QMIPS

Quantitative Modeling In Parallel Systems

Approximate Performance Analysis on Petri Net Based Models of Manufacturing Systems

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Abstract Flexible manufacturing systems (FMS) are essentially concurrent and distributed. Their complexity compels to the use of formal techniques. Petri nets (PN) offer one of the most well–accepted modelling and analysis paradigm to study its functional and performance properties. Nevertheless evaluation techniques usually suffer the state space explosion problem. This paper presents a divide and conquer approach to the approximate analysis of stochastic Petri nets. As introduced by Woodside and Li [14], it employs a multicut on a system, but our fully aggregated system (called skeleton) is determined to have the topology of state machines (SM). From another perspective, this work generalizes the ideas of Jungnitz, Desrochers and Silva [9] in two different ways: (1) increasing the kit of reduction rules applicable to get the aggregated (sub)systems to

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any transformation preserving liveness, boundedness and the existence of home states; (2) use of iterative instead of hierarchical single cuttings, leading to the already mentioned single level multicut. Our approximation is centered around the assumption of product-form for the aggregated (i.e. reduced) view of the original system. Aggregated transition rates are adjusted in the fully and some partially aggregated systems till a fixed–point is found. Experimental results confirm fast convergence and very low error.