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Eman Hammad, Ph.D.

∗ Canadian Citizen

Research Interests

My research is in the general area of cyber-physical security, resilience and data privacy. This research lies at the intersection of communication, distributed intelligence & control, cybersecurity, privacy and physical system dynamics. My research interests include: cyber-physical security modeling and analysis, resilience and trust, risk-aware operation, privacy-enabled operation and resilience-by-design. Application areas of interest include: critical infrastructure systems such as smart grids and intelligent transportation, Industrial Control Systems, Internet of Things (IoT) and smart cities.

Education

Ph.D. in Electrical & Computer Engineering - Jun. 2018.
- Institute: University of Toronto, Toronto, ON, Canada
- Dissertation: "Cyber-Physical Modeling and Analysis for Smart Grids: Resiliency & Cyber Security"
- Advisor: Prof. Deepa Kundur

M.Sc. in Electrical Engineering - Dec. 2011.
- Institute: Texas A&M University, College Station, TX, USA
- Thesis: "Exploiting Reconfigurable Antennas in Communication Systems with Delay-Sensitive Applications."
- Advisor: Prof. Jean-Francois Chamberland

Bachelor's degree in Electrical Engineering - Jun. 2000.
- Institute: University of Jordan, Amman, Jordan

Professional Appointments/Employment

1/2020–present **Assistant Professor**, *Texas A&M University - Commerce/RELLIS*, College Station, TX, USA.
- Assistant Professor of Computer Science - Cybersecurity.

1/2018–1/2020 **Cyber-Physical Security and Resilience Specialist**, *PricewaterhouseCoopers LLP (PwC)*, Toronto, ON, Canada.
- Advise on Industrial & IIoT cyber-physical security.

2/2018–12/2019 **Visiting Researcher**, *University of Toronto*, Toronto, ON, Canada.
- Investigate cyber-physical resilience of wide area monitoring and control in large power systems.

1/2013–12/2017 **Research Assistant**, *University of Toronto*, Toronto, ON, Canada.
- Investigate trust and risk to to understand and improve cyber-physical resilience of power systems.

6/2009–12/2012 **ICT Infrastructure and Applications Engineer - part time**, *Texas A&M University-Electrical and Computer Engineering Department*, College Station, TX, USA.
- Design, implement and administer the department's computing environment including virtualization, infrastructure services, security solutions and web applications.

6/2000–8/2008 **Systems Engineer**, Amman, Jordan.

- University of Jordan - Computer Center, National Electricity Power Company - NEPCO, Future Applied Computer Technology - FACT.
- Lead the design, development and implementation of an online banking solution using N-tier architecture and J2EE. The developed solution architecture integrated many secure-by-design elements.

Select Awards, Recognition, and Honors

PwC Cybersecurity & Privacy Champions, 9/2019.

IEEE Communication Society Chapter Achievement Award, 12/2018.

Featured by University of Toronto's Convocation Stories, Metro Morning, CBC National, 06/2018.

Research featured on the Smart Cybersecurity Network (SERENE-RISC) Quick Take blog, 2017.

Ontario Graduate Scholarship (OGS), 2015, 2016, 2017.

C.W. Bowman Graduate Scholarship, 2016.

Shahid U.H. Qureshi Memorial Scholarship, 2016

Best Paper Award - IEEE International Conference on Smart Grid Communications (SmartGridComm 2015), 2015.

Best Poster Award - ISE Institute for Sustainable Energy Research Symposium, 2014.

Hatch Graduate Scholarship for Sustainable Energy Research, 2014.

Pinnacle National Honor Society, 2012.

Texas A&M Graduate Teaching Academy Fellowship, 2011

Select Publications

[S1] **Eman Hammad**, "Resilient Cooperative Microgrid Networks", accepted at *IEEE Transactions on Industrial Informatics*.

[S2] **Eman Hammad**, Abdallah Farraj, and Deepa Kundur, "On Cyber-Physical Coupling and Distributed Control in Smart Grids", accepted at *IEEE Transactions on Industrial Informatics*.

[S3] **Eman Hammad**, Mellitus Ezme and Abdallah Farraj, "Implementation and development of an offline co-simulation testbed for studies of power systems cyber security and control verification", *International Journal of Electrical Power & Energy Systems*, 2019.

[S4] Abdallah Farraj, **Eman Hammad**, and Deepa Kundur, "A Storage-Based Multiagent Regulation Framework for Smart Grid Resilience", *IEEE Transactions on Industrial Informatics*, 2018.

[S5] **Eman Hammad**, Abdallah Farraj, and Deepa Kundur, "On Effective Virtual Inertia of Storage-Based Distributed Control for Transient Stability", *IEEE Transactions on Smart Grid*, 2017.

[S6] **Eman Hammad**, Ahmed Khalil, Abdallah Farraj, Deepa Kundur, and Reza Iravani "A Class of Switching Exploits Based on Inter-Area Oscillations", *IEEE Transactions on Smart Grid*, 2017.

[S7] Abdallah Farraj, **Eman Hammad**, and Deepa Kundur, "On the Impact of Cyber Attacks on Data Integrity in Storage-Based Transient Stability Control", *IEEE Transactions on Industrial Informatics*, vol. 13, no. 6, pp. 3322–3333, December 2017.

[S8] Abdallah Farraj, **Eman Hammad**, and Deepa Kundur, "A Cyber-Physical Control Framework for Transient Stability in Smart Grids", *IEEE Transactions on Smart Grid*, vol. 7, no. 4, pp. 1856–1865, July 2016.

[S9] Abdallah Farraj, **Eman Hammad**, Ashraf Al Daoud, and Deepa Kundur, "A Game-Theoretic Analysis of Cyber Switching Attacks and Mitigation in Smart Grid Systems", *IEEE Transactions on Smart Grid*, vol. 7, no. 4, pp. 1846–1855, July 2016.

[S10] **Eman Hammad**, Abdallah Farraj, and Deepa Kundur, "Fundamental Limits on Communication Latency for Distributed Control via Electromechanical Waves", *IEEE International Conference on Communications (ICC)*, pp. 1–6, Paris, France, 23 May 2017.

[S11] Abdallah Farraj, **Eman Hammad**, and Deepa Kundur, "Impact of Cyber Attacks on Data Integrity in Transient Stability Control", *Workshop on Cyber-Physical Security and Resilience in Smart Grids (CPSR-SG)*, pp. 29–34, Pittsburgh, PA, USA, 21 April 2017.

[S12] **Eman Hammad**, Jinjing Zhao, Abdallah Farraj, and Deepa Kundur, "Mitigating Link Insecurities in Smart Grids via QoS Multi-Constraint Routing", *IEEE International Conference on Communications (ICC)*, pp. 380–386, Kuala Lumpur, Malaysia, 23–27 May 2016.

[S13] Abdallah Farraj, **Eman Hammad**, and Deepa Kundur, "A Systematic Approach to Delay-Adaptive Control Design for Smart Grids", *IEEE International Conference on Smart Grid Communications (SmartGridComm)*, pp. 768–773, Miami, FL, USA, 2–5 November 2015 [**Best Paper Award**].

[S14] **Eman Hammad**, Ahmed Khalil, Abdallah Farraj, Deepa Kundur, and Reza Iravani "Tuning Out of Phase: Resonance Attacks", *IEEE International Conference on Smart Grid Communications (SmartGridComm)*, pp. 491–496, Miami, FL, USA, 2–5 November 2015.

Invited Talks & Panels

- "*IoT Cybersecurity & Privacy: Orchestrating Trust in a Hyber-connected World*", invited talk at the Canadian Women in Cybersecurity Conference, Toronto, ON, Mar. 2020.
- "*Engineering a Cyber-Resilient Smart Grid*", invited talk at 2019 4th Canadian Protection Symposium, Toronto, ON, Dec. 2019.
- "*Engineering a Cyber-Resilient Smart Grid*", invited talk at 2019 ICS Cybersecurity Conference, Atlanta, GA, Oct. 2019.
- "*Opportunities for Women in Cybersecurity*", invited talks at University of Toronto and York University, Toronto, ON, May & Mar. 2019.
- "*Resilient Power Systems in the Age of Data and Connectivity: Risk-Aware Operation & Trust*", invited talk at York University, Toronto, ON, Apr. 2019.
- "*Cities That We Can Trust*" key note at the Smart City & IoT Expo, Toronto, ON, Oct. 2018.
- "*Cyber Security Strategies and Trends*" panel at the Smart City & IoT Expo, Toronto, ON, Oct. 2018.
- "*Resilient Smart Grid Systems: A Cyber-Physical Perspective*" at the Information Security Forum (ISF), Toronto, ON, Sep. 2018.
- "*Cyber Security of Autonomous Vehicles and Resilience of Transformative Transportation Systems*" at the University of Toronto iCity Centre for Automated and Transformative Transportation Systems (iCity-CATTS), Toronto, ON, Feb. 2018.

Select Professional and Extracurricular Activities

Chairs.

- General Co-Chair; IEEE 5G World Forum - Security Topical Track (Sep.-Oct. 2019).
- General Co-Chair; IEEE Toronto 5G Innovations in Communications Summit (August. 2019).
- General Co-Chair; IEEE Toronto 5G Summit (Nov. 2015).
- Chair; IEEE Toronto Communication Society (2014–present).

Board & Professional Committees.

- IEEE ComSoc Industry Outreach Board (Oct. 2019–present).
- IEEE Future Networks INGR Roadmap Leadership (Jun. 2019–present).

Organizing Committee.

- IEEE 86th Vehicular Technology Conference (VTC 2017), Toronto – Canada, Sep. 2017.
- IEEE International Humanitarian Technology Conference (IHTC 2016), Toronto – Canada, 2016.

Extracurricular.

- Member of the PwC Staff Council 2019.
- IEEE Toronto ComSoc Chapter Chair 2014–present.
- iConnect mentor for 2014–2015 with the University of Toronto Centre for International Experience.
- Residence Advisor at the University of Toronto Student Family Housing 2013-2016.
- iLead leadership Institute participant in leadership certification programs 2013–2014.