Baud-Berthier, Guillaume; **Giráldez-Cru, Jesús**; **Simon, Laurent**
On the community structure of bounded model checking SAT problems. (English)
Zbl 06807219

Gaspers, Serge (ed.) et al., Theory and applications of satisfiability testing – SAT 2017. 20th international conference, Melbourne, VIC, Australia, August 28 – September 1, 2017. Proceedings. Cham: Springer (ISBN 978-3-319-66262-6/pbk; 978-3-319-66263-3/ebook). Lecture Notes in Computer Science 10491, 65-82 (2017).

Summary: Following the impressive progress made in the quest for efficient SAT solving in the last years, a number of researches has focused on explaining performances observed on typical application problems. However, until now, tentative explanations were only partial, essentially because the semantic of the original problem was lost in the translation to SAT.

In this work, we study the behavior of so called "modern" SAT solvers under the prism of the first successful application of CDCL solvers, i.e., bounded model checking. We trace the origin of each variable w.r.t. its unrolling depth, and show a surprising relationship between these time steps and the communities found in the CNF encoding. We also show how the VSIDS heuristic, the resolution engine, and the learning mechanism interact with the unrolling steps. Additionally, we show that the literal block distance (LBD), used to identify good learnt clauses, is related to this measure.

Our work shows that communities identify strong dependencies among the variables of different time steps, revealing a structure that arises when unrolling the problem, and which seems to be caught by the LBD measure.

For the entire collection see [Zbl 1368.68008].

MSC:

68Q25   Analysis of algorithms and problem complexity
68T20   Problem solving in the context of artificial intelligence (heuristics, search strategies, etc.)

Software:

Chaff; Plingeling; Splatz; Treengeling

Full Text: DOI