This form is a summary description of the model entitled “BART” 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 is the model of a speed controller allowing a train (we use the BART description from a case study presented in [2]) to reach appropriately a station without missing. To do so, the braking distance according to the current speed of the train is stored in place NewDistTable. This model is parameterized by $T$, the number of trains running in parallel.

References


Scaling parameter

<table>
<thead>
<tr>
<th>Parameter name</th>
<th>Parameter description</th>
<th>Chosen parameter values</th>
</tr>
</thead>
<tbody>
<tr>
<td>$T$</td>
<td>Number of trains in separate tracks</td>
<td>2, 5, 10, 20, 30, 40, 50, 60</td>
</tr>
</tbody>
</table>

Size of the colored net model

- number of places: 4
- number of transitions: 7
- number of arcs: 26
Size of the derived P/T model instances

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Number of places</th>
<th>Number of transitions</th>
<th>Number of arcs</th>
</tr>
</thead>
<tbody>
<tr>
<td>$T = 2$</td>
<td>732</td>
<td>2 282</td>
<td>13 200</td>
</tr>
<tr>
<td>$T = 5$</td>
<td>1 427</td>
<td>5 705</td>
<td>33 000</td>
</tr>
<tr>
<td>$T = 10$</td>
<td>2 582</td>
<td>11 410</td>
<td>66 000</td>
</tr>
<tr>
<td>$T = 20$</td>
<td>4 892</td>
<td>22 820</td>
<td>132 000</td>
</tr>
<tr>
<td>$T = 30$</td>
<td>7 202</td>
<td>34 230</td>
<td>198 000</td>
</tr>
<tr>
<td>$T = 50$</td>
<td>9 512</td>
<td>45 640</td>
<td>264 000</td>
</tr>
<tr>
<td>$T = 60$</td>
<td>11 822</td>
<td>57 050</td>
<td>330 000</td>
</tr>
<tr>
<td></td>
<td>14 132</td>
<td>68 460</td>
<td>396 000</td>
</tr>
</tbody>
</table>

Structural properties

- **ordinary** — all arcs have multiplicity one
- **simple free choice** — all transitions sharing a common input place have no other input place
- **extended free choice** — all transitions sharing a common input place have the same input places
- **state machine** — every transition has exactly one input place and exactly one output place
- **marked graph** — every place has exactly one input transition and exactly one output transition
- **connected** — there is an undirected path between every two nodes (places or transitions)
- **strongly connected** — there is a directed path between every two nodes (places or transitions)
- **source place(s)** — one or more places have no input transitions
- **sink place(s)** — one or more places have no output transitions
- **source transition(s)** — one or more transitions have no input places
- **sink transition(s)** — one or more transitions have no output places
- **loop-free** — no transition has an input place that is also an output place
- **conservative** — for each transition, the number of input arcs equals the number of output arcs
- **subconservative** — for each transition, the number of input arcs equals or exceeds the number of output arcs
- **nested units** — places are structured into hierarchically nested sequential units

Behavioural properties

- **safe** — in every reachable marking, there is no more than one token on a place
- **deadlock** — there exists a reachable marking from which no transition can be fired
- **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

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(a) stated by CÆSAR.BDD version 2.7 on all 8 instances (see all aforementioned parameter values).
(b) stated by CÆSAR.BDD version 2.7 on all 8 instances (see all aforementioned parameter values).
(c) stated by CÆSAR.BDD version 2.7 on all 8 instances (see all aforementioned parameter values).
(d) stated by CÆSAR.BDD version 2.7 on all 8 instances (see all aforementioned parameter values).
(e) stated by CÆSAR.BDD version 2.7 on all 8 instances (see all aforementioned parameter values).
(f) the net is not connected and, thus, not strongly connected; notice that the colored nets are connected.
(g) the net is not connected and, thus, not strongly connected; notice that the colored nets are connected.
(h) the net is not connected and, thus, not strongly connected; notice that the colored nets are connected.
(i) the net is not connected and, thus, not strongly connected; notice that the colored nets are connected.
(j) the net is not connected and, thus, not strongly connected; notice that the colored nets are connected.
(k) the net is not connected and, thus, not strongly connected; notice that the colored nets are connected.
(l) the net is not connected and, thus, not strongly connected; notice that the colored nets are connected.
(m) the net is not connected and, thus, not strongly connected; notice that the colored nets are connected.
(n) the definition of Nested-Unit Petri Nets (NUPN) is available from [http://mcc.lip6.fr/nupn.php](http://mcc.lip6.fr/nupn.php).
(o) on the P/T equivalent version, there should not be more than one token per place; stated by CÆSAR.BDD version 2.7 to be true on 1 instance(s) out of 8, and unknown on the remaining 7 instance(s).
(p) for some initial markings, transition TooEarly may be fired; stated by CÆSAR.BDD version 2.7 to be true on 1 instance(s) out of 8, and unknown on the remaining 7 instance(s).
(q) for some initial markings, transition TooEarly may be fired; stated by CÆSAR.BDD version 2.7 to be true on 1 instance(s) out of 8, and unknown on the remaining 7 instance(s).
(r) for some initial markings, transition TooEarly may be fired; stated by CÆSAR.BDD version 2.7 to be true on 1 instance(s) out of 8, and unknown on the remaining 7 instance(s).
live — for every transition $t$, from every reachable marking, one can reach a marking in which $t$ can fire. 

Size of the marking graphs

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Number of reachable markings</th>
<th>Number of transition firings</th>
<th>Max. number of tokens per place</th>
<th>Max. number of tokens per marking</th>
</tr>
</thead>
<tbody>
<tr>
<td>$T = 2$</td>
<td>$53,824$</td>
<td>$?$</td>
<td>1</td>
<td>$274$</td>
</tr>
<tr>
<td>$T = 5$</td>
<td>$672,109,330,432$</td>
<td>$?$</td>
<td>$?$</td>
<td>$277$</td>
</tr>
<tr>
<td>$T = 10$</td>
<td>$?$</td>
<td>$?$</td>
<td>$?$</td>
<td>$282$</td>
</tr>
<tr>
<td>$T = 20$</td>
<td>$?$</td>
<td>$?$</td>
<td>$?$</td>
<td>$292$</td>
</tr>
<tr>
<td>$T = 30$</td>
<td>$?$</td>
<td>$?$</td>
<td>$?$</td>
<td>$302$</td>
</tr>
<tr>
<td>$T = 40$</td>
<td>$?$</td>
<td>$?$</td>
<td>$?$</td>
<td>$312$</td>
</tr>
<tr>
<td>$T = 50$</td>
<td>$?$</td>
<td>$?$</td>
<td>$?$</td>
<td>$322$</td>
</tr>
<tr>
<td>$T = 60$</td>
<td>$?$</td>
<td>$?$</td>
<td>$?$</td>
<td>$332$</td>
</tr>
</tbody>
</table>

(1) For some initial marking, transition MissStation can be fired; stated by CÆSAR.BDD version 2.7 to be false on 1 instance(s) out of 8, and unknown on the remaining 7 instance(s).
(1) stated by prod in May 2017; confirmed by CÆSAR.BDD version 2.7.
(2) number of initial tokens, because the net is sub-conservative.
(3) stated by ITS-Tools in May 2017.
(4) number of initial tokens, because the net is sub-conservative.