Liveness analysis of the control part of a cyber-physical system specified by a Petri net

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Abstract

The doctoral thesis focuses on the liveness analysis of the control part of cyber-physical systems modeled by Petri nets. In particular, a novel liveness analysis technique is proposed and described. Firstly, an introduction to cyber-physical systems was made and the main areas of their applications were briefly summarized. The selected issues from the graph and Petri net theories are also presented in order to explain the proposed technique. Furthermore, the estimations of algorithms' computational complexity are presented in regard to the comparison of the other algorithms and analysis methods with the proposed solution. Next, existing analysis techniques and methods related to the other Petri net properties (e.g., boundedness) are reviewed. Moreover, a reference method is selected and described in detail. Finally, a description of the implementation process is provided, as well as the results of experimental research. The obtained research results are discussed in detail and compared with the reference method in order to show the effectiveness and efficiency of the technique proposed in the dissertation. Using examples, the benefits and limitations of the proposed solution were presented. The proposed approach's development prospects and future research directions were also indicated.