

Sibin Mohan

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Current Position

2016 – curr. **Research Assistant Professor.** Dept. of Computer Science and Information Trust Institute.
University of Illinois at Urbana-Champaign (UIUC)

Education

2008 **PhD** North Carolina State University. Computer Science.
2004 **MS** North Carolina State University. Computer Science
2001 **BE** PES Institute of Technology, Bangalore University, India. Computer Science and Engineering.

Professional Experience

2015 – curr Research Assistant Professor. **University of Illinois at Urbana-Champaign (UIUC).**
2012 – 2015 Research Scientist. **University of Illinois at Urbana-Champaign (UIUC).**
2009 – 2011 Visiting Research Scientist. **University of Illinois at Urbana-Champaign (UIUC).**
2008 – 2009 PostDoctoral Research Associate. **University of Illinois at Urbana-Champaign (UIUC).**
2001 – 2002 Software Engineer, India Software Operations (ISO). **Hewlett Packard**, Bangalore, India.

Research Interests — Systems

Embedded Systems, Security, Cyber-Physical and Real-Time Systems, Cloud Computing, System Composition, Software Defined Networking in Critical Infrastructures, Embedded Computer Architecture, Avionics.

Publications

Refereed Journals/Book Chapters

- [RTS '16] “*Integrating Security Constraints into Fixed Priority Real-Time Schedulers*” by **S. Mohan**, M. K. Yoon, R. Pellizzoni and R. Bobba. *Real-Time Systems (RTS) Journal* 52(5): 644-674.
- [CPS-SEPG '14] “*Intrusion Detection for CPS Real-Time Controllers*” by C. Zimmer, B. Bhatt, F. Mueller and **S. Mohan**. Accepted for publication in the Springer-Verlag book *Cyber Physical Systems Approach to Smart Electric Power Grid Book Series: Understanding Complex Systems*, November 2014.
- [TECS '07] “*Parametric Timing Analysis and its Application to DVS*” by **S. Mohan**, F. Mueller, W. Hawkins, M. Root, C. Healy, D. Whalley and E. Vivancos. Published (2007) in the ACM journal *Transactions in Embedded Computing Systems (TECS)*, Vol. 10, No. 2, Dec 2010 (accepted 2007).

In Submission:

- [TECS '15] “*Learning Execution Contexts from System Call Distributions for Intrusion Detection in Embedded Systems*” by M. K. Yoon, **S. Mohan**, J. Choi, M. Christodorescu and L. Sha. Submitted to the ACM Transactions in Embedded Computing Systems (TECS) Journal.

Refereed Conferences

1. [RTSS '16] “*Exploring Opportunistic Execution for Integrating Security into Legacy Hard Real-Time Systems*” by M. Hassan, **S. Mohan**, R. Bobba and R. Pellizzoni. Accepted for publication in the *IEEE RTSS* conference, to be held in December 2016.
2. [SYSTOR '16] “*The DragonBeam Framework: Hardware-Protected Security Modules for In-Place Intrusion Detection*” by M. K. Yoon, M. Christodorescu, L. Sha and **S. Mohan**. Published in the ACM International Systems and Storage Conference (SYSTOR), June 2016.
3. [RTAS '16] “*TaskShuffler: A Schedule Randomization Protocol for Obfuscation Against Timing Inference Attacks in Real-Time Systems*” by M. K. Yoon, **S. Mohan**, C. Y. Chen and L. Sha. Published in the *IEEE RTAS* conference, April 2016. [Acceptance Rate: **27%**]
4. [CNS '15] “*Inter-Flow Consistency: A Novel SDN Update Abstraction for Supporting Inter-Flow Constraints*” by W. Liu, R. Bobba, **S. Mohan** and R. Campbell. Published in the IEEE Conference on Communications and Network Security (CNS), September 2015.
5. [DAC '15] “*Memory Heat Map: Anomaly Detection in Real-Time Systems Using Memory Behavior*” by M. K. Yoon, **S. Mohan**, J. Choi and L. Sha. Published in the *Design Automation Conference (DAC)*, June 2015. [Acceptance Rate: **20.5%**]
6. [RTAS '15] “*A Generalized Model for Preventing Information Leakage in Hard Real-Time Systems*” R. Pellizzoni, N. Paryab, M. K. Yoon, S. Bak, **S. Mohan** and R. Bobba. Published in the IEEE conference *Real-Time and Embedded Systems and Applications Symposium (RTAS)*, April 2015. [Acceptance Rate: **21%**]
7. [ECRTS '14] “*Real-Time Systems Security Through Scheduler Constraints*” by **S. Mohan**, M. K. Yoon, R. Pellizzoni and R. Bobba. Published in the *EUROMICRO Conference in Real-Time Systems (ECRTS)*, July 2014. [Acceptance Rate: **24%**]
8. [CPSNA '13] “*On-Chip Control Flow Integrity Check for Real-Time Embedded Systems*” by F. Abdi Taghi Abad, J. Van der Woude, Y. Lu, S. Bak, M. Caccamo, L. Sha, R. Mancuso and **S. Mohan**. Published in the IEEE conference on *Cyber-Physical Systems, Networks and Applications (CPSNA)*, August 2013. [Acceptance Rate: **35%**]
9. [RTAS '13] “*SecureCore: A Multicore based Intrusion Detection Architecture for Real-time Embedded Systems*” by M. Yoon, **S. Mohan**, Jaesik Choi, Jung-Eun Kim and L. Sha. Published in the IEEE conference *Real-Time and Embedded Technology and Applications Symposium (RTAS)*, April 2013. [Acceptance Rate: **29%**]
10. [HiCons'13] “*S3A: Secure System Simplex Architecture for Safety-Critical Supervisory Control Systems*” by **S. Mohan**, S. Bak, E. Betti, H. Yun, L. Sha and M. Caccamo. Published in the ACM/IEEE conference on *High Confidence Networked Systems*, April 2012. [Acceptance Rate: **49%**]
11. [DASC '10] “*Exploring the Design Space of IMA Architectures*” by R. Bradford, S. Fliginger, M. Nam, **S. Mohan**, R. Pellizzoni, C. Kim, M. Caccamo and L. Sha. Published in the *29th Digital Avionics Systems Conference (DASC)*, Oct. 2010.
12. [ICCPS '10-1] “*Time-Based Intrusion Detection in Cyber-Physical Systems*” by C. Zimmer, B. Bhatt, F. Mueller and **S. Mohan**. Published in the ACM/IEEE *International Conference on Cyber-Physical Systems (ICCPS)*, Apr. 2010. [Acceptance Rate: **28%**]
13. [ICCPS '10-2] “*A Safety Assurance Framework for Interoperable Real-Time Medical Systems over Wireless*” by C. Kim, H. Yun, M. Sun, **S. Mohan**, A. Nayeem, L. Sha and T. Abdelzaher. Published in the ACM/IEEE *International Conference on Cyber-Physical Systems (ICCPS)*, Apr. 2010. [Acceptance Rate: **28%**]
14. [RTSS '09-1] “*Rapid Early-Phase Virtual Integration*” by **S. Mohan**, M. Nam, R. Pellizzoni, L. Sha, R. Bradford and S. Fliginger. Published in the IEEE conference *Real-Time Systems Symposium (RTSS)*, Dec. 2009. [Acceptance Rate: **21%**]

15. [CASES '09] “*CheckerCore: Enhancing an FPGA Soft Core to Capture Worst-Case Execution Times*” by J. Ouyang, R. Raghavendra, **S. Mohan**, T. Zhang, Y. Xie and F. Mueller. Published in *Compilers, Architectures, and Systems for Embedded Systems (CASES)* conference, Oct. 2009. [Acceptance Rate < **30%**]
16. [LCTES '09] “*Push-Assisted Migration of Real-Time Tasks in Multi-Core Processors*” by A. Sarkar, F. Mueller, H. Ramaprasad and **S. Mohan**. Published in the *ACM Conference on Languages, Compilers and Tools for Embedded Systems (LCTES)*, June 2009. [Acceptance Rate: **22%**]
17. [RTSS '08] “*Merging State and Preserving Anomalies in Pipelines of High-End Processors*” by **S. Mohan** and F. Mueller. Published in the IEEE conference *Real-Time Systems Symposium (RTSS)*, pages 467-477, Dec. 2008. [Acceptance Rate: **23%**]
18. [ECRTS '08] “*Temporal Analysis for Adapting Concurrent Applications to Embedded Systems*” by **S. Mohan** and J. Helander. Published in the *EUROMICRO Conference on Real-Time Systems (ECRTS)*, pages 71-82, July 2008. [Acceptance Rate: **30%**]
19. [RTAS '08] “*Hybrid Timing Analysis of Modern Processor Pipelines via Hardware/Software Interactions*” by **S. Mohan** and F. Mueller. Published in the IEEE conference *Real-Time and Embedded Technology and Applications Symposium (RTAS)*, pages 285-294, April 2008. [Acceptance Rate: **25%**]
20. [RTSS '05] “*ParaScale: Exploiting Parametric Timing Analysis for Real-Time Schedulers and Dynamic Voltage Scaling*” by **S. Mohan**, F. Mueller, W. Hawkins, M. Root, C. Healy and D. Whalley. Published in the IEEE conference *Real-Time Systems Symposium (RTSS)*, pages 233-242, December 2005. [Acceptance Rate: **21%**]
21. [RTAS '05] “*Timing Analysis for Sensor Nodes of the Atmega Processor Family*” by **S. Mohan**, F. Mueller, D. Whalley and C. Healy. Published in the IEEE conference *Real-Time and Embedded Technology and Applications Symposium (RTAS)*, pages 405-414, March 2005. [Acceptance Rate: **33%**]

Refereed Workshops/Work-in-progress

1. [SENT '15] “*Inter-Flow Consistency: Novel SDN Update Abstraction for Supporting Inter-Flow Constraints*” by W. Liu, R. Bobba, S. Mohan and R. Campbell. Published in the NDSS Workshop on *Security of Emerging Networking Technologies (SENT)* held in San Diego, Feb. 2015.
2. [ECRTS '10] “*Anytime Algorithms for Multi-core Architectures*” by A. Saba, **S. Mohan** and R. Mangharam. Published in the Work in Progress session of *EUROMICRO Conference on Real-Time Systems (ECRTS)* held in Brussels, Jul 2010.
3. [RTSS '09-2] “*Time-Based Intrusion Detection in Cyber-Physical Systems*” by C. Zimmer, B. Bhatt, F. Mueller and **S. Mohan**. Published in the Work in Progress session of IEEE conference *Real-Time Systems Symposium (RTSS)* held in Washington DC, Dec 2009.
4. [CPS '09] “*Addressing Safety and Security Contradictions in Cyber-Physical Systems*” by M. Sun, **S. Mohan**, L. Sha and C. Gunter. Presented at the First Workshop Workshop on Future Directions in Cyber-physical Systems Security held in Newark, New Jersey, July 2009.
5. [ECRTS '09] “*Time-Based Intrusion Detection in Cyber-Physical Systems*” by C. Zimmer, B. Bhatt, F. Mueller and **S. Mohan**. Published in the Work in Progress session of *EUROMICRO Conference on Real-Time Systems* held in Dublin, July 2009.
6. [CPS '08] “*Building Robust Automotive Systems through Separation of Concerns*” by **S. Mohan** and J. Helander. Presented at the NITRD National Workshop on High-Confidence Automotive Cyber-Physical Systems held in Troy, Michigan, April 2008.
7. [RTSS '07] “*Worst-Case Execution Time Analysis of Security Policies for Deeply Embedded Real-Time Systems*” by **S. Mohan**. PhD students forum on Deeply Embedded Real-Time Computing at the IEEE conference *Real-Time Systems Symposium (RTSS)*, December 2007. Published in *ACM SIGBED Review Vol 5, Number 1 – Special issue on the RTSS Forum on Deeply Embedded Real-Time Computing*, January 2008.

8. [RTAS '07] “*CheckerMode: A Hybrid Scheme for Timing Analysis of Modern Processor Pipelines involving Hardware/Software Interactions*” by **S. Mohan** and F. Mueller. Published in the Work-In-Progress section at the IEEE conference *Real-Time and Embedded Technology and Applications Symposium (RTAS)*, March 2007.

Technical Reports

1. [CoRR '16] “*Exploring Opportunistic Execution for Integrating Security into Legacy Hard Real-Time Systems*” by M. Hassan, **S. Mohan**, R. Bobba and R. Pellizzoni. *Computing Research Repository; abs/1608.07872* (CoRR), ArXiv, <https://arxiv.org/abs/1608.07872>. January 2015.
2. [CoRR '15-2] “*Intrusion Detection Using Execution Contexts Learned from System Call Distributions of Real-Time Embedded Systems*” by M. K. Yoon, **iSibin Mohan**, M. Christodorescu and L. Sha. *Computing Research Repository; abs/1501.05963* (CoRR), ArXiv, <https://arxiv.org/abs/1501.05963>. January 2015.
3. [CoRR '15-1] “*A Secure Two-Level Framework for Intrusion Detection*” by M. K. Yoon, M. Christodorescu, L. Sha and **S. Mohan**. *Computing Research Repository; abs/1501.05963* (CoRR), ArXiv, <http://arxiv.org/abs/1501.05963>. January 2015.
4. [CoRR '12] “*S3A: Secure System Simplex Architecture for Safety-Critical Supervisory Control Systems*” by **S. Mohan**, S. Bak, E. Betti, H. Yun, L. Sha and M. Caccamo. *Computing Research Repository; abs/1202.5722* (CoRR), ArXiv, <http://arxiv.org/abs/1202.5722>. February 2012.
5. [NCSU '08] “*Preserving Timing Anomalies in Pipelines of High-End Processors*” by **S. Mohan** and F. Mueller. *North Carolina State University Dept. of Computer Science Technical Report, TR-2008-13*, July 2008.
6. [MSR '08] “*Temporal Analysis for Adapting Concurrent Applications to Embedded Systems*” by **S. Mohan** and J. Helander. *Microsoft Research Technical Report MSR-TR-2008-37*, March 2008.
7. [MSR '07-1] “*Embedded Systems Research at DemoFest '07*” by O. Almeida, A. Forin, P. Garcia, J. Helander, N. Khantal, H. Lu, K. Meier, **S. Mohan**, H. Nielsen, R. Pittman, R. Serg, B. Sukhwani, M. Veanes, B. Zorn, S. Berry, C. Boyce, D. Chaszar, B. Culrich, M. Khisin, G. Knezeck, W. Linam-Church, S. Liu, M. Stewart and D. Toney. Published as the *Microsoft Research Technical Report MSR-TR-2007-94*, July 2007.

Posters

1. [CEDs '14] “*Behavior-based Intrusion Detection for Smart Grid Components with Real-Time Properties*” by **S. Mohan**, R. Bobba, M. K Yoon DoE Workshop on *Cybersecurity for Energy Delivery Systems*, August, 2014.
2. [RTSS '07-2] “*Scalable Embedded Systems*” by J. Helander, R. Serg, **S. Mohan**, M. Veanes and P. Garcia at the IEEE conference *Real-Time Systems Symposium*, December 2007.
3. [MSR '07-2] “*Scalable Embedded Systems*” by J. Helander, R. Serg, **S. Mohan**, M. Veanes and P. Garcia at the *Microsoft Research Faculty Summit*, July 2007.
4. [LCTES '04] “*Static Timing Analysis for Sensor Nodes*” by **S. Mohan** and F. Mueller in the ACM SIGBED-SIGPLAN conference on *Languages, Compilers and Tools for Embedded Systems (LCTES)*, June 2004.

Grants/Proposals

- Sept. 2016 **PI.** National Science Foundation (NSF). *CPS: Frontiers: Collaborative Research: Software Defined Control for Smart Manufacturing Systems.*
- Aug. 2016 **PI.** Department of Energy (DoE). *INGRESS: Advanced Cybersecurity Platform for Distributed Energy Resources.*
- Aug. 2016 **co-PI.** Department of Energy (DoE). *Security Domain Layer Systems to defend against hacker and insider attacks.*
- July 2014 **PI.** National Science Foundation (NSF). *Behavior-based Zero-Day Intrusion Detection for Real-Time Cyber-Physical Systems.*
- Aug. 2013 **PI.** Office of Naval Research (ONR). *Integration of Security in Real-Time Systems.*
- Aug. 2013 **Senior Investigator.** Dept. of Energy (DoE). *Software Defined Networking in Critical Systems.*
- Sept. 2012 **Co-PI.** National Security Agency Science of Security Labet. *Classification of Cyber-Physical Systems Adversaries.*
- Aug 2010 **Senior Investigator.** Rockwell Collins: *Adapting Multicore Processors for use in Real-Time Avionics Systems.*

Research Projects

- 2008 – curr. ***Security for Embedded and Real-Time Systems.*** Integration of security in real-time systems at the design/conceptual level; detecting intrusions and system protection in safety-critical systems (*e.g. protecting against Stuxnet-type Attacks*); using behavior of real-time systems to detect intrusions; analysis of avionics, medical and power systems to study security and privacy requirements; studying trade-offs in safety resulting from the integration of security policies for such systems. *Work conducted at UIUC.*
Related publications: [RTSS '16, SYSTOR '16, RTAS '16, RTS '16, RTAS '15, DAC '15, CoRR '15-1, CoRR '15-2, CRTS '14, RTAS '13, HiCons '13, CoRR '12, ICCPS '10-1, CPS '09, ECRTS '09, RTSS '07]
- 2014 – curr. ***Software Defined Networks in Safety-Critical Systems.*** Developing methods for using SDNs in critical infrastructures such as power grids; analysis and synthesis for guaranteeing failures; consistency of updates in SDN rules and controllers; use of SDNs in manufacturing control systems. *Work conducted at UIUC.*
Related publications : [CNS '15, SENT '15]
- 2014 – curr. ***Security for Multi-Tenant Cloud Computing Systems.*** Analysis of security issues for cloud computing systems; development of security mechanisms for co-located applications in public clouds. *Work conducted at UIUC.*
- 2008 – 2013 ***Virtual Integration.*** Development of System Composition techniques for complex safety-critical systems. Analysis of complex platform architectures (such as avionics), created from Commercial Off-the-Shelf components, to adjust to changing customer demands. Led to the development of an integrated ‘end-to-end’ analysis framework that obviates the need for an actual implementation (hardware or software) for performing comprehensive analysis. *Work conducted at UIUC in collaboration with Rockwell Collins.*
Related publications : [RTSS '09, DASC '10, TC '12, DAC '12]
- 2008 – 2011. ***System Integration for Plug-n-Play Medical Devices.*** Design of a set of supervisorys that will facilitate the development of “Plug-n-Play” medical devices and a “medical-grade” wireless network to inter-operate with safety interlocks, provide generalized QoS guarantees along with auditing abilities.

Work conducted at UIUC and with Massachusetts General Hospital, Boston.

Related publications : [ICCPS '10-2]

2008 – 2011. **Timing Analysis for Modern Multicore Processors.** Studying interference effects in caches and task migration among cores to bound accurate worst-case execution time (WCET) values for modern multicore architectures.

Work conducted in collaboration with NCSU.

Related publications : [LCTES '09]

2008 – 2010. **CheckerCore:** Using an FPGA platform to obtain accurate worst-case execution times for modern processing platforms. The FPGA contains a processor core attached to which is a “Checker Core” that provides the ability to obtain execution times for code segments and also transmit processor information back to a software static analyzer.

Work in collaboration with NCSU and Penn State.

Related publications : [CASES '09]

2006 – 2010 **CheckerMode:** Proposed and implemented timing analysis techniques for modern processors with the latest architectural features (out-of-order pipelines, branch predictors, *etc.*) using hardware/software interactions. I also proposed minor modifications to the design of processor pipelines to enhance the process of calculating accurate worst-case execution times. Currently analyzing loops to capture a “multi-dimensional” fixed point state.

Continuing work from North Carolina State University.

Related publications : [TECS '11, RTSS '08, NCSU '08, RTAS '08, RTAS '07]

2007 – 2009 **Temporal Analysis for Distributed Embedded Systems:** proposed, analyzed and modeled temporal behavior and dependencies in distributed embedded applications using colored graphs. Created a graph-transformation algorithm to extract the “meaning” of concurrency within applications.

Work conducted at Microsoft Research, Redmond.

Related publications : [ECRTS '08, MSR '08, RTSS '07-2, MSR '07-1, MSR '07-2]

2004 – 2006 **ParaScale:** Proposed and implemented a Parametric Timing analysis scheme, which works in conjunction with dynamic real-time schedulers, to handle statically unknown loop bounds. I also assessed the potential for power conservation by exploiting dynamically known parametric loop bounds coupled with known and innovative dynamic voltage scaling (DVS) techniques.

Work conducted at North Carolina State University in collaboration with Florida State Univ.

Related publications : [TECS '07, RTSS '05]

2003 – 2004 **Timing Analysis for Sensor Network Nodes:** I proposed and performed timing analysis to obtain the worst-case execution times (WCETs) for the Atmel (AVR) family of embedded processors, used on the Berkeley nodes. Timing analysis was performed on both – C as well as NesC code.

Work conducted at North Carolina State University.

Related publications : [RTAS '05, LCTES '04]

Teaching

Fall 2014 I co-taught the graduate course, *Cyber-Physical Systems* (CS 598).

Fall 2013 Guest lecturer for graduate/undergraduate course, *Computer Security I* (ECE 422).

Spring 2012 I co-taught the graduate course, *Cyber-Physical Systems* (CS 598). It was **listed among the highest rated courses on campus.**

Spring 2011 Guest lecturer for graduate course, *Embedded Systems Architecture and Software* (CS 431).

- Spring 2010 *Guest lecturer* for graduate course, *Embedded Systems Architecture and Software* (CS 431).
- Spring 2008 I taught an undergraduate programming course (CSC 230) in *Spring 2008*.
- 2007 – 2008 Selected for the *Preparing the Professoriate* (PtP) fellowship. Selected doctoral candidates are mentored through the processes involved in a faculty career, in designing and teaching courses, and on improving their teaching skills. Also entails attendance at various seminars that focus on teaching and course preparation. Culminates in designing and teaching a complete course.
Program conducted by the Graduate School at North Carolina State University
- 2006 – 2008 *Certificate of Accomplishment in Teaching* (CoAT). Program that provides guidance to students who wish to teach, with comprehensive seminars, mentoring and classroom evaluation.
Program conducted by the NCSU Faculty Center for Teaching and Learning
- Fall 2007 *Preparing for a Faculty Career*: workshop on preparation for a faculty career. Topics covered: teaching techniques, active learning, Bloom’s taxonomy, course design & objectives, ABET, *etc.*
Program conducted by the College of Engineering at North Carolina State University
- Fall 2007 *Guest lecturer* for undergraduate course, *Operating Systems* (CSC 246).
- Spring 2007 *Guest lecturer* for graduate course, *Operating Systems* (CSC 501).
- Fall 2006 *Guest lecturer* for graduate course, *Parallel Systems* (CSC 548).
- Fall 2005 *Teaching Assistant* for advanced graduate course, *Real-Time Systems* (CSC 714). Responsibilities involved occasionally teaching classes, grading, creating assignments, *etc.*
- Summer 2003 *Teaching Assistant* for graduate course, *Operating Systems* (CSC 501). Responsibilities involved grading, creating assignments, *etc.*
- 2002 – 2003 *Tutor* for undergraduate students. Subjects: Advanced and basic Java, Object-oriented Design, Fortran90 and Physics for Engineers.
- Spring 2003 *Advanced Tutoring Course*, conducted by the NCSU Undergraduate Tutoring center.
- Fall 2002 *Basic Tutoring Course*, conducted by the NCSU Undergraduate Tutoring center.
- 2000 – 2001 *Teaching Assistant* for undergraduate course on C++, Object-oriented programming and operating systems principles.

Graduate Student Advising

- 2015 – curr Advising five graduate students on a variety of research topics.
- 2011 – 2015 Co-advising multiple graduate and undergraduate students.
- 2008 – 2011 Co-Advising Graduate student on effects on worst-case execution time due to security violations.
- 2008 – 2010 Co-Advising Graduate student on timing analysis for multicore architectures.
- 2007 – 2009 Co-Advising Graduate student on Hybrid Timing Analysis via Multi-Mode Execution.
- 2005 – 2006 Mentored three Graduate students in their independent study/research projects. *Topics*: timing analysis for the IBM PowerPC, analysis of voltage and frequency switching on a DVS board and evaluation of the SimpleScalar processor simulator for multi-mode implementation.

Invited and Conference Talks

- Jan. 2016 Indian Institute of Science (IISc), Bangalore, India. *Bringing Real-Time Systems into a Secure World*. Invited Talk.
- Dec. 2015 United Technologies Research Center (UTRC), Hartford, CT. *Bringing Real-Time Systems into a Secure World*. Invited Talk.
- Aug. 2015 Rockwell Collins Inc., Webinar. *Bringing Real-Time Systems into a Secure World*. Invited Talk.
- Jun. 2015 Qualcomm Research Silicon Valley, Santa Clara, CA. *Behavior-based Intrusion Detection for Cyber-Physical Systems with Real-Time Constraints*. Invited Talk.
- Apr. 2015 Oregon State University, Corvallis, OR. *Behavior-based Intrusion Detection for Cyber-Physical Systems*. Invited Talk.
- Mar. 2015 University of Illinois, Urbana-Champaign. *Integrating Security in Cyber-Physical Systems with Real-Time Constraints*. ITI Trust and Security Seminar Series.

- Nov. 2014 University of Washington, Seattle. *Integrating Security in Cyber-Physical Systems with Real-Time Constraints*. Invited Talk.
- Aug. 2013 McAfee, Bangalore, India. *Behavior-based Intrusion Detection for Cyber-Physical Systems*. Invited Talk.
- Aug. 2013 ABB Research, Bangalore, India. *Behavior-based Intrusion Detection for Cyber-Physical Systems*. Invited Talk.
- Aug. 2013 Indian Institute of Science, Bangalore, India. *Behavior-based Intrusion Detection for Cyber-Physical Systems*. Invited Talk.
- Apr. 2013 IEEE/ACM Conference on High Confidence Networked Systems (HiCONS). *S3A: Secure System Simplex Architecture for Safety-Critical Supervisory Control Systems*. Philadelphia, PA.
- Apr. 2013 UIUC Information Trust Institute. *Behavior-based Intrusion Detection for Cyber-Physical Systems*. Trust and Security Seminar Series.
- Jan. 2012 Rockwell Collins Inc., Cedar Rapids IA. *Secure Architectures for Safety-Critical Cyber-Physical Systems*. Invited Talk.
- Aug. 2011 Information Trust Institute, UIUC, Urbana. *Secure Architectures for Cyber-Physical Systems*. Invited Talk.
- Jul. 2011 Microprocessor Research Labs, Intel, Santa Clara. *Analysis Techniques for Cyber-Physical Systems*. Invited Talk.
- Jun. 2011 Intel Labs, Pittsburgh. *Analysis Techniques for Cyber-Physical Systems*. Invited Talk.
- Jan. 2011 Adobe Labs, Bangalore. *Analysis Techniques for Cyber-Physical Systems*. Invited Talk.
- Feb. 2010 Virginia Tech, Blacksburg. *Analysis Techniques for Cyber-Physical Systems*. ECE Faculty Search Series.
- Dec. 2009 IEEE conference on Real-Time Systems Symposium (RTSS) 2009, Washington DC. *Rapid Early-Phase Virtual Integration*.
- Nov. 2009 Bell Labs, Bangalore. *Analysis Techniques for Cyber-Physical Systems*. Invited Talk.
- Nov. 2009 Indian Institute of Science (IISc), Bangalore. *Analysis Techniques for Cyber-Physical Systems*. Invited Talk.
- Nov. 2009 General Motors Labs, Bangalore. *Analysis Techniques for Cyber-Physical Systems*. Invited Talk.
- Oct. 2009 Indian Institute of Technology (IIT), Madras. *Analysis Techniques for Cyber-Physical Systems*. Invited Talk.
- Oct. 2009 HP Labs, Bangalore. *Analysis Techniques for Cyber-Physical Systems*. Invited Talk.
- Jul. 2009 Simon Fraser University, Vancouver. *Exploiting Hardware/Software Interactions for Embedded Systems Design*. Computer Science Faculty Search series.
- Dec. 2008 IEEE conference on Real-Time Systems Symposium (RTSS) 2008, Barcelona, Spain. *Merging State and Preserving Anomalies in Pipelines of High-End Processors*.
- Jul. 2008 EUROMICRO conference on Real-Time Systems (ECRTS) 2008, Prague, Czech Republic. *Temporal Analysis for Adapting Concurrent Applications to Embedded systems*.
- June 2008 European Microsoft Innovation Center (EMIC), Aachen, Germany. *Exploiting Hardware/Software Interactions for Embedded Systems Design*
- Apr. 2008 Southern Illinois University, Carbondale. *Exploiting Hardware/Software Interactions for Embedded Systems Design*. ECE Faculty Search series.
- Apr. 2008 IEEE conference Real-Time and Embedded Applications Symposium (RTAS) 2008, St. Louis. *Hybrid Timing Analysis of Modern Processor Pipelines via Hardware/Software Interactions*.
- Apr. 2008 Virginia Tech, Blacksburg. *Exploiting Hardware/Software Interactions for Embedded Systems Design*. ECE Research Seminar series.
- Feb 2008 George Mason University, Virginia. *Exploiting Hardware/Software Interactions for Embedded Systems Design*. Computer Science Research Seminar series.
- Feb. 2008 University of Washington, Seattle. *Exploiting Hardware/Software Interactions for Embedded Systems Design*.

- Feb 2008 University of British Columbia, Vancouver. *Exploiting Hardware/Software Interactions for Embedded Systems Design*.
- Feb. 2008 Microsoft Research, Redmond. *Exploiting Hardware/Software Interactions for Embedded Systems Design*.
- Jan 2008 Duke University, Durham. *Exploiting Hardware/Software Interactions for Embedded Systems Design*. Computer Architecture Research seminar series.
- Jan. 2008 University of North Carolina, Chapel Hill. *Exploiting Hardware/Software Interactions for Embedded Systems Design*. “Systems Tea” Research Seminar series.
- Dec. 2007 IEEE conference *Real-Time Systems Symposium (RTSS)*, Tucson. *Integrating Security Policies with Deeply Embedded Real-Time Systems*. NSF planning workshop on “Cyber Physical Challenges in the Automotive domain”.
- Dec. 2007 IEEE conference *Real-Time Systems Symposium (RTSS)*, Tucson. *Worst-Case Execution Time Analysis of Security Policies for Deeply Embedded Real-Time Systems*. PhD students forum on Deeply Embedded Real-Time Computing.
- Jul. 2007 Microsoft Research, Redmond. *Reliable Distributed Embedded Systems*.
- Mar. 2007 IEEE conference RTAS 2007 Work-in-progress session, Seattle. *CheckerMode: A Hybrid Scheme for Timing Analysis of Modern Processor Pipelines Involving Hardware/Software Interactions*.
- Dec. 2005 IEEE conference Real-Time Systems Symposium (RTSS) 2005, Miami. *ParaScale: Exploiting Parametric Timing Analysis for Real-Time Schedulers and Dynamic Voltage Scaling*.
- Mar. 2005 IEEE conference Real-Time and Embedded Applications Symposium (RTAS) 2005, San Francisco. *Timing Analysis for Sensor Network Nodes of the Atmega Processor Family*.

Professional Activities

Funding Agency Review Panels

- Jul. 2015 National Science Foundation (NSF). Directorate for Computer and Information Science and Engineering (CISE).
- Jun. 2014 National Science Foundation (NSF). Directorate for Computer and Information Science and Engineering (CISE).
- Mar. 2013 Research Grants Council (RGC) of Hong Kong.
- Feb. 2015 National Science Foundation (NSF). Directorate for Computer and Information Science and Engineering (CISE).
- Jun. 2014 National Science Foundation (NSF). Directorate for Computer and Information Science and Engineering (CISE).
- Apr. 2013 Research Grants Council (RGC) of Hong Kong.
- Apr. 2012 National Science Foundation (NSF). Directorate for Computer and Information Science and Engineering (CISE).

Journal Editor

- 2015 Guest Editor. “Advanced Technologies on Mobile IoT and Cyber-Physical Systems”, Special Issue, Hindawi Press.

Technical Program Committee Member

- Aug. 2017 26th International Conference on Computer Communication and Networks (ICCCN), **Cognitive, Cellular and Mobile Networks (CCN) Track Chair**, Vancouver, Canada.
- Jan. 2017 IEEE Consumer Communications and Networking Conference (CCNC), Las Vegas, NV.
- Dec. 2016 IEEE Real-Time Systems Symposium (RTSS), **CPS Track Chair & Publication Chair**, Porto, Portugal.

- Oct. 2012 IEEE International Conference on Cyber-Physical Systems, Networks, and Applications (CP-SNA), Nagoya, Japan.
- Aug. 2015 21st IEEE International Conference on Embedded and Real-Time Computing Systems and Applications (RTCSA 2015), Hong Kong.
- Dec. 2015 IEEE Real-Time Systems Symposium (RTSS), **Publication Chair**, San Antonio, TX.
- Aug. 2015 12th International Conference on Embedded Software and Systems (ICESS), New York, NY.
- Aug. 2015 EUROMICRO Conference on Real-time Systems (ECRTS) Work-in-progress, Lund, Sweden.
- Apr. 2015 20th IEEE Real-Time and Embedded Technology and Applications Symposium (RTAS), Seattle, WA.
- Dec. 2014 Analytical Virtual Composition of Real-Time Systems, Rome, Italy. **Co-chair** of workshop.
- Dec. 2014 20th IEEE International Conference on Parallel and Distributed Systems (ICPADS), Hsinchu, Taiwan.
- Dec. 2014 Work in Progress (WIP) Session of the IEEE Real-Time Systems Symposium (RTSS), Rome, Italy.
- Dec. 2014 35th IEEE Real-Time Systems Symposium (RTSS) Demo Session. RTSS@Work, Rome, Italy.
- Apr. 2014 19th IEEE Real-Time and Embedded Technology and Applications Symposium (RTAS), Berlin, Germany.
- Dec. 2013 19th IEEE International Conference on Parallel and Distributed Systems (ICPADS), Seoul, Korea.
- Apr. 2013 18th IEEE Real-Time and Embedded Technology and Applications Symposium (RTAS), Philadelphia, PA.
- Dec. 2012 33rd IEEE Real-Time Systems Symposium (RTSS) Demo Session. RTSS@Work, San Juan, Puerto Rico.
- Aug. 2012 17th IEEE International Conference on Embedded and Real-Time Computing Systems and Applications (RTCSA 2012), Seoul, Korea.
- Aug. 2012 2nd Workshop on Cyber-Physical Systems, Networks, and Applications (CPSNA), Seoul, South Korea.
- Apr. 2012 18th IEEE Real-Time and Embedded Technology and Applications Symposium (RTAS) Work in Progress session, Beijing, China.
- Dec. 2011 Analytical Virtual Composition of Real-Time Systems, Vienna, Austria.
- Aug. 2011 IEEE Conference on Embedded and Real-Time Computing Systems and Applications (RTCSA), Japan.
- Aug. 2011 First Workshop on Cyber-Physical Systems, Networks, and Applications (CPSNA), Japan.
- Jul. 2011 EUROMICRO Workshop on Worst-Case Execution Time (WCET) Analysis, Portugal.
- Jun. 2011 International Workshop on Safety and Security in Cyber-Physical Systems (SSCPS), Korea.
- Apr. 2011 17th IEEE Conference Real-Time and Embedded Applications Symposium (RTAS), Chicago.
- Apr. 2011 Workshop on Energy Aware Design and Analysis of Cyber Physical Systems (WEA-CPS), Chicago.
- Apr. 2011 First International Workshop on Cyber-Physical Networking Systems (CPNS), Shanghai, China.
- Dec. 2010 Analytical Virtual Composition of Real-Time Systems, San Diego, CA. **Co-chair** of workshop.
- Apr. 2010 Work in Progress (WIP) Session of the IEEE Conference Real-Time and Embedded Applications Symposium (RTAS), Stockholm, Sweden.
- Jun. 2009 International Workshop on Cyber-Physical Systems (WCPS), Montreal, Canada.
- May. 2009 International Workshop on Wireless-Grade Medical Devices (WiMD), New Orleans.
- Apr. 2009 IEEE Conference Real-Time and Embedded Applications Symposium (RTAS), San Francisco.
- Mar. 2008 Symposium for Graduate Research in Computer Science, Raleigh North Carolina.

Reviewer

- RTAS* IEEE Real-Time and Embedded Technology and Applications. [2015, 2014, 2013, 2011, 2010, 2009, 2005]

<i>IEEE TC</i>	IEEE Journal, Transactions on Computers. [2014, 2012, 2011, 2010, 2009]
<i>ACM TECS</i>	ACM Journal, Transactions in Embedded Computing Systems. [2014, 2012, 2010, 2009]
<i>RTS</i>	Springer Journal, Real-Time Systems. [2014, 2011, 2010, 2009]
<i>LITES</i>	Leibniz Transactions on Embedded Systems. [2014]
<i>IEEE TPDS</i>	IEEE Journal, Transactions on Parallel and Distributed Systems. [2013, 2010, 2009]
<i>IEEE TDSC</i>	IEEE Journal, Transactions on Dependable and Secure Computing. [2013]
<i>ACM JEA</i>	ACM Journal Experimental Algorithmics. [2012]
<i>LCTES</i>	ACM SIGPLAN/SIGBED conference, Languages, Compilers and Tools for Embedded Systems. [2012, 2011, 2010, 2008, 2007, 2005, 2004]
<i>RTCSA</i>	IEEE International Conference on Embedded and Real-Time Computing Systems/Applications. [2012, 2011, 2006]
<i>IEEE Systems</i>	IEEE Systems Journal. [2012, 2011]
<i>CASES</i>	International Conference on Compilers, Architecture and Synthesis for Embedded Systems. [2011, 2004]
<i>ESL</i>	IEEE Embedded Systems Letters. [2011, 2009]
<i>SPE</i>	Software: Practice and Experience Journal. [2010]
<i>JSA</i>	Elsevier Journal of Systems Architecture. [2010]
<i>ECRTS</i>	Euromicro Conference on Real-Time Systems. [2010, 2008, 2006, 2005, 2004, 2003]
<i>EURASIP JES</i>	Journal on Embedded Systems. [2010, 2009]
<i>IEEE TII</i>	IEEE Journal, Transactions on Industrial Informatics. [2010, 2009, 2008, 2007]
<i>RTSS</i>	IEEE Real-Time Systems Symposium. [2008, 2006, 2005]
<i>ISMM</i>	ACM SIGPLAN International Symposium on Memory Management. [2008]
<i>ICPP</i>	International Conference on Parallel Processing. [2007]
<i>ICPADS</i>	International Conference on Parallel and Distributed Systems. [2006]
<i>WCET</i>	Annual Conference on Worst-Case Execution Time. [2006]
<i>HIPEAC</i>	European Network of Excellence on High-Performance Embedded Architecture and Compilation. [2006]
<i>EMSOFT</i>	ACM SIGBED Embedded Software Conference. [2005, 2004]
<i>CTCES</i>	Workshop on Compilers and Tools for Constrained Embedded Systems. [2004]

Professional Licenses, Society Memberships, Miscellaneous

2007 – curr	Member, Association of Computing Machinery (ACM)
2007 – curr	Member, ACM Special Interest Group on Embedded Systems (SIGBED)
2004 – curr	Member, Institute of Electrical and Electronic Engineers (IEEE)
2004 – curr	Member, Institute of Electrical and Electronic Engineers Computer Society (IEEE-CS)

Visa Status

Visa Status Permanent Resident.
Citizenship India

References

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