Alireza Vahid, PhD

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Research Interests

- Wireless Communications Beyond 5G
- Information and Communication Theory
- Coding Theory and Applications in Data Security and Storage

Education

- **Cornell University** — Ithaca, NY
  MSc & PhD in Electrical and Computer Engineering – GPA 4.0/4.0 — 2015
  - PhD Thesis: The Impact of Imperfect Feedback on the Capacity of Wireless Networks
  - **2015 Cornell Best PhD Thesis Award**
  - Advisor: Professor Salman Avestimehr
  - Thesis Committee: Prof. Lang Tong, Prof. Stephen Wicker
- **Sharif University of Technology** — Tehran, Iran
  BSc in Electrical Engineering – GPA 18.9/20 — 2009

Positions Held

- **University of Colorado Denver** — Denver, CO
  Assistant Professor of Electrical Engineering — 2017 to present
- **Duke University** — Durham, NC
  Adjunct Assistant Professor of Electrical & Computer Engineering — 2018
- **Duke University** — Durham, NC
  Postdoctoral Research Scientist — 2015-2017
- **Qualcomm Inc.** — San Diego, CA
  Innovation Fellow — 2013
- **Bell Labs** — Holmdel, NJ
  Research Intern — 2012

Funding

Funding Agency	Year	Role	Total Budget	Title
National Science Foundation (NSF)	2021	PI	$500k	Adaptive Smart Surfaces for Wireless Channel Morphing to Enable Full Multiplexing and Multi-user Gains
National Science Foundation (NSF)	2020	PI	$500k	Cross-Layer Interference Management: Bringing Interference Alignment to Reality
Lab Venture Partners	2019	PI	$125k	Theia: A Low-Complexity Distributed Interference Management Solution
State of Colorado	2019	PI	$90k	Opportunistic Communication Protocols in Dynamic Wireless Systems
University of Colorado	2018	PI	$30k	Deceptive Solutions in Data Transmission
National Science Foundation (NSF)	2017	SP	$500k	High Performance Memory that Integrates Coding and Computer Architecture
Qualcomm Inc.	2013	PI	$100k	Collaborative Interference Management

Selected Awards & Honors

- Best Paper Award at IEEE CCWC with my PhD student 2020
- Lab Venture Challenge Award for my invention "Theia" ($125k) 2019
- Runner-up Best Paper Award at Dependable Systems and Networks (DSN) 2019
- New Faculty Research Award, CU Denver ($30k) 2019
- Creative Research Collaborative (CRC) Fellowship, CU Denver 2018
- Best PhD Thesis Award, School of ECE, Cornell University 2015
- Qualcomm Innovation Fellowship ($100k) 2013
- Best PhD Teaching Award, School of ECE, Cornell University 2011
- Jacobs Scholar Fellowship, School of ECE, Cornell University 2009
- Ranked 2nd among over 360,000 in Iranian University Entrance Exam 2004
- Silver Medal in Iranian National Physics Olympiad 2003

Journal Publications

(J1) A. Vahid, "Topological Content Delivery with Feedback and Random Receiver Cache," *IEEE Journal on Selected Areas in Information Theory*, 2021.

(J2) A. Vahid, S. C. Lin, I. H. Wang, Y. C. Lai, "Content Delivery over Broadcast Erasure Channels with Distributed Random Cache," *IEEE Journal on Selected Areas in Information Theory*, 2021.

(J3) I. Shomorony, A. Vahid, "Torn-Paper Coding," *IEEE Transactions on Information Theory*, 2021.

(J4) M. Johnny, A. Vahid, "Low-Complexity Blind Interference Suppression with Reconfigurable Antennas," *IEEE Transactions on Wireless Communications*, 2021.

(J5) S. C. Lin, I. H. Wang, A. Vahid, "Capacity of Broadcast Packet Erasure Channels with Single-User Delayed CSI," *IEEE Transactions on Information Theory*, 2021.

(J6) A. Vahid, S. C. Lin, I. H. Wang, "Erasure Broadcast Channels with Intermittent Feedback," *IEEE Transactions on Communications*, 2021.

(J7) S. Nassirpour, A. Vahid, "On the Stability Regions of Intermittent Interference Networks," *IEEE Transactions on Communications*, 2021.

(J8) T. Levy, A. Vahid, R. Giryes, "Ranking Recovery from Limited Comparisons using Low-Rank Matrix Completion," *Applied and Computational Harmonic Analysis*, 2021.

(J9) S. Nassirpour, A. Vahid, "Embedded Codes for Reassembling Non-Overlapping Random DNA Fragments," *IEEE Transactions on Molecular, Biological, and Multi-Scale Communications*, vol. 7, no. 1, pp. 40–50, 2020.

(J10) M. Johnny, A. Vahid, "Exploiting Coherence Time Variations for Opportunistic Blind Interference Alignment," *IEEE Transactions on Communication Theory*, vol. 68, no. 10, pp. 6054–6069, 2020.

(J11) A. Vahid, "On the Degrees-of-Freedom of Two-Unicast Wireless Networks with Delayed CSIT," *IEEE Transactions on Information Theory*, vol. 65, no. 8, pp. 5176–5188, 2019.

(J12) A. Vahid, A. R. Calderbank, "Throughput Region of Spatially Correlated Interference Packet Networks," *IEEE Transactions on Information Theory*, vol. 65, no. 2, pp. 1220–1235, 2019.

(J13) G. Mappouras, A. Vahid, R. Calderbank, D. Sorin, "Extending Flash Lifetime in Embedded Processors by Expanding Analog Choice," *IEEE Transactions on Computer-Aided Design Integrated Circuits and Systems*, vol. 37, no. 11, pp. 2462–2473, 2018.

(J14) A. Vahid, V. Aggarwal, S. Avestimehr, A. Sabharwal, "Interference Management with Mismatched Partial Channel State Information," *EURASIP Journal on Wireless Communications and Networking*, 2017.

(J15) A. Vahid, M. Maddah-Ali, S. Avestimehr, and Y. Zhu, "Binary Fading Interference Channel with No CSIT," *IEEE Transactions on Information Theory*, vol. 63, no. 6, pp. 3565–3578, 2017.

(J16) A. Vahid, A. R. Calderbank, "Two-User Erasure Interference Channels with Local Delayed CSIT," *IEEE Transactions on Information Theory*, vol. 62, no. 9, pp. 4910–4923, 2016.

(J17) A. Vahid, M. Maddah-Ali, and S. Avestimehr, "Approximate Capacity Region of the MISO Broadcast Channels With Delayed CSIT," *IEEE Transactions on Communications*, vol. 64, no. 7, pp. 2913–2924, 2016.

(J18) A. Vahid, M. Maddah-Ali, and S. Avestimehr, "Capacity Results for Binary Fading Interference Channels with Delayed CSIT," *IEEE Transactions on Information Theory*, vol. 60, no. 10, pp. 6093–6130, 2014.

(J19) A. Vahid, C. Suh, and S. Avestimehr, "Interference Channels with Rate-Limited Feedback," *IEEE Transactions on Information Theory*, vol. 58, no. 5, pp. 2788–2812, 2012.

Conference Publications

(C1) A. Vahid, "Distortion-Based Outer-Bounds for Channels with Rate-Limited Feedback," *Proceedings of International Symposium on Information Theory (ISIT)*, 2021.

(C2) A. Narayan Ravi, A. Vahid, I. Shomorony, "Capacity of the Torn Paper Channel with Lost Pieces," *Proceedings of International Symposium on Information Theory (ISIT)*, 2021.

(C3) M. A. Farahani, A. Vahid, A. E. Goodwell, "Evaluating Ecohydrological Model Sensitivity to Forcing Variability with an Information Theory-Based Approach," *Proceedings of American Geophysical Union (AGU) Fall Meeting*, 2020. **Interdisciplinary work in environmental engineering.**

(C4) I. Shomorony, A. Vahid, "Communicating over the Torn-Paper Channel," *to appear in IEEE Global Communications Conference (GLOBECOM)*, 2020.

(C5) S. C. Lin, I. H. Wang, A. Vahid, "Capacity of Erasure Broadcast Channels with Single-User Delayed CSI and Common Messages," *to appear in IEEE Global Communications Conference (GLOBECOM)*, 2020.

(C6) M. Johnny, A. Vahid, "Embedding Information in Radiation Pattern Fluctuations," *Proceedings of International Symposium on Information Theory (ISIT)*, 2020.

(C7) S. Nassirpour, A. Vahid, "Throughput, Delay, and Complexity Tradeoffs in Interference Channels," *Proceedings of 10th IEEE Annual Computing and Communication Workshop and Conference (CCWC)*, 2020. **Winner Best Paper Award**.

(C8) A. Vahid, I. H. Wang, S. C. Lin, "Capacity results for erasure broadcast channels with intermittent feedback," *Proceedings of IEEE Information Theory Workshop (ITW)*, 2019.

(C9) Mappouras, A. Vahid, R. Calderbank, D. Sorin, "GreenFlag: Protecting 3D-Racetrack Memory from Shift Errors," *Proceedings of 49th Annual IEEE/IFIP International Conference on Dependable Systems and Networks (DSN)*. **Runner-up Best Paper Award**.

(C10) S. C. Lin, I. H. Wang, A. Vahid, "No Feedback, No Problem: Capacity of Erasure Broadcast Channels with Single-User Delayed CSI," *Proceedings of International Symposium on Information Theory (ISIT)*, 2019.

(C11) A. Vahid, "Finite Field X-Channels with Delayed CSIT and Common Messages," *Proceedings of International Symposium on Information Theory (ISIT)*, 2018.

(C12) A. Vahid, R. Calderbank, "ARQ for interference packet networks," *Proceedings of International Symposium on Information Theory (ISIT)*, 2018.

(C13) G. Mappouras, A. Vahid, R. Calderbank, D. R. Hower, D. Sorin, "Jenga: Efficient Fault Tolerance for Stacked DRAM," *Proceedings of IEEE International Conference on Computer Design (ICCD)*, 2017.

(C14) A. Vahid, R. Calderbank, "When does spatial correlation add value to delayed channel state information?" *Proceedings of International Symposium on Information Theory (ISIT)*, 2016.

(C15) G. Mappouras, A. Vahid, R. Calderbank, D. Sorin, "Methuselah Flash: Rewriting Codes for Extra-Long Storage Lifetime," *Proceedings of 46th Annual IEEE/IFIP International Conference on Dependable Systems and Networks (DSN)*, 2016.

(C16) A. Eslami, A. Velasco, A. Vahid, G. Mappouras, R. Calderbank, D. Sorin, "Writing without Disturb on Phase Change Memories by Integrating Coding and Layout Design," *Proceedings of Memory Systems (MEMSYS)*, 2015.

(C17) A. Vahid, I. Shomorony, R. Calderbank, "Informational Bottlenecks in Two-Unicast Wireless Networks with Delayed CSIT," *Proceedings of Allerton conference*, 2015.

(C18) A. Vahid, R. Calderbank, "Impact of Local Delayed CSIT on the Capacity Region of the Two-User Interference Channel," *Proceedings of International Symposium on Information Theory (ISIT)*, 2015.

(C19) A. Vahid, G. Mappouras, A. Velasco, R. Calderbank, and D. J. Sorin, "Virtual Cells and Concatenated Codes for Flash Memory," *Proceedings of Fifth Non-Volatile Memories Workshop (NVMW).*

(C20) A. Vahid, M. Maddah-Ali, and S. Avestimehr, "Binary Fading Interference Channel with No CSIT," *Proceedings of International Symposium on Information Theory (ISIT)*, 2014.

(C21) A. Vahid, M. Maddah-Ali, and S. Avestimehr, "Communication Through Collisions: Opportunistic Utilization of Past Receptions," *Proceedings of IEEE Infocom*, 2014.

(C22) A. Vahid, M. Maddah-Ali, and S. Avestimehr, "Approximate Capacity of the Two-User MISO Broadcast Channel with Delayed CSIT," *Proceedings of Allerton conference*, 2013.

(C23) A. Vahid, M. Maddah-Ali, and S. Avestimehr, "Binary Fading Interference Channel with Delayed Feedback," *Proceedings of International Symposium on Information Theory (ISIT)*, 2012.

(C24) A. Vahid, M. Maddah-Ali, and S. Avestimehr, "Interference Channel with Binary Fading: Effect of Delayed Network State Information," *Proceedings of Allerton conference*, 2011.

(C25) A. Vahid, V. Aggarwal, S. Avestimehr, and A. Sabharwal, "On the Capacity of Multi-hop Wireless Networks with Partial Network Knowledge," *Proceedings of Allerton conference*, 2010.

(C26) A. Vahid and S. Avestimehr, "The Two-User Deterministic Interference Channel with Rate-Limited Feedback," *Proceedings of International Symposium on Information Theory (ISIT)*, 2010.

Preprints and Submitted Papers

(P1) A. Narayan Ravi, A. Vahid, I. Shomorony, "Coded Shotgun Sequencing," *submitted to IEEE Journal on Selected Areas in Information Theory*, 2021.

(P2) S. Nassirpour, A. Gupta, A. Vahid, D. Bharadia, "Spectrum-Efficient Communications in Interference Channels with Binary Switched Antennas," *submitted to IEEE Transactions on Wireless Communications*, 2021.

(P3) M. A. Farahani, , A. Vahid, A. E. Goodwell, "Evaluating ecohydrological model sensitivity to input variability with an information theory-based approach," *submitted to Environmental Modelling and Software*, 2021.

(P4) A. Niakanlahiji, S. Orlowski, A. Vahid, H. Jafarian, "Toward Practical DNS Traffic Obfuscation," *under review.*

Teaching Experience and Student Mentorship

- Instructor, University of Colorado Denver
  - Data and Information Inference Theory (G) — Fall 2019
  - Engineering Probability and Statistics (UG) — Spring 2019
  - Random Processes (G) — Fall 2018
  - Digital Communication Systems (G) — Spring 2018 & 2019
  - Information and Coding Theory (G) — Fall 2017 & 2019

- **Data+ Summer Program, Duke University** — Durham, NC
  Mentor for Water Reservoir Project — Jun. to Aug. 2015

  - Advised a team of undergraduates and two graduate students
  - Aligned the capabilities of the undergraduates with the demands of the external client
  - Managed communication with the external client
  - Conducted comprehensive study of water reservoirs across North America
  - Quantified the role of human operator in water level fluctuations

- **Teaching Assistant, Cornell University** Ithaca, NY
  Random Signals in Communication and Signal Processing Fall 2010
  - **2011 Cornell University Best PhD Teaching Award**

Professional Activities

- TPC member,
  - IEEE Annual Computing and Communication Workshop and Conference (CCWC) 2020
  - Non-Volatile Memories Workshop (NVMW) 2021
  - IEEE International Symposium on Information Theory (ISIT) 2021
- Reviewer:
  - IEEE Transactions on Information Theory
  - IEEE Transactions on Communications
  - IEEE Transactions on Wireless Communications
  - IEEE Transactions on Vehicular Technology
  - IEEE International Symposium on Information Theory
  - IEEE INFOCOM
  - IEEE GLOBECOM
  - IEEE Information Theory Workshop
  - IEEE Communication Letters
  - IEEE Magnetic Letters
  - IEEE Transactions on Circuits and Systems
- Panel Reviewer:
  - National Science Foundation
  - Department of Energy
- Organized the North American School of Information Theory 2016
- Chair of student travel award committee, IEEE ISIT 2020

Professional Activities

- IEEE Senior Member
- IEEE Communication Society Member
- IEEE Information Theory Society Member
- Sigma Xi, The Scientific Research Honor Society
- IEEE Young Professionals Member