

CV

Alexey Bakhirkin

Email abakhirkin@gmail.com (personal)
alexey.bakhirkin@univ-grenoble-alpes.fr (work)

Web <http://www-verimag.imag.fr/~bakhirki/>

Occupation Postdoc, Verimag/Université Grenoble Alpes

Now living in Grenoble, France

Citizenship Russian

Born 1987 in Moscow, Russia

Field of interest Program verification, temporal logics, runtime verification

About me I'm a postdoc at Verimag, France. My current research directions are: program analysis using the tools of logic and abstract interpretation (funded by the European STATOR project); and temporal logics for monitoring.

I got my PhD from the University of Leicester, UK. Before that, I was studying computing Bauman University in Moscow, Russia.

For a few years, I worked as a software developer in Moscow, mostly dealing with .NET and databases.

Brief Timeline

This is a very brief timeline. What I'm doing now, I explain just below. What I was doing in the past, I explain further down.

Oct 2016 – present Postdoc at Verimag/Université Grenoble Alpes, France.

Jun 2012 – Sep 2016 PhD Student in Computer Science, University of Leicester, UK.

Aug – Oct 2014 Intern at Microsoft Research, Cambridge, UK.

2007 – 2012 Software Developer in Moscow, Russia

2004 – 2010 Student in Computing (Engineering degree, similar to MSc) at Bauman Moscow State University, Russia

Current Work

Abstract Interpretation of Horn Clauses In this work I am developing an abstract interpreter for constrained Horn clauses (see here) that aims at overcoming the challenges of using abstract inter-

pretation in this setting: combining forward (from the initial conditions to the goal) and backward (from the goals to the initial condition) analysis [2], analysing non-linear systems of clauses, analysing systems with both numeric and Boolean variables, etc.

Horn clauses promise to be a convenient intermediate language to encode problems from program analysis, and potentially from other areas of formal methods.

This work is hosted by David Monniaux and funded by the European STATOR project.

Temporal Logics for Monitoring In collaboration with Oded Maler et al., I'm working on monitoring [1, 3]. The idea is to observe one or more traces of a running system or a model and to measure how well it satisfies some property. Monitoring is an important component of falsification (search for bad behaviours of systems), which is currently considered a promising application of formal methods in industry.

Teaching

In 2012 – 2016, I was a teaching assistant for several modules, including: C++ programming, model checking (MSc level), Java programming, Haskell programming, operating systems (BSc level). In 2016, I supervised a group of BSc students on a project involving researching a topic and preparing a report and presentations.

Technical

I can program in different languages and environments. I worked on projects that use Java, C#, C++, OCaml; both in Windows and Linux; both academic and commercial.

Publications

- [1] Alexey Bakhirkin, Thomas Ferrère, and Oded Maler. “Efficient Parametric Identification for STL”. In: *International Conference on Hybrid Systems: Computation and Control (HSCC)*. Nominated for the best repeatability evaluation award. Download links: pdf, hal, slides. 2018.
- [2] Alexey Bakhirkin and David Monniaux. “Combining Forward and Backward Abstract Interpretation of Horn Clauses”. In: *Static Analysis Symposium (SAS)*. Download links: pdf, hal. 2017.
- [3] Alexey Bakhirkin et al. “On the Quantitative Semantics of Regular Expressions over Real-Valued Signals”. In: *Formal Modelling and Analysis of Timed Systems (FORMATS)*. Download links: pdf, hal, slides. 2017.
- [4] Alexey Bakhirkin. “Recurrent Sets for Non-Termination and Safety of Programs”. Download links: official, printer-friendly. PhD thesis. University of Leicester, Department of Informatics, 2016.
- [5] Alexey Bakhirkin and Nir Piterman. “Finding Recurrent Sets with Backward Analysis and Trace Partitioning”. In: *Tools and Algorithms for the Construction and Analysis of Systems (TACAS)*. Download links: pdf, Ira, slides. 2016.
- [6] Alexey Bakhirkin, Josh Berdine, and Nir Piterman. “A Forward Analysis for Recurrent Sets”. In: *Static Analysis Symposium (SAS)*. Download links: tr pdf, Ira, slides. 2015.

- [7] Alexey Bakhirkin, Josh Berdine, and Nir Piterman. “Backward Analysis via over-Approximate Abstraction and under-Approximate Subtraction”. In: *Static Analysis Symposium (SAS)*. Download links: [tr pdf](#), [lra](#), [slides](#). 2014.
- [8] Alexey Bakhirkin. “A comparison of blocking and non-blocking synchronization in object-based software transactional memory”. In: *Parallel Computations and Control Problems (PACO)*. Download link: [pdf](#). 2010.

Workshops and Talks

On the Quantitative Semantics of Regular Expressions over Real-Valued Signals – at MT-CPS workshop, 2018. Slides – [here](#).

Combining Forward and Backward Abstract Interpretation of Horn Clauses – at HCVS workshop, 2017. Slides – [here](#).

Does My Program Ever Finish – a brief introduction to (non-)termination. At BCS event at Leicester, 2015. Slides – [here](#).

Software Transactional Memory – at Moscow ALT.NET group meeting, 2011. In Russian. Video – [here](#).

Tools

A path-focusing abstract interpreter for Horn clauses – [here](#).

Other

In Leicester, I was organizing the departmental PhD seminars – a regular event where we invite PhD student from British universities to talk about their research.

In August 2013, I attended Marktoberdorf Summer School on Software Systems Safety.

Languages English – fluent, Russian – native.

Links Verimag web page – <http://www-verimag.imag.fr/~bakhirki/>. DBLP – [here](#)

Past Timeline

June 2012 – Sep 2016 PhD Student in Computer Science, University of Leicester, UK. Supervisor: Nir Piterman. I worked on finding non-terminating behaviours in programs, which, for programs that are supposed to terminate, can be seen as bug-finding. For that, I developed two techniques based on abstract interpretation [5, 6].

In another work [7], I studied how a non-termination proof can be used in a safety proof.

Also, I had experience with shape analysis with 3-valued logic and the tool TVLA.

My thesis [4] was based on the above three papers [5, 6, 7].

Aug – Oct 2014 Intern at Microsoft Research, Cambridge, UK. Host: Josh Berdine. The goal of the project was to better understand scheduling in abstract interpretation. The order in which an abstract interpreter propagates the information, does matter a lot, and we formalized some knowledge and experience that was accumulated in MSR on this topic.

2007 – 2012 Working as Software Developer in Moscow, Russia I worked mostly with the .NET platform and Oracle database, but have experience with some other technologies as well.

Sep 2004 – Jul 2010 Student in Computing (Engineering degree, similar to MSc) at Bauman Moscow State University, Russia. My final project was on software transactional memory – I implemented a couple of STM algorithms (in C#) and performed some performance measurements. The main results of this work were published [8].