

An Instantiation Scheme for Satisfiability Modulo Theories

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Abstract State-of-the-art theory solvers generally rely on an instantiation of the axioms of the theory, and depending on the solvers, this instantiation is more or less explicit. This paper introduces a generic instantiation scheme for solving SMT problems, along with syntactic criteria to identify the classes of clauses for which it is complete. The instantiation scheme itself is simple to implement, and we have produced an implementation of the syntactic criteria that guarantee a given set of clauses can be safely instantiated. We used our implementation to test the completeness of our scheme for several theories of interest in the SMT community, some of which are listed in the last section of this paper.

Keywords Satisfiability modulo theories · Instantiation-based theorem proving · Decision procedures

1 Introduction

Most formal verification tools rely on procedures that decide the validity or, dually, the satisfiability of logical formulas. In general, the considered formula (or set of clauses) is ground and its validity needs only be tested *modulo* a background theory \mathcal{T} . In formal software verification for example, the background theory can define one or a combination of data structures such as arrays or lists. These problems are known as \mathcal{T} -decision problems or more commonly, *SMT problems*, and the tools capable of

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