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On deadlockability, liveness and reversibility in subclasses of weighted Petri nets. (English)
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Summary: Liveness, (non-)deadlockability and reversibility are behavioral properties of Petri nets that are fundamental for many real-world systems. Such properties are often required to be monotonic, meaning preserved upon any increase of the marking. However, their checking is intractable in general and their monotonicity is not always satisfied. To simplify the analysis of these features, structural approaches have been fruitfully exploited in particular subclasses of Petri nets, deriving the behavior from the underlying graph and the initial marking only, often in polynomial time.

In this paper, we further develop these efficient structural methods to analyze deadlockability, liveness, reversibility and theirmonotonicity in weighted Petri nets. We focus on the join-free subclass, which forbids synchronizations, and on the homogeneous asymmetric-choice subclass, which allows conflicts and synchronizations in a restricted fashion.

For the join-free nets, we provide several structural conditions for checking liveness, (non-)deadlockability, reversibility and their monotonicity. Some of these methods operate in polynomial time. Furthermore, in this class, we show that liveness, non-deadlockability and reversibility, taken together or separately, are not always monotonic, even under the assumptions of structural boundedness and structural liveness. These facts delineate more sharply the frontier between monotonicity and non-monotonicity of the behavior in weighted Petri nets, present already in the join-free subclass.

In addition, we use part of this new material to correct a flaw in the proof of a previous characterization of monotonic liveness and boundedness for homogeneous asymmetric-choice nets, published in [*L. Jiao* et al., Theor. Comput. Sci. 311, No. 1–3, 165–197 (2004; Zbl 1070.68106)] and left unnoticed.

MSC:

68Q85 Models and methods for concurrent and distributed computing (process algebras, bisimulation, transition nets, etc.)

Keywords:

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