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***RAPIDSIM* – SOFTWARE FOR SUPPORTING PPC AND DES SYSTEMS INTEGRATION**

Abstract: In the paper RapidSim software for supporting production planning and control (PPC) and discrete event simulation (DES) systems integration has been presented. RapidSim system is a computer implementation of a methodology based on the automatic generation of production systems simulation models methods, data mapping and transformation methods and data-to-program code transformation and is designed for multi-assortment production systems. Application of shown software together with developed data structures and data transformation definitions provides complete and fully flexible solution that could be used with any commercial PPC and DES systems.

1. Introduction

Planning and control systems and discrete event simulation systems integration would in effect, allow the use of data obtained through carried out simulation experiments to support planning and decision-making processes, and is an very effective tool for solutions verification. The problem of the use of simulation systems in supporting the decision-making process has been repeatedly considered in published research papers [3, 4, 6, 9]. The need for integration of discrete event simulation systems with current enterprise resource planning systems, such as MRPI / MRP II, ERP, MES and PDM, was considered as an important problem related to the decision making and decision support area (eg by [2, 3, 6, 7]). The authors point out the limitations that occur in the course of attempting to use discrete event simulation systems in these areas - there are no problems with the limitations of simulation and visualization systems, quite the contrary, these systems perfectly fulfill the function of analysis and verification tools for solutions suggested by PPC systems and decision-making support tools on realization of productions orders at the operational level [1, 3, 4, 6, 7]. The main problems constitute: labor-intensive, time-consuming and high demands on the skills and knowledge of engineers operating these systems. These problems have effectively blocked their application at the operational level of production planning and control.

The methodology of integration PPC and DES systems is a solution to the problems mentioned above. Suggested by the author methodology is based on the automatic generation of production systems simulation models methods, data mapping and data transformation methods and data-to-program code transformation, and is designed for multi-assortment

production systems. An innovative approach to the proposed solution is based on the universality of presented methodology, which allows the use of computer modules that will provide the implementation for automatic generation of simulation models belonging to several classes of topologies and types of production systems, production flow, and the lack of links with a specific control methods (production schedule, priority rule, the sequence, etc.).

The proposed methodology does not contain closed catalog of objects making up parts of the simulation model and may be at the discretion of interest to planners, allowing the easy and rapid development and adaptation to specific practical applications. Application of intermediate model and neutral data exchange formats allowed the independence of the proposed approach to the type of PPC or DES systems. This methodology, whose conception is shown in Fig. 1 was the subject of considerations in the papers [3, 4, 5, 8].

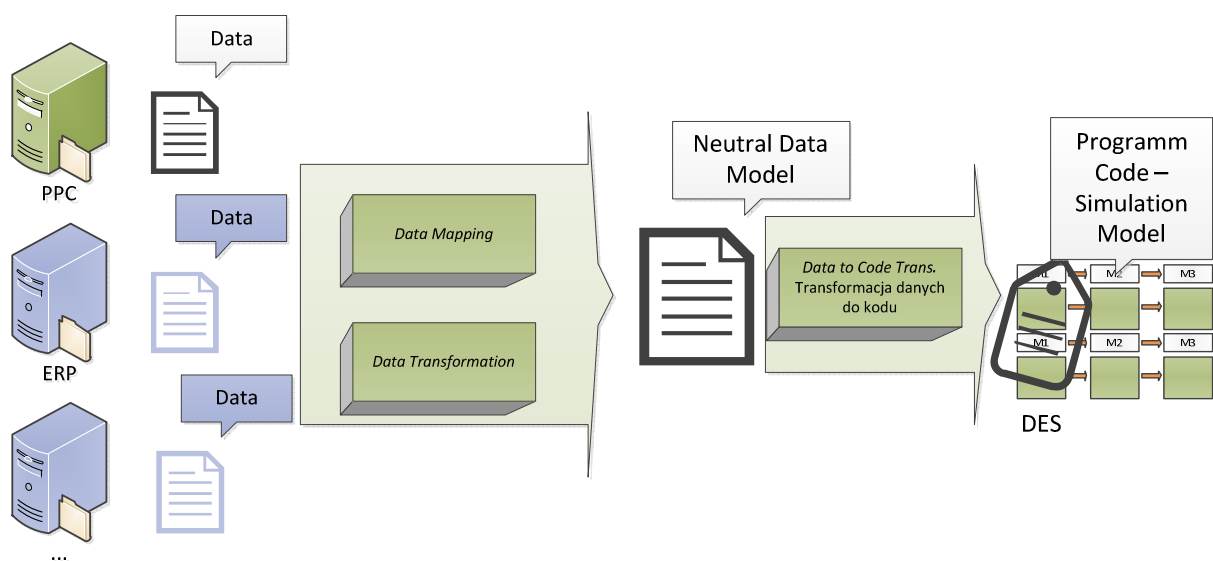


Fig.1. The methods used in the creation of simulation models with neutral data model

Furthermore, the methodology for PPC and DES systems integration with allow the use of simulation tools by planners, without a required prior knowledge on creating an simulation models to support decision-making process. This paper presents a computer program *RapidSim*, which is an implementation of the discussed methods. Implementation of the integration process requires only determination of the sources and forms of data acquisition from PPC / MRP / MES system.

2. *RapidSim* integration software

The methodology presented in the previous chapter, together with developed definitions of data structures and data transformations (for data exchange and data transformation process), in the process of implementation, required the implementation of the necessary software. The composition of this software includes the following modules: a graphical user interface, validation and parsing module of XML Documents (based on the XML Schema data structure definition), XSLT processor module, script code of simulation model generator, creating and

editing XML documents module, as well as input parameters module. A schematic flow diagram of the *RapidSim* has been shown in Fig 2. The first is used to select one of two operating modes: ZPS – with the transformation of data to a neutral intermediate model, PS – without data transformation to intermediate model (if the data obtained from the PPC system are directly exported to an XML file according to the intermediate model).

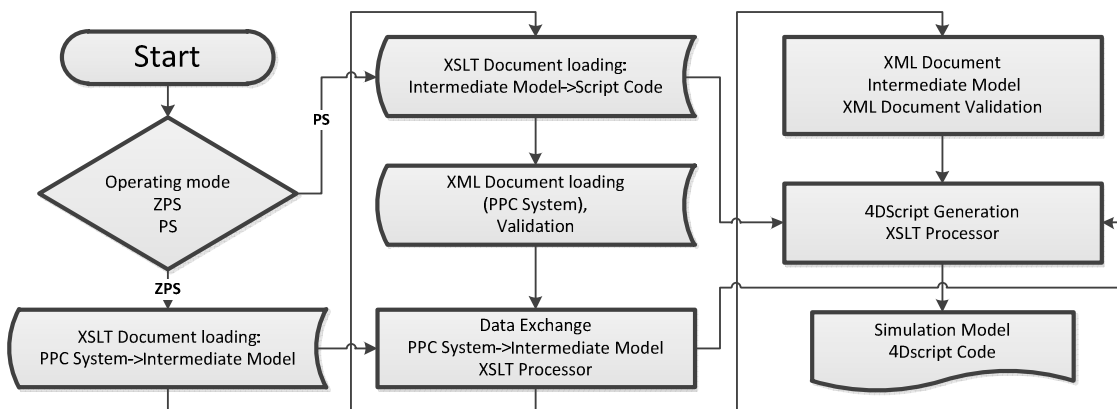


Fig.2. The algorithms of the *RapidSim* program

In the following steps, depending on the selected operation mode configuration files in the form of XSLT Documents are loaded: for data transformation between the structures obtained from the PPC system and a intermediate model; and between the intermediate model and the code in the internal programming language of DES system. Then, the XML Document is loaded from PPC system. The next stage (only in ZPS mode) the process of data exchange (transformation) between the data source (originating from PPC system) and the target (neutral intermediate data model) is executed, implemented in XSLT Processor.

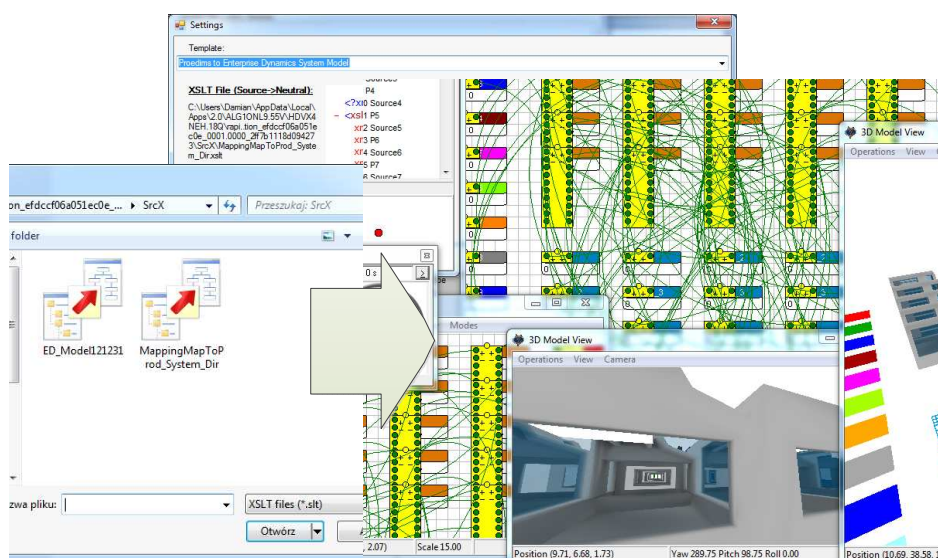


Fig.3. Simulation model

Finally, the simulation system internal programming language code is generated, using the XSLT Processor. Generated output code (including instructions for creating complete simulation model) is loaded into the DES system to perform simulation experiments (Fig. 3)

The output code contains several kinds of information - including information about the manufacturing system layout, routing of manufacturing processes with setup and cycle time, inter-resources buffers capacity and information about the control procedures for each manufacturing resource and manufacturing processes. By loading the programme code directly into the simulation system, the model is being automatically created and ready to carry out simulation experiments.

3. Conclusion

To the presented integration methodology, instances of data models definition, transformation formulas and simulation model component objects for selected commercial simulation and planning computer systems have been developed. The *RapidSim* software for PPC and DES systems integration - were subjected to verification tests, confirming the generated simulation models correctness and their efficiency and effectiveness for different types of processes flow in a production system. The source files and a trial version of the system can be found at rapidsim.imms.home.pl. *RapidSim* is fully versatile tool that could be used with any PPC or DES system. It only requires the creation of appropriate transformation formulas, definitions of used data models and simulation model component objects.

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