

Eureka-2006 SAT Solver

Alexander Nadel¹, Moran Gordon¹, Amit Palti¹, Ziyad Hanna¹

¹ Design Technology Group
Intel Corporation
Haifa, Israel

{alexander.nadel; moran.gordon; amit.palti; ziyad.hanna}@intel.com

Abstract. We describe the SAT solver Eureka. Eureka is a state-of-the-art SAT solver, used in various Formal Verification flows at Intel. Eureka is based upon backtrack search DPLL algorithm, enhanced by failure-driven assertion loop; non-standard conflict analyses; restart and clause deletion strategies; CBH decision heuristic and decision stack shrinking.

1 Basic Algorithm

Eureka makes usage of the following well known algorithms:

- Subsumption and resolution-based preprocessing [9]
- DPLL algorithm, enhanced by Boolean Constraints Propagation (BCP)
- Failure-driven assertion loop [1]
- Conflict clause recording: Eureka records the 1IUP conflict clause [2], enhanced by conflict clause minimization [3]. Eureka records another conflict clause, called local conflict clause. More details are provided in the next subsection
- Aggressive restart strategy [4, 5]
- Conflict clause deletion strategy, based on the age and the length of the clauses [4, 5]
- Decision stack shrinking [5, 6]
- CBH decision heuristic [7] is used starting from the 2nd restart. Berkmin's decision heuristic [4] is invoked for the first 2 restarts

2 Local Conflict Clause recording

Material, provided in this section, will be extensively described in [8].

On conflict occasion, Eureka records a *local conflict clause* in addition to the minimized 1IUP conflict clause. The local conflict clause is created as follows. Suppose that the decision level on conflict occasion is dl . In addition to the decision variable A , the decision level dl may contain some *flipped* variables, that is, variables whose value was flipped as a result of a failure-driven assertion. Each flipped variable is implied in some conflict clause.

Eureka treats the last flipped variable F as if it was a decision variable. It increments the decision level of F and all the implied literals, assigned after F and marks F a non-implied decision variable. Then, it creates a minimized UIP conflict clause *w.r.t to the new decision level*. This conflict clause is referred to as a local conflict clause.

Local conflict clause is usually much shorter than the regular UIP conflict clause. It characterizes only the last conflict, whereas the regular UIP conflict clause characterizes most of the conflicts, recorded while exploring the last sub-tree. Refer to [8] for more details.

Local conflict clause is used for decision stack shrinking whenever possible.

References

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