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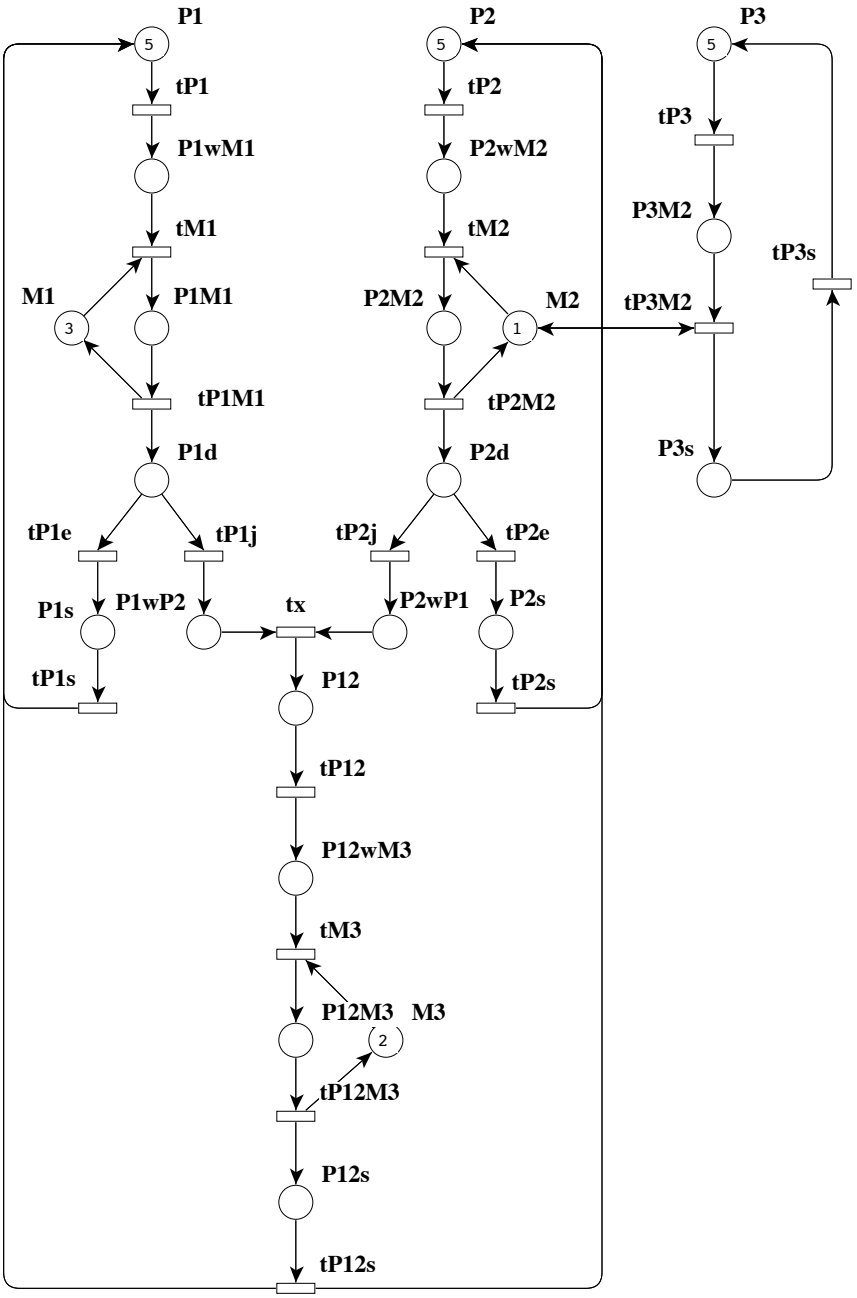
This form is a summary description of the model entitled "Flexible Manufacturing System (FMS)" proposed for the Model Checking Contest @ Petri Nets. Models can be given in several instances parameterized by scaling parameters. Colored nets can be accompanied by one or many equivalent, unfolded P/T nets.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

Description

This Petri net is extracted a benchmark used for SMART. It models a flexible manufacturing system.



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References

http://www.cs.ucr.edu/~ciardo/SMART/

Scaling parameter

Parameter name	Parameter description	Chosen parameter values
N	The scale factor is a value that changes the initial marking of places P1, P2 and P3 (M(P1)=M(P2)=M(P3)=N)	2, 5, 10, 20, 50, 100, 200, 500

Size of the model

Although the model is parameterized, its size does not depend on parameter values.

number of places:	22
number of transitions:	20
number of arcs:	50

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]
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] ..... ✗

[a] 2 arcs are not simple free choice, e.g., the arc from place "M2" (which has 2 outgoing transitions) to transition "tM2" (which has 2 input places).
[b] transitions "tM2" and "tP3M2" share a common input place "M2", but only the former transition has input place "P2wM2".
[c] 9 transitions are not of a state machine, e.g., transition "tM1".
[d] 5 places are not of a marked graph, e.g., place "P1".
[e] stated by CÆSAR.BDD version 1.7 on all 8 instances (2, 5, 10, 20, 50, 100, 200, and 500).
[f] stated by CÆSAR.BDD version 1.7 on all 8 instances (2, 5, 10, 20, 50, 100, 200, and 500).
[g] stated by CÆSAR.BDD version 1.7 on all 8 instances (2, 5, 10, 20, 50, 100, 200, and 500).
[h] stated by CÆSAR.BDD version 1.7 on all 8 instances (2, 5, 10, 20, 50, 100, 200, and 500).
[i] stated by CÆSAR.BDD version 1.7 on all 8 instances (2, 5, 10, 20, 50, 100, 200, and 500).
[j] stated by CÆSAR.BDD version 1.7 on all 8 instances (2, 5, 10, 20, 50, 100, 200, and 500).
[k] transition "tP3M2" is not loop free.
[l] 8 transitions are not conservative, e.g., transition "tM1".
[m] 4 transitions are not subconservative, e.g., transition "tP12M3".
[n] the definition of Nested-Unit Petri Nets (NUPN) is available from http://mcc.lip6.fr/nupn.php

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Behavioural properties

safe — *in every reachable marking, there is no more than one token on a place* ..... ✗ [o]
deadlock — *there exists a reachable marking from which no transition can be fired* ..... ✗ [p]
reversible — *from every reachable marking, there is a transition path going back to the initial marking* ..... ?
quasi-live — *for every transition t, there exists a reachable marking in which t can fire* ..... ✔ [q]
live — *for every transition t, from every reachable marking, one can reach a marking in which t can fire* ..... ?

Size of the marking graphs

Parameter	Number of reachable markings	Number of transition firings	Max. number of tokens per place	Max. number of tokens per marking
$N = 2$	3444 [r]	16 311 [s]	3 [t]	12 [u]
$N = 5$	2.8950E+6 [v]	2.3527E+7 [w]	5 [x]	21 [y]
$N = 10$	2.501E+9 [z]	2.7568E+10 [aa]	10 [ab]	36 [ac]
$N = 20$	6.0292E+12 [ad]	8.1442E+13 [ae]	20 [af]	66 [ag]
$N = 50$	4.2403E+17 [ah]	6.6135E+18 [ai]	50 [aj]	156 [ak]
$N = 100$	2.7031E+21 [al]	?	100 [am]	306 [an]
$N = 200$	1.9536E+25 [ao]	?	200 [ap]	606 [aq]
$N = 500$	2.7006E+30 [ar]	?	500 [as]	$\geq$ 1506 [at]

[o] in the initial marking, some places have several tokens (the number of which depends on N).
[p] stated at MCC'2014 by GreatSPN and Lola on all instances, and by Tapaal on 5 instances.
[q] stated by CÆSAR.BDD version 2.0 on all 8 instances (2, 5, 10, 20, 50, 100, 200, and 500).
[r] computed at MCC'2013 by Alpina, GreatSPN, ITS-Tools, Marcie, Neco, and PNXDD; confirmed at MCC'2014 by GreatSPN, Marcie, PNMC, PNXDD, Stratagem, and Tapaal.
[s] computed at MCC'2014 by Marcie.
[t] computed at MCC'2014 by GreatSPN, Marcie, PNMC, and Tapaal.
[u] computed at MCC'2014 by GreatSPN, Marcie, PNMC, and Tapaal.
[v] computed at MCC'2013 by Alpina, GreatSPN, ITS-Tools, Marcie, Neco, and PNXDD; confirmed at MCC'2014 by GreatSPN, Marcie, PNMC, PNXDD, Stratagem, and Tapaal.
[w] computed at MCC'2014 by Marcie.
[x] computed at MCC'2014 by GreatSPN, Marcie, PNMC, and Tapaal.
[y] computed at MCC'2014 by GreatSPN, Marcie, PNMC, and Tapaal.
[z] computed at MCC'2013 by GreatSPN, ITS-Tools, Marcie, and PNXDD; confirmed at MCC'2014 by GreatSPN, Marcie, PNMC, PNXDD, and Stratagem.
[aa] computed at MCC'2014 by Marcie.
[ab] computed at MCC'2014 by GreatSPN, Marcie, and PNMC.
[ac] computed at MCC'2014 by GreatSPN, Marcie, and PNMC.
[ad] computed at MCC'2013 by GreatSPN, ITS-Tools, Marcie, and PNXDD; confirmed at MCC'2014 by GreatSPN, Marcie, PNMC, PNXDD, and Stratagem.
[ae] computed at MCC'2014 by Marcie.
[af] computed at MCC'2014 by GreatSPN, Marcie, and PNMC.
[ag] computed at MCC'2014 by GreatSPN, Marcie, and PNMC.
[ah] computed at MCC'2013 by GreatSPN, ITS-Tools, Marcie, and PNXDD; confirmed at MCC'2014 by GreatSPN, Marcie, PNMC, and PNXDD.
[ai] computed at MCC'2014 by Marcie.
[aj] computed at MCC'2014 by GreatSPN, Marcie, and PNMC.
[ak] computed at MCC'2014 by GreatSPN, Marcie, and PNMC.
[al] computed at MCC'2013 by GreatSPN, ITS-Tools, and Marcie; confirmed at MCC'2014 by GreatSPN and PNMC.
[am] computed at MCC'2014 by GreatSPN and PNMC.
[an] computed at MCC'2014 by GreatSPN and PNMC.
[ao] computed at MCC'2013 by ITS-Tools; confirmed at MCC'2014 by GreatSPN and PNMC.
[ap] computed at MCC'2014 by GreatSPN.
[aq] computed at MCC'2014 by GreatSPN and PNMC.
[ar] computed at MCC'2014 by PNMC.
[as] computed at MCC'2014 by GreatSPN and PNMC.
[at] lower bound given by the number of initial tokens.