Michael A. Forbes

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Princeton, NJ 08540-5233 USA

Research Interests

Theoretical Computer Science, Complexity Theory, Pseudorandomness, Algebraic Computation

Education

Massachusetts Institute of Technology (MIT) 2009–2014

- ◇ Ph.D. in Electrical Engineering and Computer Science, 2014.
  - – Co-advised by Prof. Scott Aaronson (MIT) and Prof. Amir Shpilka (Technion — Israel Institute of Technology).
  - – Thesis title: *Polynomial Identity Testing of Read-Once Oblivious Algebraic Branching Programs*.
- ◇ S.M. in Electrical Engineering and Computer Science, 2011.
  - – Advised by Prof. Scott Aaronson (MIT).
  - – Thesis Title: *Tensor Rank: Some Lower and Upper Bounds*.
- ◇ (Graduate) GPA is 5 out of 5.

MIT 2005–2009

- ◇ Bachelors of Science in Mathematics. GPA is 4.9 out of 5, 4.9 in major.

Montgomery Blair High School (MBHS) 2001–2005

- ◇ Mathematics, Science and Technology Magnet Program. Graduated with a GPA of 3.96 out of 4.

Positions

Princeton University Fall 2015 – Spring 2016

- ◇ Postdoctoral Research Associate in the Department of Computer Science.

Institute for Advanced Study Spring 2015

- ◇ Member of the School of Mathematics.
- ◇ Postdoc in the Theoretical Computer Science and Discrete Mathematics group, led by Avi Wigderson.

Simons Institute for the Theory of Computing Fall 2014

- ◇ University of California, Berkeley
- ◇ Google Research Fellow in the Algorithms and Complexity in Algebraic Geometry program.

Research Intern Summer 2012

- ◇ Microsoft Research Silicon Valley. Mountain View, California.
- ◇ Hosted by Sergey Yekhanin.

Research Intern Summer 2010

Date: November 27, 2015.

◇ Microsoft Research India. Bangalore, India.
◇ Hosted by Neeraj Kayal.

Undergraduate Researcher — Summer 2008

◇ MIT, Computer Science and Artificial Intelligence Lab. Cambridge, Massachusetts.
◇ Hosted by Prof. Scott Aaronson.

Mathematics Researcher — 2006–2009

◇ National Institute of Standards and Technology (NIST). Gaithersburg, Maryland.
◇ Summer Undergraduate Research Fellowship (SURF), Summers of 2006 and 2007
◇ Math and Computational Sciences Division Guest Researcher, Fall 2007–2009
◇ Hosted by Dr. James Lawrence and Dr. Raghu Kacker.

Research Intern — Summer 2005

◇ NIST. Gaithersburg, Maryland.
◇ Hosted by Dr. Ram Sriram.

Algorithms Researcher — Summer 2004

◇ University of Maryland, College Park. College Park, Maryland.
◇ Hosted by Prof. Samir Khuller.

Teaching

18.404/6.860: Introduction to the Theory of Computation — Fall 2010, 2011

◇ Teaching Assistant to Prof. Michael Sipser
◇ Undergraduate/Graduate class
◇ Enrollment: 72, 75
◇ Overall Student Rating: 6.6/7, 6.2/7

Professional Activities

◇ Program Committees, Workshops Organized:
  – Co-organizer of the 4th Workshop on Algebraic Complexity Theory (WACT 2016), with Ramprasad Saptharishi and Amir Shpilka
  – 47th Annual ACM Symposium on Theory of Computing (STOC 2015)
◇ Refereeing:
  – *ACM Symposium on Theory of Computing (STOC)*, 2012, 2014
  – *IEEE Symposium on Foundations of Computer Science (FOCS)*, 2014, 2015
  – *Computational Complexity Conference (CCC)*, 2012, 2015
  – *International Colloquium on Automata, Languages and Programming (ICALP)*, 2014, 2015
  – *ACM-SIAM Symposium on Discrete Algorithms (SODA)*, 2014, 2015, 2016
  – *International Workshop on Randomization and Computation (RANDOM)*, 2013, 2015
  – *Innovations in Theoretical Computer Science (ITCS)*, 2013
  – *International Conference on Foundations of Software Technology and Theoretical Computer Science (FSTTCS)*, 2016
  – *SIAM Journal on Computing*
  – *Journal of the Association for Computing Machinery*
  – *Foundations and Trends in Theoretical Computer Science*

  - P, NP, *and* NP-*Completeness: The Basics of Computational Complexity*, by Oded Goldreich
- ◇ Department Service:
  - Organizer of the *Algebraic Complexity Seminar*. Simons Institute for the Theory of Computing, University of California at Berkeley. Fall 2014.
  - Founding Czar of the MIT Theory Group's Student Retreat, 2012
  - Founding Head of the MIT Theory Group's Weekly Tea, Fall 2010–Spring 2011
  - Organizer of the MIT Theory Group *Introductory Theory Seminar*, 2010
- ◇ Member of Association of Computing Machinery, and special interest group SIGACT

Publications

Preprints/Presentations.

- ◇ Michael A. Forbes, Amir Shpilka, Iddo Tzameret, Avi Wigderson. *Proof Complexity Lower Bounds from Algebraic Circuit Complexity*. Submitted, 2015.
- ◇ Michael A. Forbes, Mrinal Kumar, Ramprasad Saptharishi. *Functional Lower Bounds for Arithmetic Circuits and Boolean Circuit Complexity*. Submitted, 2015.

[AFS+15] Matthew Anderson, Michael A. Forbes, Ramprasad Saptharishi, Amir Shpilka, Ben Lee Volk. *Identity Testing and Lower Bounds for Read-k Oblivious Algebraic Branching Programs*.

[FKMS11] Michael A. Forbes, Neeraj Kayal, Rajat Mittal, Chandan Saha. *Square root Bound on the Least Power Non-residue using a Sylvester-Vandermonde Determinant*.

Conference Papers/Presentations.

[For15] Michael A. Forbes. *Deterministic Divisibility Testing via Shifted Partial Derivatives*. FOCS 2015.
- Reunion Workshop for the *Algorithms and Complexity in Algebraic Geometry* program, Simons Institute for the Theory of Computing. **Invited Speaker**. December 2015.
- 56th Annual IEEE Symposium on Foundations of Computer Science (FOCS 2015). October 18, 2015.
- Workshop on *Connections Between Algorithm Design and Complexity Theory*, Simons Institute for the Theory of Computing. **Invited Speaker**. September 29, 2015.
- *Workshop on Algebraic Complexity Theory (WACT 2015)*, Saarland University. **Invited Speaker**. March 16, 2015.
- Rutgers University. March 11, 2015.

[FG15] Michael A. Forbes, Venkatesan Guruswami. *Dimension Expanders via Rank Condensers*. RANDOM 2015.
- 19th International Workshop on Randomization and Computation (RANDOM 2015). August 26, 2015.
- Courant Institute at New York University. March 27, 2015.
- Institute for Advanced Study. February 3, 2015.
- University of California, San Diego. December 8, 2014.

[FSS14] Michael A. Forbes, Ramprasad Saptharishi and Amir Shpilka. *Hitting Sets for Multilinear Read-Once Algebraic Branching Programs, in any Order*. STOC 2014.

- Workshop on *Algebra in Computational Complexity*, Schloss Dagstuhl — Leibniz-Zentrum für Informatik. Contributed Talk. September 24, 2014.
- 46th Annual ACM Symposium on Theory of Computing (STOC 2014). June 3, 2014.
- Harvard University. March 11, 2014.
- Workshop on *Recent Progress in Arithmetic Complexity*, Tata Institute for Fundamental Research. **Invited Speaker**. February 15, 2014.
- MIT. October 30, 2013.
- Princeton University. September 27, 2013.

[FS13b] Michael A. Forbes, Amir Shpilka. *Quasipolynomial-time Identity Testing of Non-Commutative and Read-Once Oblivious Algebraic Branching Programs*. FOCS 2013.

- *Workshop on Algebraic Complexity Theory (WACT 2014)*, Saarland University. Contributed Talk. March 25, 2014.
- MIT Theory Graduating Student Day. March 7, 2014.
- University of Toronto. February 28, 2014.
- 54th Annual IEEE Symposium on Foundations of Computer Science (FOCS 2013). October 27, 2013.
- *Workshop on Algebraic Complexity Theory (WACT 2013)*, Aarhus University. Contributed Talk. March 21, 2013.
- Stanford University. January 24, 2013.
- Institute for Advanced Study. November 26, 2012.
- Workshop on *Computational Complexity*, Mathematisches Forschungsinstitut Oberwolfach. Contributed Talk. November 2012.
- Microsoft Research, New England. October 12, 2012.

[FS13a] Michael A. Forbes, Amir Shpilka. *Explicit Noether Normalization for Simultaneous Conjugation via Polynomial Identity Testing*. RANDOM 2013.

- 17th International Workshop on Randomization and Computation (RANDOM 2013). August 23, 2013.
- Massachusetts Institute of Technology. April 24, 2013.

[FS12] Michael A. Forbes, Amir Shpilka. *On identity testing of tensors, low-rank recovery and compressed sensing*. STOC 2012.

- Charles River Science of Information Day, at MIT. April 28, 2014.
- Hebrew University. June 18, 2012.
- Technion. June 6, 2012.
- 44th Annual ACM Symposium on Theory of Computing (STOC 2012). May 20, 2012.
- University of Maryland. April 27, 2012.
- Microsoft Research, New England. October 14, 2011.

[AFT11] Boris Alexeev, Michael A. Forbes, Jacob Tsimerman. *Tensor Rank: Some Lower and Upper Bounds*. CCC 2011.

- 26th Annual IEEE Conference on Computational Complexity (CCC 2011). June 10, 2011.
- Microsoft Research, New England. February, 2011.
- Microsoft Research, India Seminar. July 14, 2010.
- Microsoft Research, New England. March 12, 2010.

Journal Papers/Presentations.

[FY14] Michael A. Forbes, Sergey Yekhanin. *Locality of Codeword Symbols in Non-Linear Codes*. Discrete Mathematics.
– Microsoft Research, Silicon Valley. September 19, 2012.

[CF13] Alessandro Chiesa, Michael A. Forbes. *Improved Soundness for QMA with Multiple Provers*. Chicago J. of Theor. Comp. Sci.

[LKL+11] Jim Lawrence, Raghu Kacker, Yu Lei, D. Richard Kuhn, Michael A. Forbes. *A Survey of Binary Covering Arrays*. Electr. J. Comb.

[FLL+08] Michael A. Forbes, Jim Lawrence, Yu Lei, Raghu N. Kacker, D. Richard Kuhn. *Refining the in-parameter-order strategy for constructing covering arrays*. J. Res. NIST.
– NIST Summer Undergraduate Research Colloquium. **Plenary speaker**. August 7, 2007.
– NIST Summer Undergraduate Research Colloquium. **Plenary speaker**. August 8, 2006.

Theses and Surveys.

[FS15] Michael A. Forbes, Amir Shpilka. *Challenges in Polynomial Factorization* (survey). SIGACT News.

[For14] Michael A. Forbes. *Polynomial Identity Testing of Read-Once Oblivious Algebraic Branching Programs*. Ph.D. Thesis.

[For11] Michael A. Forbes. *Tensor Rank: Some Lower and Upper Bounds*. S.M. Thesis.

Awards

- Siebel Scholar 2011
- National Science Foundation, Graduate Research Fellowship Program, Honorable Mention, 2011
- Putnam Exam Participant 2006 (Rank of 747$^{\text{th}}$ out of 3640), 2007 (Rank of 707$^{\text{th}}$ out of 3753), and Honorable Mention in 2008 (Rank of 61$^{\text{st}}$ out of 3627)
- Intel Science Talent Search Finalist for algorithmic research under Prof. Khuller, 2005
- USA Computer Olympiad, Gold Division, 2003–2005

References

[AFS+15] Matthew Anderson, Michael A. Forbes, Ramprasad Saptharishi, Amir Shpilka, and Ben Lee Volk. Identity testing and lower bounds for read-k oblivious algebraic branching programs. *Electronic Colloquium on Computational Complexity (ECCC)*, 22:184, 2015.

[AFT11] Boris Alexeev, Michael A. Forbes, and Jacob Tsimerman. Tensor rank: Some lower and upper bounds. In *Proceedings of the 26th Annual IEEE Conference on Computational Complexity (CCC 2011)*, pages 283–291, 2011. Full version at `arXiv:1102.0072`.

[CF13] Alessandro Chiesa and Michael A. Forbes. Improved soundness for QMA with multiple provers. *Chicago Journal of Theoretical Computer Science*, 2013(1), January 2013. Preliminary version at `arXiv:1108.2098`.

[FG15] Michael A. Forbes and Venkatesan Guruswami. Dimension expanders via rank condensers. In *Proceedings of the 19th International Workshop on Randomization and Computation (RANDOM 2015)*, volume 40 of *Leibniz International Proceedings in Informatics (LIPIcs)*, pages 800–814, 2015. Full version at `arXiv:1411.7455`.

[FKMS11] Michael A. Forbes, Neeraj Kayal, Rajat Mittal, and Chandan Saha. Square root bound on the least power non-residue using a Sylvester-Vandermonde determinant. *arXiv*, abs/1104.4557, 2011.

[FLL+08] Michael A. Forbes, Jim Lawrence, Yu Lei, Raghu N. Kacker, and D. Richard Kuhn. Refining the in-parameter-order strategy for constructing covering arrays. *Journal of Research of the National Institute of Standards and Technology*, 113(5):287–297, 2008.

[For11] Michael A. Forbes. *Tensor Rank: Some Lower and Upper Bounds*. PhD thesis, Massachusetts Institute of Technology, June 2011.

[For14] Michael A. Forbes. *Polynomial Identity Testing of Read-Once Oblivious Algebraic Branching Programs*. PhD thesis, Massachusetts Institute of Technology, June 2014.

[For15] Michael A. Forbes. Deterministic divisibility testing via shifted partial derivatives. In *Proceedings of the 56th Annual IEEE Symposium on Foundations of Computer Science (FOCS 2015)*, 2015.

[FS12] Michael A. Forbes and Amir Shpilka. On identity testing of tensors, low-rank recovery and compressed sensing. In *Proceedings of the 44th Annual ACM Symposium on Theory of Computing (STOC 2012)*, pages 163–172, 2012. Full version at arXiv:1111.0663.

[FS13a] Michael A. Forbes and Amir Shpilka. Explicit Noether Normalization for simultaneous conjugation via polynomial identity testing. In *Proceedings of the 17th International Workshop on Randomization and Computation (RANDOM 2013)*, pages 527–542, 2013. Full version at arXiv:1303.0084.

[FS13b] Michael A. Forbes and Amir Shpilka. Quasipolynomial-time identity testing of non-commutative and read-once oblivious algebraic branching programs. In *Proceedings of the 54th Annual IEEE Symposium on Foundations of Computer Science (FOCS 2013)*, pages 243–252, 2013. Full version at arXiv:1209.2408.

[FS15] Michael A. Forbes and Amir Shpilka. Challenges in polynomial factorization. *SIGACT News*, December 2015.

[FSS14] Michael A. Forbes, Ramprasad Saptharishi, and Amir Shpilka. Hitting sets for multilinear read-once algebraic branching programs, in any order. In *Proceedings of the 46th Annual ACM Symposium on Theory of Computing (STOC 2014)*, pages 867–875, 2014. Full version at arXiv:1309.5668.

[FY14] Michael A. Forbes and Sergey Yekhanin. On the locality of codeword symbols in non-linear codes. *Discrete Mathematics*, 324:78–84, 2014. Preliminary version at arXiv:1303.3921.

[LKL+11] Jim Lawrence, Raghu Kacker, Yu Lei, D. Richard Kuhn, and Michael A. Forbes. A survey of binary covering arrays. *Electr. J. Comb.*, 18(1), 2011.