一個能分析彈性製造資源共享系統支派翠網路工具

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主持人：趙玉 yaw@mis.nccu.edu.tw　國立政治大學資訊管理學系(所)

一、中文摘要

我們已(1) 發展一有效率的技術去找出壞的 siphons。(2)擴大工具以至於他它能分析每個工作流程能被取得的 M-nets。(3)執行未知工程流程位置的演算法。一組新的不好的 siphons 藉由一組普遍存在的壞的 siphons 和其他的結合以及一組一般位置的刪除而被獲得(4)執行較普遍的存活的 marking 條件(5)用經合成(synthesis)指導的分析加強工具(6)學習各種合成(synthesis)規則和極小的 siphons 的合成(synthesis)相結合的種類之間的關係。

關鍵詞：關鍵詞： 派屈網路 活性 有限性 重復性 良性 同部選擇網路 合成 分析

Abstract

We have enhanced our advanced analysis tool developed for NSC90 to handle FMS with resource-sharing. This proposal (1) extend the tool so that it can analyze M-nets where each WP (working process) can be extracted (2) implement the algorithm where the locations of WP are unknown (3) implement an efficient technique to find all bad siphons. A set of new bad siphons can be obtained by the union of a common existing bad siphon with another and the deletion of a common set of places (4) implement more general marking conditions for liveness (5) enhance the tool with synthesis directed analysis and (6) study the relationship between various synthesis rules and the classes associated with the synthesis of minimal siphons.

Keywords: Petri Nets, Live, Bounded, Reversible, Well-behaved, Synchronized-Choice, Free-Choice.

二、緣由與目的

Previously, we developed a very powerful CAD tool for designing protocols and Petri nets. Currently, the tool is able to draw Petri nets, state diagrams, data flow graphs, (extended) finite state machines, and general graphical objects. Once the graph is drawn, the tool can analyze, simulate, reduce, animate, and synthesize them. Few existing tools are capable of such integration.

We propose to enhance our advanced analysis tool developed for NSC90 to handle FMS with resource-sharing. Our NSC90 integrates the algorithms for detecting SNC and TP- and PT- inconsistent pair of places into our CAD tool for analysis. This forms the basis to develop efficient techniques for dealing analysis for M-nets where SNC components interact by sharing resources such as robots.

The implementation will be the world's first in its kind.and is important because it (1) constructs classes of nets for FMS resource sharing more complicated than any existing class of nets, (2) avoids reachability analysis and can analyze arbitrarily large SNC and M-nets, (3) supports III which has developed a Petri-nets based workflow (WF) system with DCOM component implementation. This tool lacks the ability to check the syntactic and logical properties. We have delivered three DCOM (Distributed Common Object Model) components for workflow analysis and simulation based on PN. But it suffers state explosion problem. The implementation will render III the leading player in the WF business.

四、結果與討論

A FMS model consists of a set of working processes (WP) competing for resources. We divide the net into a number of SNC components (each being a WP) serving as the backbone. The net is the set of all WP merged along resource places. Such a net is called a Merged SNC or a MSNC.

Each WP has all the resources it requires. If any WP has TP-inconsistent pair of places, it is not live. Otherwise, we merge resource place p_r one by one. The system deadlock occurs only under inappropriate resource sharing. Each time we add a new p_r', we find new bad siphons which takes less time than to search them in the whole net.

The algorithm of finding all bad siphons is proposed as follows:

Bad Siphons Search Algorithm

1. Add a new p_r'.
2. Find a new elementary circuit c' containing p_r' and a border p_r within an existing elementary circuit c. If "not found", go to Step 1.
3. Add all PP- followed by all TP-handles to c'. Denote the resulting net I' (I-subnet) where the set of places P(I') forms a new bad siphon D_m^n.
4. Delete all TT- and PT-paths in I∪I' where I is the I-subnet of any existing D_m^e that contains c to form new I".
5. Construct new D_m= P(I"). If D_m contains a P-semiflow of a p_r in c, discard D_m, which is not a bad siphon. Go to Step 2 and repeat.

We have developed the algorithm to find c' based on the S-Matrix concept. We have implemented the algorithm. In addition, we further generalized and implemented the algorithm so that it can handle the synthesis of multi-party protocol.

The actual algorithm is much more complicated that that presented here. We have yet to extract the algorithm from the code. In addition, we need to test the tool against various cases which are rather hard to find. Our future efforts would be to search various literatures and continues updating the tool in case modification is necessary.

Based on the siphon synthesis concept, we have discovered the maximal class of nets that does not satisfy Commoner's property. That is, even if every siphon is never empty, the net may not be live because some transitions are not live.

五、計畫成果自評

A set of theorems and algorithms have been developed. We are currently compiling the results into a result to be submitted to journals. The resulting technique should advance and help us understand the PN structure theory. We have completed all our project objectives.

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