, A. Albu-Schaffer, P. J. Clary, M. Daley, **S. Faraji**, R. Furnemont, M. Garabini, H.t Geyer, A. M. Grabowski, J. Hurst, J. Malzahn, G. Mathijssen, D. Remy, W. Roozing, M. Shahbazi, S. N. Simha, J. Song, N. Smit-Anseeuw, S. Stramigioli, B. Vanderborght, Y. Yesilevskiy and N. Tsagarakis, An Overview on Principles for Energy Efficient Robot Locomotion, **Frontiers** in Robotics and AI, vol. 5, p. 2296-9144, 2018.

S. Faraji, A. R. Wu and A. Ijspeert. A simple model of mechanical effects to estimate metabolic cost of human walking, in **Nature Scientific Reports**, 8(1):10998, 2018.

S. Faraji and A. Ijspeert. 3LP: a linear 3D-walking model including torso and swing dynamics, in The International Journal of Robotics Research (**IJRR**), vol. 36, num. 4, p. 436-455, 2017.

S. Faraji and A. Ijspeert. Modeling robot geometries like molecules, application to fast multi-contact posture planning for humanoids, in IEEE Robotics and Automation Letters (**RA-L**), vol. 3, num. 1, p. 289-296, 2017.

S. Faraji and A. Ijspeert. Singularity-tolerant inverse kinematics for bipedal robots: An efficient use of computational power to reduce energy consumption, in IEEE Robotics and Automation Letters (**RA-L**), vol. 2, num. 2, p. 1132-1139, 2017.

S. Faraji and M. S. Tavazoei. The effect of fractionality nature in differences between computer simulation and experimental results of a chaotic circuit, in Central European Journal Of Physics (**CEJP**)**,** vol. 11, num. 6, p. 836-844, 2013.

S. Haghzad, **S. Faraji** and S. Bagheri. Finding Proper Configurations for Modular Robots by Using Genetic Algorithm on Different Terrains, in International Journal of Materials, Mechanics and Manufacturing (**IJMMM**), vol. 1, num. 4, p. 360-365, 2013.

CONFERENCE ARTICLES

N. Figueroa, **S. Faraji**, M. koptev and A. Billard. A Dynamical System Approach for Adaptive Grasping, Navigation and Co-Manipulation with Humanoid Robots. 2020 IEEE International Conference on Robotics and Automation (**ICRA**), p. 7676-7682, Parice, France, 2020.

S. Faraji and A. Ijspeert. Scalable closed-form trajectories for periodic and non-periodic human-like walking. 2019 IEEE International Conference on Robotics and Automation (**ICRA**), Montreal, Canada, p. 5295-5301, 2019.

J. Arreguit, **S. Faraji** and A. Ijspeert. Fast multi-contact motion planning with a 5-link model and molecule-inspired formulations for humanoids, *IEEE-RAS International Conference on Humanoid Robots (**Humanoids**), p. 1-9*, 2018.

S. Faraji and A. Ijspeert. Designing a virtual whole body tactile sensor suit for a simulated humanoid robot using inverse dynamics. IEEE/RSJ International Conference on Intelligent Robots and Systems (**IROS**), Daejeon, South Korea, p. 5564-5571, 2016.

S. Faraji, L. Colasanto and A. Ijspeert. Practical considerations in using inverse dynamics on a humanoid robot: torque tracking, sensor fusion and Cartesian control laws. IEEE/RSJ International Conference on Intelligent Robots and Systems (**IROS**), Hamburg, Germany, p.1619-1626, 2015.

S. Faraji, S. Pouya and A. Ijspeert. Robust and Agile 3D Biped Walking With Steering Capability Using a Footstep Predictive Approach. Robotics Science and Systems (**RSS**), Berkeley, CA, USA, 2014.

S. Faraji, S. Pouya, C. G. Atkeson and A. J. Ijspeert. Versatile and robust 3D walking with a simulated humanoid robot (Atlas): A model predictive control approach. 2014 IEEE International Conference on Robotics and Automation (**ICRA**), Hong Kong, China, p. 1943-1950, 2014.

S. Faraji, S. Pouya, R. Moeckel and A. J. Ijspeert. Compliant and adaptive control of a planar monopod hopper in rough terrain. 2013 IEEE International Conference on Robotics and Automation (**ICRA**), Karlsruhe, Germany, p. 4818-4825, 2013.

ARTICLES IN PROCESS

S. Faraji, P. Müllhaupt and A. Ijspeert. Time-projection control to recover inter-sample disturbances, application to walking control, in preparation.

A. R. Wu, **S. Faraji** and A. Ijspeert. Modeling asymmetries of torso bending in inclined walking over different speeds, in preparation.

POSTERS

S. Faraji and A. R. Wu, Walking framework with simplified 3LP model and time-projection control, Dynamic Walking, Pensacola, Florida, USA, 2018.

A. R. Wu and **S. Faraji**, Effects of trunk lean and ground slope on leg angle symmetry during gait, Dynamic Walking, Pensacola, Florida, USA, 2018.

A. R. Wu, , **S. Faraji**, A. Ijspeert. Simple combinations of major energy components to predict cost of human walking. IROS workshop, Vancouver, Canada, 2017.

J. P. Arreguit, **S. Faraji**, A. Ijspeert. Multi-contact motion planning with a five-mass template model and vector-based equations. IROS workshop, Vancouver, Canada, 2017.

S. Faraji and A. Ijspeert. A singularity-tolerant inverse kinematics including joint position and velocity limitations. Dynamic Walking, Mariehamn, Finland, 2017.

S. Faraji and A. Ijspeert. A virtual tactile sensing suit for humanoids based on dynamic equations and internal sensors. Dynamic Walking, Holly, Michigan, USA, 2016.

S. Faraji and A. Ijspeert. Time-Projection control on 3LP, a simple idea to deal with intermittent pushes online. Dynamic Walking, Holly, Michigan, USA, 2016.

S. Faraji and A. Ijspeert. 3LP: A linear model of locomotion including falling, swing and torso dynamics. Dynamic Walking, Holly, Michigan, USA, 2016.

S. Faraji, S. Pouya and A. Ijspeert. Robust 3D Walking Using Inverse Dynamics And Footstep Planning With Model Predictive Control. 9th Dynamic Walking Conference (DWC 2014), ETH Zurich, Switzerland, 2014.

S. Pouya, **S. Faraji**, R. Möckel and A. Ijspeert. Dynamics Modeling and Control Architecture for Efficient, Manoeuvrable and Robust Monoped Hopping over Rough Terrain. 8th Dynamic Walking Conference (DWC 2013), Pittsburgh, USA, 2013.

TALKS

S. Faraji, Model based control approaches for multi-modal locomotion of a humanoid robot, in Automatic Control Laboratory, hosted by Prof. Colin Jones, EPFL, 2014.

S. Faraji, Multi-Modal locomotion, in Movement generation and control group, hosted by Prof. Ludovic Righetti, Max Planck Institute, 2015

S. Faraji, 3LP walking model: a Fresh Breath for optimizations, Workshop on Robust Optimization-Based Control and Planning for Legged Robots, ICRA conference, 2016.

S. Faraji, Walking Control of Bipedal Robots with Heavy Legs Using Foot Stepping Strategy, in Robotic Systems Laboratory, hosted by Prof. Marco Hutter, ETH Zurich, 2018.

S. Faraji, A Simple Mechanical Model to Estimate the Metabolic Cost of Human Walking, in Laboratory of Movement Analysis and Measurement, hosted by Prof. Kamyar Aminian, EPFL, 2019.