LUAN V. NGUYEN
Curriculum Vitae

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--------------- **EDUCATION**

Spring 2018   **Ph.D., Computer Engineering**, *University of Texas at Arlington*, Arlington, TX
- **Dissertation**: *Cyber-Physical System: from Specification Analysis to Verification*
- **Adviser**: Taylor T. Johnson
- **GPA**: 4.00/4.00

12/2012   **M.Sc., Computer Science,** *The Catholic University of America*, Washington, DC

5/2012   **B.Sc., Electrical Engineering**, *The Catholic University of America*, Washington, DC

--------------- **RESEARCH INTEREST**

- Model-based Design and Formal Verification for Cyber-Physical Systems
- Safe Autonomy
- Cyber Security and Privacy,
- Information Flow Analysis
- Software Safety and Reliability
- Logic-guided Testing and Specification Mining

--------------- **RESEARCH EXPERENCE**

8/2020 - now   **Assistant Professor**, *Department of Computer Science*, *University of Dayton,* Dayton, OH
- Performing research on model-based design, safe control, formal verification, and cyber security of autonomous cyber-physical systems. Teaching undergraduate and graduate courses. Writing grant proposals. Running a research lab and mentoring students to conduct research in CPS.

9/2019-7/2020   **Postdoctoral Research Associate**, *University of Notre Dame,* Notre Dame, IN
- Worked with Prof. Vijay Gupta the Electrical Department and Environmental Change Initiative to conduct research on topics including formal methods for learning and game theory.

6/2018-8/2019   **Postdoctoral Research Associate**, *Precise Center, University of Pennsylvania*, Philadelphia, PA
- Worked with Prof. Rajeev Alur to develop techniques and software tools to 1) facilitate integration of evolving resiliency requirements in model-based design and verification of hybrid systems 2) perform safety verification of cyber-physical systems with machine learning components.

1/2014-5/2018   **Research Assistant**, *University of Texas at Arlington*, Arlington, TX
- Worked with Prof. Taylor T. Johnson to conduct research on formal verification and system testing for cyber-physical systems, hybrid systems and distributed systems.

Summer 2017   **Researcher at Summer of Innovation Event**, *Air Force Research Lab & Wright Brothers Institute,* Dayton, OH
- Developed a new class of requirements for UxAS, a software system architecture that enables autonomous capabilities on-board unmanned systems; and added a new service in UxAS to enable mission planning with timing constraints, resulting in paper [C6].

Spring 2017 **Researcher Co-op**, *Toyota Motor North America Research & Development*, Gardena, CA
- Researched with the Model-Based Design group to develop and apply a new falsification technique to check hyperproperties of complex automotive control systems, resulting in paper [C4].

Spring 2016 **Researcher Co-op**, *Toyota Motor North America Research & Development*, Gardena, CA
- Researched with the Model-Based Design group to develop and apply time-frequency logic to capture abnormal behaviors of different types of automotive signals, resulting in paper [C3].

-------------- **AWARDS AND HONORS**

2019 **Best Paper Award** for the paper "Detecting Security Leaks in Hybrid Systems with Information Flow Analysis," in 17th ACM-IEEE International Conference on Formal Methods and Models for System Design (MEMOCODE 2019), San Diego, October 2019.

2019 **Postdoctoral Fellowships Award** provided by the *Notre Dame Environmental Change Initiative* for the proposal: "*Safe and Secure Model-Based Design for Engineered systems*", October 2019.

2017 **Toyota Travel Award** for paper presentation at 20th ACM International Conference on Hybrid Systems: Computation and Control 2017 (HSCC 2017), Pittsburgh, PA, April 2017.

2015 **NSF Travel Award** for PhD Student Forum, in 15th International Conference on Formal Methods in Computer-Aided Design (FMCAD), Austin, TX.

2015 **NSF and ACM SIGBED Travel Awards** for Cyber-Physical Systems Week (CPSWeek 2015), Seattle, WA.

2014 **NSF Travel Award** for CPS Verification and Validation: Industrial Challenges and Foundations (CPS V&V I&F), Carnegie Mellon University, Pittsburgh, PA.

2014 **3rd Place Winner and $1000 Award** in US/India Chamber DFW (USICOC) Spirit of Innovation Competition, Dallas, TX.

-------------- **SOFTWARE TOOLS**

REAFFIRM: Model-Based Repair of Hybrid Systems for Improving Resiliency (*main developer*)
HyRG: A Random Generation Tool for Affine Hybrid Automata (*main developer*)
NNV: A MATLAB Toolbox for Neural Network Verification (*contributor*)
Hynger: A Prototype toward Identifying Cyber-Physical Specification Mismatches (*contributor*)
HyST: A Source Transformation and Translation Tool for Hybrid Automaton Models (*contributor*)

-------------- **PUBLICATIONS**

Papers Submitted

[S4] **Luan Viet Nguyen**, Gautam Mohan, James Weimer, Oleg Sokolsky, Insup Lee, and Rajeev Alur, "REAFFIRM: Model-Based Repair of Hybrid Systems for Improving Resiliency," in 18th ACM ACM-IEEE International Conference on Formal Methods and Models for System Design (MEMOCODE 2020).

[S3] **Luan Viet Nguyen**, Hoang Dung Tran, Taylor T. Johnson, and Vijay Gupta, "Decentralized Safe Control for Distributed Cyber-Physical Systems using Real-time Reachability Analysis," IEEE Transactions on Control of Network Systems.

[S2] Omar Beg, **Luan Viet Nguyen**, Taylor T. Johnson, and Ali Davoudi, "Anomaly Detection in DC and AC Microgrids Using Parametric Time-frequency Logic," IEEE Transactions on Smart Grid.

[S1] **Luan Viet Nguyen** and Vijay Gupta, "Resilient Operation of Cyber-physical Systems with Unknow Dynamics" ACM Transactions on Cyber-Physical Systems (TCPS).

Journal Articles

[J6] Hoang Dung Tran, **Luan Viet Nguyen**, Patrick Musau, Weiming Xiang, and Taylor T. Johnson, "Real-Time Verification for Distributed Cyber-Physical Systems," Logical Methods in Computer Science, Special Issue, 2019 (invited paper). [link]

[J5] Stanley Bak, Omar Ali Beg, Sergiy Bogomolov, Taylor T. Johnson, **Luan Viet Nguyen**, and Christian Schilling, "Hybrid Automata: from Verification to Implementation," International Journal on Software Tools for Technology Transfer (2019) Springer, February 2019 (impact factor 1.62). [link]

[J4] **Luan Viet Nguyen**, Khaza Anuarul Hoque, Stanley Bak, Steven Drager, and Taylor T. Johnson, "Cyber-Physical Specification Mismatches," ACM Transactions on Cyber-Physical Systems (TCPS), September 2018. [link]

[J3] Omar Beg, **Luan Viet Nguyen**, Taylor T. Johnson and Ali Davoudi, "Signal Temporal Logic-based Attack Detection in DC Microgrids," IEEE Transactions on Smart Grid, 2017 (impact factor 6.65). [link]

[J2] Hoang Dung Tran, **Luan Viet Nguyen**, Weiming Xiang, and Taylor T. Johnson, "An Automatic Order-Reduction Abstraction for Safety Verification of Periodically Switched Systems," Springer Discrete Event Dynamic Systems, Special Issue on Formal Methods in Control, February 2017 (impact factor 1.66). [link]

[J1] **Luan Viet Nguyen**, Hoang-Dung Tran, and Taylor T. Johnson, "Virtual Prototyping for Distributed Control of a Fault-Tolerant Modular Multilevel Inverter for Photovoltaics," in IEEE Transactions on Energy Conversion, vol. 29, pp. 841-850, December 2014 (impact factor 3.81). [link]

Conference Proceeding Papers

[C14] Hoang-Dung Tran, Xiaodong Yang, Diego Manzanas Lopez, Patrick Musau, **Luan Viet Nguyen**, Weiming Xiang, Stanley Bak and Taylor T. Johnson, "NNV: A Tool for Verification of Deep Neural Networks and Learning-Enabled Cyber-Physical Systems," in 32nd International Conference on Computer-Aided Verification (CAV), 2020, July. [link]

[C13] **Luan Viet Nguyen**, Gautam Mohan, James Weimer, Oleg Sokolsky, Insup Lee, and Rajeev Alur, "Detecting Security Leaks in Hybrid Systems with Information Flow Analysis," in 17th ACM-IEEE International Conference on Formal Methods and Models for System Design (MEMOCODE 2019), San Diego, October 2019. [link] (**Best Paper Award**) (acceptance rate: 35%)

[C12] Hoang Dung Tran, Patrick Musau, Manxanas Lopez Diego, Xiao Dong Yang, **Luan Viet Nguyen**, Weiming Xiang, and Taylor T. Johnson, "Star-Based Reachability Analysis of Deep Neural Networks," in 23rd International Symposium on Formal Methods (FM 2019), Portugal, October 2019. [link] (acceptance rate: 30%)

[C11] Hoang Dung Tran, **Luan Viet Nguyen**, Weiming Xiang, and Taylor T. Johnson, "Reachability Analysis for High-Index Large Linear Differential Algebraic Equations," in 17th International Conference on Formal Modeling and Analysis of Timed Systems (FORMAT 2019), Amsterdam, August 2019. [link] (acceptance rate: 40%)

[C10] Hoang Dung Tran, **Luan Viet Nguyen**, Patrick Musau, Weiming Xiang, and Taylor T. Johnson, "Decentralized Real-Time Safety Verification for Distributed Cyber-Physical Systems," in 39th International Conference on Formal Techniques for Distributed Objects, Components, and Systems (FORTE 2019), Denmark, June 2019. [link] (acceptance rate: 42%)

[C9] Hoang Dung Tran, Patrick Musau, Manxanas Lopez Diego, Xiao Dong Yang, **Luan Viet Nguyen**, Weiming Xiang, and Taylor T. Johnson, "Parallelizable Reachability Analysis Algorithms for Feed-Forward Neural Networks," in 7th International Conference on Formal Methods in Software Engineering (FORMALISE 2019) , Montreal, May 2019 (acceptance rate: 28%). [link]

[C8] **Luan Viet Nguyen**, Bardh Hoxha, Georgios Fainekos and Taylor T. Johnson, "Mission Planning for Multiple Unmanned Vehicles using UxAS," in IFAC Conference on Analysis and Design of Hybrid Systems, (ADHS 2018), Oxford, July 2018. [link]

[C7] Omar Beg, **Luan Viet Nguyen**, Taylor T. Johnson and Ali Davoudi, "Computer-Aided Formal Verification of Power Electronics Circuits," in Frontiers in Analog CAD, Proceedings of, pp. 1-6. VDE, Frankfurt, July 2017. [link]

[C6] **Luan Viet Nguyen**, James Kapinski, Xiaoqing Jin, Jyotirmoy Deshmukh, and Taylor T. Johnson, "Hyperproperties of Real-Valued Signals," in 15th ACM-IEEE International Conference on Formal Methods and Models for System Design (MEMOCODE 2017), Vienna, October 2017 (acceptance rate: 46%). [link]

[C5] **Luan Viet Nguyen**, James Kapinski, Xiaoqing Jin, Jyotirmoy Deshmukh, Ken Butts, and Taylor T. Johnson, "Abnormal Data Classification Using Time-Frequency Temporal Logic," in 20th ACM International Conference on Hybrid Systems: Computation and Control 2017 (HSCC 2017), Pittsburgh, April 2017 (acceptance rate: 38%). [link]

[C4] Parasara Sridhar Duggirala, Chuchu Fan, Matthew Potok, Bolun Qi, Sayan Mitra, Mahesh Viswanathan, Stanley Bak, Sergiy Bogomolov, Taylor T. Johnson, **Luan Viet Nguyen**, Christian Schilling, Andrew Sogokon, Hoang-Dung Tran, and Weiming Xiang, "Tutorial: Software Tools for Hybrid Systems Verification, Transformation, and Synthesis: C2E2, HyST, and TuLiP," In Proceedings of the IEEE Multi-Conference on Systems and Controls (MSC 2016), Las Vegas, September 2016. [link]

[C3] **Luan Viet Nguyen**, Christian Schilling, Sergiy Bogomolov, and Taylor T. Johnson, "Runtime Verification for Hybrid Analysis Tools," in 15th International Conference on Runtime Verification (RV 2015), Vienna, September 2015 (acceptance rate: 51%). [link]

[C2] **Luan Viet Nguyen**, Christian Schilling, Sergiy Bogomolov, and Taylor T. Johnson, "HyRG: A Random Generation Tool for Affine Hybrid Automata," in 18th International Conference on Hybrid Systems: Computation and Control (HSCC 2015), Seattle, April 2015. [link]

[C1] **Luan Viet Nguyen**, Eric Nelson, Amol Vengurlekar, Ruoshi Zhang, Kristopher I White, Victor Salinas, and Taylor T. Johnson, "Model-Based Design and Analysis of a Reconfigurable Continuous-Culture Bioreactor (Work-in-Progress)," in 4th ACM Conference on Model-Based Design of Cyber-Physical Systems (Cyphy 2014), Berlin, Germany, April 2014. [link]

Workshop Proceeding Papers

[W5] Hoang-Dung Tran, **Luan Viet Nguyen**, Weiming Xiang and Taylor T. Johnson, "Distributed Autonomous Systems (Benchmark Proposal)," in 4th International Workshop on Applied Verification for Continuous and Hybrid Systems (ARCH 2017), Pittsburgh, PA, April 2017. [link]

[W4] Hoang-Dung Tran, **Luan Viet Nguyen**, and Taylor T. Johnson, "Large-Scale Linear Systems from Order-Reduction (Benchmark Proposal)," in 3rd International Workshop on Applied Verification for Continuous and Hybrid Systems (ARCH 2016), Vienna, Austria, April 2016. [link]

[W3] **Luan Viet Nguyen**, Djordje Maksimovic, Taylor T. Johnson, and Andreas Veneris, "Quantified Bounded Model Checking for Rectangular Hybrid Automata," in 9th International Workshop on Constraints in Formal Verification (CFV 2015), Austin, TX, November 2015. [link]

[W2] Hoang-Dung Tran**, Luan Viet Nguyen**, and Taylor T. Johnson, "Benchmark: A Nonlinear Reachability Analysis Test Set from Numerical Analysis," in 2nd International Workshop on Applied Verification for Continuous and Hybrid Systems (ARCH 2015), Seattle, WA, April 2015. [link]

[W1] **Luan Viet Nguyen** and Taylor T. Johnson, "Benchmark: DC-to-DC Switched-Mode Power Converters (Buck Converters, Boost Converters, and Buck-Boost Converters)," in 1st International Workshop on Applied Verification for Continuous and Hybrid Systems Workshop (ARCH 2014), Berlin, Germany, April 2014. [link]

Posters

[P3] **Luan Viet Nguyen**, James Kapinski, Xiaoqing Jin, Jyotirmoy Deshmukh, and Taylor T. Johnson, "Hyperproperties of Real-Valued Signals," Hybrid Systems Computation and Control 2017 (HSCC 2017), Pittsburgh, PA, April 2017.

[P2] **Luan Viet Nguyen**, and Taylor T. Johnson, "Towards Bounded Model Checking for Timed and Hybrid Automata with a Quantified Encoding," in PhD Student Forum, 15th International Conference on Formal Methods in Computer-Aided Design (FMCAD), Austin, TX, September 2015.

[P1] **Luan Viet Nguyen** and Taylor T. Johnson, "Model-Based Design and Analysis of a Continuous Culture Bioreactor for Systems Biology Experiments," Texas Systems Day, Texas A&M University, College Station, TX, March 2014.

Patent

[Q1] Jyotirmoy Deshmukh, James Kapinski, Xiaoqing Jin, and **Luan Viet Nguyen**, "Privacy-Aware Signal Monitoring Systems and Methods," Patent No. US 20180286143, April 2018. [link]

-------------- **PRESENTATIONS**

[T9] Invited presentation, "Verifying Information Flow of Cyber-Physical Systems", Missouri Science and Technology, Missouri, April 2020.

[T8] Presented paper [C13], "Detecting Security Leaks in Hybrid Systems with Information Flow Analysis," in 19th ACM-IEEE International Conference on Formal Methods and Models for System Design (MEMOCODE 2019), San Diego, October 2019.

[T7] Invited presentation, "Specification Learning for Autonomous Cyber-Physical Systems", University of Notre Dame, Indiana, June 2019.

[T6] Invited presentation, "Specification-Driven Analysis of Cyber-Physical Systems," New Mexico Tech, New Mexico, April 2019.

[T5] Invited presentation, "Specifications of Cyber-Physical Systems," University of Massachusetts Lowell, Lowell, MA, March 2018.

[T4] Invited presentation, "Cyber-physical System: from Specification Inference to Design Analysis," Galois, Inc., Portland, Oregon, September 2017.

[T3] Presented paper [C3], "Abnormal Data Classification Using Time-Frequency Temporal Logic," Hybrid Systems Computation and Control 2017 (HSCC 2017), Pittsburgh, PA, April 2017.

[T2] Presented "Towards Bounded Model Checking for Timed and Hybrid Automata with a Quantified Encoding," in PhD Student Forum, 15th International Conference on Formal Methods in Computer-Aided Design (FMCAD), Austin, TX, September 2015.

[T1]   Presented paper [W1], "Model-Based Design and Analysis of a Continuous Culture Bioreactor for Systems Biology Experiments," ACES, March 2014, Arlington, TX.

--------------- **TECHNICAL SKILLS**

Programming Languages: Matlab, Python, Java, C++
Verification Tools: SpaceEx, Flow*, dReach, UPPAAL
Model Checkers & SMT Solvers: NuSMV, HyComp, Spin, Z3, dReal
Falsification Tools: Breach, S-TaLiRo
Misc.: Simulink/Stateflow, Latex, Git, Mercurial, Pytorch, TensorFlow

--------------- **TEACHING EXPERENCE**

2014-2017   **Teaching Assistant**, *University of Texas at Arlington*, Arlington, TX
- Computer operating systems (CSE3320), Fall 2017 and Spring 2018. Contributed to develop the course content including homework, exams and programming assignments, held office hours.
- Object-oriented programming (CSE1325), Spring 2014 to Spring 2015. Led discussion sections on programming in Java, managed office hours, contributed to design exam and homework, graded tests and programming assignments, substituted instructors to give lectures.

--------------- **PROFESSIONAL ACTIVITES**

2014-   **Student Member,** Institute of Electrical and Electronics Engineers (IEEE).
2014-   **Student Member,** Association for Computing Machinery (ACM).
2015-   **Reviewer**
- IEEE International Conference on Software Testing, Verification and Validation.
- IEEE Real-Time Systems Symposium (RTSS) 2015, 2017.
- ACM SIGBED International Conference on Embedded Software (EMSOFT) 2016, 2017, 2018.
- ACM Transaction on Cyber Physical System (TCPS) 2017.
- ACM International Conference on Hybrid Systems: Computation and Control (HSCC) 2016, 2017, 2018.
- ACM International Conference on Cyber-Physical Systems (ICCPS) 2018.
- Proceedings of the IEEE 2017.
- American Control Conference 2018, 2020.
- ACM International Conference on Hybrid Systems: Computation and Control (HSCC) 2020.
- ACM 32nd International Conference on Computer-Aided Verification (CAV) 2020.
- IEEE Transactions on Power Electronics 2020