Abstract

In the dissertation, the author has taken up the problem of proving the following thesis: “Controlling of selected discrete sequential and concurrent processes in the warehouse of production components can be accomplished efficiently using algorithms designed using the modified Petri net”.

The modeling, synthesis and analysis of sequential control systems and concurrent discrete processes using a modified Petri net are discussed. The structure of the work consists of eight chapters. Chapter one is introductory. It presents the problems of work. General comments on the problems of modeling the technical systems and the need to diagnose the correctness of their work are discussed. The benefits to the economy have been highlighted as a result of the improved efficiency of discrete process control modeling in the warehouse of production components. The purpose and scope of the work have been presented. The thesis has been formulated. Chapter two shows the characteristics of the warehouse of production components as a control object. Described selected discrete processes and their peculiarities, affecting the choice of control method. The tasks and problems connected with realization of selected discrete processes occurring in the warehouse were presented. The third chapter recalls basic information about the Petri net and reviewed the state of the art in terms of their applicability to discrete process modeling and control algorithms. The available methods for assessing the correctness of algorithms, designed using the Petri net, are discussed. The concept of a formal description of the modified Petri net is presented. Particular emphasis has been placed on solving the problem of control of concurrent processes. Chapter four provides a detailed description of the rules for transforming a control algorithm model in the form of modified Petri net into a programmatic form, using properties of the CASE OF Structured Text language. The fifth chapter presents how to implement the control algorithm, in the form of a modified Petri net, as a program for PLC, using CASE OF statement of Structured Text language. Chapter six presents a proposal for integration of a diagnostic system with a control system, which aims to improve the effectiveness of fault detection. The importance of diagnosing control systems and fault detection was highlighted. An overview of known methods of process diagnostics has been made, with particular focus on the important direction of Fault-Tolerant-Control systems. Chapter seven contains a practical example of algorithms for control of selected discrete processes occurring in a warehouse. The methodology for the study of the efficiency of the designed algorithms, both using computer simulation and in real conditions, was discussed. The results of the tests performed in the simulation environment and in the real warehouse are presented. It has been shown that the use of a modified Petri net allows for a clear and hierarchical structure of the control algorithm, and enables the efficient use of the PLC resources. The eighth chapter contains a summary of the work carried out and the conclusions of the research.