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HIERARCHIES OF PETRI NET LANGUAGES AND A SUPER-NORMAL FORM [1]

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ABSTRACT

Some restrictions on the in- and out-degree of transitions in Petri nets are imposed, and some hierarchies of Petri net languages are obtained. For λ-labelled Petri nets a new normal form is derived. It is called the *Super-Normal Form* of Petri nets and it improves the PELZ's normal form, with respect to the interleaving semantics.

Keywords: Petri net, normal form, language.

1. Introduction and Preliminaries

In [5] a systematic investigation of graph theoretic properties of Petri nets within the framework of language theory was initiated. In other words, various subclasses of Petri nets were introduced by imposing various restrictions on the in- and out-degree of nodes in the graph of the underlying net structure. The language generative power of the nets in question was chosen as a classification criterion. That is, each net was considered as a generator of language which may be either a "lassical" language consisting of the so-called firing sequences or the language of the so-called subset firing sequences.

In this paper we refine the restrictions imposed in [5] on the in- and out-degree of transitions. Thus we obtain interesting hierarchies of Petri net languages. In the case of λ-labelled Petri nets, we improve the PELZ's normal form of Petri nets [3], with respect to the interleaving semantics. We assume the reader familiar with the basic concepts of Petri net theory [4, 1, 2]. To establish the notation used in our paper we recall a few definitions of this theory.

A *(finite) Petri net*, abbreviated *PN*, is a 4-tuple $\Sigma = (S, T; F, W)$, where S and T are two finite sets, of *places* and *transitions*, such that $S \cap T = \emptyset$ and $S \cup T \neq \emptyset$, $F \subseteq (S \times T) \cup (T \times S)$ is the *flow relation* and $W : (S \times T) \cup (T \times S) \longrightarrow \mathbb{N}$ is the *weight function* of Σ verifying $W(x, y) = 0$ iff $(x, y) \notin F$. A function $M : S \longrightarrow \mathbb{N}$ is called a *marking* of Σ and it will be sometimes identified with a vector $M \in \mathbb{N}^{|S|}$.

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