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1 Purpose of visit

The two main goals of this visit to Newcastle were: discussing a new class of Petri nets named Clean Choice-Concurrency Petri Nets (CCC PN) and participation in the 11th UK Asynchronous Forum with a talk on the same topic.

2 Brief technical overview

Consider Petri net properties as to belong to two groups: behavioral - marking-dependent properties defined using the PN execution rules, its reachability graph (RG) or any implications of the net dynamic behavior, and structural - marking-independent (with the only exception for sometimes considered initial marking) properties depending on the interconnection of the PN nodes.

Behavioral properties are those we are usually interested in, but due to the dynamic nature and usually exponential size of the PN RG (relative to the PN size) these properties are hard to analyze.

Structural properties’ analysis is computationally easier for it only uses the usually compact PN structure - interconnection of the net vertices.

Various PN classes have been proposed over the time from trivial to complicated with different correlation between the net structure and its behavior. For instance for state machines (SM) - PNs with no concurrency, the RG structure coincides with that of a PN. Many conjectures relating the PN structural and behavioral properties hold for yet non-trivial extensively studied class of Petri nets called free-choice (FC) PNs.

The new class nets we call Clean Choice-Concurrency Petri Nets mimic (while not coinciding with) the structure of the net RG making the net behavior clear from the net structure on one hand and compactly represented on the other. To facilitate the dynamic behavior analysis we rely not only on the net structure but also on the precomputed PN concurrency and choice relations.

CCC nets are close in many aspects to Free Choice PNs but many of these properties need to be proven. Another important problem crucial for the new class to be used is identifying a wider PN class that can be transformed to CCC and an algorithm to automatically perform such a transformation in a reasonable time.
CCC nets were proposed for and first applied in Signal Transition Graph’s (STG) analysis and automated refinement but then appeared to be closely related to some ongoing research at Department of Computing Science, University of Newcastle upon Tyne on visual representation of concurrent systems, detecting STG coding conflicts and direct mapping. These were the main topics discussed in Newcastle.

3 Results

1. Several discussions with the VLSI design group members have helped to identify other CCC nets applications and shown unfolding-based techniques to be another approach to the problem of automated transformation of connected, bounded, live and safe PNs to the CCC form;

2. One-hour seminar one at the University of Newcastle 12.12.01 10am Room T517 as scheduled at http://www.cs.ncl.ac.uk/old/events/ASL/asl2001.html on the asynchronous circuits design using a newly developed Clean Concurrency-Choice (CCC) Petri Net model;

3. 30-minute talk titled “Clean concurrency-choice PN model” at the 11th UK Asynchronous Forum held at the Computer Laboratory of the University of Cambridge.