Waseem Abbas

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Research Interests

Networked control systems, cyber-physical systems, distributed control algorithms, graph-theoretic methods in multiagent systems, learning and control, robustness and resilience in complex networks, multirobot systems.

Education

Georgia Institute of Technology, Atlanta, GA USA

- **PhD Electrical and Computer Engineering**, Dec. 2013.
  Thesis: *Network-centric Methods for Heterogeneous Multiagent Systems*
  Advisor: Magnus Egerstedt
- **MS Electrical and Computer Engineering**, Aug. 2010.
  Major Area of Study: Systems and Control
  Minor Area of Study: Mathematics

University of Engineering and Technology, Lahore, Pakistan

- **BSc Electrical Engineering**, Aug. 2007.
  Majors: Electronics and Communication

Awards

- **Highest Faculty Evaluation (Teaching)** among all the faculty members in the Electrical Engineering Department at Information Technology University, Lahore, Pakistan for Fall 2018 (Linear Control Systems) and Spring 2019 (Network Control Systems).
- **Nominated** for the **Postdoc of the Year Award** (2016) at Vanderbilt University, Nashville, TN USA
- **Fulbright Fellowship** for PhD (2010–2013)
- **Fulbright Fellowship** for MS (2009–2010)
- **Tech to Teaching: Higher Education Pathway Advanced Certificate** awarded by the Georgia Institute of Technology, Atlanta, GA (2014).
- **Honors** in BSc Electrical Engineering (2007)
- **Federal Board of Intermediate and Secondary Education Fellowship** for BSc Electrical Engineering (2003–2007)

Academic and Research Experience

Vanderbilt University, Nashville, TN USA

- **Research Assistant Professor (Computer Engineering)** Jul. 2019 – Present
  Department of Electrical Engineering and Computer Science

Information Technology University, Lahore, Pakistan

- **Assistant Professor** Sep. 2017 – Jul. 2019
  Department of Electrical Engineering

Vanderbilt University, Nashville, TN USA

- **Postdoctoral Research Scholar** Mar. 2014 – Aug. 2017
  Institute for Software Integrated Systems

Massachusetts Institute of Technology, Cambridge, MA USA

- **Visiting Research Scholar** Feb. 2015, Sep. 2015, Jul. 2016
  Resilient Infrastructure Networks Lab in the Department of Civil and Environmental Engineering

Georgia Institute of Technology, Atlanta, GA USA

- **Research Assistant** Aug. 2010 – Dec. 2013
  Georgia Robotics and Intelligent Systems (GRITS) Lab in the School of Electrical and Computer Engineering

Refereed Book Chapter

1. **W. Abbas**, A. Laszka, and X. Koutsoukos, Resilient Wireless Sensor Networks for Cyber-Physical Systems, In *Cyber-Physical System Design with Sensor Networking Technologies*, S. Zeadally and N. Jabeur (Eds.), The Institution of Engineering and Technology (IET), 2016.

Refereed Journal Publications

Under Review

2. **W. Abbas**, M. Shabbir, Y. Yazicioglu, and A. Akber, Trade-off Between Controllability and Robustness in Diffusively Coupled Networks, *(revision submitted) IEEE Transactions on Control of Network Systems*, 2019.
3. A. Mitra, F. Ghawash, S. Sundaram, and **W. Abbas**, On the Impacts of Redundancy, Diversity and Trust in Resilient Distributed State Estimation, *(under review) IEEE Transactions on Control of Network Systems*, 2019.
4. Y. Yazicioglu, **W. Abbas**, and M. Shabbir, Structural Robustness to Noise in Consensus Networks: Impact of Degrees and Distances, Fundamental Limits, and Extremal Graphs, *(under review) IEEE Transactions on Automatic Control*, 2019.
5. M. Shabbir, **W. Abbas**, and Y. Yazicioglu, On Computation of the Distance-based Bound on Strong Structural Controllability in Networks, *(revision submitted) IEEE Transactions on Control of Network Systems*, 2019.
6. A. Said, S. Hassan, **W. Abbas**, and M. Shabbir, NetKI: Spectral Graph Embedding in Nearly Linear Time, *(under review) Neurocomputing*, 2019.

Published

7. J. Li, **W. Abbas**, and X. Koutsoukos, Resilient Distributed Diffusion in Networks with Adversaries, *IEEE Transactions on Signal and Information Processing over Networks*, 2019.
8. A. Laszka, **W. Abbas**, Y. Vorobeychik, X. Koutsoukos, Detection and Mitigation of Attacks on Transportation Networks as a Multi-Stage Security Game, *Computers & Security (Elsevier)*, 2019.
9. A. Laszka, **W. Abbas**, Y. Vorobeychik, X. Koutsoukos, Integrating Redundancy, Diversity, and Hardening to Improve Security of Industrial Internet of Things, *Cyber-Physical Systems (Taylor & Francis)*, 2019.
10. A. Ghafouri, A. Laszka, **W. Abbas**, Y. Vorobeychik, X. Koutsoukos, A Game-Theoretic Approach for Selecting Optimal Time-Dependent Thresholds for Anomaly Detection, *Autonomous Agents and Multi-Agent Systems (Springer)*, 2019.
11. **W. Abbas**, A. Laszka, M. Shabbir, and X. Koutsoukos, A Graph-Theoretic Approach for Increasing Participation in Networks with Assorted Resources, *IEEE Transactions on Network Science and Engineering*, 2019.
12. **W. Abbas**, A. Laszka, and X. Koutsoukos, Improving Network Connectivity and Robustness Using Trusted Nodes with Application to Resilient Consensus, *IEEE Transactions on Control of Network Systems*, Vol. 5, No. 4, 2018.
13. **W. Abbas**, A. Laszka, Y. Vorobeychik, and X. Koutsoukos, Scheduling Resource-Bounded Monitoring Devices for Event Detection and Isolation in Networks, *IEEE Transactions on Network Science and Engineering*, Vol. 5, No. 1, 2018.

14. A. Laszka, **W. Abbas**, and X. Koutsoukos, Scheduling Battery-Powered Sensor Networks for Minimizing Detection Delays, *IEEE Communications Letters*, Vol. 21, No. 4, pp. 789-792, 2017.
15. **W. Abbas**, M. Egerstedt, C.-H. Liu, R. Thomas, and P. Whalen, Deploying Robots with Two Sensors in $K_{1,6}$-free Graphs, *Journal of Graph Theory (Wiley)*, Vol. 82, No. 3, pp. 236-252, 2016.
16. L. S. Perelman, **W. Abbas**, X. Koutsoukos, and S. Amin, Fault Location Identification in Water Distribution Networks: A Minimum Test Cover Based Approach, *Automatica (Elsevier)*, Vol. 72, pp. 166–176, 2016.
17. A. Y. Yazicioglu, **W. Abbas**, M. Egerstedt, Graph Distances and Network Controllability, *IEEE Transactions on Automatic Control*, Vol. 61, 2016.
18. **W. Abbas** and X. Koutsoukos, Efficient Complete Coverage through Heterogeneous Sensing Nodes, *IEEE Wireless Communication Letters*, Vol. 4, No. 1, pp. 14–17, 2015.
19. **W. Abbas**, M. Egerstedt, Characterizing Heterogeneity in Cooperative Networks from a Resource Distribution View-point, *Communications in Information and Systems*, Vol. 14, No. 1, pp. 1-22, 2014.
20. S. Mohsin, N. Sheikh, and **W. Abbas**, MRI Induced Heating of Artificial Bone Implants, *Journal of Electromagnetic Waves and Applications (Taylor & Francis)*, Vol. 23, No. 5-6, pp. 799-808, 2009.

Refereed Conference Publications

21. **W. Abbas**, M. Shabbir, H. Jaleel, and X. Koutsoukos, Improving Network Robustness through Edge Augmentation While Preserving Strong Structural Controllability, *(submitted to) American Control Conference (ACC)*, Denver, CO, 2020.
22. M. Shabbir, J. Li, **W. Abbas**, and X. Koutsoukos, Resilient Vector Consensus in Multi-Agent Networks Using Centerpoints, *(submitted to) American Control Conference (ACC)*, Denver, CO, 2020.
23. Z. Hassan, M. Shabbir, I. Khan, and **W. Abbas**, Estimating Descriptors for Large Graphs, *(submitted to) Pacific-Asia Conference on Knowledge Discovery and Data Mining (PAKDD)*, Singapore, 2020.
24. M. Shabbir, **W. Abbas**, and Y. Yazicioglu, On the Computation of a Lower Bound on Strong Structural Controllability in Networks, *IEEE Conference on Decision and Control (CDC)*, Nice, France, 2019.
25. Y. Yazicioglu, **W. Abbas**, and M. Shabbir, Structural Robustness to Noise in Consensus Networks: Impact of Average Degrees and Average Distances, *IEEE Conference on Decision and Control (CDC)*, Nice, France, 2019.
26. H. Jaleel, **W. Abbas**, and J. Shamma, Robustness of Stochastic Learning Dynamics to Player Heterogeneity in Games, *IEEE Conference on Decision and Control (CDC)*, Nice, France, 2019.
27. F. Ghawash and **W. Abbas**, Leveraging Diversity for Achieving Resilient Consensus in Sparse Networks, *IFAC Workshop on Distributed Estimation and Control in Networked Systems (NecSys)*, Chicago, IL, 2019.
28. **W. Abbas**, M. Shabbir, Y. Yazicioglu, and A. Akber, On the Trade-off Between Controllability and Robustness in Networks of Diffusively Coupled Agents, *American Control Conference (ACC)*, Philadelphia, PA, 2019.
29. **W. Abbas**, A. Laszka, and X. Koutsoukos, Diversity and Trust to Increase Structural Robustness in Networks, *American Control Conference (ACC)*, Philadelphia, PA, 2019.

30. A. Laszka, **W. Abbas**, Y. Vorobeychik, and X. Koutsoukos, Synergistic Security for the Industrial Internet of Things: Integrating Redundancy, Diversity, and Hardening, *IEEE Conference on Industrial Internet (ICII)*, Bellevue, WA, 2018.
31. A. Mitra, **W. Abbas**, and S. Sundaram, On the Impact of Trusted Nodes in Resilient Distributed State Estimation of LTI Systems, *57th IEEE Conference on Decision and Control (CDC)*, Miami, FL, 2018.
32. H. Jaleel and **W.Abbas**, A Connectivity Preserving Framework for Distributed Motion Coordination in Proximity Networks, *American Control Conference (ACC)*, Milwaukee, WI, 2018.
33. M. Haque, **W. Abbas**, A. Rafter, and J. Adams, Efficient Topological Distances and Comparable Metric Ranges, *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, Vancouver, Canada, 2017.
34. **W. Abbas**, A. Laszka, Y. Vorobeychik, and X. Koutsoukos, Improving Network Connectivity Through Trusted Nodes, *American Control Conference (ACC)*, Seattle, WA, 2017.
35. **W. Abbas**, P. Sela, S. Amin, and X. Koutsoukos, Resilient Sensor Placement for Fault Localization in Water Distribution Networks, *8th ACM/IEEE International Conference on Cyber-Physical Systems (ICCPS)*, Pittsburgh, PA, 2017.
36. **W. Abbas**, A. Laszka, and X. Koutsoukos, Graph-theoretic Approach for Increasing Participation in Social Sensing, *2nd International Workshop on Social Sensing (SocialSens)*, Pittsburgh, PA, 2017.
37. A. Laszka, **W. Abbas**, Y. Vorobeychik, and X. Koutsoukos, Synergic Security for Smart Water Networks: Redundancy, Diversity, and Hardening, *3rd International Workshop on Cyber-Physical Systems for Smart Water Networks (CySWater)*, Pittsburgh, PA, 2017.
38. A. Ghafouri, **W. Abbas**, A. Laszka, Y. Vorobeychik, and X. Koutsoukos, Optimal Thresholds for Anomaly-Based Intrusion Detection in Dynamical Environments, *7th International Conference on Decision and Game Theory for Security (GameSec)*, pp. 415–434, New York, NY, 2016.
39. A. Ghafouri, **W. Abbas**, Y. Vorobeychik, and X. Koutsoukos, Vulnerability of Fixed-Time Control of Signalized Intersections to Cyber-Tampering, *9th International Symposium on Resilient Control Systems (ISRCS)*, Chicago, IL, 2016.
40. A. Laszka, **W. Abbas**, S. Sastry, Y. Vorobeychik, and X. Koutsoukos, Optimal Thresholds for Intrusion Detection Systems, *Proceedings of the Symposium and Bootcamp on the Science of Security (HotSoS)*, pp. 72–81, Pittsburgh, PA, 2016.
41. **W. Abbas**, P. Sela, S. Amin, and X. Koutsoukos, An Efficient Approach to Fault Identification in Urban Water Networks Using Multi-Level Sensing, In *Proceedings of the 2nd ACM International Conference on Embedded Systems for Energy-Efficient Built Environments (BuildSys)*, pp. 147–156, Seoul, South Korea, 2015.
42. **W. Abbas**, A. Laszka, Y. Vorobeychik, and X. Koutsoukos, Scheduling Intrusion Detection Systems in Resource-Bounded Cyber-Physical Systems, In *Proceedings of the 1st ACM Workshop on Cyber-Physical Systems Security and Privacy (CPS-SPC)*, pp. 55-66, Denver, CO, 2015.
43. **W. Abbas**, S. Bhatia, and X. Koutsoukos, Guarding Networks through Heterogeneous Mobile Guards, *American Control Conference (ACC)*, Chicago, IL, 2015.
44. **W. Abbas**, S. Bhatia, Y. Vorobeychik, and X. Koutsoukos, Immunization against Infection Propagation In Heterogeneous Networks, *13th IEEE International Symposium on Network Computing and Applications (NCA)*, Cambridge, MA, 2014.

45. **W. Abbas**, Y. Vorobeychik, and X. Koutsoukos, Resilient Consensus Protocol in the Presence of Trusted Nodes, *7th IEEE International Symposium on Resilient Control Systems (ISRCS)*, Denver, CO, 2014.
46. **W. Abbas**, H. Jaleel, M. Egerstedt, Energy-Efficient Data Collection in Heterogeneous Wireless Sensor and Actor Networks, *IEEE Conference on Decision and Control (CDC)*, Florence, Italy, 2013.
47. **W. Abbas**, M. Egerstedt, Distribution of Agents with Multiple Capabilities in Multiagent Networks - A Graph Theoretic View, *IEEE Conference on Decision and Control (CDC)*, Maui, HI, 2012.
48. A. Y. Yazicioglu, **W. Abbas**, M. Egerstedt, A Tight Lower Bound on the Controllability of Networks with Multiple Leaders, *IEEE Conference on Decision and Control (CDC)*, Maui, HI, 2012.
49. **W. Abbas**, M. Egerstedt, Robust Topologies for Networked Systems, *IFAC Workshop on Distributed Estimation and Control in Networked Systems (NecSys)*, Santa Barbara, CA, 2012.
50. **W. Abbas**, M. Egerstedt, Securing Multiagent Systems against a Sequence of Intruder Attacks, *American Control Conference (ACC)*, Montreal, Canada, 2012.
51. **W. Abbas**, M. Egerstedt, Distribution of Agents in Heterogeneous Multiagent Systems, *50th IEEE Conference on Decision and Control (CDC)*, Orlando, FL, 2011.
52. **W. Abbas**, M. Egerstedt, Hierarchical Assembly of Leader-Asymmetric, Single-Leader Networks, *American Control Conference (ACC)*, San Francisco, CA, 2011.

Teaching Certificate

Georgia Institute of Technology, Atlanta Mar. 2014

- **Tech to Teaching: Higher Education Pathway Advanced Certificate**
  The certificate was awarded by the Georgia Institute of Technology after the completion of a program consisting of 12 credit hours of relevant course work and practical training at the Center for Teaching and Learning (CTL). The program focused on learning knowledge and skills necessary to create learner-centered classrooms, design courses, and mentor students.

Teaching Experience

Vanderbilt University, Nashville, TN USA

- **Instructor**
  CS 2212 – Discrete Structures Fall 2019

Information Technology University, Lahore, Pakistan

- **Instructor**
  EE 540 – Linear Control Systems Fall 2017, Fall 2018
  EE 571 – Networked Control Systems Spring 2018, Spring 2019

Vanderbilt University, Nashville, TN USA

- **Co-instructor**
  CS 396 – Security in Cyber-physical Systems Spring 2015

Georgia Institute of Technology, Atlanta, GA USA

- **Co-instructor**
  CETL 8000 – ECE Graduate Teaching Assistant Preparation Fall 2013
- **Teaching Assistant**
  ECE 3085 – Introduction to Systems and Control Spring 2012

ECE 8823 – Network Control Systems Fall 2011
ECE 6550 – Fourier Techniques and Signal Analysis Fall 2010

University of Engineering and Technology, Lahore, Pakistan

- **Instructor**
  EE 599c – Network Control Systems Spring 2014
- **Lab Instructor / Teaching Assistant**
  EE 440 – Digital Signal Processing Fall 2008
  EE 453 – Power Electronics Spring 2008

Referee Services

- **Journals**
  Automatica (Elsevier)
  IEEE Transactions on Automatic Control,
  IEEE Transactions on Control of Network Systems,
  IEEE Transactions on Robotics
  IEEE Transactions on Emerging Topics in Computing,
  IEEE Systems Journal,
  ACM Transactions on Cyber-Physical Systems
  IET Wireless Sensor Systems
  Journal of Discrete Event Dynamic Systems (Springer),
  Journal of Intelligent and Robotic Systems (Springer),
  OR Spectrum (Springer),
  Computers and Electrical Engineering (Elsevier),
  Nonlinear Analysis and Hybrid Systems (Elsevier),
- **Conferences**
  Member TPC: The 2nd and 3rd IEEE International Conferences on Cyber Security of Smart Cities, Industrial Control System and Communications (SSIC) in 2016 (Paris) and 2018 (Shanghai) respectively.

  Member TPC: Workshop on Security issues in Cyber-Physical System(SecCPS) (in conjunction with 19th IEEE HASE), 2019, Hangzhou, China.

  Reviewer: IEEE Conference on Decision and Control (CDC), American Control Conference (ACC), IEEE International Conference on Automation Science and Engineering (CASE), IEEE Global Communications Conference (GLOBECOM), European Conference on Wireless Sensor Networks (EWSN), IEEE Conference on Control Technology and Applications (CCTA), IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS).

References

- **Dr. Magnus Egerstedt**
  Professor at the School of Electrical and Computer Engineering,
  Georgia Institute of Technology, Atlanta, GA USA.
  E-mail: magnus@gatech.edu
- **Dr. Xenofon D. Koutsoukos**
  Professor of Computer Science, Electrical, and Computer Engineering,
  Vanderbilt University, Nashville, TN USA.
  E-mail: xenofon.koutsoukos@vanderbilt.edu
- **Dr. Saurabh Amin**
  Professor at the Department of Civil and Environmental Engineering,
  Massachusetts Institute of Technology, Cambridge, MA USA.
  E-mail: amins@mit.edu