Quantification of FRAM models using Coloured Petri Nets

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The problem considered is: Can a variability value of a function output be reached?. The goal of the presented research is expressive and decision power of Coloured Petri Nets in quantification and dynamic analysis of FRAM models, more specifically in solving the above problem. The starting point are two approaches towards the quantification. The first is based on papers (Van Kleef, 2014) and (Slater, 2016). Van Kleef networks are the base for Dynamic Bayesian Belief Nets (DBBN) model. A DBBN consists of a sequence of sub-models (static BBNs), each representing the system at a particular point in time (time slice). In the second approach (Patriarca *et al*.), Monte Carlo simulation is applied in estimation process of system variability. It has been noticed, that in addition to the types of variability already defined for the technological, human and organizational functions, in real case it would be necessary to have different types of these functions, in line with their real variability. Thanks to the use of Monte Carlo simulation (Patriarca *et al*.), it was possible to find out which functions have larger variability and then to choose monitoring indicators. In CPN Tools (CPN Tools, 2015), timed and stochastic events, and relatively complicated semantics can be expressed. Petri nets are oriented on dynamics modelling, and it is not required to build a sequence of static models as in the DBBN case. The use of Colored Petri Nets can reflect the actual operation of individual functions. Many of them have a complex internal algorithm, and their output variability is strongly dependent on the variability of the other aspects, i.e. input, control, precondition, time, resource. In the paper, variability is characterized by time and precision variability as in the paper (Patriarca *et al*.). The values of these variabilities are characterized by discrete probability distributions. CPN models of FRAM functions and couplings are given.

References

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