

Reuben D. Brewer, Ph.D.

Design Portfolio Online at www.reubotics.com

Education

Ph.D. in Mechanical Engineering, Stanford University, June 2015
Advisor: J. Kenneth Salisbury and Mark Cutkosky (Co-Advisor)
Specialization: Medical Robotics and Electromechanical Design
Dissertation: “Improving Peripheral IV Catheterization Through Robotics: From Simple Assistive Devices to a Fully-Autonomous System”
GPA: 3.94/4.00

M.S. in Mechanical Engineering, Stanford University, January 2008
Advisor: J. Kenneth Salisbury
Specialization: Robotics
GPA: 3.87/4.00

B.S. in Mechanical Engineering, Johns Hopkins University, May 2006
Graduated 1st of 326 students in School of Engineering, 4th of 1122 students across university-wide Class of 2006.
GPA: 3.99/4.00

Awards, Fellowships

Timothy Francis Kennedy Memorial Scholarship, 2013 – 2014
National Science Foundation Graduate Research Fellowship, 2009 – 2011
Department of Defense NDSEG Fellowship, 2006 – 2009
Stanford Graduate Fellowship, 2006 – 2011
Hertz Foundation Fellowship, Awarded in 2006, Declined
Charles A. Miller Award, JHU Dept. of Mech. Eng., 2006
Robert George Gerstmeyer Award, JHU Dept. of Mech. Eng., 2005
National Merit Scholarship, Awarded in 2002, Declined

Professional Positions Held

Principal Mechatronics Engineer, Laza Medical, September 2023 – Present
Senior Robotics Engineer, SRI International, January 2018 – August 2023
Adjunct Lecturer, Stanford University Dept. of Mechanical Engineering, Fall 2022
Senior Mechanical Engineer, Juicero, Inc., August 2015 – December 2017
Mechanical Engineer, Intuitive Surgical, Inc., June 2015 – August 2015
Course Lecturer, “CS235: Applied Robot Design”, Stanford University, Spring 2012
Lab Manager, Salisbury Robotics Lab, Stanford University, 2010 – 2015
Vice-President, Tau Beta Pi, JHU Chapter, national engineering honor society, 2005
President, Pi Tau Sigma, JHU Chapter, national mechanical eng. honor society, 2005

Skills

Programming: Extensive experience with C (computer and embedded/microcontroller), C++, Python, Matlab, and Animatics SmartMotor. Extensive GUI development experience with C++ QT and Python Tkinter. Some experience with Fortran, Javascript, and website-backend (via Python and Flask).

Computer Aided Design (CAD): Extensive experience designing with Solidworks and some experience with Onshape and Pro Engineer.

Mechanical Design/Fabrication: Extensive experience performing manual milling, manual lathe turning, laser cutting, 3D printing, and silicone molding. Some experience with vacuum forming, rotocasting, and MIG welding.

Electronic Design, Fabrication: Extensive experience performing circuit design/prototyping for digital sensors and microcontrollers. Moderate experience performing circuit design/prototyping for analog sensors, filters, and PID controllers. Moderate experience performing PCB design/layout and extensive experience performing PCB and wire-harness assembly. Extensive experience with National Instruments Data Acquisition cards, including wiring and programming (mostly C++, some LabView). Extensive experience integrating 3rd-party electronics (e.g. motor controllers, sensors, etc.) into robotic systems, including wiring and communications.

Photography/Videography: Extensive experience documenting engineering projects with multiple, synchronized DSLR cameras, including macro, wide-angle, and zoom lenses and custom back-drops and lighting.

Industry Experience

Laza Medical, a Shifamed portfolio company, Campbell, CA
-Principal Mechatronics Engineer, September 2023 – Present

Performing mechatronic design in the development of robotic and digital solutions to address important cardiovascular needs.

SRI International, Menlo Park, CA
-Senior Robotics Research Engineer, January 2018 – August 2023

- Served as program manager and technical lead on [robotic excavator](#) project (remote and automated digging).
 - Developed excavator firmware (Python).
 - Designed/fabricated electromechanical motorization of all levers/pedals, overhead beacon/camera assembly.
 - Performed system-level wiring and electronics integration.
 - Edited movie (and filmed half of footage).

- Created “[GoBetween Robotics](#): a Robot for Making Police Traffic Stops Safer for Everyone”. Performed all electromechanical design/fabrication and software development (Python). Patent issued for this work.
- Served as technical lead on project to develop a custom, high voltage electrostatic end-effector for material-handling robot. Performed all electromechanical design/fabrication and software development (Python).
- Developed prototypes of
 - automated hole-drilling robot as part of bomb-disposal system,
 - alternative gripper for Enaex Robominer,
 - a fully-balanced [Inception Drive](#) (Infinitely Variable Transmission) with resulting, issued patent,
 - hardware for [vineyard-grapes-inspection robot](#),
 - GPS-localization-test-rig for autonomous groundskeeping robot,
 - methods of marking meat for robotic handling (prov. patent filed), and
 - system for tracking the motion of a small mobile robot and removing its self-weight (to simulate weightlessness).

Juicero, Inc., San Francisco, CA

-Senior Mechanical Engineer, August 2015 – December 2017

Created and ran the Automated Testing Lab, developing and deploying [automated electromechanical systems](#) to 1. test product designs/lifetime for existing and up-and-coming products, 2. support factory manufacturing (e.g. force-vs-motor-current-calibration for every machine), and 3. facilitate and semi-automate data collection during food-science experiments. Performed all mechanical design/fabrication, electronics, and software development.

Intuitive Surgical, Inc., Sunnyvale, CA

-Mechanical Engineer, June 2015 – August 2015

Performed electromechanical design on early version of the master-input-device for the "Ion", a robotic endoluminal platform for minimally invasive peripheral lung biopsy. Developed concept and working prototype that were included in issued U.S. Patent 11,116,586 B2.

Lockheed Martin, MS2, Baltimore, MD

-Intern, Mechanical Engineering, Summers 2004, 2005

Developed multiple concept designs for sea-based UAV catcher. Designed storage structure for power electronics of electric counter measure launcher that was tested at Sandia National Labs in Albuquerque, NM.

Academic Research Experience

Graduate Research, 2006 – 2015, Stanford University

Advisor: J. Kenneth Salisbury

Co-Advisor: Mark Cutkosky

Robotic IV Catheter Insertion. Developed a [robotic system](#) capable of autonomously locating veins in the human hand and placing an IV catheter in a vein. Featured project on Stanford School of Medicine's "Discovery Walk", a series of laser-etched granite panels that narrate the history of medical innovation at Stanford. (Dissertation topic)

Force Control of Permanent Magnets for Minimally-Invasive Procedures. Developed a [system capable of modulating the magnetic force](#) on a small permanent magnet on a tool tip inside of the body.

A Friction Differential and Cable Transmission Design for a 3-DOF Haptic Device with Spherical Kinematics. Designed and fabricated a novel mechanical design for a 3-DOF [haptic device](#) with spherical kinematics (pitch, yaw, and prismatic radial).

Multiplexed, Underactuated Drivetrain for High-Dexterity Robotic Hand. Designed and fabricated an underactuated, [15-DOF, 5-fingered hand](#) driven by a multiplexed drivetrain consisting of 1 powerful motor and 5 small motors.

Omni-Directional Base. Designed and fabricated the proof-of-concept [omnidirectional platform](#) for the PR1 mobile base. This design was later adapted by Willow Garage for the PR2 mobile base.

Design of a Low-Cost Robot Arm. Performed the mechanical design and fabrication of a [low-cost, 7-DOF robot arm](#).

GI/Colonoscopy Robots. Developed a variety of small robots for navigating the large intestine towards colonoscopy.

Undergraduate Research, 2003 – 2005, Johns Hopkins University

Advisor: Roger Ghanem

FEA simulation for understanding failure in airplane wings.

Advisor: Greg Chirikjian

Developed master for pneumatic robot that could mechanically-self-replicate.

Teaching Experience

- [T1] Adjunct Lecturer for graduate course, "[ME223: Applied Robot Design](#)" in Department of Mechanical Engineering, Stanford University, Fall 2022.
- [T2] Developed and lectured graduate course, "[CS235: Applied Robot Design](#)" in Department of Computer Science, Stanford University, Spring 2012.

Publications

Book Chapters

- [B1] P.J. Pasricha, M. J. Krier, R. D. Brewer "The Future of Colonoscopy." Colonoscopy Principles and Practice. 2nd Edition. Ed. J. D. Waye, D. K. Rex & C. B. Williams. Oxford UK: Wiley-Blackwell Pub., 2009, pp. 784-790.

Refereed Conference Articles

- [C1] R. D. Brewer, K. E. Loewke, E. F. Duval, and J. K. Salisbury, "Force Control of a Permanent Magnet for Minimally-Invasive Procedures." International Conference on Biomedical Robotics and Biomechatronics, 2008, pp. 580-586.
- [C2] R. D. Brewer and J. K. Salisbury, "Visual Vein-Finding for Robotics IV Insertion." IEEE International Conference on Robotics and Automation, 2010, pp. 4597-4602.
- [C3] M. Quigley, R. Brewer, S. P. Soudararaj, V. Pradeep, Q. Le, and A. Y. Ng, "Low-cost Accelerometers for Robotic Manipulator Perception," in Proceedings of the IEEE/RSJ International Conference on Intelligent Robots and Systems, 2010, pp. 6168-6174.
- [C4] R. D. Brewer, A. E. Leeper, and J. K. Salisbury, "A Friction Differential and Cable Transmission Design for a 3-DOF Haptic Device with Spherical Kinematics." IEEE/RSJ Intern. Conf. on Intelligent Robots and Systems, 2011, pp. 2570-2577.

Workshop Presentations and Posters

- [W1] M. Quigley, R. Brewer, and A. Y. Ng, "OpenArms: Towards Low-cost Robotic Manipulation," poster and live demonstration at workshop, International Joint Conference on Artificial Intelligence, 2009.

Patents, Issued

- [P1] R. Brewer, J. K. Salisbury, K. Loewke, and D. Camarillo, “System and Method for Guiding a Medical Instrument with Magnetic Force Control”. U.S. Patent 8,316,861 B2 issued November 27, 2012. Work performed at Stanford University.
- [P2] R. Brewer and J. K. Salisbury, “Assistive Method and Visual-Aid Device for Vascular Needle Insertion”. U.S. Patent 8,715,233 B2 issued May 6, 2014. Work performed at Stanford University.
- [P3] R. Brewer and J. K. Salisbury, “Remote Center of Motion Mechanism and Method of Use”. U.S. Patent 9,227,326 B2 issued on January 5, 2016. Work performed at Stanford University.
- [P4] K. Chao, A. Roop, G. Magee, R. Jou, R. Brewer, C. Pell, B. Duggan, C. Dong, and T. Ruby, “Surgical Device and Methods”. U.S. Patent 9,308,011 B2 issued April 12, 2016. Continuation of Patent Appl. PCT/US2010/001,036 filed April 5, 2010. Work performed at Stanford University.
- [P5] R. Brewer, “Vehicle Mountable Robotic and Communication Systems”. U.S. Patent 10,814,472 B2 issued October 27, 2020. Work started at home-lab and continued at SRI International.
- [P6] D. Bailey, F. Barbagli, R. Brewer, C. Carlson, V. Duindam, T. Morimoto, M. Paris, and O. Wagner, “Systems and Methods of Steerable Elongate Device”. U.S. Patent 11,116,586 B2 issued September 14, 2021. Work performed at Intuitive Surgical.
- [P7] A. Kernbaum, R. Shear, R. Brewer, M. Kitchell, and J. Marlow, “Variable Transmissions with Nested Pulleys”. U.S. Patent 11,566,690 issued January 31, 2023. Work performed at SRI International.

Patents, Application Pending

- [A1] R. Brewer, “System and Method for Marking Food Products Based on Temperature Differential”. U.S. Provisional Patent Application 63/421,211 filed November 1, 2022. Work performed at SRI International.
- [A2] R. Brewer, “System and Methods for Unplugging an Electric Vehicle Charging Cable”. U.S. Provisional Patent Application 63/523,745 filed June 28, 2023. Work performed at SRI International.

Grants

[G1] **Stanford Department of Computer Science**, Grant for Novel Initiatives in Education and Teaching, "Applied Robot Design: How to Fix, Modify, and Build Robots", Reuben Brewer and J. Kenneth Salisbury. \$50,000 over 1 year. (9/2012-6/2013).

[G2] **Intuitive Surgical Inc.**, Tech. Research Grant, "Robotic Assistance for Intravenous Catheterization", J. K. Salisbury and R. Brewer. \$49K over 1 year (4/2010 - 6/2012).

Personal

U.S. Citizen

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Github: <https://github.com/Reuben-Brewer>

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