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EDUCATION AND WORK EXPERIENCE

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| Korea Advanced Institute of Science and Technology | Assistant Professor | Sep 06 – present |
| Pohang University of Science and Technology | Researcher | 2004 – Aug 2006 |
| Samsung SECUi.COM | Research Engineer | 2002 – 2004 |
| University of Pennsylvania | Ph.D. , Computer and Information Science Dissertation: “Information Extraction for Run-time Formal Analysis” Advisors: Sampath Kannan and Insup Lee | 1997 – 2001 |
| Korea Advanced Institute of Science and Technology | M.S. , Computer and Information Science | 1995 – 1997 |
| Seoul Science High-school | B.S. , Computer Science | 1992 – 1995 |
| | Graduate Certificate | 1990 – 1991 |

RESEARCH INTERESTS

- Software Engineering (automated software analysis and reverse-engineering/re-engineering)
- Formal Methods (runtime verification and model checking)
- Embedded Systems (formal techniques for modeling, designing and testing)

RESEARCH EXPERIENCE

Software Engineering

- **Feature Model based Re-engineering:** Designed a feature model for the home service robot and re-engineered the robot with utilizing the relationships between features in the feature model. This approach was also applied to information system domain such as the LG credit card authorization system.
- **Virtual Prototyping of a Home Service Robot:** Developed a 3D virtual prototype of SHR100 using ASADAL/OBJ to analyze and compare alternative designs of the robot controller visually and efficiently

Formal Methods

- **A MaC based Debugger for Model Checkers:** Developed the McBugger (MaC-based Debugger) framework to detect multiple bugs by analyzing all counter examples without revising a target model by fixing bugs, which is more complex than detecting bugs and even infeasible in many situations.
- **A Framework for Runtime Verification:** Designed and developed a framework for runtime verification, called Monitoring and Checking (MaC), to check the correctness of program execution at runtime. The MaC framework has been extended and successfully applied to various target applications such as Ad-hoc On-Demand Vector routing protocol and a physical inverted pendulum system. The MaC framework is my PhD thesis topic.
- **Verification & Validation (V&V) of Distributed Protocols:** Designed a framework to analyze simulation of network protocols, called Verisim. Using Verisim, non-trivial bugs in an implementation of AODV routing protocol for radio packet network were detected. Also verified a distributed management protocol for a group of network security appliances and detected several design flaws that blocked progress of group activities.

Design/Analysis of Embedded Systems

- **Formal Construction and Verification of a Home Service Robot:** Re-engineered the home service robot SHR100 developed by Samsung Advanced Institute of Technology to improve reliability - re-designed software architecture and re-implemented the robot controller in a reactive programming language Esterel. Through the re-engineering, detected and fixed a feature interaction problem that caused the robot to ignore user's stop command.
- **Verification of an Autonomous Robot Coordination Algorithm:** Designed an algorithm to control multiple autonomous robots in the linear hybrid automata formalism and analyzed the algorithm using the model checker HyTech. A novel use of parametric analysis revealed scenarios where the algorithm would perform optimally.
- **Development of a Commercial Network Security Appliance:** Developed a NPU based gigabit network security appliance. For performance, programmed packet processing and HW management in assembly language and made a modular system design to exploit advantages of heterogeneous platforms (MicroEngines, Xscale and host CPU).

PUBLICATIONS

JOURNAL ARTICLES

- "Re-engineering Home Service Robots for Improving Software Reliability: A Case Study"
M. Kim
Submitted to *IEEE Transaction of Software Engineering*
- "Foundations for Monitoring and Checking Reactive Systems"
M. Viswanathan and M. Kim
Submitted to *Springer Formal Aspects of Computing*
- "Using Formal Modeling with an Automated Analysis Tool to Design and Parametrically Analyze a Multi-robot Coordination Protocol: a Case Study"
J. Esposito and M. Kim
IEEE Transactions on Systems, Man, and Cybernetics, Part A Systems and Humans. To appear.
- "Java-MaC: A Run-time Assurance Approach for Java Programs"
M. Kim, S. Kannan, I. Lee, O. Sokolsky, and M. Viswanathan .
Kluwer Formal Methods in System Design, 2004 (vol 24, no 2)
- "Verisim: Formal Analysis of Network Simulations"
K. Bhargavan, C.A. Gunter, M. Kim, I. Lee, D. Obradovic, O. Sokolsky, and M. Viswanathan,
IEEE Transaction on Software Engineering, 2002 (vol. 28, no. 2)

CONFERENCE PUBLICATIONS

- "Formal Modeling and Verification of Management on a Group of Network Security Appliances"
M. Kim and E. Choi
Workshop on Information Security Applications, Jeju Island, South Korea, Aug 2006
- "Re-engineering a Credit Card Authorization System for Maintainability and Re-usability of Components – a Case Study"
K.C.Kang, J.Lee, B. Kim, M.Kim, C. Seo, and S. Yu
International Conference on Software Reuse, Torino, Italy, 2006 (LNCS 4039)
- "Formal Construction and Verification of Home Service Robots: A Case Study"
M. Kim and K.C.Kang
Automated Technology for Verification and Analysis, Taiwan, Taipei, Oct 2005 (LNCS 3707)
- "Feature-oriented Re-engineering of Legacy Systems into Product Line Assets – A Case Study"
K.C.Kang, M. Kim, J. Lee, and B. Kim
International Software Product Line Conference, Rennes, France, Sep 2005 (LNCS 3714)
- "Re-engineering Software Architecture of Home Service Robots: A Case Study"
M. Kim, J. Lee, K.C.Kang, Y. Hong, and S. Bang
International Conference on Software Engineering, St. Louis Missouri, USA, May 2005
- "3D Virtual Prototyping of Home Service Robots Using ASADAL/OBJ"
K.C.Kang, M. Kim, J. Lee, B. Kim, Y. Hong, H. Lee, and S. Bang
International Conference on Robotics and Automation, Barcelona, Spain, April 2005
- "Formal Verification of the Robot Movements- a Case Study on Home Service Robot SHR100"
M. Kim, K.C.Kang, and H. Lee
International Conference on Robotics and Automation, Barcelona, Spain, April 2005
- "Foundations for the Run-time Monitoring of Reactive Systems – Fundamentals of the MaC Language"
M. Viswanathan and M. Kim

- *International Colloquium on Theoretical Aspects of Computing, Guiyang, China Sep 2004 (LNCS 3407)*
- “Computational Analysis of Run-time Monitoring – Fundamentals of Java-MaC”
M. Kim, S. Kannan, I. Lee, O. Sokolsky, and M. Viswanathan
Runtime Verification, Copenhagen Denmark, July 2002 (ENTCS vol 70 no 4)
- “Monitoring, Checking, and Steering of Real-time Systems”
M. Kim, I. Lee, U. Sammapun, J. Shin, and O. Sokolsky
Runtime Verification, Copenhagen Denmark, July 2002 (ENTCS vol 70 no 4)
- “Java-MaC: a Run-time Assurance Tool for Java Programs”
M. Kim, S. Kannan, I. Lee, O. Sokolsky, and M. Viswanathan
Runtime Verification, Paris France, July 2001(ENTCS vol 55 no 2)
- “Verisim : Formal Analysis of Network Simulations”
K. Bhargavan, C. A. Gunter, M. Kim, I. Lee, D. Obradovic, O. Sokolsky and M. Viswanathan.
International Symposium on Software Testing and Analysis, Portland Oregon, Aug 2000
- “Run-time Monitoring and Steering based on Formal Specifications”
S. Kannan, M. Kim, I. Lee, O. Sokolsky and M. Viswanathan
Workshop on Modelling Software System Structures in a Fastly Moving Scenario, Santa Margherita Ligure, Italy, June 2000
- “Formal Modeling and Analysis of Hybrid Systems: A Case Study in Multirobot Coordination”
R. Alur, J. Esposito, M. Kim, V. Kumar and I. Lee
FM'99 World Congress On Formal Methods, Toulouse France, Sep 1999 (LNCS 1708)
- “Runtime Assurance Based On Formal Specifications”
I. Lee, S. Kannan, M. Kim, O. Sokolsky, M. Viswanathan
International Conference on Parallel and Distributed Processing Techniques and Applications, Monte Carlo Resort, Las Vegas Nevada, USA, June 28 - July 1, 1999
- “Formally Specified Monitoring of Temporal Properties”
M. Kim, M. Viswanathan, H. Ben-Abdallah, S. Kannan, I. Lee, and O. Sokolsky
European Conference on Real-Time Systems, York UK, June 1999
- “Steering of Real-Time Systems based on Monitoring and Checking”
O. Sokolsky, S. Kannan, M. Kim, I. Lee and M. Viswanathan
Fourth International Workshop on Object-oriented Real-time Dependable Systems, Santa Barbara California, Jan 1999
- “A Monitoring and Checking Framework for Run-time Correctness Assurance”
I. Lee, H. Ben-Abdallah, S. Kannan, M. Kim, O. Sokolsky, M. Viswanathan
Korea-U.S. Technical Conference on Strategic Technologies, Vienna VA , Oct 22-24, 1998

PROFESSIONAL ACTIVITIES

PROJECTS

- Joint project on formal verification of embedded storage systems (OneNAND flash memory) with Software Engineering Lab of Samsung Electronics Sep 06 – Apr 07
- International joint project on formal modeling/verification of fault-tolerant distributed systems, with Center for Verification and Semantics (CVS), National Institute of Advanced Industrial Science and Technology (AIST), Japan Apr 06 – Mar 07
- Joint project on re-engineering the home service robot SHR100 with Samsung Advanced Institute of Technology to improve reliability May 04 – Dec 04
- Joint project “국방정보통신망에 VPN 적용시 최적의 통신회선 구축방안연구” with Samsung Networks to propose a roadmap for secure evolution of the Korean military network toward all-IP network July 02 – Dec 02

INVITED TALKS

- “McBugger: A Monitoring and Checking (MaC) based Debugger for Formal Models”
- Information and Communication University July 2006
- “Formal Construction and Verification of Home Service Robots: A Case Study”
- CVS AIST, Japan Feb 2006
- “Formal Construction and Verification of Home Service Robots: A Case Study”

- CVS AIST, Japan Feb 2006
- Sogang Univ. Nov 2005
- The University of Seoul Aug 2005
- Software Engineering Research Dept. of Samsung Electronics June 2005
- Korea Univ. April 2005
- “Software Monitoring and Checking Technology”
- Korea Univ. Sep 2004
- “End-to-end Deployment of Formal Methodologies ”
- Pohang University of Science and Technology Sep 2002

CONFERENCE PRESENTATIONS

- “Formal Modeling and Verification of Management on a Group of Network Security Appliances”
Workshop on Information Security Applications, Jeju Island, South Korea, Aug 2006
- “Formal Construction and Verification of Home Service Robots: A Case Study”
Automated Technology for Verification and Analysis, Taiwan, Taipei, Oct 2005
- “Re-engineering Software Architecture of Home Service Robots: A Case Study”
International Conference on Software Engineering, St. Louis Missouri, USA, May 2005
- “3D Virtual Prototyping of Home Service Robots Using ASADAL/OBJ”
International Conference on Robotics and Automation, Barcelona, Spain, April 2005
- “Formal Verification of the Robot Movements- a Case Study on Home Service Robot SHR100”
International Conference on Robotics and Automation, Barcelona, Spain, April 2005
- “Foundations for the Run-time Monitoring of Reactive Systems – Fundamentals of the MaC Language”
International Colloquium on Theoretical Aspects of Computing, Guiyang, China, Sep 2004
- “Computational Analysis of Run-time Monitoring – Fundamentals of Java-MaC”
Runtime Verification, Copenhagen Denmark, July 2002
- “Java-MaC: a Run-time Assurance Tool for Java Programs”
Runtime Verification Paris France, July 2001
- “Formal Modeling and Analysis of Hybrid Systems: A Case Study in Multirobot Coordination”
FM’99 World Congress On Formal Methods, Toulouse France, Sep 1999
- “Formally Specified Monitoring of Temporal Properties”
European Conference on Real-Time Systems, York UK, June 1999

CONFERENCE REVIEWING

- International Conference on Formal Engineering Methods
- Formal Methods Europe
- Foundations of Software Technology and Theoretical Computer Science
- Real-Time Computing Systems and Applications
- Real-Time Systems Symposium
- Real-Time Technology and Applications Symposium
- International Symposium on Object-oriented Real-time Distributed Computing

PUBLICLY DISTRIBUTED SOFTWARE

- MaCware 0.991

MaCware is a prototype implementation of the MaC framework. MaCware automatically inserts probes into a target Java program to monitor and check the execution of the Java program with respect to the requirement specification. MaCware can incorporate the third-party tools easily for various extensions. The latest version of MaCware is 0.991 and available from <http://www.cis.upenn.edu/~rtg/mac>

COMMERCIAL PRODUCT DEVELOPMENT

- NXG6000

I worked on early development of NXG6000 (<http://www.secui.com/>) that is a NPU based commercial gigabit network security appliance that utilizes parallel packet processing and direct HW resource manipulation. The advantages of heterogeneous platforms (MicroEngines, Xscale and host CPU) were achieved while sustaining integration of the security functions of IDS, VPN, and Firewall.

TEACHING EXPERIENCE

- EECE700A “Introduction to Formal Verification” (a graduate class) Spring 2005
CSE Dept., Pohang University of Science and Technology
- CSE504 “Theory of Computation” (a graduate class) Fall 2002
CS Dept., Korea University

HONORS AND AWARDS

- JangRyu award at Samsung Humantech Thesis Contest 2001
- Dean’s fellowship, University of Pennsylvania 1995-1996
- Dean’s fellowship, KAIST 1992-1995