Swarat Chaudhuri

Curriculum vitae

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Research interests

My primary research interests are in programming languages and software engineering—in particular, specification, analysis, and verification of software systems. I am also interested in logic, algorithms, and concurrency theory.

Education

2001 onwards **Doctor of Philosophy**, *University of Pennsylvania*, Summer 2007 (expected).

Thesis *Algorithms and Logics for Software Analysis*.
Advisor: Professor Rajeev Alur.
The foci of my thesis are: (1) strengthening the foundations of formal specifications for software, and (2) developing provably fast algorithms for program analysis. In the former direction, my thesis offers a unified theory of software specifications in terms of formal languages of structures called nested trees. As for the latter, it presents the first subcubic solution to the CFL-reachability problem, implying that Datalog chain query evaluation and many program analysis problems do not in fact suffer from a "cubic bottleneck."

1997–2001 **Bachelor of Technology (Hons.)**, *Indian Institute of Technology, Kharagpur, India*.

Summer schools Attended the Marktoberdorf Summer School on Models, Algebras, and Logics for Engineering Software, 2002.

Awards University of Pennsylvania Fellowship (September 2001–present); Jagadis Bose National Science Talent Search (JBNSTS) scholarship (1997–2001); West Bengal Council of Higher Secondary Education Award of Excellence.

Publications

Three representative papers are available for download at
`http://www.cis.upenn.edu/∼swarat/app.html`.

[1] Instrumenting C programs with nested word monitors. With Rajeev Alur. *Draft*, 2007. (Tool paper describing a specification language based on nested word automata that can state context-sensitive safety properties of programs and can be used to automatically instrument C code.)

[2] CFL-Reachability in subcubic time. *IBM Research Report # RC24126 (W0611-203)*, 2006. (Shows that CFL-reachability and reachability in pushdown automata may be solved in subcubic time. Also shows that these problems become easier as recursion is restricted, and presents a new algorithm for graph transitive closure.)

[3] Model-checking tree logics with path equivalences. With Rajeev Alur and Pavol Černý. In *13th Conference on Tools and Algorithms for the Construction and Analysis of Systems (TACAS)*, 2007. (Proposes a temporal logic framework suitable for expressing information-flow requirements such as secrecy, and gives model-checking algorithms for these logics.)

[4] Logics and automata for software model-checking. With Rajeev Alur. In *Lecture notes, Marktoberdorf Summer School*, 2006. (Survey article summarizing the applications of nested word and tree languages to program verification.)

[5] Branching pushdown tree automata. With Rajeev Alur. In *26th Conference on Foundations of Software Technology and Theoretical Computer Science (FSTTCS)*, 2006. (Finds that traditional definitions of pushdown tree automata cannot capture the full interplay of tree branching and the pushdown stack, and identifies a way to remedy this issue.)

[6] Languages of nested trees. With Rajeev Alur and P. Madhusudan. In *18th Conference on Computer-Aided Verification (CAV)*, 2006. (Introduces finite automata on nested trees, shows that they have a robust theory, and establishes their connections with the fixpoint logic NT-μ.)

[7] A fixpoint calculus for local and global program flows. With Rajeev Alur and P. Madhusudan. In *33rd Symposium on Principles of Programming Languages (POPL)*, 2006. (Introduces a fixpoint logic called NT-μ, interpreted on structures known as nested trees, that captures the essence of interprocedural program analysis and has a symbolic model-checking procedure.)

[8] On-the-fly reachability and cycle detection for recursive state machines. With Rajeev Alur, Kousha Etessami and P. Madhusudan. In *11th Conference on Tools and Algorithms for the Construction and Analysis of Systems (TACAS)*, 2005. (Proposes and implements algorithms for linear-time model-checking of pushdown models of programs.)

[9] Compression of partially ordered strings. With Rajeev Alur, Kousha Etessami, Sudipto Guha, and Mihalis Yannakakis. In *14th Conference on Concurrency Theory (CONCUR)*, 2003. (Identifies the problem of grammar-based compression of partial orders representing concurrent program executions, and studies approximation algorithms for this problem.)

Internships

2006 IBM T.J. Watson Research Center, Hawthorne, NY. Worked on the CFL-reachability problem and incremental analysis of recursive programs.

2005 Grammatech, Inc, Ithaca, NY. Worked on program analysis algorithms implemented in CodeSonar, a tool for systematic bug-finding in C code.

2002 Lucent Bell Laboratories, Murray Hill, NJ. Designed and implemented an algorithm for "on-the-fly" analysis of recursive programs.

2000 BRICS, University of Aarhus, Denmark. Studied logics that express properties of concurrent programs.

Teaching

Teaching assistant for undergraduate and graduate courses on formal language and automata theory in Fall 2002, and Spring and Summer 2003.

Selected talks

Slides for some of the talks are available for download at
`http://www.cis.upenn.edu/~swarat/app.html`.

2006 Algorithms and logics for software analysis. At IBM T. J. Watson Research Center, Hawthorne, NY.

Branching pushdown tree automata. At *FSTTCS 2006, Kolkata, India*.

CFL-Reachability in subcubic time. At *Northeastern Verification Seminar, New York University*, 2006.

Languages of nested trees. At *CAV 2006*, Seattle, WA.

Software model-checking with languages of nested trees. Dissertation proposal, University of Pennsylvania. Also at IBM Research, Hawthorne, NY

A fixpoint calculus for local and global program flows. At *POPL 2006*, Charleston, SC.

2005 On-the-fly reachability and cycle detection for recursive state machines. At *TACAS 2005*, Edinburgh, UK.

2003 Compression of partially ordered strings. At *CONCUR 2003*, Marseilles, France.

Miscellaneous

Reviewer for TACAS, CSR, LICS, Journal of Logic and Algebraic Programming.

Organizer, *Thursday lunch seminar on software and hybrid systems*, Fall 2005, and *Some-are-reading seminar in software analysis*, June–July 2004.

Bilingual in English and Bengali. Published travel writer and technology columnist.

Personal

Date of birth March 27, 1979.

Citizenship Indian.

References

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