

Shinya Umeno

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RESEARCH INTEREST Mathematical techniques to formal verify real-time, hybrid, concurrent and distributed systems. My current focus is on developing new abstraction techniques to reduce the state space of a time-parametric system model, so that time-parametric model-checking can be conducted using a conventional untimed model-checker.

EDUCATION – **Massachusetts Institute of Technology**, Cambridge, MA, USA.
Master of Science.
Thesis title: *Proving Safety Properties of an Aircraft Landing Protocol Using Timed and Untimed I/O Automata: A Case Study*
Adviser: Professor Nancy Lynch

– **Tokyo Institute of Technology**, Tokyo, Japan
Bachelor of Science.
Thesis title: *On Routing Strategies in Update Networks*
Adviser: Professor Osamu Watanabe

FELLOWSHIP – MIT Presidential Fellowship, 2004-2005

RESEARCH EXPERIENCE – CSAIL, MIT, 2006-ongoing. Novel abstraction techniques for real-time systems by focusing on event orders in executions of the system. Developed a novel abstraction technique, *event order abstraction* to formally verify safety properties of real-time systems. Constructed a tool *METEORS* that can be used with the abstraction technique to automatically derive timing constraints under which the underlying system does not exhibit specified event orders. Now developing a similar kind of abstraction techniques for a certain class of loosely synchronized systems.

– NASA Langley Research Center/National Institute of Aerospace, 2007 (six-week summer intern), Formal verification of the startup protocol of the NASA SPIDER fault-tolerant bus architecture. Constructed a formal model of the protocol in the input language of the SAL model-checker, developed by the SRI International. Conducted infinite-state model-checking of key properties of the protocol using *k-induction*.

– CSAIL, MIT, 2004-2007. Formal verification of the NASA SATS aircraft landing protocol. Constructed timed and untimed I/O automata models of the protocol. Conducted a theorem proving using PVS to verify key safety properties of the untimed model. Developed a new automata refinement technique, and applied it to carry over the verification result for the untimed model to the timed model of the protocol. Conducted a hand-written invariant proof for the timed model to verify key safety properties of the protocol that can be represented only by the timed model.

TEACHING EXPERIENCE – Teaching assistant for an MIT undergraduate course, Introduction to EECS I, in the Spring term 2007.

JOURNAL PAPER 1. Myla Archer, HongPing Lim, Nancy Lynch, Sayan Mitra and Shinya Umeno. Specifying and proving properties of timed I/O automata using Tempo. *Design Automation for Embedded Systems*, 12(1-2):139-170, 2008.

CONFERENCE PAPERS 1. Shinya Umeno. Machine-Assisted Parameter Synthesis of the Biphase Mark Protocol Using Event Order Abstraction. To appear in *The 7th International Conference on Formal Modelling and Analysis of Timed Systems (FORMATS 2009)*, Budapest, Hungary, September 13-16, 2009.

2. Shinya Umeno. Event Order Abstraction for Parametric Real-Time System Verification. *The 8th ACM & IEEE International Conference on Embedded Software (EMSOFT) 2008*, Atlanta, Georgia, October 19 - 24, 2008, pages 1-10, ACM, 2008.

3. Shinya Umeno and Nancy Lynch. Safety Verification of an Aircraft Landing Protocol: A Refinement Approach. *Hybrid Systems: Computation and Control (HSCC 2007)*, Pisa, Italy, April 3-5, 2007, volume 4416 of Lecture Notes in Computer Science, pages 557-572, Springer, 2007
4. Shinya Umeno and Nancy Lynch. Proving safety properties of an aircraft landing protocol using I/O Automata and the PVS theorem prover: a case study. *FM 2006: Formal Methods, International Symposium of Formal Methods Europe*, Hamilton, Ontario Canada, August, 2006. Volume 4085 of Lecture Notes in Computer Science, pages 64-80, Springer, 2006
5. Myla Archer, HongPing Lim, Nancy Lynch, Sayan Mitra and Shinya Umeno. Specifying and Proving Properties of Timed I/O Automata in the TIOA Toolkit. *Fourth ACM-IEEE International Conference on Formal Methods and Models for Codesign (MEM-OCODE'06)*, Napa Valley, California, July, 2006.

REVIEWING DISC 2006, TACAS 2008

LANGUAGES English, Japanese

CITIZENSHIP Citizen of Japan, USA J1 Student Visa

SOCIAL ACTIVITIES – President, Japanese Association of MIT, 2006-2007
 – Officer, Japanese Association of MIT, 2005-ongoing