Github: https://github.com/stevenjj   Website: https://stevenjensjorgensen.com

Apptronik   **Steven Jens Jorgensen, PhD**   **ROBOTICS ENGINEER**
Austin, TX, 77058   stevenjensj@gmail.com   310-381-9924

Education

The University of Texas at Austin (UT Austin) – Austin, Texas   2014-2020
- *PhD in Mechanical Engineering:* Dynamics Systems and Controls (May 2020). *Dissertation: "Towards Deploying Legged Humanoids in Human Environments."*
- *Master's of Science Engineering (2017). Master's Thesis: "Human Detection, Gesture Recognition and Policy Generation for human-aware robots"*

Massachusetts Institute of Technology (MIT) – Cambridge, MA   2010-2014
- *BS Engineering: Control Instrumentation and Robotics.*

Work Experience

Sr. Software Engineer in Robotics @ Apptronik   June 2022 – present
- Developing controllers and motion planners for humanoids

Robotics Engineer @ NASA Johnson Space Center, ER4 - Robotics Systems Technology Branch   June 2020 – June 2022
- Developed a state-of-art Kinematics Model-Predictive Controller (MPC) for the Valkyrie humanoid.
- Analyzed and developed software tools to parameterize the design of an ankle mechanism with closed-kinematic loops that optimizes for workspace and torque-speed profiles. A research paper is in preparation.
- Created mechanical design tools to quantify performance requirements for designing NASA's next-gen biped.
- Developed a state-of-art Virtual-Reality (VR) interface using Unity for low-latency, high-throughput control of Valkyrie as the sole software engineer for UI/UX, networking, and end-to-end systems integration. Optimized code for point cloud processing performance, bootstrapped libraries to enable *remote* mixed-reality (MR) with the ZEDm sensor, and robustified the ROS#-based networking protocol.
- Developed tools for system identification of robot link inertias for accurate URDF construction and frequency response tools to baseline and tune low-level controllers of Series-elastic Actuators for the next-gen biped.

NASA Space Technology Research Fellow (NSTRF) @ NASA Johnson Space Center   August 2015 – May 2020
- Developed a novel mobile manipulation approach for humanoids by learning locomanipulability regions with a neural network classifier, and performing a fast weighted A* approach to solve for motion plans in seconds.
- Developed a variety of techniques for solving nonlinear dynamics and inverse-kinematics problems with unilateral and nonlinear constraints for the Valkyrie humanoid robot using Sequential Quadratic Programming (SQP)-based approaches, path planning algorithms, and projection-based whole-body control techniques.
- Characterized and modeled the thermal properties of the Series-Elastic Actuators (SEA) of the Valkyrie robot which was used to develop a novel thermal recovery procedure.
- Applied supervised-learning to detect humans from 3D lidar point cloud data with ROS, PCL and Scikit-learn.

NASA Pathways Intern (ER4-Robotics Systems Tech Branch) @ NASA Johnson Space Center   August 2018-May 2019
- Performed a variety of software tasks such as developing ROS-based C++ and python code to control the robot and visualize sensor data, writing unit-tests for accepting testing of new controllers, maintaining Gazebo plugins, implementing GUI capabilities, deploying ROS action servers, integrating 3rd party libraries, and documenting sensor calibration procedures for the IMU, Multisense SL, and absolute position encoders.
- Developed different locomotion and manipulation strategies for IED response such as traversing rough terrain and narrow gaps, opening a car door, grabbing a bag, and operating a total containment vessel (TCV).
- Performed thermal experiments on the 6-axis force/torque sensor to identify drift properties and its effect on bipedal walking performance, which led to new warm-up protocols and lessons learned for the next-gen robot.
- Operated the robot for 200+ hours and gave successful demos to Department of Defense (DoD) partners.

Human Centered Robotics Laboratory (HCRL) Graduate Research Assistant@ UT Austin   June 2014-Present
- Performed research duties under Dr. Luis Sentis. See Publications below for a list of novel research output.

Undergraduate Researcher (UROP) @ MIT Museum, CSAIL, MechE. - Cambridge, MA   September 2010-May 2014
- Designed, manufactured, and programmed a silent omni-directional robotic platform for the MIT Museum as the base of a 200lb light-ballet museum exhibit.
- Programmed Object Template Description Formats (OTDFs) for valve manipulation which helped win an Atlas robot from Boston Dynamics and built test environments for MIT's DARPA Robotics Challenge team.
- Integrated encoders, force sensors, and an accelerometer within a traditional walker for monitoring elder care.

Awards

In Industry: *2022 NASA JSC (ER4) Elite Team Award, 2019 NASA JSC (ER4) Excellence Recognition Award, 2019 NASA JSC (ER4) Elite Team Award, Fall 2018 NASA JSC Pathways Intern Employment Award.*

In Academia: NASA Space Technology Research Fellowship (NSTRF 2015-2019). NSF Graduate Research Fellowship Honorable Mention (2014, 2015). Rylander Longhorn M.E Club Excellence in Teaching Fellowship (2015). UT Austin Continuing Student Fellowship (2015).

In Robotics Competitions (as team leader and/or member): 3rd place in 2017 Robocup@Home Competition in Nagoya, Japan. 2013 MIT Intro To Robotics Most Valuable Engineer, 2013 MIT Bipedal Robot Best Design Award and overall 1st Runner-up, 2013 DARPA Virtual Robotics Challenge (VRC) 3rd place. 2011 Autonomous Lego Robotics 1st Place, 2008 VRC Division World Champions, VRC Pan Pacific Champions,2006 VRC 1st Runnerup, 2007 VRC Build Award, 2008 VRC Engineering Design Award, 2008 VRC Judges Award, 2008 2009 FTC 1st runner-up, 2009 FTC Community-Service Award, 2010 FRC Engineering Inspiration Award.

Skills

Software: ROS, Python, C, C++, Linux bash script, Ruby, G-Code, Matlab, Octave, Labview, LaTex, and M.S. Office.

Design and Manufacturing: Computer Aided Design (CAD) with Autodesk Inventor & SolidWorks, Computer Aided Manufacturing (CAM) with EdgeCam. Ability to use the following tools: conventional/CNC Mill, lathe, water Jet, 3D printer, laser cutter and various power tools. Finite-element analysis with LS-DYNA and Solidworks.

Electronics: Electromechanical integration of sensors and electric motors with an Arduino, Labview's myRIO, breadboards, and IC chips. General soldering of components and programming of custom logic gate circuits.

Academic Publications

Peer-Reviewed Journal Publications

[01] Ahn, J., **Jorgensen, S.J.**, Bang, S.H., & Sentis, L. (2021). Versatile Locomotion planning and control for humanoids robots. *Frontiers in Robotics and AI.*, 257.

[02] Kim, D., **Jorgensen, S.J.**, Lee, J., Ahn, J., Luo, J., & Sentis, L. (2020). Dynamic locomotion for passive-ankle biped robots and humanoids using whole-body locomotion control. *The International Journal of Robotics Research, 39*(8), 936-956.

[03] **Jorgensen, S. J.**, Holley, J., Mathis, F., Mehling, J. S., & Sentis, L. (2019). Thermal recovery of multi-limbed Robots with electric actuators. *IEEE Robotics and Automation Letters*, *4*(2), 1077-1084.

[04] Zhao, Y., Paine, N., **Jorgensen, S. J.**, & Sentis, L. (2017). Impedance control and performance measure of series elastic actuators. IEEE Transactions on Industrial Electronics, 65(3), 2817-2827.

[05] Nguyen, Q. A., **Jorgensen, S. J.**, Ho, J., & Sentis, L. (2015, September). Characterization and testing of an electrorheological fluid valve for control of ERF actuators. In Actuators (Vol. 4, No. 3, pp. 135-155). Multidisciplinary Digital Publishing Institute.

Peer-Reviewed Conference Publications

[06] **Jorgensen, S. J.**, Vedantam, M., Gupta, R., Cappel, H., & Sentis, L. (2019). Finding Locomanipulation Plans in the Locomotion Constrained Manifold. In *2020 IEEE International Conference on Robotics and Automation (ICRA)* (pp. 6611-6617). IEEE.

[07] **Jorgensen, S.J**. Lanighan M.W., Bertrand, S., Watson A., Altemus, J.S., Askew, R.S., Bridgwater, L., Domingue, B., Kendrick, C., Lee, J, Paterson, M., Sanchez, J., Beeson, P., Gee, S., Hart, S., Quispe A.H., Griffin, R., Lee, I., McCrory, S., Sentis, L., Pratt, J., Mehling, J.S. Deploying the NASA Valkyrie humanoid for IED response: An initial approach and evaluation summary. In *2019 IEEE-RAS 19th International Conference on Humanoid Robots (Humanoids).* IEEE, 2019.

[08] Kim, D., **Jorgensen, S. J.**, Hwang, H., & Sentis, L. (2018, November). Control Scheme and Uncertainty Considerations for Dynamic Balancing of Passive-Ankled Bipeds and Full Humanoids. In 2018 IEEE-RAS 18th International Conference on Humanoid Robots (Humanoids) (pp. 1-9). IEEE.

[09] Kim, D., **Jorgensen, S. J.**, Stone, P., & Sentis, L. (2016, November). Dynamic behaviors on the NAO robot with closed-loop whole body operational space control. In 2016 IEEE-RAS 16th International Conference on Humanoid Robots (Humanoids) (pp. 1121-1128). IEEE.

[10] Tedrake, R, Fallon, M, Karumanchi, S, Kuindersma, S, Antone, M, Schneider, T, Howard, T, Walter, M, Dai, H, Deits, R, Fleder, M, Fourie, D, Hammoud, R, Hemachandra, S, Ilardi, P, Perez-d'arpino, C, Pillai, S, Valenzuela, A, Cantu, C, Dolan, C, Evans, I, **Jorgensen, S.J.**, Kristeller, J, Shah, JA, Iagnemma, K & Teller, S 2014, A summary of team MIT's approach to the virtual robotics challenge. in Robotics and Automation (ICRA), 2014 IEEE International Conference on. Institute of Electrical and Electronics Engineers (IEEE), pp. 2087-2087, 2014 IEEE International Conference on Robotics and Automation (ICRA), United Kingdom, 31/05/14. DOI: 10.1109/ICRA.2014.6907140

Preprints, Reports, Workshops, and Theses

[11] **Jorgensen, S. J.** (2020). Towards deploying legged humanoids in human environments. PhD Thesis. Department of Mechanical Engineering. The University of Texas at Austin.

[12] **Jorgensen, S. J.**, Campbell, O., Llado, T., Lee, J., Shang, B., & Sentis, L. (2018). Prioritized Kinematic Control of Joint-Constrained Head-Eye Robots using the Intermediate Value Approach. arXiv preprint arXiv:1809.08750.

[13] Kim, M., Lee, J., **Jorgensen, S. J.**, & Sentis, L. (2018). Social Navigation Planning Based on People's Awareness of Robots. arXiv preprint arXiv:1809.08780.

[14] **Jorgensen, S. J.**, Campbell, O., Llado, T., Kim, D., Ahn, J., & Sentis, L. (2017). Exploring Model Predictive Control to Generate Optimal Control Policies for HRI Dynamical Systems. arXiv preprint arXiv:1701.03839.

[15] M. Arduengo, **S. J. Jorgensen**, K. Hambuchen, L. Sentis, F. MorenoNoguer, and G. Alenya (2017). ROS wrapper for real-time multi-person pose estimation with a single camera estimation with a single camera. Institut de Robotica i Informatica Industrial, CSIC-UPC, Tech. Rep., 2017.

[16] **Jorgensen, S.J.** (2017). Human detection, gesture recognition, and policy generation for human-aware robots. Master's Thesis. Department of Mechanical Engineering. The University of Texas at Austin.

[17] **Jorgensen, S. J.,** & Sentis, L (2016). Arm Motion Gesture Recognition using Dynamic Movement Primitives and Gaussian Mixture Models. Workshop at the ACM/IEEE International Conference on Human-Robot Interaction (HRI 2016).