

# Alexey S. Ignatiev

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Born: October 27, 1983 — Irkutsk, Russia  
Nationality: Russian

## Current position

*Senior Lecturer*, [Optimisation group](#), [Faculty of IT](#), Monash University, Australia

## Research interests

Decision procedures and discrete optimization algorithms: Boolean satisfiability (SAT) and its extensions including MaxSAT, MinSAT, QBF, QMaxSAT, SMT/MaxSMT. Formal methods in software/hardware synthesis/verification/repair and artificial intelligence.

## Appointments held

2019–date	<i>Senior Lecturer</i> , Faculty of IT, Monash University, Australia
2019–2019	<i>Researcher</i> , Faculty of Sciences, University of Lisbon, Portugal
2016–2019	<i>Postdoctoral researcher</i> , Faculty of Sciences, University of Lisbon, Portugal
2012–2016	<i>Postdoctoral researcher</i> , INESC-ID, IST, University of Lisbon, Portugal
2009–2012	<i>Researcher</i> , Institute for System Dynamics and Control Theory SB RAS, Irkutsk, Russia
2007–2008	<i>Software engineer</i> , Delcam plc., Irkutsk, Russia

## Education

2010	PhD in Computer Science, Institute for System Dynamics and Control Theory SB RAS Title: “ <i>Methods of inverting discrete functions with the use of binary decision diagrams</i> ” Advisor: <i>Alexander A. Semenov</i>
2006	MSc in Applied Mathematics, Irkutsk State University Title: “ <i>Solving sets of logical equations with BDDs</i> ” Advisor: <i>Alexander A. Semenov</i>

## Awards

- 2019 [RC2 MaxSAT solver](#) won *gold* in both complete categories (unweighted and weighted) of the main track of [MaxSAT Evaluation 2019](#)
- 2018 [RC2 MaxSAT solver](#) won *gold* in both complete categories (unweighted and weighted) of the main track of [MaxSAT Evaluation 2018](#)
- 2016 [MSCG MaxSAT solver](#) is one of the best overall MaxSAT solvers in the industrial category of the [Eleventh Evaluation of MaxSAT solvers](#) (*1st* and *2nd* place in plain industrial and weighted industrial categories, resp.)
- 2015 [MSCG MaxSAT solver](#) is one of the best overall MaxSAT solvers in the industrial category of the [Tenth Evaluation of MaxSAT solvers](#) (*1st*, *2nd*, and *1st* place in plain industrial, partial crafted, and weighted industrial categories, resp.)
- 2014 [MSCG MaxSAT solver](#) is one of the best overall MaxSAT solvers in the industrial category of the [Ninth Evaluation of MaxSAT solvers](#) among non-portfolio solvers (*4th*, *3rd*, and *2nd* place in plain, partial, and weighted industrial categories, resp.)

## Grants

- 2019–date FCT researcher grant SAMPLE (CEECIND/04549/2017)
- 2018–date FCT grant FaultLocker (*co-PI*) (PTDC/CCI-COM/29300/2017)
- 2017–date FCT postdoctoral grant SAFETY (SFRH/BPD/120315/2016)

## Project participation

- 2018–date FCT grant ABSOLV (LISBOA-01-0145-FEDER-028986)
- 2013–2015 FCT grant POLARIS (PTDC/EIA-CCO/123051/2010)
- 2012–2013 FCT grant ATTEST (CMU-PT/ELE/0009/2009)
- 2011–2012 Grant 11-07-00377-a of Russian Foundation for Basic Research
- 2007–2009 Grant 07-01-00400-a of Russian Foundation for Basic Research

## Publications & talks

### JOURNAL PAPERS

- J2019 A. Ignatiev, A. Morgado, and J. Marques-Silva. “RC2: An Efficient MaxSAT Solver”. In *Journal on Satisfiability, Boolean Modeling and Computation*, vol. 11, pp. 53–64 (2019)
- J2016a A. Ignatiev, M. Janota, and J. Marques-Silva. “Quantified Maximum Satisfiability”. In *Constraints*, vol. 21(2), pp. 277–302 (2016)
- J2016b A. Ignatiev, A. Morgado, J. Planes, and J. Marques-Silva. “Maximal Falsifiability: Definitions, Algorithms, and Applications”. In *AI Communications*, vol. 29(2), pp. 351–370 (2016)
- J2015 A. Morgado, A. Ignatiev, and J. Marques-Silva. “MSCG: Robust Core-Guided MaxSAT Solving. System Description”. In *Journal on Satisfiability, Boolean Modeling and Computation*, vol. 9, pp. 129–134 (2015)

## CONFERENCE PAPERS

- C2020a O. Zaikin, A. Ignatiev, J. Marques-Silva. “Branch Location Problems with Maximum Satisfiability”. In *Proc. 24th European Conference on Artificial Intelligence (ECAI’20)*. (2020)
- C2020b A. Ignatiev. “Towards Trustable Explainable AI”. In *Proc. 29th International Joint Conference on Artificial Intelligence (IJCAI’20)*.
- C2019a A. Ignatiev, N. Narodytska, J. Marques-Silva. “Abduction-Based Explanations for Machine Learning Models”. In *Proc. 33rd AAAI Conference on Artificial Intelligence (AAAI’19)*. pp. 1511–1519 (2019)
- C2019b A. Morgado, A. Ignatiev, M. L. Bonet, J. Marques-Silva, S. Buss. “DRMaxSAT with MaxHS: First Contact”. In *Proc. 22nd International Conference on Theory and Applications of Satisfiability Testing (SAT’19)*. Lecture Notes in Computer Science, vol. 11628, pp. 239–249 (2019)
- C2019c N. Narodytska, A. Shrotri, K. Meel, A. Ignatiev, J. Marques-Silva. “Assessing Heuristic Machine Learning Explanations with Model Counting”. In *Proc. 22nd International Conference on Theory and Applications of Satisfiability Testing (SAT’19)*. Lecture Notes in Computer Science, vol. 11628, pp. 267–278 (2019)
- C2019d C. Mencía, O. Kullmann, A. Ignatiev, J. Marques-Silva. “On Computing the Union of MUSes”. In *Proc. 22nd International Conference on Theory and Applications of Satisfiability Testing (SAT’19)*. Lecture Notes in Computer Science, vol. 11628, pp. 211–221 (2019)
- C2019e A. Ignatiev, A. Morgado, G. Weissenbacher, J. Marques-Silva. “Model-Based Diagnosis with Multiple Observations”. In *Proc. 28th International Joint Conference on Artificial Intelligence (IJCAI’19)*. pp. 1108–1115 (2019)
- C2019f I. Zakirzyanov, A. Morgado, A. Ignatiev, V. Ulyantsev, J. Marques-Silva. “Efficient Symmetry Breaking for SAT-Based Minimum DFA Inference”. In *Proc. 13th International Conference on Language and Automata Theory and Applications (LATA’19)*. Lecture Notes in Computer Science, vol. 11417, pp. 159–173 (2019)
- C2019g A. Ignatiev, N. Narodytska, J. Marques-Silva. “On Relating Explanations and Adversarial Examples”. In *Proc. 33rd Conference on Neural Information Processing Systems (NeurIPS’19)*. pp. 15857–15867 (2019)
- C2018a M. L. Bonet, S. Buss, A. Ignatiev, J. Marques-Silva, A. Morgado. “MaxSAT Resolution with the Dual Rail Encoding”. In *Proc. 32nd AAAI Conference on Artificial Intelligence (AAAI’18)*. pp. 6565–6572 (2018)
- C2018b A. Semenov, O. Zaikin, I. Otpuschennikov, S. Kochemazov, A. Ignatiev. “On Cryptographic Attacks Using Backdoors for SAT”. In *Proc. 32nd AAAI Conference on Artificial Intelligence (AAAI’18)*. pp. 6641–6648 (2018)
- C2018c A. Ignatiev, A. Morgado, J. Marques-Silva. “PySAT: A Python Toolkit for Prototyping with SAT Oracles”. In *Proc. 21st International Conference on Theory and Applications of Satisfiability Testing (SAT’18)*. Lecture Notes in Computer Science, vol. 10929, pp. 428–437 (2018)
- C2018d A. Ignatiev, F. Pereira, N. Narodytska, J. Marques-Silva. “A SAT-Based Approach to Learn Explainable Decision Sets”. In *Proc. 9th International Joint Conference on Automated Reasoning (IJCAR’18)*. Lecture Notes in Artificial Intelligence, vol. 10900, pp. 627–645 (2018)

- C2018e N. Narodytska, A. Ignatiev, F. Pereira, J. Marques-Silva. “Learning Optimal Decision Trees with SAT”. In *Proc. 27th International Joint Conference on Artificial Intelligence (IJCAI’18)*. pp. 1362–1368 (2018)
- C2017a R. Peñaloza, C. Mencía, A. Ignatiev, J. Marques-Silva. “Lean Kernels in Description Logics”. In *Proc. 14th Extended Semantic Web Conference (ESWC’17)*. Lecture Notes in Computer Science, vol. 10249, pp. 518–533 (2017)
- C2017b A. Ignatiev, A. Morgado, J. Marques-Silva. “Cardinality Encodings for Graph Optimization Problems”. In *Proc. 26th International Joint Conference on Artificial Intelligence (IJCAI’17)*. pp. 652–658 (2017)
- C2017c A. Ignatiev, A. Morgado, J. Marques-Silva. “On Tackling the Limits of Resolution in SAT Solving”. In *Proc. 20th International Conference on Theory and Applications of Satisfiability Testing (SAT’17)*. Lecture Notes in Computer Science, vol. 10491, pp. 164–183 (2017)
- C2017d J. Marques-Silva, A. Ignatiev, A. Morgado. “Horn Maximum Satisfiability: Reductions, Algorithms & Applications”. In *Proc. 18th EPIA Conference on Artificial Intelligence (EPIA’17)*. Lecture Notes in Computer Science, vol. 10423, pp. 681–694 (2017)
- C2017e A. Previti, A. Ignatiev, M. Järvisalo, J. Marques-Silva. “On Computing Generalized Backbones”. In *Proc. 29th International Conference on Tools with Artificial Intelligence (ICTAI’17)*. pp. 1050–1056 (2017)
- C2016a C. Mencía, A. Ignatiev, A. Previti, and J. Marques-Silva. “MCS Extraction with Sublinear Oracle Queries”. In *Proc. 19th International Conference on Theory and Applications of Satisfiability Testing (SAT’16)*. Lecture Notes in Computer Science, vol. 9710, pp. 342–360 (2016)
- C2016b M. F. Arif, C. Mencía, A. Ignatiev, N. Manthey, R. Peñaloza, and J. Marques-Silva. “BEACON: An Efficient SAT-Based Tool for Debugging EL+ Ontologies”. In *Proc. 19th International Conference on Theory and Applications of Satisfiability Testing (SAT’16)*. Lecture Notes in Computer Science, vol. 9710, pp. 521–530 (2016)
- C2016c A. Ignatiev, A. Morgado, and J. Marques-Silva. “Propositional Abduction with Implicit Hitting Sets”. In *Proc. 22nd European Conference on Artificial Intelligence (ECAI’16)*. Frontiers in Artificial Intelligence and Applications, vol. 285, pp. 1327–1335 (2016)
- C2016d A. Ignatiev, A. Previti, and J. Marques-Silva. “On Finding Minimum Satisfying Assignments”. In *Proc. 22nd International Conference on Principles and Practice of Constraint Programming (CP’16)*. Lecture Notes in Computer Science, vol. 9892, pp. 287–297 (2016)
- C2016e X. Si, X. Zhang, V. Manquinho, M. Janota, A. Ignatiev, and M. Naik. “On Incremental Core-Guided MaxSAT Solving”. In *Proc. 22nd International Conference on Principles and Practice of Constraint Programming (CP’16)*. Lecture Notes in Computer Science, vol. 9892, pp. 473–482 (2016)
- C2016f J. Marques-Silva, A. Ignatiev, C. Mencía, R. Peñaloza. “Efficient Reasoning for Inconsistent Horn Formulae”. In *Proc. 15th European Conference On Logics In Artificial Intelligence (JELIA’16)*. Lecture Notes in Computer Science, vol. 10021, pp. 336–352 (2016)
- C2015a A. Previti, A. Ignatiev, A. Morgado, and J. Marques-Silva. “Prime Compilation of Non-Clausal Formulae”. In *Proc. 24th International Joint Conference on Artificial Intelligence (IJCAI’15)*. pp. 1980–1987 (2015)

- C2015b J. Marques-Silva, M. Janota, A. Ignatiev, and A. Morgado. “Efficient Model Based Diagnosis with Maximum Satisfiability”. In *Proc. 24th International Joint Conference on Artificial Intelligence (IJCAI’15)*. pp. 1966–1972 (2015)
- C2015c A. Ignatiev, A. Previti, M. Liffiton, and J. Marques-Silva. “Smallest MUS Extraction with Minimal Hitting Set Dualization”. In *Proc. 21st International Conference on Principles and Practice of Constraint Programming (CP’15)*. Lecture Notes in Computer Science, vol. 9255, pp. 173–182 (2015)
- C2015d A. Ignatiev, A. Previti, and J. Marques-Silva. “SAT-Based Formula Simplification”. In *Proc. 18th International Conference on Theory and Applications of Satisfiability Testing (SAT’15)*. Lecture Notes in Computer Science, vol. 9340, pp. 287–298 (2015)
- C2014a A. Ignatiev, M. Janota, and J. Marques-Silva. “Towards Efficient Optimization in Package Management Systems”. In *Proc. 36th International Conference on Software Engineering (ICSE’14)*. pp. 745–755 (2014)
- C2014b A. Ignatiev, A. Morgado, and J. Marques-Silva. “On Reducing Maximum Independent Set to Minimum Satisfiability”. In *Proc. 17th International Conference on Theory and Applications of Satisfiability Testing (SAT’14)*. Lecture Notes in Computer Science, vol. 8561, pp. 103–120 (2014)
- C2014c J. Marques-Silva, A. Ignatiev, A. Morgado, V. Manquinho, and I. Lynce. “Efficient Autarkies”. In *Proc. 21st European Conference on Artificial Intelligence (ECAI’14)*. Frontiers in Artificial Intelligence and Applications, vol. 264, pp. 603–608 (2014)
- C2014d A. Ignatiev, A. Morgado, V. Manquinho, I. Lynce, and J. Marques-Silva. “Progression in Maximum Satisfiability”. In *Proc. 21st European Conference on Artificial Intelligence (ECAI’14)*. Frontiers in Artificial Intelligence and Applications, vol. 264, pp. 453–458 (2014)
- C2013a A. Ignatiev, M. Janota, and J. Marques-Silva. “Quantified Maximum Satisfiability: A Core-Guided Approach”. In *Proc. 16th International Conference on Theory and Applications of Satisfiability Testing (SAT’13)*. Lecture Notes in Computer Science, vol. 7962, pp. 250–266 (2013)
- C2013b A. Ignatiev, A. Morgado, J. Planes, and J. Marques-Silva. “Maximal Falsifiability: Definitions, Algorithms, and Applications”. In *Proc. 19th International Conference on Logic for Programming Artificial Intelligence and Reasoning (LPAR’13)*. Lecture Notes in Computer Science, vol. 8312, pp. 439–456 (2013)
- C2011 A. Ignatiev and A. Semenov. “DPLL+ROBDD Derivation Applied to Inversion of Some Cryptographic Functions”. In *Proc. 14th International Conference on Theory and Applications of Satisfiability Testing (SAT’11)*. Lecture Notes in Computer Science, vol. 6695, pp. 76–89 (2011)
- C2009 A. Ignatiev, A. Semenov, and D. Besspalov. “Binary Decision Diagrams in Parallel Algorithms for Discrete Function Inversion” (in Russian). In *Proc. 3rd International Conference on Parallel Computing Technologies (PAVT’09)*. pp. 688–696 (2009)

#### REFEREED WORKSHOP PAPERS

- W2017 A. Ignatiev, J. Marques-Silva, C. Mencía, R. Peñaloza. “Debugging  $EL^+$  Ontologies through Horn MUS Enumeration”. In *Proc. 30th International Workshop on Description Logics (DL’17)*.

- W2014 A. Ignatiev, A. Morgado, J. Planes, and J. Marques-Silva. “Maximal Falsifiability: Definitions, Algorithms, and Applications”. In *Proc. 21st RCRA International Workshop on Experimental Evaluation of Algorithms for solving problems with combinatorial explosion* (2014)

#### TALKS

- T2020 “Rigorous Verification and Explanation of ML Models”. *AAAI Tutorial (together with Joao Marques-Silva, Kuldeep Meel and Nina Narodytska)*. New York, USA. February 8, 2020.
- T2019a “Abduction-Based Explanations for Machine Learning Models”. *AAAI*. Honolulu, USA. January 30, 2019.
- T2019b “Computing With SAT Oracles”. *IJCAI Tutorial (together with Joao Marques-Silva and Antonio Morgado)*. Macau, China. August 12, 2019.
- T2019c “Model-Based Diagnosis with Multiple Observations”. *IJCAI*. Macau, China. August 14, 2019.
- T2018 “On Cryptographic Attacks Using Backdoors for SAT”. *AAAI*. New Orleans, USA. February 4, 2018.
- T2017a “Cardinality Encodings for Graph Optimization Problems”. *IJCAI*. Melbourne, Australia. August 23, 2017.
- T2017b “On Tackling the Limits of Resolution in SAT Solving”. *SAT*. Melbourne, Australia. August 29, 2017.
- T2016a “On Incremental Core-Guided MaxSAT Solving”. *CP*. Toulouse, France. September 6, 2016.
- T2016b “On Finding Minimum Satisfying Assignments”. *CP*. Toulouse, France. September 9, 2016.
- T2015a “Efficient Model Based Diagnosis with Maximum Satisfiability”. *IJCAI*. Buenos Aires, Argentina. July 31, 2015.
- T2015b “Efficient Model Based Diagnosis with Maximum Satisfiability”. *RiSE Seminar*. Vienna, Austria. August 14, 2015.
- T2014a “Towards Efficient Optimization in Package Management Systems”. *ICSE*. Hyderabad, India. June 5, 2014.
- T2014b “On Reducing Maximum Independent Set to Minimum Satisfiability”. *SAT*. Vienna, Austria. July 14, 2014.
- T2014c “Maximal Falsifiability: Definitions, Algorithms, and Applications”. *RCRA*. Vienna, Austria. July 17, 2014.
- T2013a “Quantified Maximum Satisfiability: A Core-Guided Approach”. *SAT*. Helsinki, Finland. July 11, 2013.
- T2013b “Maximal Falsifiability: Definitions, Algorithms, and Applications”. *LPAR*. Stellenbosch, South Africa. December 15, 2013.
- T2011 “DPLL+ROBDD Derivation Applied to Inversion of Some Cryptographic Functions”. *SAT*. Ann Arbor, USA. June 19, 2011.
- T2009 “Binary Decision Diagrams in Parallel Algorithms for Discrete Function Inversion”. *PAVT*. Nizhny Novgorod, Russia. April 2, 2009.

## Other activities

- Co-organizer of the SAT/SMT/AR Summer School 2019
- SPC member of the *International Joint Conference on Artificial Intelligence (IJCAI)* 2020
- PC member of the *AAAI Conference on Artificial Intelligence (AAAI)* 2018, 2019, and 2020
- PC member of the *International Joint Conference on Artificial Intelligence (IJCAI)* 2015, 2017, 2018, and 2019
- PC member of the *European Conference on Artificial Intelligence (ECAI)* 2020
- PC member of the *International Conference on Theory and Applications of Satisfiability Testing (SAT)* 2017, 2019, and 2020
- PC member of the *International Conference on Principles and Practice of Constraint Programming (CP)* 2019
- member of the Artifact Evaluation Committee of the *International Conference on Computer-Aided Verification (CAV)* 2019
- PC member of the *Workshop on Pragmatics of SAT (POS)* 2018, 2019, and 2020
- External reviewer for CAV 2014, CP 2018, FMCAD 2017, SAT 2013, SAT 2014, SAT 2015, SAT 2016, SAT 2018, and TACAS 2016