Jianwei Sun

Curriculum Vitae

☏ +1 (310) 923-6599
✉ jian58sun@gmail.com
🖳 jianwei-sun.github.io

Education

2020 to Present **Ph.D. in Systems and Control**,
University of California, Los Angeles (UCLA).
Advised by Prof. Dr. Jacob Rosen

2019 to 2020 **M.Sc. in Systems and Control**,
University of California, Los Angeles (UCLA).
Cumulative GPA: *4.0/4.0*

2017 to 2019 **M.Sc. in Electrical Engineering and Information Technology**,
Swiss Federal Institute of Technology (ETH Zürich).
Cumulative GPA: *5.71/6.0*

2012 to 2017 **B.A.Sc. in Engineering Science (Electrical and Computer Engineering)**,
University of Toronto (UofT).
Cumulative GPA: *3.79/4.0*

Research Experience

Feb 2019 to Present **Bionics Lab**, University of California Los Angeles.
"Control, Safety, and Estimation in Physical Human-Robot Interaction with Exoskeleton Robots"
Supervised by Prof. Dr. Jacob Rosen.
- Developed an open-source safety-focused admittance control library (including multi-arm collision avoidance) for physical human-robot interaction with real-time collision avoidance (QP solved online) (C/C++) (GitHub)
- Investigated holonomically constrained admittance control using feedback linearization for robot-assisted rehabilitation (C/C++)
- Implemented a feedback linearization-based joint-space controller with symbolic dynamics for a Harmonic drive and brushless DC-actuated exoskeleton (C/C++)
- Implemented a rate-limiting filter to suppress unstable human-induced oscillations due to physiological and mechanical time delays (C/C++)

Feb 2019 to Sep 2019 **Bionics Lab**, University of California Los Angeles.
"Improving Transparency in Physical Human-Robot Interaction for the EXO-UL8 Exoskeleton"
Project co-supervised by Prof. Dr. Jacob Rosen and Prof. Dr. Maryam Kamgarpour.
- Developed a Kalman filter-based sensor fusion method to achieve similar human-exoskeleton transparency using only a subset of six-axis force/torque sensors (C/C++)
- Coauthored a paper for the 2019 IEEE International Conference on Rehabilitation Robotics

Feb 2018 to **Institute for Dynamic Systems and Control**, ETH Zürich.
Aug 2018 *"Vehicle Platoon Control with Virtual Path Constraints"*
Project co-supervised by Rajan Gill and Prof. Dr. Raffaello D'Andrea.
- Designed and implemented a distributed feedback-linearized admittance controller to enable safe physrical human-robot interaction with a path-stabilized quadrotor platoon using transverse feedback linearization (C/C++)
- Primary author of a paper submitted to the 2019 IEEE Conference on Control Technology and Applications, awarded Outstanding Paper Award and finalist for Best Student Paper

Oct 2017 to **Computer Engineering and Networks Laboratory**, ETH Zürich.
Feb 2018 *"DCF77 Based Long-Term Timer"*
Project co-supervised by Roman Trüb and Prof. Dr. Lothar Thiele.
- Designed and implemented a radio clock-based ultra low power ($\sim 10\mu W$) clock synchronizer capable of overcoming arbitrarily long clock drift for wireless network devices (MSP430, C)
- Developed a benchmark device based on received timepulses from GPS for characterizing the timer device to nanosecond precision (MSP430, Raspberry Pi, C, Python)

Sep 2016 to **Reconfigurable Antenna Laboratory**, University of Toronto.
Jun 2017 *"Synthesis of a Multibeam Dual Reflectarray Beam Pattern Using Genetic Algorithms"*
Project supervised by Prof. Dr. Sean V. Hum.
- Developed a genetic algorithm-based multi-objective non-convex optimizer for beam synthesis on a Cassegrain reflectarray antenna system (MATLAB)
- Coauthored a paper for the 2017 IEEE Antennas and Propagation Symposium

May 2016 to **Institute for Dynamic Systems and Control**, ETH Zürich.
Aug 2016 Project co-supervised by Rajan Gill and Prof. Dr. Raffaello D'Andrea.
- Developed toolchains for automatic dynamic response characterization of nonlinear brushless DC motors for quadrotor vehicles (C/C++, MATLAB)
- Developed a motor selection tool to automatically scrape off-the-shelf motor data from the web and suggest the best suited based on dynamic response requirements (Ruby)

May 2014 to **Department of Mechanical Engineering**, National University of Singapore.
Aug 2014 Project co-supervised by Goh Yu Feng and Prof. Dr. Koh Soo Jin Adrian.
- Characterized dynamic responses of dielectric elastomers as soft actuators for use as artificial muscles (MATLAB)
- Developed a waveform generator for a 5kV high voltage power supply to actuate elastomers (LabVIEW)

Work Experience

Jun 2022 to **Skydio**, *Autonomy*, San Mateo.
Sep 2022
- Evaluated feasibility of a quadrotor emergency three-rotor landing
- Implemented an IMU-based reduced-attitude controller to stabilize relaxed hover solutions (C++, Python)
- Tested dynamically feasible optimal braking and landing polynominal trajectories (C++, Python)

Sep 2018 to Feb 2019	**Apple**, *Wearable Systems*, Cupertino.
	○ Designed a drop-in replacement system-in-package for the Apple Watch to measure RF coexistence issues only quantifiable in system form-factor (Cadence)
	○ Developed software toolchain to automatically extract, process, and present data from the Apple Watch (Python)
	○ Developed experiment setup to investigate a critical system coexistence issue between a power management IC and a MEMS sensor
Jun 2017 to Sep 2017	**Intel**, *Programmable Solutions Group*, San Jose.
	○ Developed hardware interfaces based on Avalon-Streaming for an H.265/HEVC 4K video encoder on a PCIe accelerator card with the Intel Arria-10 FPGA (Verlog, VHDL)
	○ Simulated and debugged hardware with ModelSim, VCS-MX simulators, and custom test scripts (Python)
May 2015 to May 2016	**Apple**, *Wearable Systems*, Cupertino.
	○ Designed a multi-purpose hardware validation platform, including schematic entry, component selection, and PCB routing (Cadence)
	○ Developed a fault-tolerant software API for a microprocessor to continuously stress-test (for 500 hours) sensors subject to unpredictable device and digital interface failures in a high temperature/humidity environment (MSP432, C/C++)
	○ Successfully identified a rare reliability failure mode and aided cross-functional teams in arriving at a mass-producible solution

Publications

[JP4] **J. Sun**, Y. Foroutani, J. Rosen, "Virtually Constrained Admittance Control using Feedback Linearization for Physical Human-Robot Interaction with Rehabilitation Exoskeletons." Under review.

[JP3] **J. Sun**, E. H. Kramer, J. Rosen, "A Safety-Focused Admittance Control Approach for Physical Human-Robot Interaction with Rigid Multi-Arm Serial Link Exoskeletons." Under review.

[JP2] P. W. Ferguson, **J. Sun** and J. Rosen, "On the OTHER Hand: A Bimanual, Reconfigurable Hand Exoskeleton with Opposable Thumbs for Use with Upper Limb Exoskeletons." Under review.

[JP1] **J. Sun**, Y. Shen, J. Rosen, "Sensor Reduction, Estimation, and Control of an Upper-Limb Exoskeleton," in *IEEE Robotics and Automation Letters (RA-L)*, vol. 6, no. 2, pp. 1012-1019, April 2021, doi: 10.1109/LRA.2021.3056366.

[CP4] **J. Sun**, P. W. Ferguson and J. Rosen, "Suppressing Delay-Induced Oscillations in Physical Human-Robot Interaction with an Upper-Limb Exoskeleton using Rate-Limiting," *2022 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, Kyoto, Japan, 2022, pp. 6695-6701, doi: 10.1109/IROS47612.2022.9981943. Video.

[CP3] Y. Shen, **J. Sun**, J. Ma, J. Rosen, "Admittance Control Scheme Comparison of EXO-UL8: A Dual-Arm Exoskeleton Robotic System," *2019 IEEE 16th International Conference on Rehabilitation Robotics (ICORR)*, Toronto, ON, Canada, 2019, pp. 611-617, doi: 10.1109/ICORR.2019.8779545.

[CP2] **J. Sun** and R. Gill, "Vehicle Platoon Control with Virtual Path Constraints," *2019 IEEE Conference on Control Technology and Applications (CCTA)*, Hong Kong, China, 2019, pp. 456-461, doi: 10.1109/CCTA.2019.8920555. Video.

[CP1] C. Geaney, **J. Sun**, S. V. Hum, E. Martinez-de-Rioja, and J. A. Encinar, "Synthesis of a multi-beam dual reflectarray antenna using genetic algorithms," *2017 IEEE International Symposium on Antennas and Propagation & USNC/URSI National Radio Science Meeting (AP-S/URSI)*, San Diego, CA, USA, 2017, pp. 1179-1180, doi: 10.1109/APUSNCURSINRSM.2017.8072632.

Service

Ad-hoc Reviewer	Transactions on Robotics (T-RO), Transactions on Mechatronics (TMECH), Transactions on Medical Robotics and Bionics (T-MRB), Robotics and Automation Letters (RA-L), Control System Letters (L-CSS), International Conference on Robotics and Automation (ICRA), International Conference on Intelligent Robots and Systems (IROS), Conference on Decision and Control (CDC)

Awards

2023	Outstanding TA Award, Mechanical and Aerospace Engineering, University of California, Los Angeles
2022	Mechanical and Aerospace Engineering Department Fellowship, University of California, Los Angeles
2021	Grad Slam Top 10, University of California, Los Angeles.
2019	Best Student Paper Finalist, Outstanding Paper Award, 3rd IEEE Conference on Control Technology and Applications (CCTA).
2017	Dean's Honours List, University of Toronto, awarded for all academic years.
2016	University of Toronto, Center for International Experience Award, for funding summer research conducted at ETH Zürich.
2014	Nortel Institute Undergraduate Scholarship, University of Toronto.
2014	University of Toronto, Center for International Experience Award, for funding summer research conducted at the National University of Singapore.
2012	President's Scholars of Excellence entrance scholarship, University of Toronto.
2012	Alexander Rutherford Scholarship.

Conference Participation

2023   2023 Southern California Robotics Symposium (SCR). Participant.

2022   35th IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS). Podium presentation.

2019   16th IEEE/RAS-EMBS International Conference on Rehabilitation Robotics (ICORR). Podium presentation.

2019   IEEE/AIM Workshop on "Towards Soft Robotics for Biomimetics and Applications: Emerging Sensors, Actuators, and Methods". Poster.

Teaching and Mentoring Experience

Jan 2024 to Apr 2024   **Teaching Fellow**, MECH&AE M20 - Introduction to Computer Programming with MATLAB, University of California Los Angeles (Winter Quarter).
20 hours per week

Sep 2023 to Dec 2023   **Teaching Fellow**, ENGR 214 - Management Communication, University of California Los Angeles (Fall Quarter).
20 hours per week

Apr 2022 to Jun 2022   **Teaching Fellow**, LIFESCI 30B - Mathematics for Life Scientists (Python), University of California Los Angeles (Spring Quarter).
20 hours per week

Jan 2022 to Apr 2022   **Teaching Fellow**, LIFESCI 30B - Mathematics for Life Scientists (Python), University of California Los Angeles (Winter Quarter).
20 hours per week

Sep 2021 to Dec 2021   **Teaching Fellow (Head TA)**, MECH&AE M20 - Introduction to Computer Programming with MATLAB, University of California Los Angeles (Fall Quarter).
20 hours per week

Apr 2021 to Jun 2021   **Teaching Associate**, EC ENGR 141 - Principles of Feedback Control, University of California Los Angeles (Spring Quarter).
20 hours per week

Jan 2021 to Apr 2021   **Teaching Associate**, LIFESCI 30B - Mathematics for Life Scientists (Python), University of California Los Angeles (Winter Quarter).
20 hours per week

Sep 2020 to Dec 2020   **Teaching Associate (Head TA)**, MECH&AE M20 - Introduction to Computer Programming with MATLAB, University of California Los Angeles (Fall Quarter).
20 hours per week

Apr 2020 to Jun 2020   **Teaching Assistant**, LIFESCI 30B - Mathematics for Life Scientists (Python), University of California Los Angeles (Spring Quarter).
20 hours per week

Jan 2020 to Apr 2020	**Teaching Assistant**, LIFESCI 30B - Mathematics for Life Scientists (Python), University of California Los Angeles (Winter Quarter). 20 hours per week
Sep 2019 to Dec 2019	**Teaching Assistant**, MECH&AE M20 - Introduction to Computer Programming with MATLAB, University of California Los Angeles (Fall Quarter). 20 hours per week
Aug 2016 to Jun 2017	**Mentor**, IEEE Student Branch, University of Toronto. 10 hours per week ○ Mentored first and second year engineering students in hands-on electronics, design, and debugging (Arduino, C/C++)

Volunteering Experience

Aug 2016 to Jun 2017	**Director of Events**, IEEE Student Branch, University of Toronto. 10 hours per week ○ Headed logistics and operations for a hardware Hackathon event with focus on wireless embedded technologies, resulting the largest participant turnout in recent years ○ Negotiated with suppliers and sponsors to ensure sufficient funding for the club's operations
2013 to 2014	**Volunteer Team Member**, Supermileage Club, University of Toronto. 5 hours per week ○ Designed the fuel pressurization system and engine dynamometer ○ Assisted in carbon fiber layups, development, and assembly of completely new vehicle
2011 to 2013	**Volunteer**, Telus Spark Science Center, Calgary. 5 hours per week
2010 to 2011	**Volunteer**, Canadian Red Cross, Calgary. 5 hours per week

Personal Projects

	Banana Split, Split-style ergonomic mechanical keyboard. ○ Designed single PCB for both left and right sides in Altium ○ Designed enclosure in SolidWorks and 3D printed
Link	**Website**, Personal website developed with Jekyll.
Github	**HarryPlotter**, open source plotting library for MATLAB.
Video	**Boomerang**, persistence of vision display. ○ Implemented a dynamic self-calibrating algorithm to calculate frame flashing rates of LEDs in a high-RPM rotating display

Technical Skills

Software

Languages	C/C++, Python, MATLAB, LATEX, {x86_64, ARM, PIC} assembly, Java, Ruby, Bash
Environments	Linux, Windows, Qt, LabVIEW, Jekyll, Ruby on Rails, Flask
Tools	Eigen, Boost, Git, CMake, Make, Ninja, PREEMPT_RT

Hardware

Embedded	ATmega, MSP43x, PIC, STM32, {Cyclone, Arria 10} FPGA, Arduino, Raspberry Pi
Lab	Oscilloscopes, function generators, DC power supplies, DMMs, LCR meters, vector network analyzers, spectrum analyzers, logic analyzers, frequency counters
Soldering	Hands-on experience with DIP, SMT down to 01005, BGA, LGA, QFP packages

Tools

Simulation	MuJoCo, MATLAB, Simulink, PSpice, LTSpice, ModelSim, VCS-MX
Design	Cadence, Altium, KiCad, Eagle, SolidWorks

Languages

Native	English
Native	Mandarin Chinese
Intermediate	German
Basic	French

Hobbies

Boxing

Mountain biking

Hiking