

Bjarke Hammersholt Rouné

PhD

Danish citizen on H-1B

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Work experience

- 2013 – Present **Software Engineer**, *Google Inc.*, USA.
Since April, 2015: Working on improving compiler optimizations for GPUs in the open source LLVM-based CUDA compiler. *First 1.5 years:* Part of the small team behind Google's successful launch of custom affinity ad targeting - wrote a substantial part of the code for custom affinity and coordinated efforts among multiple teams, back-end and front-end, to get audience estimation ready leading up to the launch. At the same time trusted with responsibility for an ad quality system that brings \$250 million in annual incremental revenue.
- 2012 – 2013 **Postdoc**, *University of Kaiserslautern — Department of Mathematics*, Germany.
Made Gröbner basis computation in Macaulay 2 and Singular >10x faster for many inputs.
- 2010 – 2012 **Postdoc**, *Cornell University — Department of Mathematics*, USA.
Published research in computational algebra with a focus on Gröbner basis computation.
- 2006 – 2010 **Teaching assistant**, *Aarhus University*, Denmark.
- 2003 – 2006 **Programmer**, *Injection*, Denmark.
Implemented custom functionality in C# for a Web Content Management System. Part-time.

Education

- 2006 – 2010 **PhD — Computer Science**, *Aarhus University*, Denmark.
2008 **Research stay at Yale University**, 5 months, USA.
2006 **Research stay at University of Minnesota**, 10 months, USA.
- 2005 – 2008 **MS — Mathematics**, *Aarhus University*, Denmark.
- 2002 – 2005 **BA — Computer Science and Mathematics**, *Aarhus University*, Denmark.
- 1999 – 2002 **High School**, *Haderslev Katedralskole*, Denmark.

Selected honors and grants

- 2010 **1.640.000 DKK personal postdoc grant for stay at Cornell University**, *The Danish Council for Independent Research | Natural Sciences*.
- 2008 **250.000 DKK EliteResearch PhD travel grant**, *The Danish Ministry of Science*.
- 2002 – 2006 Qualified several times in the top 3 to represent Aarhus University at the ACM-ICPC North Western Regional Programming Contest (NWERC), including the freshman year.
- 2002 **Honorable mention**, *International Mathematics Olympiad*, Scotland, Rep. Denmark.
- 2002 **Silver medal**, *International Olympiad in Informatics*, Korea, Representing Denmark.
- 2001 **Silver medal**, *International Olympiad in Informatics*, Finland, Representing Denmark.

Languages

Danish **Fluent**, *First language*.

English **Fluent**, *Speaking, reading and writing*.

Started learning English in third grade. Obtained best possible grade at concluding exam in high school. Have lived in the US for three years with no language difficulties.

Programming languages

I have been writing code since I was ten years old. I taught myself C++ in high school and have used it since then for personal projects, programming competitions, my studies, as an algorithms researcher and as a software engineer. I have been using C++ and educating myself about it for 15+ years. I have taught C++11 to experienced Google software engineers in a 4 hour format. I know C++ very well by now.

I have spent much of my life writing code and I have used many different programming languages. In high school I wrote a mosaic program in Python for art class. The largest non-C++ program I have written was for a compiler class to write a fully functional compiler in ML targeting MIPS assembly with a graph coloring register allocator. I have taught Java and other languages at university. During my studies I also held a C# programming job involving emitting JavaScript GUIs connecting to an SQL database.

Open source software

I conceived of, designed, implemented, tested and distributed these software projects. The line counts include tests, comments and whitespace.

- 47,411 lines **Frobby**, C++ library and program for computations with monomial ideals. Open source (GPL 2.0+) code that I wrote as part of my PhD thesis research. The library is used in the computer algebra systems Macaulay 2 and CoCoA and is also available for Sage. Available at <http://www.broune.com/frobby/>
- 1,743 lines **Mentailor**, C++ library of special-purpose memory allocators. Open source (BSD). Offers an arena allocator (stack order allocation/deallocation on the heap) and a memory pool (many same-size buffers). Available at <https://github.com/broune/mentailor>
- 11,091 lines **Mathic**, C++ template library of data structures for computer algebra. Open source (LGPL 2.0+). Available at <https://github.com/broune/mathic>
- 24,611 lines **MathicGB**, Multithreaded C++ program for Gröbner basis computation. Open source (GPL 2.0+). Based on the Mathic data structures. Gröbner bases are at the core of computer algebra. The closed source program Magma has been fastest at this for many years. MathicGB is now faster than Magma in some cases, especially on multicore systems. MathicGB will be included in the open source systems Macaulay 2 and Singular. Available at <https://github.com/broune/mathicgb>

Peer reviewed publications

- 2013 **Signature rewriting in Gröbner basis computation**, *Proceedings of the 38th International Symposium on Symbolic and Algebraic Computation*, Coauthor **Christian Eder**.
<http://www.broune.com/papers/signature.pdf>
- 2013 **Complexity and algorithms for Euler characteristic of simplicial complexes**, *Journal of Symbolic Computation*, Volume 50. Coauthor **Eduardo Sáenz-de-Cabezón**.
<http://arxiv.org/abs/1112.4523>
- 2012 **Practical Gröebner basis computation**, *Proceedings of the 37th International Symposium on Symbolic and Algebraic Computation*, Coauthor **Michael Stillman**.
<http://arxiv.org/abs/1206.6940>
- 2010 **A slice algorithm for corners and Hilbert-Poincaré series of monomial ideals**, *Proceedings of the 2010 Internat. Symposium on Symbolic and Algebraic Computation*.
<http://www.broune.com/papers/corners.pdf>
- 2009 **The slice algorithm for irreducible decomposition of monomial ideals**, *Journal of Symbolic Computation*, Volume 44, Number 4, Pages 358-381.
<http://arxiv.org/abs/0806.3680>
- 2008 **Solving thousand digit Frobenius problems using Gröbner bases**, *Journal of Symbolic Computation*, Volume 43, Number 1, Pages 1 – 7.
<http://arxiv.org/abs/math/0702040>

Preprints

- 2012 **Connect Four and Graph Decomposition**, Coauthors **Laurent Evain, Mathias Lederer**. <http://arxiv.org/abs/1210.4367>.

Selected talks

- 2013 **Computational algebra seminar**, *Kaiserslautern, Germany*.
Fast prime field Gröbner basis computation
- 2011 **Monomial Ideals, Computations and Applications**, *Castro Urdiales, Spain*.
Algorithms and complexity of monomial expressions
- 2011 **Cornell CS Theory Seminar**, *Ithaca, USA*.
Complexity and Algorithms for Euler Characteristic
- 2011 **Computational and Commutative Algebra Seminar**, *Ithaca, USA*.
Recent Developments in Gröbner Basis Computation
- 2010 **Computational and Commutative Algebra Seminar**, *Ithaca, USA*.
Euler Characteristic and Monomial Ideal Computations
- 2009 **Current trends in Algorithms, complexity theory, and cryptography**, *Beijing*.
Computing Frobenius Numbers Using Test Sets (invited talk).
- 2008 **Special Session of Annual AMS meeting**, *San Diego, USA*.
Computing Frobenius Numbers Using Test Sets (invited talk).
- 2008 **The Macaulay 2 Conference**, *Cornell University, USA*.
The Slice Algorithm for Irreducible Decomposition of Monomial Ideals.
- 2006 **Algebraic geometry and applications seminar**, *University of Minnesota, USA*.
On Faugere's F4 Algorithm — Speeding Up Groebner Basis Computation Using Linear Algebra.