Bitwuzla at the SMT-COMP 2024

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Abstract—In this paper, we present our Satisfiability Modulo Theories (SMT) Bitwuzla as submitted to SMT-COMP 2024. Bitwuzla is a solver for the theories of bit-vectors, floating-points, arrays and uninterpreted functions and their combinations (with and without quantifiers).

I. Introduction

Bitwuzla is a Satisfiability Modulo Theories (SMT) solver for the (quantifier-free and quantified) theories of fixed-size bit-vectors, floating-point arithmetic, arrays and uninterpreted functions and their combinations. A comprehensive system description of Bitwuzla can be found in [9].

Bitwuzla implements the lazy, abstraction/refinement-based SMT paradigm *lemmas on demand*, using a bit-vector abstraction similar to [5, 11].

The bit-vector theory solver implements two orthogonal approaches, classic *bit-blasting* and *ternary propagation-based local search* [8], and a sequential combination of both. Additionally, Bitwuzla's bit-blasting solver now integrates an abstraction-refinement approach for bit-vector arithmetic, which will be presented at CAV'24 [10].

The array theory solver implements and extends the array procedure from [5] with support for reasoning over (equalities of) nested arrays. For theory of floating-point arithmetic, Bitwuzla implements a technique called *word-blasting* and integrates SymFPU [4], a C++ library of bit-vector encodings of floating-point operations. For uninterpreted functions, Bitwuzla implements a lazy form of Ackermann's reduction called *dynamic Ackermannization* [6]. Quantifier reasoning is handled by a dedicated quantifiers module, which implements model-based quantifier instantiation (MBQI) [7].

Bitwuzla further supports incremental solving (including incremental preprocessing), model generation, unsat core and unsat assumptions extraction.

This paper serves as system description for Bitwuzla as entered in the SMT competition 2024 [2]. Bitwuzla is licensed under the MIT license. Source code, releases and more information is available on the Bitwuzla website [1].

II. Configurations

Bitwuzla participates in the single query, incremental, unsat core, and model validation tracks in the logics matching the following regular expression:

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^(QF_)?(A)?(UF)?(BV|FP|FPLRA)+$
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Bitwuzla uses CaDiCaL version 1.7.4 [3] as default SAT back end.

III. License

Bitwuzla is licensed under the MIT license. For more details, refer to the actual license text, which is distributed with the source code.

References

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