

# Nannan He

1400 WARREN STREET  
MANKATO, MN 56001

CELL: 5073515287

E-MAIL: HONANCY2@GMAIL.COM

WEBPAGE: [HTTPS://MAVDISK.MNSU.EDU/HEN/](https://MAVDISK.MNSU.EDU/HEN/)

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## EDUCATION

- 2005.9-2009.5** VIRGINIA POLYTECHNIC INSTITUTE & STATE UNIVERSITY (Virginia Tech)  
Ph.D. in **Computer Engineering**  
Advisor: Prof. Michael S. Hsiao (IEEE Fellow)  
Dissertation: Exploring Abstraction Techniques for Scalable Bit-Precise Verification of Embedded Software
- 2002.10-2003.11** UNIVERSITY OF ESSEX, England  
Master of Science in **Computer Science**  
Major: **Distributed Information Management Systems**
- 2000.8-2002.7** TSINGHUA UNIVERSITY, Beijing, China  
Double-Bachelor in **Software Engineering (Second)**  
Ranked top 10% of the college
- 1996.8-2000.7** ZHENGZHOU UNIVERSITY, China  
Bachelor in **Electrical Engineering (first)**  
Thesis: Design of 15000 kilowatts VVVF (Frequency Converter to Adjust Speed) Motor

## AWARDS

- AND HONORS**
- Best paper nominee of ACM Design Automation Conference (2011)
  - Recipient of William A. Blackwell Award for best research presentation (2006-2007)
  - Research Assistantship, Virginia Tech (2004 – 2009)
  - Graduate Assistantship, CACS in University of Louisiana (2003-2004)
  - Graduate with Distinction (First class), University of Essex, England (2003)
  - Excellent Thesis (2 out of 200) in Zhengzhou University (2000)
  - People's Fellowship, Zhengzhou University, waiver of tuition (1996-2000)

## RESEARCH EXPERIENCE

- 2012.8-Present** **Dept. of ECET, Minnesota State University at Mankato, USA**  
*Tenure-track ASSISTANT PROFESSOR*  
Faculty Research Grant: Model-based Verification of Real-time Embedded Software
- 2012.3-2012.7** **Advanced Digital Sciences Centre (UIUC Research in Singapore)**  
*POSTDOCTORAL FELLOW*  
Project: Integrated Security Assessment of Smart Grid Cyber Infrastructure
- 2009.6-2012.2** **Dept. of CS, Oxford University, UK**  
*POST-DOC RESEARCHER*  
Two EU projects on embedded systems: **CESAR** and **MOGENTES**  
- **CESAR**: Designed cost-effective methods and processes for safety relevant embedded systems, especially automated formal verification with model checking and contract-based compositional design and verification.  
- **MOGENTES**: Worked on model-based test generation for dependable embedded systems, especially fault-based testing of Matlab/Simulink models and C programs.
- 2005.9-2009.5** **Dept. of ECE, Virginia Tech, USA**  
*RESEARCH ASSISTANT*  
**NSF-NIJ** Project: validation and verification of embedded cognitive Radio systems.

- Verified and validated asserted properties of C code in radio systems by SAT-based bounded model checking. Incorporated slicing and various abstraction techniques to enhance the scalability of formal verification of large scale designs.
- Developed (in C++) a software prototype that automatically builds the verification model and performs assertion checking of ANSI-C code. Proposed the hybrid of slicing algorithms and testability guided abstraction approach. (LOC ≈ 9000)

**2004.8-2005.7 Dept. of CS, Virginia Tech, USA**

*RESEARCH ASSISTANT*

**DAPAR Project: CMDA - Cougaar Model Driven Architecture.**

- Proposed a model-level debugger and a component repository of CMDA system.
- Developed (in Java) several Eclipse Plugins for component repository in CMDA system. (LOC ≈ 8000)

**2003.8 – 2004.7 Center for Advanced Computer Studies, University of Louisiana at Lafayette, USA**

*GRADUATE ASSISTANT*

Project: High-performance Circuit Design of JPEG 2000 Encoder.

- Co-designed and simulated encoder circuits with Synopsys tools.

Project: Fault Detection and Fault Tolerant Research on Boeing 747 aircraft model.

- Performed model simulations with Matlab/Simulink.

**2003.5-2003.8 Institute for Computational Vision, Koblenz University, Germany**

*RESEARCHER*

Project: New Image Segmentation Algorithm on Colour Structure Code (CSC).

- Designed new algorithms of the fast counting boundary pixels for real-time colour image segment recognition.
- Developed (in C++) new algorithms to fast identify and count boundary pixels of image segments used for a visualization tool (BV-Tool). (Final LOC ≈ 5000)

**TEACHING EXPERIENCE**

**2012.8 - Present Dept. of ECET, Minnesota State University at Mankato, USA**

- Courses taught: Real-time Embedded Systems, Intro to Digital Systems, Microprocessor I/II, Integrated Computer Technology I, Programming Tools, Senior/Junior Design Projects (co-teach), Advanced Embedded Networking, Embedded Systems.

**2010.1-2011.12 Dept. of CS, Oxford University, UK**

- Conducted grading for two graduate courses (including Q&A session): Concurrency, Concurrent Programming.
- Did practical training for one undergraduate course: Intelligent Systems.

**2007.9-2009.5 Dept. of ECE, Virginia Tech, USA**

- Guest lecturer. Courses taught: Testing of Digital Systems, Verification of Digital Systems, Theoretical and Algorithmic Foundations of Computer Engineering

**2003.8-2004.7 Centre for Advanced Computer Studies, University of Louisiana at Lafayette, USA**

- Conducted tutoring for two undergraduate courses: Computer Hardware Design, Control Systems.

**INDUSTRIAL EXPERIENCE**

**2001.8-2002.7 Lenovo Ltd. Beijing, China**

*Research Developer*

Project: New secure file system for company internal use.

- Transformed an internal use file system format to the conventional file system format (FAT32, NTFS). This transformation is critical for a project of restoring and copying disk data to secure partitions non-intrusively.
- Designed and implemented (in C) a tool for the FAT-32 file system migration and format transformation. (Final LOC ≈ 9000)

## FUNDING PROPOSALS PARTICIPATED

- Applied an NSF grant as the PI under *Improving undergraduate STEM education (IUSE:EHR)*. Title: Creating a New “Laboratory in a box” with Model-based Design for Teaching Programming Microcontroller, 2014. (Budget: \$99781 for two years.)
- Applied an NSF grant as a co-PI under *Improving undergraduate STEM education (IUSE:EHR)*. Title: Retooling Optical Fiber Communication Instruction with A Hybrid Continuous-Time and Discrete-Time Approach, 2014.
- Received the Faculty Research Grant in Minnesota State University at Mankato, 2013. (\$5000)
- Helped my Ph.D. advisor at Virginia Tech prepare a NSF proposal, which targeted at designing the routing protocols, using the research results on the model checking and bit-precise verification. Results: It was granted with the title as “An Open Architecture for the Evolutionary Design of Routing Protocols.” (I graduated in 2009 and did not follow the progress of this project.)
- Helped my post-doc advisor in Oxford University prepare two grant proposals.
  - o System-level verification of hardware/firmware for Intel.
  - o Validating changes and upgrades in networked software for IBM.
 Both grant proposals were funded.

## LIST OF PUBLICATIONS (Reverse Chronological)

### BOOK

1. One of the authors of book *CESAR - Cost-efficient Methods and Processes for Safety-relevant Embedded Systems*. Springer Verlag, <http://www.springer.com/engineering/production+engineering/book/978-3-7091-1386-8>, 2013.

## PEER-REVIEWED PUBLICATIONS

### Journals

1. **Nannan He**, Han-way Huang and Qijie Cai. “Teaching Touch Sensing Technologies Using ARM Cortex-M4 Microcontrollers”, *Journal of Computers in Education (CoED)*, April - June Issue, 2016.
2. Lakshmi Teja Mullapudi, **Nannan He**, “Introducing Model-based Design Methodology with LabVIEW to Teaching ARM-based Embedded System Design”, *International Journal for Innovation Education and Research, Vol-3, No-8*, 2015.
3. **Nannan He**, Han-way Huang, Navya Mereddy. “Experience of Teaching Internet-of-Things Using TI ARM based Connected Launchpad”, *Transactions on Techniques for STEM Education*, October - December 2015.
4. **Nannan He**, Han-way Huang, “Using Eclipse-based Software Tools to Teach Model-based Design Methodology in a Programming Tools Course and an Embedded Computer Systems Course”, *Journal of Computers in Education (CoED)*, July-September Issue, 2015.
5. **Nannan He**, Han-way Huang, “Use of FreeRTOS in Teaching Real-Time Embedded Systems Design Course”, In *Journal of Computers in Education (CoED)*, October-December Issue, 2014.
6. **Nannan He**, Michael S. Hsiao. “Testability Guided Abstraction for Scalable Bounded Model Checking of Embedded Software”. In *International Journal of Modern Engineering*, Volume 14, Number 2, Spring/Summer, 2014.

### Conference Proceedings

7. **Nannan He**, Han-way Huang, "Introducing Model-based Design Methodology to Microcontroller-based Embedded Systems Course," *Proceedings of the ASEE/IEEE International Conference on Frontiers in Education*, Erie, PA, 2016.

8. **Nannan He**, Han-way Huang and Ying Qian, "Teaching Touch Sensing Technologies through Project-based Learning," *Proceedings of the ASEE/IEEE International Conference on Frontiers in Education*, Erie, PA, 2016.
9. **Nannan He**, Allen Gale and Victor Oke, "Model-based Verification of PLC programs using Simulink Design," *Proceedings of the IEEE International Conference on Electro/Information Technology (EIT)*, Grand Forks, ND, 2016, pp211-216.
10. **Nannan He**, Ying Qian and Han-way Huang, "Experience of Teaching Embedded Systems Design with BeagleBone Black Board," *Proceedings of the IEEE International Conference on Electro/Information Technology (EIT)*, Grand Forks, ND, 2016, pp217-220.
11. **Nannan He**, Han-way Huang, "Teaching Advanced Touch Sensing Technologies Using ARM Cortex-M based Microcontroller", *Proceedings of the ASEE Annual Conference*, Seattle, 2015.
12. **Nannan He**, Han-way Huang, "Experience of Teaching Advanced Touch Sensing Technologies", In *proceeding of the ASEE North Midwest Sectional Conference*, Iowa City, 2014.
13. **Nannan He**, Han-way Huang, "The Use of BeagleBone Black Board in Engineering Design and Development", In *proceeding of the ASEE North Midwest Sectional Conference*, Iowa City, 2014.
14. **Nannan He**, Han-Way Huang, "Utilization of Eclipse-based Software Tools in Teaching a New Software Development Methodology to Engineers". In *proceeding of the International Forum of ASEE Annual Conference*, Indianapolis, 2014.
15. **Nannan He**, Han-Way Huang, "Use of FreeRTOS in Teaching Real-time Embedded Systems Design Course". In *proceeding of the ASEE Annual Conference*, Indianapolis, 2014.
16. **Nannan He**. "Incorporating On-going Verification & Validation Research to a Reliable Real-Time Embedded Systems Course". In *proceeding of the ASEE North Midwest Sectional Conference*, Fargo, 2013.
17. **Nannan He**, Gale Allen, Cameron Johnson. "Exploring Real-Time Applications in Hands-On Automation Courses". In *Proceeding of the ASEE North Midwest Sectional Conference*, Fargo, 2013.
18. **Nannan He**, Han-Way Huang. "Integrating Modern Model-based Development Concepts and Tools in a Programming Tools Course". In *Proceeding of the ASEE North Midwest Sectional Conference*, Fargo, 2013.
19. Han-Way Huang, **Nannan He**. "Experience of Teaching Embedded System Design using FPGAs". In *Proceeding of the ASEE North Midwest Sectional Conference*, Fargo, 2013.
20. Han-Way Huang, **Nannan He**. "Teaching the ARM Microcontroller to Keep Up with the Embedded Industry Technology Change". In *Proceeding of the ASEE North Midwest Sectional Conference*, Fargo, 2013.
21. **Nannan He**, Daniel Kroening, Thomas Wahl, Kung-Kiu Lau, Faris Taweel, Cuong M. Tan, Philipp Ruemmer, Sanjiv S. Sharm. Component-based Design and Verification in X-MAN. In *Proceedings of Intl. Embedded Real Time Software and Systems Conference, 2012*.(cites: 15, based on google search)
22. **Nannan He**, Philipp Rummer, Daniel Kroening. Test-Case Generation for Embedded Simulink via Formal Concept Analysis. In *Proceedings of Intl. ACM Design Automation Conferences (DAC), 2011*.(**Best paper nomination, 7 out of around 740 submissions**) (cites: 33, based on google search)
23. Alastair F. Donaldson, **Nannan He**, Daniel Kroening, Philipp Rümmer. Tightening Test Coverage Metrics: A Case Study in Equivalence Checking using k-induction. In *Proceedings of FMCO 2010*.
24. Angelo Brillout, **Nannan He**, Michele Mazzucchi, Daniel Kroening, Mitra Purandare, Philipp Rümmer, Georg Weissenbacher. Mutation-Based Test Case Generation for Simulink Models. In *Proceedings of FMCO 2009*. (cites: 33, based on google search)

25. **Nannan He**, Michael S. Hsiao. An Efficient Path-oriented Bit-vector Encoding Width Computation Algorithm for Bit-precise Verification. *In Proceedings of IEEE/ACM Design Automation and Test in Europe Conference (DATE), 2009.*
26. **Nannan He**, Michael S. Hsiao. A New Testability Guided Abstraction to Solving Bit-vector Formula. *In Proceedings of the Joint Workshops of the 6th International Workshop on Satisfiability Modulo Theories and 1st International Workshop on Bit-Precise Reasoning, 2008.* (cites:5, based on google search)
27. **Nannan He**, Xueqi Cheng, Michael S. Hsiao. A New Hybrid Static/Run-time Secure Memory Access Protection. *In Proceedings of IEEE Intl. Conf. on Technologies for Homeland Security, 2008.*
28. Xueqi Cheng, **Nannan He**, Michael S. Hsiao. A New Security Sensitivity Measurement for Software Variables. *In Proceedings of IEEE Intl. Conf. on Technologies for Homeland Security, 2008.* (cites:3, based on google search)
29. Xueqi Cheng, **Nannan He**, Michael S. Hsiao. Hybrid Testing and Verification Techniques for a Cognitive Radio System. *In Proceedings of Intl. Conf. on Software Engineering and Applications, 2007.*
30. **Nannan He**, Michael S. Hsiao. Bounded Model Checking of Embedded Software in Wireless Cognitive Radio Systems. *In Proceedings of IEEE Intl. Conference on Computer Design (ICCD), 2007.* (cites:9, based on google search)
31. **Nannan He**, Michael S. Hsiao. Using symbolic simulation and weakening abstraction for formal verification of embedded software. *In Proceedings of Intl. Conf. on Software Engineering and Applications, 2006.* (cites:3, based on google search)
32. Bobby George, Shawn A. Bohner, **Nannan He**. Towards a Model Level Debugger for the Cougar Model Driven Architecture System. *In Proceedings of Workshop on Radical Agent Concepts, 2005.*

**COMPUTER SKILLS**

Languages:	C/C++ (more than 9 years), Java, Verilog
Operating systems:	UNIX/LINUX, Windows
Tools:	CBMC, Eclipse, MatLab, Subversion, GeneAuto, LabVIEW
Microprocessors:	Intel C8051, ARM Cortex-M, Arduino, Beaglebone

## PROFESSIONAL SERVICES

Reviewer for conferences and journals:

- IEEE Transactions on Design & Test of Computers
- IEEE Transactions on Computers
- Journal of Formal Methods in System Design
- Journal of Electronic Testing: Theory and Applications
- Intl. Conference on Computer Aided Verification (CAV)
- IEEE Formal Methods in Computer Aided Design (FMCAD)
- ACM/EDAC/IEEE Design Automation Conference (DAC)
- ACM /IEEE Conference on Design, Automation, Test in Europe (DATE)
- IEEE International Conference on Computer Design (ICCD)
- Intl. Conference on Tools and Algorithms for the Construction and Analysis of Systems (TACAS)
- ACM/IEEE Ninth International Conference on Formal Methods and Models for Codesign (MEMOCODE)
- Intl. Symposium on Formal Methods for Components and Objects (FMCO)
- Intl. Symposium on Automated Technology for Verification and Analysis (ATVA)
- International Workshop on Formal Methods for Industrial Critical Systems (FMICS)
- Haifa Verification Conference (HVC)