

Yices2 in SMT-COMP 2025

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1 Introduction

Yices2 [3] is an open-source (GPLv3) SMT solver developed and distributed by SRI International. It can be downloaded at <http://yices.csl.sri.com> and on our GitHub repository at <https://github.com/SRI-CSL/yices2>. The solver supports linear and non-linear arithmetic, bit-vectors, finite fields, uninterpreted functions, and arrays.

Yices2 uses the standard CDCL(T) [10] architecture and a variant of the Nelson-Oppen method for combining decision procedures. Details are presented in [3]. The solver also includes a Model-Construction Satisfiability Calculus (MCSat) [2, 8, 4, 7, 6] implementation. By default, MCSat is used for all theories that require non-linear arithmetic and CDCL(T) is used for everything else. Quantifier reasoning is supported for the UF theory, via E-graph matching and model-based instantiation. Yices2 can use third-party backend SAT solvers for bitvector solving. Currently, it supports three SAT solvers: CaDiCaL [1], CryptoMiniSat [11], and Kissat [1].

2 What's new?

Yices2 MCSat now includes two recent MCSat improvements: theory-specific decision heuristics [5] with target caching for better value selection, and local search integration [9] that guides the search using promising assignments.

3 Competition Version

For SMT-COMP 2025, we are participating with the latest development version of Yices2 (<https://github.com/SRI-CSL/yices2/tree/smtcomp2025>). This version will compete in all supported logics and divisions, including the incremental, model-validation, and unsat-core tracks. Additionally, we are submitting a portfolio solver for the nonlinear arithmetic logics in the parallel track.

Like last year, we are utilizing Kissat as the backend SAT solver in the single-query and model-validation tracks of QF_BV.

For the QF_NIA logic, we enable the new local search feature in MCSat for both single-query and model-validation tracks.

References

- [1] Armin Biere, Tobias Faller, Katalin Fazekas, Mathias Fleury, Nils Froleyks, and Florian Pollitt. CaDiCaL, Gimsatul, IsaSAT and Kissat entering the SAT Competition 2024. In Marijn Heule, Markus Iser, Matti Järvisalo, and Martin Suda, editors, *Proc. of SAT Competition 2024 – Solver, Benchmark and Proof Checker Descriptions*, volume B-2024-1 of *Department of Computer Science Report Series B*, pages 8–10. University of Helsinki, 2024.
- [2] Leonardo Mendonça de Moura and Dejan Jovanovic. A model-constructing satisfiability calculus. In Roberto Giacobazzi, Josh Berdine, and Isabella Mastroeni, editors, *Verification, Model Checking, and Abstract Interpretation, 14th International Conference, VMCAI 2013, Rome, Italy, January 20-22, 2013. Proceedings*, volume 7737 of *Lecture Notes in Computer Science*, pages 1–12. Springer, 2013.
- [3] Bruno Dutertre. Yices 2.2. In Armin Biere and Roderick Bloem, editors, *Computer Aided Verification - 26th International Conference, CAV 2014, Held as Part of the Vienna Summer of Logic, VSL 2014, Vienna, Austria, July 18-22, 2014. Proceedings*, volume 8559 of *Lecture Notes in Computer Science*, pages 737–744. Springer, 2014.
- [4] Stéphane Graham-Lengrand, Dejan Jovanovic, and Bruno Dutertre. Solving bitvectors with MCSAT: explanations from bits and pieces. In Nicolas Peltier and Viorica Sofronie-Stokkermans, editors, *Automated Reasoning - 10th International Joint Conference, IJCAR 2020, Paris, France, July 1-4, 2020, Proceedings, Part I*, volume 12166 of *Lecture Notes in Computer Science*, pages 103–121. Springer, 2020.
- [5] Thomas Hader, Ahmed Irfan, and Stéphane Graham-Lengrand. Decision heuristics in mcsat.
- [6] Thomas Hader, Daniela Kaufmann, Ahmed Irfan, Stéphane Graham-Lengrand, and Laura Kovács. Mcsat-based finite field reasoning in the yices2 smt solver (short paper). In *International Joint Conference on Automated Reasoning*, pages 386–395. Springer, 2024.
- [7] Ahmed Irfan and Stéphane Graham-Lengrand. Arrays Reasoning in MCSat. *SMT Workshop 2024*, 2024.
- [8] Dejan Jovanovic, Clark Barrett, and Leonardo De Moura. The design and implementation of the model constructing satisfiability calculus. In *2013 Formal Methods in Computer-Aided Design*, pages 173–180. IEEE, 2013.
- [9] Enrico Lipparini, Thomas Hader, Ahmed Irfan, and Stéphane Graham-Lengrand. Boosting mcsat modulo nonlinear integer arithmetic via local search. *CADE 2025*, To appear.

- [10] Robert Nieuwenhuis, Albert Oliveras, and Cesare Tinelli. Abstract DPLL and abstract DPLL modulo theories. In Franz Baader and Andrei Voronkov, editors, *Logic for Programming, Artificial Intelligence, and Reasoning, 11th International Conference, LPAR 2004, Montevideo, Uruguay, March 14-18, 2005, Proceedings*, volume 3452 of *Lecture Notes in Computer Science*, pages 36–50. Springer, 2004.
- [11] Mate Soos, Karsten Nohl, and Claude Castelluccia. Extending SAT solvers to cryptographic problems. In Oliver Kullmann, editor, *Theory and Applications of Satisfiability Testing - SAT 2009, 12th International Conference, SAT 2009, Swansea, UK, June 30 - July 3, 2009. Proceedings*, volume 5584 of *Lecture Notes in Computer Science*, pages 244–257. Springer, 2009.