

# Dongpeng Xu

Assistant Professor  
Department of Computer Science  
College of Engineering and Physical Science  
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## RESEARCH INTERESTS

**Cybersecurity.** I am interested in software security, especially program analysis on binary code, malware detection, software protection, software testing, program similarity analysis, and model checking.

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## EDUCATION

The Pennsylvania State University Ph.D. in Information Sciences and Technology	PENNSYLVANIA, USA 08/2013 – 08/2018
University of Science and Technology of China Master of Engineering, Software Engineering	ANHUI, CHINA 09/2010 – 03/2013
Jilin University Bachelor of Engineering, Fashion Design and Engineering	JILIN, CHINA 09/2005 – 06/2009

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## APPOINTMENTS

University of New Hampshire Assistant Professor	NEW HAMPSHIRE, USA 08/2018 – present
The Pennsylvania State University Graduate Research Assistant/Teaching Assistant	PENNSYLVANIA, USA 09/2013 – 08/2018
Fujitsu Laboratories of America Summer Intern	CALIFORNIA, USA 05/2017 – 08/2017
National High Performance Computing Center Graduate Research Assistant	ANHUI, CHINA 09/2011 – 03/2013

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## TEACHING

### University of New Hampshire, Instructor

• CS 727/827: Software Security	Spring 2023, Spring 2022
• CS 527: Fundamentals of Cybersecurity	Fall 2023, Fall 2022, Fall 2021
• GenCyber Summer Camp	Summer 2021
• CS 727/827: Computer Security	Spring 2021, Spring 2020, Spring 2019
• CS 927: Software Security Analysis	Fall 2023, Fall 2022, Fall 2021, Fall 2020, Fall 2019, Fall 2018

### The Pennsylvania State University, Teaching Assistant

• IST 261: Application Development Design Studio	Spring 2017
• SRA 468: Visual Analytics for Security Intelligence	Spring 2015
• IST 451: Network Security	Fall 2014
• IST 230: Discrete Mathematics	Spring 2014

## GRANTS

1. The Center for Cybersecurity Leadership, Education, and Outreach (CCLEO) Vision
  - Role: Team member; with Maeve Dion (Lead), Charlie French, Karl Grindal, Liz Gray, Mike Mengers, Qiaoyan Yu, Ron Danault
  - Total: \$15,000
  - UNH CoRE Interdisciplinary Working Groups (IWGs)
  - September 2023 to October 2024
2. SaTC: CORE: Small: Beat Modern Virtualization Obfuscation at Their Own Game: A Bottom-Up Deobfuscation Approach
  - Role: Sole PI
  - Total: \$599,991
  - National Science Foundation (NSF)
  - 01/01/2023 to 12/31/2025
3. Effectiveness and adoption of a Smart home-based social assistive robot for care of individuals with Alzheimer's Disease
  - Role: Senior Person; with Sajay Arthanat (PI) and Momotaz Begum (PI). My work is designing and developing the network protocol and cybersecurity functions for the robot and sensor systems.
  - Total: \$2,803,716
  - Personal Share: \$88,128
  - National Institutes of Health (NIH)
  - 08/15/2022 to 07/31/2027
4. SaTC: EDU: Building a NHCyberSEE Laboratory for Hands-on Experience Oriented Cybersecurity Education
  - Role: Co-PI; with Qiaoyan Yu (PI), Diliang Chen (Co-PI), Hong Jin (Co-PI). My work is to develop the hands-on materials and configure virtual machines for the summer camps.
  - Total: \$399,999
  - Personal Share: \$18,430
  - National Science Foundation (NSF)
  - 07/15/2022 to 06/30/2025
5. Developing a Cybersecurity Assessment Testbed for Advanced Manufacturing
  - Role: Co-PI; with Qiaoyan Yu (PI)
  - Other Co-PIs: John Roth, Edward Song, Diliang Chen, Karen Jin
  - Total: \$15,000
  - UNH CoRE Interdisciplinary Working Groups (IWGs)
  - 08/01/2021 to 07/31/2022
6. IUCRC Planning Grant University of New Hampshire: Center for Digital Factory Innovations (CDFI)
  - Role: Senior Personnel; with Nicolas Kirsch (PI), Bob Noseworthy (Co-PI), Momotaz Begum (Co-PI)
  - Other senior personnel: Jinjin Ha, Brad Kinsey, Qiaoyan Yu, Marek Petrik, Se Young (Pablo) Yoon
  - Total: \$20,000
  - National Science Foundation (NSF)
  - 06/01/2021 to 05/31/2022
7. SaTC: CORE: Small: Towards Securing the Hardware and Software for Approximate Computing Systems
  - Role: Co-PI; with Qiaoyan Yu (PI). My work is to design and implement methods to solve software security problems in approximate computing systems.
  - Total: \$499,988
  - Personal Share: \$226,726
  - National Science Foundation (NSF)
  - 10/01/2020 to 09/30/2023
8. GenCyber Student Camp 2020

- Role: Senior Person; with Scott Valcourt (Program Director), Ken Graf, Laura Nickerson. My work is to collaborate with others to propose and implement the summer camp content, recruit UNH mentors, give lectures, and mentor the campers.
  - Total: \$99,994.91
  - Personal Share: \$5,860
  - National Security Agency (NSA) and National Science Foundation (NSF)
  - Summer 2020 (postponed to 2021 due to Covid-19)
9. CRII: SaTC: Simplification of Mixed Boolean-Arithmetic Obfuscated Expression
- Role: Sole PI
  - Total: \$174,982
  - National Science Foundation (NSF)
  - 05/01/2020 to 04/30/2022
10. Integrating Socially Assistive Robot (SAR) and Smart Home to support caregiving of individuals with Alzheimer’s disease: A Proof-of-Concept Research
- Role: PI; with Momotaz Begum (Lead PI), Sajay Arthanat (Lead PI), Dain La Roche (PI)
  - Total: \$30,000
  - UNH CoRE Pilot Research Partnerships
  - Summer 2019

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## PUBLICATIONS

### Refereed Conference Proceedings

1. [DSN ‘23] Naiqian Zhang, Daroc Alden, Dongpeng Xu, Shuai Wang, Trent Jaeger, and Wheeler Ruml, “No Free Lunch: On the Increased Code Reuse Attack Surface of Obfuscated Programs,” In *Proceedings of The 53rd Annual IEEE/IFIP International Conference on Dependable Systems and Network*, June 27–30, 2023
2. [ISEC ‘23] Qiaoyan Yu, Dean Sullivan, Diliang Chen, Dongpeng Xu, Karen Jin, and Joshua Calzadillas, “WIP: Interdisciplinary Teaching via Hands-on Practice in Cybersecurity,” In *Proceedings of The 2023 IEEE Integrated STEM Education Conference*, March 11, 2023
3. [EMNLP ‘21] Weijie Feng, Binbin Liu, Dongpeng Xu, Qilong Zheng, Yun Xu, “GraphMR: Graph Neural Network for Mathematical Reasoning,” In *Proceedings of The 2021 Conference on Empirical Methods in Natural Language Processing*, Virtual Event, November 7–11, 2021
4. [ICICS ‘21] Binbin Liu, Weijie Feng, Qilong Zheng, Jing Li, and Dongpeng Xu, “Software Obfuscation with Non-Linear Mixed Boolean-Arithmetic Expressions,” In *Proceedings of The 23rd International Conference on Information and Communications Security*, Virtual Event, September 17–19, 2021
5. [DSN ‘21] Chengbin Pang, Ruotong Yu, Dongpeng Xu, Eric Koskinen, Georgios Portokalidis, and Jun Xu, “Towards Optimal Use of Exception Handling Information for Function Detection,” In *Proceedings of The 51st Annual IEEE/IFIP International Conference on Dependable Systems and Networks*, Virtual Event, June 21–24, 2021
6. [PLDI ‘21] Dongpeng Xu, Binbin Liu, Weijie Feng, Jiang Ming, Jing Li, Qilong Zheng, and Qiaoyan Yu, “Boosting SMT Solver Performance on Mixed-Bitwise-Arithmetic Expressions,” In *Proceedings of The 42nd ACM SIGPLAN Conference on Programming Language Design and Implementation*, Virtual Event, June 20–26, 2021.
  - ★ Passed Artifact Evaluation with the “Available” and “Functional” badges.
  - ★ Used by IDA Pro’s plugin GooMBA: <https://hex-rays.com/blog/deobfuscation-with-goomba>
7. [USENIX Security ‘21] Binbin Liu, Junfu Shen, Jiang Ming, Qilong Zheng, Jing Li, and Dongpeng Xu, “MBA-Blast: Unveiling and Simplifying Mixed Boolean-Arithmetic Obfuscation,” In *Proceedings of The 30th USENIX Security Symposium*, Virtual Event, August 11–13, 2021.
  - ★ Passed Artifact Evaluation.
  - ★ Used by IDA Pro’s plugin GooMBA: <https://hex-rays.com/blog/deobfuscation-with-goomba>

8. **[ICAPS '20]** Tianyi Gu, Momotaz Begum, Naiqian Zhang, Dongpeng Xu, Sajay Arthanat, Dain LaRoche, "An Adaptive Software Framework for Dementia-care Robots," In *Proceedings of 2020 International Conference on Automated Planning and Scheduling*, Virtual Event, October 19–30, 2020.
9. **[CCS '20]** Luman Shi, Jiang Ming, Jianming Fu, Guojun Peng, Dongpeng Xu, Kun Gao, and Xuanchen Pan, "VAHunt: Warding Off New Repackaged Android Malware in App-Virtualization's Clothing," In *Proceedings of The 27th ACM Conference on Computer and Communications Security*, Virtual Event, November 10–12, 2020.
10. **[GLSVLSI '20]** Pruthvy Yellu, Landon Buell, Dongpeng Xu, and Qiaoyan Yu, "Blurring Boundaries: A New Way to Secure Approximate Computing Systems," In *Proceedings of Great Lakes Symposium on VLSI*, Virtual Event China, September 2020.
11. **[ASP-DAC '20]** Pruthvy Yellu, Mohammad Mezanur Rahman Monjur, Timothy Kammerer, Dongpeng Xu, and Qiaoyan Yu, "Security Threats and Countermeasures for Approximate Arithmetic Computing," In *Proceedings of The 25th Asia and South Pacific Design Automation Conference*, Beijing, China, January 13–16, 2020.
12. **[CCS '18]** Dongpeng Xu, Jiang Ming, Yu Fu, and Dinghao Wu, "VMHunt: A Verifiable Approach to Partially-Virtualized Binary Code Simplification," In *Proceedings of The 25th ACM Conference on Computer and Communications Security*, Toronto, Canada, October 15–19, 2018.
13. **[USENIX Security '17]** Jiang Ming, Dongpeng Xu, Yufei Jiang, and Dinghao Wu, "BinSim: Trace-based Semantic Binary Diffing via System Call Sliced Segment Equivalence Checking.," In *Proceedings of The 26th USENIX Security Symposium*, Vancouver, BC, Canada, August 16–18, 2017.
14. **[SP '17]** Dongpeng Xu, Jiang Ming, and Dinghao Wu, "Cryptographic Function Detection in Obfuscated Binaries via Bit-precise Symbolic Loop Mapping," In *Proceedings of The 38th IEEE Symposium on Security and Privacy*, San Jose, CA, May 22–24, 2017.  
★ Top 10 Finalist in CSAW 2017 Best Applied Research Competition.
15. **[ISC '16]** Dongpeng Xu, Jiang Ming, and Dinghao Wu, "Generalized Dynamic Opaque Predicates: A New Control Flow Obfuscation Method," In *Proceedings of The 19th Information Security Conference*, Honolulu, HI, USA, September 7–9, 2016.
16. **[CCS '15]** Jiang Ming, Dongpeng Xu, Li Wang, and Dinghao Wu, "LOOP: Logic-Oriented Opaque Predicate Detection in Obfuscated Binary Code," In *Proceedings of The 22nd ACM Conference on Computer and Communications Security*, Denver, Colorado, USA, October 12–16, 2015.
17. **[IFIP SEC '15]** Jiang Ming, Dongpeng Xu, and Dinghao Wu, "Memoized Semantics-Based Binary Diffing with Application to Malware Lineage Inference," In *Proceedings of The 30th IFIP SEC 2015 International Information Security and Privacy Conference*, Hamburg, Germany, May 26–28, 2015.
18. **[PAAP '12]** Dongpeng Xu and Qilong Zheng, "An Address-Based Compiling Optimization for FFT on Multi-cluster DSP," In *Proceedings of The 5th International Symposium on Parallel Architectures, Algorithms and Programming*, Taiwan, December 17–20, 2012.
19. **[HPC China '12]** Dongpeng Xu and Qilong Zheng, "A Clustering Algorithm for Multi-cluster DSP Based on Analysis of Memory Address," In *Proceedings of National Annual Conference on High Performance Computing*, Changsha, Hunan, China, October 27–31, 2012.

## Refereed Journal Articles

20. Binbin Liu, Qilong Zheng, Jing Li, and Dongpeng Xu, "An In-Place Simplification on Mixed Boolean-Arithmetic Expressions," In *Journal of Security and Communication Networks*, 2022.
21. **[TODAES '21]** Yellu Pruthvy, Buell Landon, M. Mark, Michel Kinsy, Dongpeng Xu, and Qiaoyan Yu, "Security Threat Analyses and Attack Models for Approximate Computing Systems: From Hardware and Micro-Architecture Perspectives," In *Transactions on Design Automation of Electronic Systems*, 2021.
22. **[TDSC '20]** Huaijin Wang, Shuai Wang, Dongpeng Xu, Xiangyu Zhang, and Xiao Liu, "Generating Effective Software Obfuscation Sequences with Reinforcement Learning," In *IEEE Transactions on Dependable and Secure Computing*, December 2020.

23. Sajay Arthanat, Momotaz Begum, Tianyi Gu, Dain LaRoche, Dongpeng Xu, and Naiqian Zhang, “Caregiver Perspectives on a Smart Home-based Socially Assistive Robot for Individuals with Alzheimer’s Disease and Related Dementia,” In *Disability and Rehabilitation: Assistive Technology*, Volume 15, 2020.
24. Wenjie Li, Dongpeng Xu, Wei Wu, Xiaorui Gong, Xiaobo Xiang, Yan Wang, Fangming Gu, and Qianxiang Zeng, “Memory Access Integrity: Detecting Fine-grained Memory Access Errors in Binary Code,” In *Journal of Cybersecurity*, 2019.
25. Jiang Ming, Dongpeng Xu, and Dinghao Wu, “MalwareHunt: Semantics-Based Malware Diffing Speedup by Normalized Basic Block Memoization,” In *Journal of Computer Virology and Hacking Techniques*, , 2017.

## Refereed Workshop and Other Proceedings

26. [SPARK ’23] Naiqian Zhang, Daroc Alden, Dongpeng Xu, Shuai Wang, Trent Jaeger, and Wheeler Ruml, “Using Planning to Construct Code Reuse Attacks in Obfuscated Programs,” In Proceedings of *Scheduling and Planning Applications workShop (SPARK) in the 33rd International Conference on Automated Planning and Scheduling (ICAPS)*, Prague, Czech Republic, July 8–13, 2023.
27. Weijie Feng, Binbin Liu, Dongpeng Xu, Qilong Zheng, and Yun Xu, “NeuReduce: Reducing Mixed Boolean-Arithmetic Expressions by Recurrent Neural Network,” In Proceedings of *Findings of the Association for Computational Linguistics: EMNLP 2020*, November 2020.
28. [SPRO ’19] Li Wang, Dongpeng Xu, Jiang Ming, Yu Fu, and Dinghao Wu, “MetaHunt: Towards Taming Malware Mutation via Studying the Evolution of Metamorphic Virus,” In Proceedings of *The 3rd ACM Workshop on Software PROtection*, London, UK, November 11–15, 2019.

## Book Chapters

29. Dongpeng Xu, Xiao Yuan, Dinghao Wu, and Chimay J. Anumba, “Model Checking — Case Study of a Temporary Structures Monitoring System,” Book chapter in *Cyber Physical Systems in the Built Environment*, 2020.

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## ADVISING

### Ph.D. Students

- Yanjie Xu (2023 – Present)
- Zheyun Feng (2021 – Present)
- Rachael Little (2020 – Present)
- Naiqian Zhang (2019 – Present)
  - *Publications: ICAPS ’20, DSN ’23*
- Binbin Liu (2019 – 2021) → Lecturer, Hefei University of Technology (#88 in Best Universities in China)
  - *Visiting PhD student from the University of Science and Technology of China*
  - *Publications: USENIX Sec ’21, PLDI ’21, EMNLP ’21, ICICS ’21*

### Master Students

- Abishek Bangalore Muralikrishna (2023 – Present)
- Akshita Reddy Mavurapu (2023 – Present)
- Connor Tess (2023 – Present)
- Samuel Stone (2022 – Present)
- George Trabucchi (2022 – 2023) → Software Engineer, Fidelity Investments  
Project: “*Evaluating Coverage-Guided Fuzzers*”
- Rui Sun (2021 – 2022) → Software Engineer, TicketMaster  
Project: “*Automated Jump Table Extraction in Software Obfuscated by Code Virtualizer*”
- Vinayak Chaturvedi (2020 – 2021)  
Project: “*Identification of Windows Malware Using Dynamic Analysis and Machine Learning*”
- Dhawal Darji (2020 – 2021)  
Project: “*Analyzing Binary Program Obfuscated by Code Virtualizer*”

- Boyao Xu (2020 – 2021)  
Project: *“The Research of VMProtect Obfuscation”*
- Daroc Alden (2019 – 2020, Co-advised with Wheeler Ruml as the primary advisor)  
Thesis: *“Exploiting More Binaries by Using Planning to Assemble ROP Attacks”*
- Junfu Shen (2018 – 2019) → Software Engineer, Microsoft Bing Search.  
Project: *“Obfuscation with Mixed Boolean-Arithmetic Expressions”*

## Undergraduate Students

- **Cohort 2022:** Calli Bouchard, Tyler Geffrard, Quinn Junco, Aidan Kane, Zihan Pan, Sean Pothier, Max Vivino
- **Cohort 2021:** Troy Jacobs, Ryan Pereira, William Saulnier, Jon Doherty, Jacob Hodgdon, Ryan Johnson, Will Leverone, Andrew Litcofsky, Harry Fardin, Connor Harrington, Peter Sunkenberg
- **Cohort 2020:** Christian Baduria, Cristian Colon, Marcus Dominguez, Ben Haddad, Henry Harman, Joshua Hoffman, Donghyun Kim, Jared King, Andrew Kirk, Luke Knedeisen, Hasan Polat
- **Cohort 2019:** Joseph Heacock, Owen Hilyard, Mark Hynes, Sanen Imchen, Anuj Joshi
- **Cohort 2018:** Brandon Lo, Jeffrey Pitts, Zachary Taylor, William Tu

## Undergraduate Thesis

- Lex King: currently working on a project about WebAssembly.
- Zachary Taylor: *“Risk Factors Identification for Work-Related Musculoskeletal Disorders with a Wearable Motion Tracking System”*, 2022, co-advised with Diliang Chen from ECE department.

## Graduate Depth Exam/Dissertation Committee

- Naiqian Zhang
- Mohammad Mezanur Rahman Monjur (ECE Student)
- Lizhi Xu
- Abhinav Gupta
- Sepideh Koohfar
- Sumanta Kashyapi
- Shubham Chatterjee
- Matt Magnusson
- Zhiming Zhang (ECE Student)
- Pruthvy Yellu (ECE Student)

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## PROFESSIONAL ACTIVITIES

### Conference Program Committee

- [PLDI] ACM SIGPLAN Conference on Programming Language Design and Implementation (Artifact Evaluation Committee): 2023, 2022
- [ICICS] International Conference on Information and Communications Security: 2022, 2021
- [RAID] International Symposium on Research in Attacks, Intrusions and Defenses: 2019
- [SP] IEEE Symposium on Security and Privacy: (Student PC) 2018
- [USENIX Security] USENIX Security Symposium: (External reviewer) 2021
- [SecureComm] EAI International Conference on Security and Privacy in Communication Networks: (External reviewer) 2017
- [CCS] The ACM Conference on Computer and Communications Security: (External reviewer) 2017
- [SEIP] ICSE Software Engineering in Practice Track: (External reviewer) 2016

### Journal Reviewer

- [TDSC] IEEE Transactions on Dependable and Secure Computing: 2023, 2022, 2021
- [Access] IEEE Access: 2021
- [TACO] ACM Transactions on Architecture and Code Optimization: 2021
- [TIFS] IEEE Transactions on Information Forensic and Security: (External reviewer) 2017

- ACM Transactions on Privacy and Security: (External reviewer) 2016
- Journal of Language Resources and Evaluation: (External reviewer) 2016

## Other Services

- [NSF] National Science Foundation Review Panel: 2023
  - [CSAW] Cybersecurity Awareness Worldwide Review Committee and Preliminary Judges: 2023, 2021, 2020, 2019, 2018
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## INTERNAL SERVICES

- CS graduate study committee member, 2019–Present.
  - CS Department representative, Hamel Center liaison, 2023.
  - Advisor, CS new student orientation, 2023.
  - CS faculty search committee member, 2021–2022.
  - FY22 UNH CoRE Pilot Research Partnerships Review Panel, 2021.
  - ECE faculty search committee member, 2020–2021.
  - CS faculty search committee member, 2019–2020.
  - Member for UNH HARNESS Center (Hardware Assurance, Attack-Resilient Network, Embedded Systems & Sensor network Security), 2019–Present.
  - Advisor, CEPS Faculty-Student Research Mixer, 2019.
  - Advisor, CS new student orientation, 2019.
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## TALKS

- Software Obfuscation and Reverse Engineering  
1st New Hampshire Cybersecurity Day, October 20, 2022.
- Software Obfuscation and Reverse Engineering  
UNH Cybersecurity Awareness Month, October 14, 2022.
- Boosting SMT Solver Performance on Mixed-Bitwise-Arithmetic Expressions  
Northwestern University, April 29, 2022.
- Deobfuscate Mixed Boolean Arithmetic Expressions  
UNH CS Student and Faculty Meetup, February 4, 2022.
- Boosting SMT Solver Performance on Mixed-Bitwise-Arithmetic Expressions  
The 42nd ACM SIGPLAN Conference on Programming Language Design and Implementation, June 24, 2021.
- Software Obfuscation: How to Encrypt a Program  
UNH CS Student and Faculty Meetup, March 19, 2021.
- Emerging Software Analysis Techniques  
UNH MicroGrid workshop, August 5, 2019.
- A Verifiable Approach to the Simplification of Virtualized Binary Code  
Baidu X Lab, Sunnyvale, CA, May 21, 2019.
- The Attack and Defense on Partially-Virtualized Binary Code  
University of Science and Technology of China, Hefei, China, January 14, 2019.
- The Attack and Defense on Partially-Virtualized Binary Code  
Nanjing University of Posts and Telecommunications, Nanjing, China, January 7, 2019.
- A Verifiable Approach to the Simplification of Virtualized Binary Code  
Shanghai Jiaotong University, Shanghai, China, December 13, 2018.
- Searching for Cryptographic Functions in Obfuscated Binaries  
Hefei University of Technology, Hefei, China, December 17, 2018.
- The Attack and Defense on Partially-Virtualized Binary Code  
Institute of Software, Chinese Academy of Science, Beijing, China, December 23, 2018.

- VMHunt: A Verifiable Approach to Partially-Virtualized Binary Code Simplification  
The 25th ACM Conference on Computer and Communications Security, Toronto, Canada, October 16, 2018.
- Cryptographic Function Detection in Obfuscated Binaries via Bit-precise Symbolic Loop Mapping  
University of Science and Technology of China, January 5, 2018.
- Doctoral Journey Up To Now  
The Pennsylvania State University, September 1, 2017.
- A New Method for Detection of Encryption/Decryption Function in Binary Code  
Alibaba, June 14, 2017.
- Cryptographic Function Detection in Obfuscated Binaries via Bit-precise Symbolic Loop Mapping  
The 38th IEEE Symposium on Security and Privacy, San Jose, CA, May 24, 2017.
- Generalized Dynamic Opaque Predicates: A New Control Flow Obfuscation Method  
The 19th Information Security Conference, Honolulu, HI, September 9, 2016.
- An Address-Based Compiling Optimization for FFT on Multi-cluster DSP  
The 5th International Symposium on Parallel Architectures, Algorithms and Programming, Taiwan, December 19, 2012.