

ManyGlucose 4.1-60

Hidetomo Nabeshima
University of Yamanashi, JAPAN

Katsumi Inoue
National Institute of Informatics, JAPAN

Abstract—ManyGlucose is a deterministic parallel SAT solver based on Glucose-syrup 4.1. In order to achieve reproducible behavior, ManyGlucose has a special mechanism called *delayed clause exchange* and accurate estimation of execution time of clause exchange interval between solvers.

I. INTRODUCTION

ManyGlucose 4.1-60 is a deterministic portfolio parallel SAT solver for shared memory multi-core systems. Given an instance, a deterministic solver has reproducible results in terms of solution (satisfying assignment or proof of unsatisfiability) and running time. ManyGlucose supports such reproducible behavior. The base solver is Glucose-syrup 4.1 [1] which is a non-deterministic parallel SAT solver. To achieve reproducible behavior, ManyGlucose has a special mechanism called *delayed clause exchange* and accurate estimation of execution time of clause exchange interval between solvers [2].

II. MAIN TECHNIQUES

ManySAT 2.0 [3] is the first parallel SAT solver that supports reproducibility. To achieve deterministic behavior, it periodically synchronizes all threads, each of which executes MiniSat 2.2 [4], before and after the clause exchange. The exchange interval is called a *period*. In ManySAT, all threads need to be synchronized periodically. Hence, waiting threads frequently occur in a many-core environment.

In order to reduce the idle time of threads, ManyGlucose uses the following two techniques [2]:

- 1) Delayed clause exchange: each thread receives learnt clauses acquired in m periods ago of the other threads. This eliminates the need to wait if the gap of the period of each thread is less than or equal to m , where m is an admissible delay, called *margin*.
- 2) Accurate estimation of execution time of period: In ManySAT, the length of a period is defined as the number of conflicts. The generation speed of conflicts fluctuates frequently since it is affected by the number and length of clauses. In ManyGlucose, two new definitions of a period are available. The first one is based on the number of literal accesses and the second one is based on the number of executions of blocks (statements enclosed in curly braces in C++).

From version 4.1-2 (SAT Competition 2018), the management of the clause database for exchange has been completely changed. In 4.1-2, there is one global clause database and mutual exclusion control is required to access

the database. In 4.1-60, each thread and each period has a clause database. As a result, the solver does not have to do mutually exclusive control to access the database.

III. MAIN PARAMETERS

We set the margin to 20 and use the block execution based period. The portfolio strategy of ManyGlucose is same as Glucose-syrup except that each thread uses different random seeds to hold the diversity of solvers. We submit ManyGlucose 4.1-60 with 32 threads and with 64 threads to Parallel track.

IV. AVAILABILITY

ManyGlucose 4.1-60 is developed based on Glucose-syrup 4.1. Permissions and copyrights of ManyGlucose follows that of Glucose-syrup. ManyGlucose can be downloaded at <https://github.com/nabesima/manyglucose-satcomp2020>.

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