Collections of Open Problems in DES Research

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Open Problems by Martin Fabian

Problem 1:

- Compositional synthesis for EFSM. Currently, we know how to verify non-blocking for EFSM, and we also know how to compute a coordinator to make an EFSM-system non-blocking if the verification turns out negative. However, surprisingly (maybe) EFSM controllability is not well-defined, and before we can agree on how to interpret controllability for EFSM, we are stuck on doing full synthesis. From my perspective, it seems reasonable to define "weak" and "strong" controllability.

Problem 2:

- Optimal selection of the automata to compose. During the compositional synthesis, we currently use different heuristics to select the next set (typically pair) of automata to compose and to then abstract, and though those heuristics work reasonably well, we would want to do better, preferably be optimal in the size of the resulting automata that the algorithm currently works on. It is not clear yet though even how to define that objective criterion (state-space, number of transitions, number of local events,...).

Problem 4:

- Parallelization of the compositional synthesis and verification algorithms. The way the algorithms work, they would seem to be obvious candidates for parallelization, but this has not been looked into yet. Potentially there is a big gain.

Problem 4:

- Unobservable events. The current approaches (that we have) do not support unobservability. The local events are sort of treated as unobservable, but they are not really; the supervisor may use them for control. The inclusion of real unobservable events would probably have a huge effect on the abstractions, but this has not yet been researched (by us).

Open Problems by Mariagrazia Dotoli

Problem 1:

- Petri Nets are hardly applied in the related literature to address air and road freight transport decision problems.

Problem 2:

- In the context of water and multimodal and intermodal transport, the employment of high-level Petri Nets is limited.

Problem 3:

- Scientific contributions generally overlook the possibility to use hybrid or continuous Petri Nets for control purposes.

Problem 4:

- Although high level Petri Nets allow a more compact representation of real systems than traditional Petri nets, the modeling of particularly complex and extended transportation systems remains nontrivial.

(Reference)

G. Cavone, M. Dotoli and C. Seatzu, "A Survey on Petri Net Models for Freight Logistics and Transportation Systems," in IEEE Transactions on Intelligent Transportation Systems, vol. 19, no. 6, pp. 1795-1813, June 2018.