Ming Fu

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EXPERTISE

Operating system architecture and formal verification of OS, concurrency verification, weak memory consistency, program logics, and interactive theorem proving.

EDUCATION

University of Science and Technology of China (USTC), Hefei, Anhui, China

Ph.D. in Computer Science, University of Science and Technology of China, July 2010.
- Dissertation Topic: "Formal Verification of Concurrent Assembly Code (Chinese)"
- Advisors: Yu Zhang & Yiyun Chen.

University of Science and Technology of China, Hefei, Anhui, China

B.S. in Computer University of Science and Technology of China, July 2004.

INDUSTRIAL EXPERIENCE

Director at **Huawei Dresden Research Center**, **March, 2019 - Present**

- Creating Huawei Dresden Research Center from the scratch. Leading more than 30 researchers for doing industrial-oriented research on OS architecture, multicore scalability, weak memory consistency, and formal verification of OS and processors

Senior Expert at **Huawei OS Kernel Lab**, **July, 2017 - March, 2019**

- SE for the Hongmeng OS project. Leading the formal verification team to verify some key components of Hongmeng microkernel. Participating in designing and developing Hongmeng microkernel

ACADEMIC EXPERIENCE

Associate Professor at **USTC**, **August, 2016 - June, 2017**

- Applying our OS verification framework to verify SpaceOS developed by a Chinese corporation.

Post Doc. Researcher at **USTC**, **Januaray, 2011 - July, 2016**

- Developing concurrent program logic and refinement verification techniques for verifying fine-grained concurrency.
- Applying refinement verification techniques to verify software transactional memory (STM) algorithms.
- Leading a verification group (one Ph.D and five master students) to apply refinement verification techniques to formally verify a commercial real-time embedded OS kernel μC/OS-II in Coq.

Advisor: Xinyu Feng.

Visiting assistant in research at **Yale University**, **November, 2009 - October, 2010**
Developing program logic to verify optimistic concurrent programs. Advisor: Zhong Shao

PUBLICATIONS

Rafael Lourenco de Lima Chehab, Antonio Paolillo, Diogo Behrens, **Ming Fu***, Hermann Haertig, Haibo Chen. CLoF: A Compositional Lock Framework for Multi-level NUMA Systems. The 28th ACM Symposium on Operating Systems Principles *(SOSP'21)* , October 25-28, 2021.

Jonas Oberhauser, Lilith Oberhauser, Antonio Paolillo, Diogo Behrens, Ming Fu, Viktor Vafeiadis. Verifying and Optimizing the HMCS Lock for Arm Servers. The 9th International Conference on Networked Systems *(NETYS'21)*, May, 2021.

Jonas Oberhauser, Rafael Lourenco de Lima Chehab, Diogo Behrens, **Ming Fu***, Antonio Paolillo, Lilith Oberhauser, Koustubha Bhat, Yuzhong Wen, Haibo Chen, Jaeho Kim, Viktor Vafeiadis. VSync: Push-Button Verification and Optimization for Synchronization Primitives on Weak Memory Models. The 26th ACM International Conference on Architectural Support for Programming Languages and Operating Systems *(ASPLOS'21, Distinguished Paper Award)*, April, 2021.

Jiawei Wang, **Ming Fu**, Lei Qiao, Xinyu Feng. Formalizing SPARCv8 instruction set architecture in Coq. Science of Computer Programming , 187: 102371 (2020).

Mo Zou, Haoran Ding, Dong Du, **Ming Fu**, Ronghui Gu, Haibo Chen. Using Concurrent Relational Logic with Helper for Verifying the AtomFS File System. The 27th ACM Symposium on Operating System Principles (*SOSP'19*). Deerhurst Resort, Huntsville, Ontario, Canada, October 27-30, 2019.

Fengwei Xu, **Ming Fu***, Xinyu Feng, Xiaoran Zhang, Hui Zhang and Zhaohui Li. A Practical Verification Framework for Preemptive OS Kernels. Proc. 28th International Conference on Computer Aided Verification (*CAV'16*), Toronto, Ontario, Canada, pages 59–79, July, 2016.

Jingyuan Cao, **Ming Fu*** and Xinyu Feng. Practical Tactics for Verifying C Programs in Coq Proc. 4th ACM-SIGPLAN Conference on Certified Programs and Proofs (*CPP'15*), Mumbai, India, pages 97–108, January, 2015.

Xiaoxiao Yang, Yu Zhang, **Ming Fu** and Xinyu Feng. A Temporal Programming Model with Atomic Blocks Based on Projection Temporal Logic Frontiers of Computer Science (*FCS*) 8(6):958–967, 2014.

Hongjin Liang, Xinyu Feng and **Ming Fu**. Rely-Guarantee-Based Simulation for Compositional Verification of Concurrent Program Transformations. ACM Transactions on Programming Languages and Systems(*TOPLAS*), Volume 36, Issue 1, Article No. 3, March 2014.

Yanni Kouskoulas, **Ming Fu**, Zhong Shao and Peter Kazanzides. Applying Mathematical Logic to Create Zero-Defect Software. JOHNS HOPKINS APL TECHNICAL DIGEST, VOLUME 32, NUMBER 2 (2013).

Xiaoxiao Yang, Yu Zhang, **Ming Fu** and Xinyu Feng. A Concurrent Temporal Programming Model with Atomic Blocks Proc. 14th International Conference on Formal Engineering Methods (*ICFEM'12*) Kyoto, Japan, pages 22–37, November, 2012

Hongjin Liang, Xinyu Feng and **Ming Fu**. A Rely-Guarantee-Based Simulation for Verifying Concurrent Program Transformations. Proc. 39th ACM SIGPLAN-SIGACT Symposium on Principles of Programming Languages (*POPL'12*), pages 455-468, January 2012.

Zipeng Zhang, Xinyu Feng, **Ming Fu**, Zhong Shao and Yong Li. A Structural Approach to Prophecy Variables. Proc. 9th annual conference on Theory and Applications of Models of Computation (*TAMC'12*), pages 61-71, 2012.

Yanni Kouskoulas, **Ming Fu**, Zhong Shao and Peter Kazanzides. Certifying the Concurrent State Table Implementation in a Surgical Robotic System. Proc. 3rd Joint Workshop on High Confidence Medical Devices, Software, and Systems& Medical Device Plug-and-Play Interoperability, Chicago, USA. June 2011.

Ming Fu, Yong Li, Xinyu Feng, Zhong Shao, and Yu Zhang. Reasoning about optimistic concurrency using a program logic for history, Proc. of 21st International Conference on Concurrency Theory (***CONCUR'10***), Paris, France, August 2010. Lecture Notes in Computer Science Vol.6269, pages 388-402, 2010 Springer-Verlag.

Yong Li, Yu Zhang, Yiyun Chen and **Ming Fu**. Formal reasoning about lazy-STM programs. *Journal of Computer Science and Technology* (***JCST***) , 25(4):841-852, 2010

Ming Fu, Yu Zhang and Yong Li. Formal verification of concurrent programs with read-write locks. Frontiers of Computer Science (***FCS***) , 4(1): 65-77, Jan, 2010.

Ming Fu, Yu Zhang and Yong Li. Formal reasoning about concurrent assembly code with reentrant locks. Proc. of 3rd IEEE International Symposium on Theoretical Aspects of Software Engineering(***TASE'09***) , July 29-31, 2009, Tianjin, China, pages 233-240.

Yong Li, Yu Zhang, Yiyun Chen and **Ming Fu**. On the verification of strong atomicity in programs using STM. Proc. of 3rd IEEE International Conference on Secure Software Integration and Reliability Improvement(***SSIRI'09***), July 8-10, 2009, Shanghai, China, pages 117-125.

Ming Fu and Yu Zhang. Homomorphism resolving of XPath trees based on automata. Proc. of a joint conference of the 9th 9th Asia-Pacific Web Conference and the 8th International Conference on Web-Age Information Management (***APWeb/WAIM'07***), June16-18, Huang Shan, China.

(∗: corresponding author)

CONFERENCE PRESENTATIONS

Taking Formal Verification of Systems Software from Academia to Industry Verified Software Workshop Programme *(VeTSS)* Tuesday, 24th September 2019 in UK (https://vetss.org.uk/verified-software-workshop-programme/).

A Practical Verification Framework for Preemptive OS Kernels. Presented at ***CAV'16***, Toronto, Canada, July, 22nd, 2015.

Practical Tactics for Verifying C Programs in Coq. Presented at ***CPP'15***, Tata research institute, Mumbai, India, 2015.

A refinement-based verification framework for lock-based software transactional memory. Presented at ***SAVE'14***, Beijing, China, 2014.

Reasoning about optimistic concurrency using a program logic for history. Presented at ***CONCUR'10***, IBM programming language day, and Yale programming language seminar, 2010.

SERVICE

- Reviewer for journals: Journal of Software (***JOS***), Frontiers of Computer Science (***FCS***).
- Reviewer for conferences: ***LICS'15***, ***ITP'15***, ***ESOP'13***.

TEACHING EXPERIENCE

Instructor for the graduate level course, **Multicore Programming**, college of software, USTC, 2012, 2013, 2014, 2015, 2016.

Instructor for the under graduate level course, **Frontier of Research on High-Confidence Software**, USTC, summer, 2012.

SKILLS

- OS Architecture, multicore programming, weak memory consistency.
- separation logic, concurrent program logic, refinement-based program logic.
- Interactive theorem proving (Coq).

- Familiar with Java, C/C++, OCaml, LaTex.

HONORS AND AWARDS	Student fellowship for attending CONCUR'10, 2010.
	Fellowship of the China Scholarship Council for visiting Yale University, 2009-2010.
	Third prize fellowship of University of Science and Technology of China, 2000.
	New student fellowship of University of Science and Technology of China, 1999
GRANTS	Verifying lock-free concurrent data structures. National Science Foundation of China. Grant No.61103023 (RMB 315,000), 2012.1-2014.12. (PI)
	Refinement-based verification framework for software transactional memory. Fundamental Research Funds for the Central Universities. Grant No. WK0110000031 (RMB 75,000), 2012.1-2013.12. (PI)
	China Postdoctoral Science Foundation, Grant No.2012M511420 (RMB 50,000), 2012.8- 2013.8. (PI)