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This form is a summary description of the model entitled "Three-Module Ring" proposed for the Model Checking Contest @ Petri Nets. Models can be given in several instances parameterized by scaling parameters. Colored nets can be accompanied by one or many equivalent, unfolded P/T nets. Models are given together with property files (possibly, one per model instance) giving a set of properties to be checked on the model.

Description

- Comment from the submitter: The Petri net is a nice example for a safe Petri net with a reasonably large state space. It originally models a hardware circuit.
- Original description: The net models a three-module ring architecture. The communication architecture contains as many channels as there are modules. It tests the occurrence of global deadlock arising from a local one. It uses pausible clocking scheme on arbitrated input and output channels.

In March 2020, Pierre Bouvier and Hubert Garavel provided a decomposition of this model into a network of communicating automata. This network is expressed as a Nested-Unit Petri Net (NUPN) that can be found in the "toolspecific" section of the corresponding PNML file.

References

Sohini Dasgupta, from the University of Newcastle

Scaling parameter

This model is not parameterized.

Size of the model

number of places:	139
number of transitions:	87
number of arcs:	410
number of units:	62
HWB code (*height-width-bits*):	1–61–80

Structural properties

ordinary — *all arcs have multiplicity one* ..... ✔
simple free choice — *all transitions sharing a common input place have no other input place* ..... ✘ [a]
extended free choice — *all transitions sharing a common input place have the same input places* ..... ✘ [b]
state machine — *every transition has exactly one input place and exactly one output place* ..... ✘ [c]
marked graph — *every place has exactly one input transition and exactly one output transition* ..... ✘ [d]
connected — *there is an undirected path between every two nodes (places or transitions)* ..... ✔ [e]
strongly connected — *there is a directed path between every two nodes (places or transitions)* ..... ✔ [f]
source place(s) — *one or more places have no input transitions* ..... ✘ [g]

[a] 105 arcs are not simple free choice, e.g., the arc from place "P138" (which has 3 outgoing transitions) to transition "T35" (which has 2 input places).
[b] transitions "T30" and "T32" share a common input place "P10", but only the former transition has input place "P3".
[c] 82 transitions are not of a state machine, e.g., transition "T1".
[d] 60 places are not of a marked graph, e.g., place "P1".
[e] stated by CÆSAR.BDD version 1.7.
[f] stated by CÆSAR.BDD version 1.7.
[g] stated by CÆSAR.BDD version 1.7.

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sink place(s) — *one or more places have no output transitions* ..... ✗ (h)
source transition(s) — *one or more transitions have no input places* ..... ✗ (i)
sink transitions(s) — *one or more transitions have no output places* ..... ✗ (j)
loop-free — *no transition has an input place that is also an output place* ..... ✗ (k)
conservative — *for each transition, the number of input arcs equals the number of output arcs* ..... ✗ (l)
subconservative — *for each transition, the number of input arcs equals or exceeds the number of output arcs* ..... ✗ (m)
nested units — *places are structured into hierarchically nested sequential units* (n) ..... ✔

Behavioural properties

safe — *in every reachable marking, there is no more than one token on a place* ..... ✔ (o)
dead place(s) — *one or more places have no token in any reachable marking* ..... ✗ (p)
dead transition(s) — *one or more transitions cannot fire from any reachable marking* ..... ✗ (q)
deadlock — *there exists a reachable marking from which no transition can be fired* ..... ? (r)
reversible — *from every reachable marking, there is a transition path going back to the initial marking* ..... ?
live — *for every transition t, from every reachable marking, one can reach a marking in which t can fire* ..... ?

Size of the marking graph

number of reachable markings:	9.0265×10^{11} (s)
number of transition firings:	$9.6628E \times 10^{12}$ (t)
max. number of tokens per place:	1 (u)
max. number of tokens per marking:	61 (v)

(h) stated by CÆSAR.BDD version 1.7.
(i) stated by CÆSAR.BDD version 1.7.
(j) stated by CÆSAR.BDD version 1.7.
(k) 21 transitions are not loop free, e.g., transition “T17”.
(l) 56 transitions are not conservative, e.g., transition “T11”.
(m) 27 transitions are not subconservative, e.g., transition “T11”.
(n) the definition of Nested-Unit Petri Nets (NUPN) is available from http://mcc.lip6.fr/nupn.php
(o) confirmed by CÆSAR.BDD version 3.3.
(p) stated by CÆSAR.BDD version 3.3.
(q) stated by CÆSAR.BDD version 3.3.
(r) found to be false at MCC’2014 by GreatSPN.
(s) computed at MCC’2013 by ITS-Tools, Marcie, and PNXDD; confirmed at MCC’2014 by GreatSPN, Marcie, PNMC, and PNXDD.
(t) computed at MCC’2014 by Marcie.
(u) confirmed at MCC’2014 by GreatSPN, Marcie, and PNMC.
(v) computed at MCC’2014 at Marcie and PNMC.