Proposal for POWERENG'2013 Tutorial

Title of Tutorial:

Petri nets based digital controller development

The lack of tools ready to be integrated in engineering development frameworks are one major drawback when considering Petri nets usage within specific areas of application. This tutorial addresses usage of Petri nets for networked controller development. The tutorial is divided into two parts, being the first one more on Petri nets fundamentals, while the second one emphasizes the development of networked controllers. Both parts use a set of tools for digital controller development support and a selected set of application examples. In the first part, Petri nets main characteristics and classes are presented, including firing semantics and common semantics (namely interleaving semantics used in most simulation environments, as well as maximal step semantics used in most control applications), structuring mechanisms and net operations (namely addition and splitting), and proprieties verification techniques (namely formal techniques based on invariants and state space exploration). The tutorial will cover situations where a centralized execution is used, as well as others where distributed execution is the goal. In the second part, a set of tools based on IOPT nets (a Petri nets class defined on top of the well-known Place-Transition Petri nets class), represented using PNML format as the common link across the set of tools, is presented. The tool framework includes a graphical editor, a state-space analyzer for the verification of properties, tools for net operations, automatic code generators for different target languages (namely C and VHDL), as well as tools for animation of graphical user interfaces both within simulation environment and integrated with physical FPGA-based controllers. A few application examples will be used to illustrate the application of the referred tool framework within several kinds of systems, namely globally-asynchronous-locally-synchronous (GALS) systems, as well as integrated in power electronics industrial controllers.

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Estimated number of hours: 3 hours