Weight-Balanced Timed Event Graphs to Model Periodic Phenomena in Manufacturing Systems

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Résumé en anglais	Timed event graphs (TEGs) are suitable to model manufacturing systems in which synchronization and delay phenomena appear. Since 1980s, TEGs are studied as a class of linear discrete event systems in idempotent semirings such as the (min,+) algebra. In this paper, we consider the class of weighted TEGs (WTEGs) that corresponds to TEGs where the edges have integer weights. By introducing nonunitary weights, WTEGs widen the class of manufacturing systems that can be modeled, especially systems with batches and duplications. Moreover, a subclass of WTEGs called weight-balanced TEGs (WB-TEGs) can be studied with the algebraic tools that stem from the theory of (min,+) linear systems. In this paper, the focus lies on some modeling issues for manufacturing systems. Besides cutting and palletization operations, it is shown that WB-TEGs are also well adapted to describe periodic routing policies and, in a symmetrical way, how to merge flows similar to a multiplexer. In order to simplify the modeling step, a class of cycloweighted TEGs (CW-TEGs) is introduced. It is an extension of WTEGs where the weights of the edges can change according to a periodic sequence. Finally, we propose some elements of modeling that can be described by CW-TEGs or equivalently with an input-output transfer relation in an appropriate idempotent semiring of operators.
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