Dalsgaard, Andreas E.; **Enevoldsen, Søren**; **Fogh, Peter**; **Jensen, Lasse S.**; **Jepsen, Tobias S.**; **Kaufmann, Isabella**; **Larsen, Kim G.**; **Nielsen, Søren M.**; **Olesen, Mads Chr.**; **Pastva, Samuel**; **Srba, Jiří**

Extended dependency graphs and efficient distributed fixed-point computation. (English)

Zbl 1393.68098

van der Aalst, Wil (ed.) et al., Application and theory of Petri nets and concurrency. 38th international conference, PETRI NETS 2017, Zaragoza, Spain, June 25–30, 2017. Proceedings. Cham: Springer (ISBN 978-3-319-57860-6/pbk; 978-3-319-57861-3/ebook). Lecture Notes in Computer Science 10258, 139-158 (2017).

Summary: Equivalence and model checking problems can be encoded into computing fixed points on dependency graphs. Dependency graphs represent causal dependencies among the nodes of the graph by means of hyper-edges. We suggest to extend the model of dependency graphs with so-called negation edges in order to increase their applicability. The graphs (as well as the verification problems) suffer from the state space explosion problem. To combat this issue, we design an on-the-fly algorithm for efficiently computing fixed points on extended dependency graphs. Our algorithm supplements previous approaches with the possibility to back-propagate, in certain scenarios, the domain value 0, in addition to the standard back-propagation of the value 1. Finally, we design a distributed version of the algorithm, implement it in an open-source tool, and demonstrate the efficiency of our general approach on the benchmark of Petri net models and CTL queries from the Model Checking Contest 2016.

For the entire collection see [Zbl 1365.68011].

MSC:

68Q60 Specification and verification (program logics, model checking, etc.)
68Q85 Models and methods for concurrent and distributed computing (process algebras, bisimulation, transition nets, etc.)
68W15 Distributed algorithms

Software:

TAPAAL; MARCIE; LTSmin; CADP; FDR3; SPIN

Full Text: DOI