

Biographical Sketch and Scientific Achievements

Rupak Majumdar

Biographical Sketch

Rupak Majumdar was born in 1975. He received the B.Tech. degree in Computer Science from the Indian Institute of Technology at Kanpur in 1998 and the Ph.D. degree in Computer Science from the University of California at Berkeley in 2003. Since then, he has been an Assistant Professor (2004-2008), and an Associate Professor (2008-present) in the Department of Computer Science at the University of California, Los Angeles. Prof. Majumdar received the President's Gold Medal from IIT, Kanpur, the Leon O. Chua award from UC Berkeley, and an NSF CAREER award.

He is chairing the Hybrid Systems Computation and Control conference (HSCC 2009) and the ETAPS Tools and Algorithms for the Construction and Analysis of Systems (TACAS 2010) conferences.

Significant Contributions

Prof. Majumdar's research is in the field of formal verification. His research spans the spectrum of formal verification techniques: from the theoretical foundations in logic and automata theory (especially stochastic systems and games) to practical software engineering tools that systematically analyze thousands of lines of code for programmer errors or proofs of correct behavior (software model checking and testing); from the low level (embedded systems analysis and logic synthesis) to the high level (design and analysis of enterprise computer systems). As such, he has published in major venues of several different communities: in programming languages and verification (POPL, PLDI, CAV, TACAS), in software engineering (ICSE, FSE), in electronic design automation (ICCAD, DAC), in theory/logic (LICS, ICALP), and in embedded systems (EMSOFT, HSCC), among others.

Prof. Majumdar has made major contributions in the field of software model checking, and he wrote the software model checker BLAST with Ranjit Jhala. The success of BLAST in scalably and precisely analyzing over 100,000 lines of code for complex temporal properties was a major milestone and proof of feasibility in the field of software verification and led to a flurry of academic and industrial activity in the area. He introduced the notion of *lazy abstraction*, an idea which forms the cornerstone of scalable software verification systems. (His two main papers on the subject have been cited about 1000 times together.) Recently he has extended the capability of software model checkers to precisely analyze *event-driven* programs, a common systems idiom.

Prof. Majumdar was one of the pioneers in the study of *quantitative temporal properties* of systems. Unlike Boolean logics, in which a formula evaluates to true or false, formulas in quantitative logics determine a continuum of possible values (e.g., the real interval $[0, 1]$). Prof. Majumdar proved a fundamental theorem in the analysis of *concurrent stochastic games* relative to quantitative omega-regular properties, and since then, has proved several fundamental theorems relating to the theory of infinite stochastic games, quantitative logics, and metrics on systems. These results help define notions of *approximations* and *robustness* in systems theory relative to temporal properties. Quantitative logics have since found applications in diverse domains, such as fault-tolerant VLSI design and robust hybrid controller design. His results on quantitative stochastic games have led to many further discoveries in the field that use similar techniques.

In addition to these areas, more recently, Prof. Majumdar has started working on new directions in VLSI design at the low level and enterprise software systems at the high level. In VLSI design, Prof. Majumdar is pioneering logic synthesis techniques for variation- and fault-tolerant VLSI design. Process variations and faults are becoming key obstacles in the push toward nano-scale VLSI systems design, and this research will

provide a scalable design flow that gives better-than-worst-case performance. In enterprise software systems, Prof. Majumdar developed theories and tools for fine-grained access control in inter-operating enterprise applications, and these ideas are already in the process of being commercialized.

Prof. Majumdar has published over 80 peer-reviewed technical articles in conferences and journals. A longer version of his research statement is available from <http://www.cs.ucla.edu/%7Erupak/research.pdf> and his C.V. from <http://www.cs.ucla.edu/%7Erupak/cv.pdf>.