

Bérard, Béatrice; Haar, Stefan; Schmitz, Sylvain; Schwoon, Stefan

The complexity of diagnosability and opacity verification for Petri nets. (English)

Zbl 1401.68221

Fundam. Inform. 161, No. 4, 317-349 (2018).

Summary: *Diagnosability* and *opacity* are two well-studied problems in discrete-event systems. We revisit these two problems with respect to expressiveness and complexity issues.

We first relate different notions of diagnosability and opacity. We consider in particular fairness issues and extend the definition of V. Germanos et al. [“Diagnosability under weak fairness”, ACM Trans. Embedded Comput. Syst. 14, No. 4, Article No. 69, 19 p. (2015; doi:10.1145/2832910)] of weakly fair diagnosability for safe Petri nets to general Petri nets and to opacity questions.

Second, we provide a global picture of complexity results for the verification of diagnosability and opacity. We show that diagnosability is NL-complete for finite state systems, PSPACE-complete for safe convergent Petri nets (even with fairness), and EXPSPACE-complete for general Petri nets without fairness, while non diagnosability is inter-reducible with reachability when fault events are not weakly fair. Opacity is ESPACE-complete for safe Petri nets (even with fairness) and undecidable for general Petri nets already without fairness.

MSC:

- 68Q85 Models and methods for concurrent and distributed computing (process algebras, bisimulation, transition nets, etc.)
- 68Q17 Computational difficulty of problems (lower bounds, completeness, difficulty of approximation, etc.)
- 68Q60 Specification and verification (program logics, model checking, etc.)

Keywords:

diagnosability; opacity; verification; complexity; Petri nets

Full Text: DOI