

STEVE MAJERUS

2123 Martin Luther King Jr. Blvd., Glennan Building, Room 508, Cleveland, OH 44106 | 330-592-6009 | steve.majerus@case.edu

EDUCATION

Case Western Reserve University, Cleveland, OH

Ph.D. in Electrical Engineering

May 2014

GPA: 4.0 / 4.0

Dissertation: "Wireless, Implantable Microsystem for Chronic Bladder Pressure Monitoring"

Dissertation Advisor: Professor Steven L. Garverick

Support provided by the Rehabilitation Research Service of the US Dept. of Veterans Affairs

My dissertation research focused on the design and *in vivo* demonstration of a wireless, implantable bladder pressure sensor based on a custom, application-specific integrated circuit. The integrated circuit monolithically combined mixed-signal, digital, and RF circuitry and was connected with external components to form an implantable microsystem. The implantable sensor is currently the only published example of a wirelessly-rechargeable, ultra-low-power pressure sensing implant capable of providing real-time bladder pressure telemetry in a chronic application. The sensor was tested *in vivo* using anesthetized and ambulatory feline and canine models. Future rehabilitation uses for the device include real-time feedback to a neuromodulator for closed-loop bladder control in spinal-cord injured patients, as well as broader application to other organs.

Case Western Reserve University, Cleveland, OH

M.S. in Electrical Engineering

May 2008

GPA: 4.0 / 4.0

Thesis: "A Low-Power Wireless Transceiver for Deeply Implanted Biomedical Devices"

The focus of my M.S. thesis was the development of a low-power wireless telemetry platform suitable for use in implanted devices embedded in more than 20 cm of human tissue. The monolithic transceiver circuits were implemented as part of a custom integrated circuit. The system supported full-duplex telemetry with different frequency bands and orthogonal modulations schemes and had sufficient bandwidth to transmit uncompressed neural recordings. The platform was implanted and used for *in vivo* neurological studies of *Aplysia Californica*.

Case Western Reserve University, Cleveland, OH

B.S. in Electrical Engineering

May 2006

GPA: 3.76 / 4.0, *magna cum laude*

Minor in Artificial Intelligence

PROFESSIONAL EXPERIENCE

APT Rehabilitation R&D Center, Louis Stokes Cleveland VA Medical Center, Cleveland, OH

Investigator

2008 – Present

Designing and integrating ASICs for wireless implantable microsystems, e.g. for bladder and ECoG sensing applications.

Leading large-animal studies and regulatory approval for a wireless bladder pressure sensor

Continuously gathering preliminary data, generating new hypotheses and applying for research grant funding

Department of Electrical Engineering and Computer Science, CWRU, Cleveland, OH

Research Associate

2014 – Present

Designing and testing silicon carbide (SiC) integrated circuits for very high temperature (> 450 °C) operation.

Bluberry, LLC, Columbia Station, OH

Integrated Circuit Designer

2012 – Present

Designing custom integrated circuits for use in high-temperature aerospace applications.

Drafting specifications requirements documents for sign-off with customers.

Private Optoelectronics Consultant

2009 – Present

Inventing circuitry for a portable medical device and supporting manufacturing efforts
Performing claim construction and consulting for expert witness IP testimony.

Scientific Monitoring, Inc., Scottsdale, AZ

Integrated Circuit Designer

2009 – 2012

Designed and tested a set of integrated circuits for a high-temperature distributed control aerospace application.

Fabricated an autonomous aircraft sensor/actuator system and subjected it to long-term durability testing on representative flight hardware.

TEACHING EXPERIENCE

Case Western Reserve University, Cleveland, OH

Supplementary Instructor – Advanced Integrated Circuit Design

2015-Present

Presented weekly IC design lectures to graduate students

Teaching Assistant – Introduction to Circuits, Digital Logic, Signals & Systems

2007-2010

Held weekly recitation sessions, met with students during regular office hours, organized and taught final exam reviews, and proctored and graded exams.

Course Tutor – Educational Services for Students

2008-2010

Tutored undergraduate students on topics including digital logic circuits, frequency-domain analysis, and signals and systems.

HONORS AND AWARDS

Poster Award, Innovating for Continence 2015, Chicago, IL

2015

Best Poster Silver Medal, Research Showcase, Case Western Reserve University

2009

Research Excellence Award, Case Western Reserve University

2008

Dean's High Honors, 10 semesters (undergraduate), Case Western Reserve University

2002 – 2007

Alumni Association Scholarship, Case Western Reserve University

2003 – 2007

Provost's Scholarship, Case Western Reserve University

2002 – 2006

PATENTS AND INVENTION DISCLOSURES

R. Karam, S. Bhunia, M. Damaser, S. Majerus, D. Bourbeau, "Abdominal Pressure Free Bladder Contraction Detection System." *Invention Disclosure*, Case Western Reserve University, July 2014.

M.S. Damaser, **S. Majerus**, P. Fletter, S. L. Garverick, K. Wen, P. Zaszczurynski, "Implantable Pressure Sensor." *U.S. Patent Application No. US 13/889,852*, filed May 8, 2013.

S.L. Garverick, P. Samsukha, **S. Majerus**, "Low-Power Telemetry Platform for Biomedical Environments." *Invention Disclosure*, Case Western Reserve University, July 2009.

P.C. Fletter, **S.J.A. Majerus**, P. Cong, M.S. Damaser, S.L. Garverick, D.J. Young, J.R. Buckett, P.J. Zaszczurynski, W.H. Ko, "Wireless Implantable Micro-Manometer: Intravesical Pressure Monitoring System." *Invention Disclosure*, Case Western Reserve University, April 2009.

P.C. Fletter, **S.J.A. Majerus**, P. Cong, M.S. Damaser, S.L. Garverick, D.J. Young, J.R. Buckett, P.J. Zaszczurynski, W.H. Ko, "Wireless Implantable Pressure Monitor for Internal Organs." *Invention Disclosure*, Cleveland Clinic Foundation, 2008.

PUBLICATIONS AND PAPERS

Books and Book Chapters

S. Bhunia, **S. Majerus**, M. Sawan, *Implantable Biomedical Microsystems*. Oxford, UK: Elsevier Science & Technology, 2014.

S.J.A. Majerus, P.C. Fletter, H. Zhu, M.S. Damaser, "Implantable Bladder Pressure Sensor for Chronic Application: A Case Study," in *Implantable Biomedical Microsystems*, S. Bhunia, **S. Majerus**, M. Sawan, Oxford, UK: Els. Science & Tech., 2014.

Journal Publications

R. Karam, D. Bourbeau, **S. Majerus**, I. Makovey, H.B. Goldman, M.S. Damaser, S. Bhunia, "Real-Time Classification of Bladder Events for Effective Diagnosis and Treatment of Urinary Incontinence," *IEEE Transactions on Biomedical Engineering*, preprint, Aug. 2015.

I. Makovey, **S. Majerus**, R. Karam, B. Hanzlicek, M. Streicher, H. Zhu, M. Damaser, "Wireless implantable rechargeable bladder pressure sensor: cystoscopic implantation and ambulatory data collection." *The Journal of Urology*, 04/2015; 193(4):e489.

S.J.A. Majerus, S.L. Garverick, M.A. Suster, P.C. Fletter, M.S. Damaser, "Wireless, ultra-low-power implantable sensor for chronic bladder pressure monitoring." *ACM Journal of Emerging Technology*, vol. 8, no. 2, pp. 11.1-11.13, 2012.

P. Fletter, **S. Majerus**, H. Zhu, A. Boger, S. Garverick, K. Gustafson, M. Damaser, "Feasibility of submucosal bladder pressure sensing." *Journal of Urology*, vol. 185, no. 4, pp. e317–e318, 2011.

S.J.A. Majerus, P.C. Fletter, M.S. Damaser, S.L. Garverick, "Low-power wireless micromanometer system for acute and chronic bladder-pressure monitoring." *IEEE Transactions on Biomedical Engineering*, vol. 58, no. 3, pp. 763-768, 2011.

Refereed Conference Full Papers

S Majerus, I Makovey, H Zhu, W. Ko, M.S. Damaser, "Wireless implantable pressure monitor for conditional bladder neuromodulation." *2015 Biomedical Circuits and Systems Conference*, Atlanta, Georgia, Oct. 22, 2015.

S Majerus, M.S. Damaser, "Automatic drift cancellation of implanted bladder pressure sensor." *2015 Biomedical Circuits and Systems Conference*, Atlanta, Georgia, Oct. 22, 2015.

P. Wang, **S.J.A. Majerus**, R. Karam, S. Bhunia, B. Hanzlicek, D.L. Lin, H. Zhu, J.M. Anderson, M.S. Damaser, C.A. Zorman, W.H. Ko, "Long-Term Evaluation of Non-hermetic Micropackage Technology for Pressure Sensor in Medical Microsystem," in *Proc. of the 18th Ann. Intl. Conf. on Solid-State Sensors, Actuators, and Microsystems (TRANSDUCERS 2015)*, Anchorage, AK, June 21-25, 2015.

S. Majerus, S. L. Garverick, M. S. Damaser, "Wireless battery charge management for implantable pressure sensor." *IEEE Dallas Circuits and Systems Conf.*, Dallas, TX, USA, Oct. 11-13, 2014.

S.J.A. Majerus, D. Goff, W. Merrill, S. Garverick, "A 200 °C custom CMOS chipset for distributed control applications." *12th Intl. Energy Conversion Engineering Conf.*, Cleveland, OH, USA, July 28-30, 2014.

S.J.A. Majerus, D. Goff, W. Merrill, S. Garverick, "A 200 °C Motor Control ASIC." *2014 International Conference on High Temperature Electronics (HiTEC 2014)*, Albuquerque, NM, USA, May 13–15, 2014, pp. 159-164.

D. Goff, **S.J.A. Majerus**, W. Merrill, S. Garverick, "A 200 °C Quad-Output Switched Mode Power Supply IC." *2014 Intl. Conf. on High Temperature Electronics (HiTEC 2014)*, Albuquerque, NM, USA, May 13–15, 2014, pp. 22-27.

S. Majerus, S. Garverick, "Power Management Circuits for a 15- μ A, Implantable Pressure Sensor." *IEEE Custom Integrated Circuits Conference*, San Jose, CA, September 15–17, 2013.

S. Majerus, W. Merrill, S. Garverick, "Design and long-term operation of high-temperature, bulk-CMOS integrated circuits for instrumentation and control." *IEEE EnergyTech 2013*, Cleveland, OH, USA, May 21 – 23, 2013.

S. Majerus, D. Howe, S. Garverick, W. Merrill, K. Semega, "High-temperature, distributed control using custom CMOS ASICs." *Proc. of the 2012 SAE Power Systems Conference*, Phoenix, AZ, USA, Oct. 30 – Nov. 1, 2012.

D. Howe, **S. Majerus**, S. Garverick, W. Merrill, K. Semega, "High-temperature, bulk-CMOS integrated circuits for a distributed control system – performance results." *Proc. of the 2012 IMAPS Intl. Conf. on High Temperature Electronics (HITEC 2010)*, Albuquerque, NM, USA, May 8-10, 2012, pp. 2-9.

W. Merrill, J.H. Kim, S. Lall, **S. Majerus**, D. Howe, A. Behbahani, "Distributed engine control design considerations." *Proc. of the 46th AIAA/ASME/SAE/ASEE Joint Propulsion Conf. and Ex.* July 25-28, 2010.

S. Majerus, D. Howe, S. Garverick, D. Hiscock, W. Merrill, "High-temperature, bulk-CMOS integrated circuits for a distributed FADEC system." *Proc. of the 2010 IMAPS Intl. Conf. and Exhibition on High Temperature Electronics (HITEC 2010)*, Albuquerque, NM, USA, May 11-13, 2010, pp. 47-53.

P.C. Fletter, **S. Majerus**, P. Cong, M.S. Damaser, W.H. Ko, D.J. Young, S.L. Garverick. "Wireless micromanometer system for chronic bladder pressure monitoring." *Proc. of the Sixth Intl. Conference on Networked Sensing Systems (INSS 2009)*, Pittsburgh, PA, June 17-19, 2009, pp. 1-4.

S. Majerus and S.L. Garverick, "Telemetry platform for deeply implanted biomedical sensors." *Proc. of the Fifth Intl. Conference on Networked Sensing Systems (INSS 2008)*, Kanazawa, Japan, June 17-19, 2008, pp. 87-92.

Technical Reports

W. Merrill, **S. Majerus**, D. Howe, S. Garverick, "Reliable, High Temperature Engine Control." *SBIR Phase II Report*, submitted to Air Force Research Laboratory, Wright-Patterson Air Force Base, OH, 2012.

Published Conference Abstracts

I. Makovey, R. Karam, **S. Majerus**, D. Bourbeau, H. Zhu, S. Bhunia, M. Damaser, "Event detection algorithm in single channel bladder pressure recording." *30th Engineering and Urology Society Annual Meeting (AUA EUS 2015)*, New Orleans, LA, May 16, 2015.

I. Makovey, **S. Majerus**, E. Ferry, H. Zhu, M. Damaser, "Cystoscopic implantation of a wireless implantable rechargeable bladder pressure sensor." *Innovating for Continence: The Engineering Challenge*, Chicago; 04/2015

R. Karam, D. Bourbeau, **S. Majerus**, I. Makovey, H. Goldman, M. Damaser, Swarup Bhunia, "Real-time contraction event detection from bladder pressure recordings for effective diagnosis and treatment of urinary incontinence." *Innovating for Continence: The Engineering Challenge*, Chicago; 04/2015

S. Majerus, Iryna Makovey, Elizabeth Ferry, Peng Wang, Brett Hanzlicek, Matthew Streicher, Wen Ko, Hui Zhu, Margot S Damaser, "Conference Paper: Demonstration of wireless, catheter-free bladder pressure sensor for ambulatory monitoring and closed-loop bladder control." *Innovating for Continence: The Engineering Challenge*, Chicago; 04/2015

S. Majerus, I. Makovey, E. Ferry, P. Wang, B. Hanzlicek, M. Streicher, W. Ko, H. Zhu, M. Damaser, "Cystoscopic implantation and ambulatory demonstration of a wireless pressure sensor for real-time, catheter-free bladder pressure monitoring." *2015 Midwest American Society of Biomechanics Regional Meeting*, Akron, OH, Feb. 17, 2015.

P. Wang, **S. J. A. Majerus**, J. M. Anderson, M. S. Damaser, C. A. Zorman, and W. H. Ko, "Long-Term Implant Evaluation of Non-hermetic Micropackage Technology," in *Proc. Ann. Int. Conf. IEEE Eng. Med. Biol. Soc.*, San Antonio, TX, Oct. 22-25, 2014.

E. Ferry, **S. Majerus**, H. Zhu, S. Garverick, M. Damaser, "Cystoscopic implantation of a wireless implantable pressure sensor in a large animal model." *29th Engineering and Urology Society Annual Meeting (AUA EUS 2014)*, Orlando, FL, May 16–21, 2014.

E. Ferry, **S. Majerus**, H. Zhu, S. Garverick, M. Damaser, "Cystoscopic submucosal bladder device implantation." *2014 Society for Urodynamics, Female Pelvic Medicine & Urogenital Reconstruction Annual Winter Meeting (SUFU 2014)*, Miami, FL, Feb. 25 – March 1, 2014.

E. Ferry, **S. Majerus**, B. Balog, M. Streicher, H. Zhu, M. Damaser, "Calf urodynamics: a novel large-animal urologic model." *2014 Society for Urodynamics, Female Pelvic Medicine & Urogenital Reconstruction Annual Winter Meeting (SUFU 2014)*, Miami, FL, Feb. 25 – March 1, 2014.

P. Wang, S.B. Lachhman, D. Sun, **S.J.A. Majerus**, M.S. Damaser, C.A. Zorman, P.X.-L. Feng, W.H. Ko, "Non-Hermetic Micropackage for Chronic Implantable Systems." *46th International Symposium on Microelectronics (IMAPS 2013)*, Orlando, FL, September 30 – October 3, 2013.

P. Wang, D. Sun, **S. Majerus**, S. Lachhman, S. Li, D. Margot, C. Zorman, W. H. Ko, "Implantable Pressure Telemetry Device with Thin Film Micropackage." *2013 Biomedical Engineering Society Annual Meeting (BMES 2013)*, Seattle, WA, September 25 – 28, 2013.

S.J.A. Majerus, P.C. Fletter, P. Zaszczurynski, H. Zhu, M.S. Damaser, S.L. Garverick, "In vivo demonstration of an implantable bladder pressure sensor in an ambulatory canine subject." *Point-of-Care Technologies Research Network International Forum: "Clinically Driven Commercialization: Moving Technologies to the Point of Need"*, Sacramento, CA, USA, June 24, 2011.

P. Fletter, **S. Majerus**, A. Boger, K. Gustafson, S. Garverick, H. Zhu, M. Damaser, "Feasibility of submucosal bladder pressure sensing." *Society of Urodynamics, Female Pelvic Medicine, and Urogenital Reconstruction 2011 Winter Meeting*, Phoenix, AZ, USA, March 1-5, 2011.

P.C. Fletter, **S.J. Majerus**, P. Cong, W.H. Ko, D.J. Young, S.L. Garverick, M.S. Damaser, "Wireless ambulatory system for chronic bladder pressure monitoring." *BMES 2009 Annual Fall Scientific Meeting*, Pittsburgh, PA, October 7-10, 2009.

INVITED PRESENTATIONS

S.J. Majerus, "Innovating with the latest sensor technologies." *MedTechWorld BIOMEDevice Wireless Medical Devices Conference*, San Jose, CA, December 3-4, 2014.

UNIVERSITY ACTIVITIES

Proposal reviewer and presentation judge	2011 – present
Support of Undergraduate Research & Creative Endeavors (SOURCE), CWRU	

PROFESSIONAL ACTIVITIES

Reviewer (journals)

IEEE Transactions on Biomedical Engineering	2014 – present
IEEE Transactions on Biomedical Circuits and Systems	2014 – present
ACM Journal of Emerging Technology in Computing	2011 – present
IEEE Transactions on Very Large Scale Integration Systems	2011 – present
IEEE Journal on Emerging and Selected Topics in Circuits and Systems	2011 – present
Biomedical Microdevices	2012 – present
Analog Integrated Circuits and Signal Processing	2013 – present

Reviewer (conferences)

Biomedical Circuits and Systems Conference	2012 – present
IEEE International Symposium on Circuits and Systems	2012 – present
IEEE International Symposium on Medical Measurements and Applications	2012 – present
IEEE International Conference on Electronics Design, Systems, and Applications	2012 – present
IEEE International Symposium on Bioelectronics and Bioinformatics	2014 – present

Technical Program Committee

2015 IEEE International Circuits and Systems Symposium (ICSS2015)	2015
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SOCIETY MEMBERSHIPS

Institute of Electrical and Electronics Engineers (IEEE)
IEEE Solid-State Circuits Society
IEEE Sensors Council
IEEE Circuits and Systems Society
International Microelectronics Assembly and Packaging Society (IMAPS)
Society of Automotive Engineers (SAE International)

REFERENCES

REFERENCES HAVE BEEN HIDDEN ON PUBLIC CV