

# Yices-ismt for SMT COMP 2022

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## 1 Overview

We propose a wrapper solver Yices-ismt for QF\_NIA that combines Yices2 [1] and ismt, where Yices2 is the winner solver of QF\_NIA of UNSAT performance in SMT-COMP 2021. The solver ismt is our experimental SMT solver, composed of a parser, a preprocessor, and a theory solver. The preprocessor performs a sequence of calls to formula rewriters. The theory solver mainly consists of four parts: collector, decider, searcher, and resolver. In addition, ismt implements optional algorithm plugins invoked in the theory solver, such as bit-blasting, interval arithmetic, etc.

## 2 Dependencies

For completeness, Yices-ismt invokes the SMT solver Yices 2.6.2 as a sub-solver. Rewriters and algorithms related to polynomial and interval are implemented on the libpoly library v0.1.11 [2]. The back-end SAT solver of the bit-blasting algorithm is from CaDiCal 1.5.2 [3].

## 3 Implementation

**Ismt.** Currently, ismt only supports QF\_NIA. The decider assigns each integer variable an interval while checking consistency via interval arithmetic and resolving conflicts via re-assigning. For example, the interval assignment  $x \rightarrow [0, 1], y \rightarrow [0, 1]$  conflicts with constraint  $y = x + 2$  and then ismt re-assigns  $y \rightarrow [0, 3]$  before searching. In addition, we propose a series of bit-width decision heuristics. After all variables are (partially or) completely decided, the searcher attempts to find a model in the space via the bit-blasting method [4].

**Yices-ismt.** Assume that the original SMT formula is  $\phi$ , ismt searches in a finite space  $F = \bigotimes_{x \in V} I(x)$ , where  $V$  is the set of variables and  $I(x) = l_x \leq x \leq u_x$  is the interval constraint for variable  $x$ . If ismt has not found a model in  $F$ , the

combined solver Yices-ismt will generate a lemma  $\psi$  to rule out the space where  $\psi = \bigvee_{x \in V} \neg I(x)$ . Otherwise if ismt runs out of resources during searching,  $\psi = \top$ . We implement the solver Yices-ismt with portion of time bound allocation  $\{0.1, 0.8, 0.1\}$  for sequential execution of  $\{\text{Yices2}(\phi), \text{ismt}(\phi), \text{Yices2}(\phi \wedge \psi)\}$ . If the first two end earlier, then  $\text{Yices2}(\phi \wedge \psi)$  runs within the remaining time. Yices-ismt returns  $\{sat, unsat\}$  once Yices2 or ismt results  $\{sat, unsat\}$ , and *unknown* when the time budget is exhausted.

## References

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