WILLIE K. HARRISON: CV

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Phone: (801) 422-4355

Professional Preparation

Utah State University	Electrical Engineering	BS, 2007
Utah State University	Electrical Engineering	MS, 2007
Georgia Institute of Technology	Electrical & Computer Engr	PhD, 2012

Appointments

Brigham Young University	Assistant Professor in ECE	2017–Present
University of Colorado Colorado Springs	Assistant Professor in ECE	2012–2017
Georgia Institute of Technology	Graduate Research Assistant in ECE	2007–2012
Utah State University	Graduate Research Assistant in ECE	2005–2007

Expertise

- Research: Physical-layer security, error-control coding, cryptography, information theory, graph theory, network coding, software radios, signal & image processing, telecommunications, probability and statistics, linear algebra, number theory, and sports performance analytics.
- Teaching: Previously taught information theory, coding theory, digital signal processing, probability and statistics, satellite communications, signals and systems, freshman seminar for engineers. Can also teach telecommunications, random processes, cryptography, wireless networks, real-time processors, spatial array processing, detection and estimation theory.

Journal Papers

[1] J. L. Salmon and W. K. Harrison, "A data analytics approach to evaluation of competition in the 2012 Summer Olympics," *Journal of Data Science*, vol. 15, no. 3, pp. 373–390, July 2017.

[2] J. P. Vilela, M. Gomes, W. K. Harrison, D. Sarmento, and F. Dias, "Interleaved concatenated coding for secrecy in the finite blocklength regime," *IEEE Signal Processing Letters*, vol. 23, no. 3, pp. 356–360, Mar. 2016.

[3] W. K. Harrison, "The role of graph theory in system of systems engineering," *IEEE Access*, vol. 4, pp. 1716–1742, 2016.

[4] W. K. Harrison, J. Almeida, M. R. Bloch, S. W. McLaughlin, and J. Barros, "Coding for secrecy: An overview of error-control coding techniques for physical-layer security," *IEEE Signal Processing Magazine*, vol. 30, no. 5, pp. 41–50, Sept. 2013.

[5] W. K. Harrison, J. Almeida, S. W. McLaughlin, and J. Barros, "Coding for cryptographic security enhancement using stopping sets," *IEEE Transactions on Information Forensics and Security*, vol. 6, no. 3, pp. 575–584, Sept. 2011.

[6] D. J. Baker, B. K. Thurgood, W. K. Harrison, M. G. Mlynczak, and J. M. Russell, "Equatorial enhancement of the nighttime OH mesospheric infrared airglow," *Physica Scripta*, vol. 75, no. 5, pp. 615–619, 2007. [Online]. Available: http://stacks.iop.org/1402-4896/75/i=5/a=004

Conference Papers

[1] G. T. Rendon, M. A. C. Gomes, J. P. Vilela, and W. K. Harrison, "Nested QPSK encoding for information theoretic security," in *Proc. IEEE Int. Conf. Communications (ICC)*, Kansas City, MO, May 2018, pp. 1–6, to appear.

[2] M. H. Johnson and W. K. Harrison, "A rateless approach to physical-layer security," in *Proc. IEEE Int. Conf. Communications (ICC)*, Kansas City, MO, May 2018, pp. 1–6, to appear.

[3] J. Pfister, M. A. C. Gomes, J. P. Vilela, and W. K. Harrison, "Quantifying equivocation for finite blocklength wiretap codes," in *Proc. IEEE Int. Conf. Communications (ICC)*, Paris, France, May 2017, pp. 1–6.

[4] W. K. Harrison and J. L. Salmon, "Bullpen strategies for Major League Baseball," in *Proc. MIT Sloan Sports Analytics Conference*, Boston, MA, Mar. 2017, pp. 1–8, 4th place paper award of approximately 200 submissions. [Online]. Available: http://www.sloansportsconference.com/wp-content/uploads/2017/02/1684.pdf

[5] J. L. Salmon and W. K. Harrison, "Tracking pitcher performance with instantaneous component ERA and moving averages," in *Proc. MIT Sloan Sports Analytics Conference*, Boston, MA, Mar. 2016, pp. 1–8. [Online]. Available: http://www.sloansportsconference.com/wp-content/uploads/2016/02/1564-Tracking-Pitcher-Performance-with-Instantaneous-Component-ERA-and-Moving-Averages.pdf

[6] D. Sarmento, J. P. Vilela, W. K. Harrison, and M. Gomes, "Interleaved coding for secrecy with a hidden key," in *Proc. IEEE Global Telecommunications Conf. (GLOBECOM) Workshops*, San Diego, CA, Dec. 2015, pp. 1–6.

[7] S. Schmidt and W. K. Harrison, "Real-time rate-adaptable coding for fading channels," in *Proc. IEEE Signal Processing & SP Education Workshop (SP/SPE)*, Salt Lake City, UT, Aug. 2015, pp. 151–156.

[8] W. K. Harrison and P. Boyce, "Parity modifications and stopping sets in high-rate codes for physical-layer security," in *Proc. IEEE Conf. Communications and Network Security (CNS)*, San Francisco, CA, Oct. 2014, pp. 115–120.

[9] N. L. Gross and W. K. Harrison, "An analysis of an HMM-based attack on the substitution cipher with error-prone ciphertext," in *Proc. IEEE Int. Conf. Communications (ICC)*, Sydney, AU, June 2014, pp. 749–754.

[10] W. K. Harrison, "Coset codes in a multi-hop network," in *Proc. IEEE Global Telecommunications Conf. (GLOBECOM) Workshops*, Atlanta, GA, Dec. 2013, pp. 1270–1274.

[11] W. K. Harrison and S. W. McLaughlin, "Equivocations for the simple substitution cipher with erasure-prone ciphertext," in *Proc. IEEE Information Theory Workshop (ITW)*, Lausanne, CH, Sept. 2012, pp. 622–626.

[12] W. Harrison, J. Almeida, S. McLaughlin, and J. Barros, "Physical-layer security over correlated erasure channels," in *Proc. IEEE Int. Conf. Communications (ICC)*, Ottawa, ON, June 2012, pp. 888–892.

[13] W. K. Harrison, J. Almeida, D. Klinc, S. W. McLaughlin, and J. Barros, "Stopping sets for physical-layer security," in *Proc. IEEE Information Theory Workshop (ITW)*, Dublin, IE, Aug. 2010, pp. 1–5.

[14] W. K. Harrison and S. W. McLaughlin, "EXIT charts applied to tandem coding and cryptography in a wiretap scenario," in *Proc. IEEE Information Theory Workshop (ITW)*, Taormina, Sicily, Oct. 2009, pp. 173–177.

[15] ——, "Tandem coding and cryptography on wiretap channels: EXIT chart analysis," in *Proc. IEEE Int. Symp. Information Theory (ISIT)*, Seoul, Korea, June-July 2009, pp. 1939–1943.

[16] ——, "Physical-layer security: Combining error control coding and cryptography," in *Proc. IEEE Int. Conf. Communications (ICC)*, Dresden, Germany, June 2009, pp. 1–5.

Theses

[1] W. K. Harrison, "Physical-layer security: Practical aspects of coding and cryptography," Ph.D.

dissertation, Georgia Institute of Technology, Atlanta, GA, June 2012. [Online]. Available: https://smartech.gatech.edu/handle/1853/44818

[2] W. K. Harrison, "Mesospheric infrared airglow measurements of molecular twilight transitions by means of satellite-based radiometry," Master's thesis, Utah State University, Logan, UT, May 2007.

Funded Projects (External funding in bold)

1) W. K. Harrison, PI, "HIDRA Application," Funding Entity: Graduate Studies at BYU, Project dates: Fall 2018–Summer 2021, Total funded amount: $90,000.
2) W. K. Harrison, PI, "Secrecy Codes in Real-Life Environments," Funding Entity: Ira A. Fulton College of Engineering and Technology at BYU, Project dates: 1/1/18–12/31/19, Total funded amount: $12,500.
3) W. K. Harrison, PI, "Continuous Phase Demodulation Firmware Implementations," Funding Entity: **RT Logic: A Kratos Company**, Project dates: 7/1/16–6/30/17, Total funded amount: **$31,345**.
4) W. K. Harrison, PI, "URS: Algebraic Secrecy Coding Structures," Funding Entity: University of Colorado Colorado Springs, Project dates: 7/1/16–6/30/17, Total funded amount: $2,000.
5) W. K. Harrison, PI, "IRES: Practical Physical-Layer Security in Coimbra, Portugal," Funding Entity: **National Science Foundation**, Project dates: 9/1/15–8/31/18, Total funded amount: **$249,798**.
6) W. K. Harrison, PI, "CRCW: Secrecy Codes in Real-Life Environments," Funding Entity: University of Colorado Colorado Springs, Project dates: 7/1/15–6/30/16, Total funded amount: $7,500.
7) W. K. Harrison, PI, "URA/URS: Rateless Physical-Layer Security Coding," Funding Entity: University of Colorado Colorado Springs, Project dates: 6/1/15–5/31/16, Total funded amount: $7,000.
8) W. K. Harrison, PI, "URS: Convolutional Codes for Secrecy," Funding Entity: University of Colorado Colorado Springs, Project dates: 7/1/14–6/30/15, Total funded amount: $2,500.
9) A. Ketsdever, PI, Co-PIs: W. K. Harrison, R. Lewis, S. Johnson, L. Lauderbaugh, R. Cascaval, "Model-Based Simulation for System of Systems Engineering," Funding Entity: **AMRDEC/Missile Defense Agency**, Project Dates: 8/1/14–12/31/14, Total funded amount: **$94,409**.
10) W. K. Harrison, PI, "CRCW: Noisy-Ciphertext Attack Model for Cryptographic Protocols," Funding Entity: University of Colorado Colorado Springs, Project dates: 7/1/13-6/30/14, Total funded amount: $7,428.

Patent Applications

1) S. W. McLaughlin, W. K. Harrison, J. McConnell, and C. Argon, "System for providing physical layer security," Jun. 5 2014, US Patent App. 13/908,230. [Online]. Available: http://www.google.com/patents/US20140153723
2) S. W. McLaughlin, W. K. Harrison, J. McConnell, and C. Argon, "Applications for physical-layer security," Jun. 19 2014, US Patent App. 13/962,777. [Online]. Available: http://www.google.com/patents/US20140171856

Academic Research Experience (As Student)

- PhD: Dr. Steven W. McLaughlin's lab at Georgia Institute of Technology, Aug. 2007–Aug. 2012.
- PhD Study Abroad: Dr. João Barros's lab at University of Porto in Porto, Portugal, Jan. 2009–Apr. 2009.
- MS: Dr. Doran J. Baker's lab in conjunction with the Rocky Mountain NASA Space Grant Consortium at Utah State University, Apr. 2005–Aug. 2007.

Industry Experience

- Whisper Communications, LLC, Principal Scientist, Atlanta GA, July 2010–Aug. 2012.
- MIT Lincoln Laboratory, Communications Engineering Intern, Lexington MA, Aug. 2009–Dec. 2009.
- Micron Technology, Inc., Electrical Engineering Intern, Boise ID, May 2005–Aug. 2005 and May 2006–Aug. 2006.
- Space Dynamics Laboratory, Student Engineer, North Logan UT, Aug. 2003–May 2005.

Research Team

Current:

- Matthew Johnson (PhD)
- Jack Pfister (MS)
- Scott Dye (BS)
- Ximena Briceno (BS)
- Kaela Nelson (BS)
- Joan Ferreras (BS)

Graduated:

- Roxanne L. Beem (MS Thesis: Low-Density Parity-Check Codes for Security in Low-Power Networks), 2013.
- Nathan Gross (MS Thesis: Beyond Cryptography: A Multi-layer Approach to Communication Privacy), 2016.
- Dustin Lovell (MS Project: Secure Wireless Transmission by Scrambling using USRP Software Radios), 2016.
- Parker Boyce (BS), 2016.
- Gregory Larmore (MS Thesis: Topology Inference in Store, Code, and Forward Networks), 2016.
- Sam Schmidt (BS), 2016.
- Jayadev Nair (MS Thesis: A Study of Secrecy Codes and Their Real-World Performance), 2017.

Service

- Member of the Technical Program Committee for GLOBECOM 2014, 2015 & 2016—Workshop on Trusted Communications with Physical Layer Security, ICC 2015, 2018—Wireless Communications Symposium, WiComSec-Phy 2015—Workshop on Wireless Communication Security at the Physical Layer, ICC 2016—Workshop on Wireless Physical Layer Security, CCWC 2017, 2018—IEEE Annual Computing and Communication Workshop and Conference, WCS 2017—Workshop on Communication Security, WCNC 2018—IEEE Wireless Communications and Networking Conference.
- Served on NSF proposal review panels: 2015, 2017; served as a "Remote Reviewer" for CHIST-ERA ERA-NET, a European consortium of 20 research funding organizations, 2016.
- Scholarly reviewer for several IEEE Transactions, IEEE Signal Processing Magazine, IEEE Signal Processing Letters, Wireless Communications and Mobile Computing, IEEE sponsored conferences, EURASIP, Cryptography, Sensors, Entropy, and Information Visualization journals.
- Member of BYU ECEn Department Undergraduate Committee, 2017–Present.
- Faculty advisor to UCCS IEEE student club, 2012–2017.
- STEM outreach activities with high school students—"What has STEM got to do with you?"
- STEM cub scouts—"Mad Scientist Night"
- Served on UCCS proposal committee, 2014.
- Member of UCCS instructor search committee, 2014.
- Member of UCCS graduate fellowship selection committee, 2016.

- Member of UCCS Internationalization Advisory Committee, 2015–2017.
- Member of UCCS ECE Graduate Committee, 2012-2017, UCCS ECE Grievance Committee, 2014–2017.
- Full-time volunteer missionary service 2000–2002.

Miscellaneous

- Director of NSF-funded International Research for Students (IRES) program in conjunction with the University of Coimbra, Portugal; 2015–2018.
- MIT Sloan Sports Analytics Conference 4th Place Paper Award, 2017. Work was referenced by the Washington Post at https://www.washingtonpost.com/news/fancy-stats/wp/2017/04/03/a-bold-plan-to-build-a-statistically-perfect-bullpen/
- Teacher of the Year award 2015–2016, College of Applied Science, UCCS.
- Member of Phi Kappa Phi Honor Society.
- Member of IEEE.
- Speak, read, and write Mandarin Chinese.
- Outstanding Teaching Assistant Award, Georgia Institute of Technology, 2007-2008 school year.
- President's Fellowship, Georgia Institute of Technology, 2007-2011.
- Presidential Scholarship, Utah State University, 1999-2005.