

# Sara Achour

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## EDUCATION

### MIT

2014-Present | Cambridge, MA

### PHD CANDIDATE IN COMPUTER SCIENCE

Advised by Martin Rinard

Program Analysis and Compilation Group  
CSAIL/EECS

GPA: 4.80

2013-2014 | Cambridge, MA

### MASTERS IN COMPUTER SCIENCE

GPA: 4.80

### UCLA

2008-2013 | Los Angeles

### BS IN COMPUTER SCIENCE

Henry Samueli Engineering School  
(HSSEAS)

Dean's List all Quarters

Summa Cum Laude (top 5%)

### BS IN COMPUTATIONAL BIOLOGY

Computational Systems Conc.

College of Letters and Science

Valedictorian

Major GPA: 3.97/4.00

Cumulative GPA: 3.87/4.00

## COURSEWORK

### GRADUATE

Computer Architecture, Program Analysis,  
Machine Learning, Theory Of  
Computation, User Interface Design

### UNDERGRADUATE

**Computer Science:** Parallel Computing,  
Databases, Numerical Computing,  
Computer Architecture, Logic Design of  
Digital Systems / Digital Design  
Laboratory, Software Engineering,  
Networking, Programming Languages,  
Algorithms and Complexity, Operating  
Systems, Formal Languages and Automata,  
Computer Graphics

**Math/EE:** Digital and Analog Signal  
Processing and Feedback Control,  
Statistics, Probability Differential  
Equations, Linear Algebra, Discrete Math,  
Single/Multivariable Calculus

**Biology:** Biomedical Engineering,  
Modelling and Simulation of Biological  
Systems, Organic and Inorganic Chemistry,  
Molecular Biology, Physiology, Cells  
Tissues and Organs, Genetics, Evolution  
Ecology and Biodiversity

## PUBLICATIONS

### Configuration Synthesis for Programmable Analog Devices with Arco

[Sara Achour](#), [Rahul Sarpeshkar](#), and [Martin Rinard](#). PLDI 2016.

**Dagstuhl Seminar in Approximate and Probabilistic Computing: Design, Coding, Verification**  
November 29-December 4, 2015. Dagstuhl Seminar 15491.

### Energy Efficient Approximate Computation in Topaz

[Sara Achour](#) and [Martin Rinard](#). OOPSLA/SPLASH 2015.

### An Analysis of Patch Plausibility and Correctness for Generate-And-Validate Patch Generation Systems

Zichao Qi, Fan Long, [Sara Achour](#) and [Martin Rinard](#). ISSTA 2015.

### Chisel: Reliability- and Accuracy-Aware Optimization of Approximate Computational Kernels

Sasa Misailovic, Michael Carbin, [Sara Achour](#), Zichao Qi and [Martin Rinard](#)

OOPSLA/SPLASH 2014. Best Paper.

## RESEARCH

### ARCO

#### Martin Rinard | 2015

Programmable analog devices have emerged as a powerful computing substrate for performing complex neuromorphic and cytomorphic computations. We present Arco, a new solver that, given a dynamical system specification in the form of a set of differential equations, generates physically realizable configurations for programmable analog devices that are algebraically equivalent to the specified system.

- designed, parsed hardware and dynamical system specification language
- implemented synthesizing algebraic solver that generates configurations.
- formalized tableau, transitions over tableaus and search space.

### TOPAZ

#### Martin Rinard | 2014

Topaz is a task-based language and runtime for developing programs to run on approximate computing platforms that may occasionally produce arbitrarily inaccurate results. Topaz deploys a novel outlier detection and reliable reexecution mechanism to prevent unacceptably inaccurate task results from corrupting the overall computation.

- designed and implemented Topaz runtime, control systems for output outlier detection.
- designed compute-combine extension to C, implemented cross compiler into pure C.
- designed and implemented approximate hardware simulated for Pin.
- implemented five benchmarks from various domains for experiments (in C++).

### CHISEL

#### Sasa Misailovic, Michael Carbin, Martin Rinard | Fall-Summer 2013-2014

Chisel is a system for reliability- and accuracy-aware optimization of approximate computational kernels that run on approximate hardware platforms. Given a combined reliability and accuracy specification, Chisel automatically selects approximate kernel operations to synthesize an approximate computation that minimizes energy consumption while satisfying its reliability and accuracy specification.

- designed and implemented reliability search algorithm, given final output quality (in Python).
- implemented kernel output checkers.
- implemented five benchmarks from various domains for experiments (in C/Rely).

## SKILLS

**Programming/Scripting Languages:** C, C++, Java, javascript, python, OCaml, haskell, bash, go

**Markup Languages:** latex, HTML, markdown, CSS

**Libraries:** standard, scientific computing [scipy,numpy], parser/generator [menhir,ocamlyacc], web [jquery,nodejs], graphical [d3,3js], Android, chrome APIs

**Tools:** SMT Solvers [Z3], ILP Toolkits [gurobi], Automated Theorem Provers [Coq]

**Operating Systems:** debian-based, arch-linux, OSX Mavericks, Windows 7

## AWARDS

2015	NSF GRFP Fellowship
2014	Merill Lynch Fellowship
2013	Summa Cum Laude in Computer Science (top 5%)
2013	Valedictorian in Computational Biology (1st)
2012	Roberto Padovani Fellowship (8 awarded)
2011	CDSC Fellowship
2010-2013	Dean's List (HSSEAS)

## SOCIETIES

2012	Upsilon Pi Epsilon (Computer Science Honor Society)
2011	Tau Beta Pi (Engineering Honor Society)

## LINKS

MIT: [people.csail.mit.edu/sachour](http://people.csail.mit.edu/sachour)

GitHub: [github.com/sarachour](https://github.com/sarachour)

Linkedin: [linkedin.com/pub/sara-achour/9/b09/76a](https://www.linkedin.com/pub/sara-achour/9/b09/76a)

## PERSONAL

**SigTBD:** I started a yearly faux conference at MIT and served as general chair for its inaugural year.

**1001 Radio Program:** I run a radio program on audio dramas and other spoken word fiction.

**Interactive Fiction:** I am minoring in digital/interactive fiction and am planning on making a submission to the interactive fiction competition.

**8Tracks Virtuoso:** I wrote a chrome extension for power users of 8tracks. Supports synchronization with Spotify as well as mix search, notifications and hotkey mapping.

**Open Source Boat Project:** I am writing a tool that converts electronic nautical charts to Json for visualization purposes.

## PATCH ANALYSIS

Zichao Qi, Fan Long, Sara Achour and Martin Rinard | Spring 2015

Performed a comparative analysis of patch generation tools from the software engineering community and published our findings in Spring 2015.

## MAGPIE

Michael Gordon, MIT | Spring 2014

Magpie is a code reuse detection tool that, given a Java project, scans online repositories for similar snippets of code. Magpie then communicates the results to the user through the code reuse summarizer and browser. Magpie is implemented as an Eclipse plugin.

- implemented distinct code feature extraction from Java source file.
- implemented code feature search using ohloh code aggregator as backend.
- implemented tree-based similarity summarizer for project, with side-by-side structural comparator.

## MATLAB TO HABENERO C COMPILER

Jens Palsberg, Center for Domain Specific Computing (CDSC), UCLA, CA

June-Sept 2011

The Matlab to Habanero C compiler cross-compiles a subset of the Matlab language to Habanero C.

- implemented Typed Matlab AST to Habanero source cross compiler (in Java).
- implemented subset of matlab library functions using Blas, LaPack, C.
- implemented loop optimization for cross cutting matrix operations.
- presented results at CDSC poster session.

## THYROID SIMULATOR

I wrote a partial differential equation simulator for the pediatric thyroid hormone model. This project was part of my Computational Biology thesis.

- implemented differential equation simulator for stiff systems (in Python).
- implemented pediatric thyroid hormone model ( 60 differential equations).
- implemented support for (dis)continuous inputs and time-delayed state variables.
- implemented web interface for specifying inputs and displaying outputs.

## INDUSTRY

### QUALCOMM | SOFTWARE RESEARCH INTERN

June-Sept 2012,2013 | Qualcomm Research Division, San Diego, CA

For my project, I developed high throughput realtime neurological visualizations to facilitate in-browser monitoring of simulations.

- designed and implemented neurological visualizations - including (hardware accelerated) heatmap, basic graphs, raster plot with histograms, fan-in/fan-out diagram, and connectivity diagram (javascript+webgl/canvas).
- implemented fuzzy unit testing framework for Sproutcore library which supports relaxed graphical comparisons and structural comparisons for complex data structures. The framework maintains an easily exportable internal representation of the test results.
- presented findings in company poster session, one of eight interns awarded Roberti Padovani scholarship.

### GERARD MANNING (PI), RAZAVI-NEWMAN LAB, SALK INSTITUTE OF BIOLOGICAL SCIENCES | RESEARCH INTERN

Summer 2007, 2008, 2009 | San Diego, CA

For my research, I studied the effects of whole genome duplications on kinase evolution in ciliates. Kinases are enzymes that phosphorylate substrates.

- annotated the *Paramecium Tetraurelia* kinome.
- constructed the kinome of the common ancestor between *Paramecium Tetraurelia* and *Tetrahymena Thermophila*
- analyzed kinome to draw conclusions about evolution of particular kinases
- presented findings in final presentation, poster session.