SIMULATION AS PART OF INDUSTRIAL PRACTICE

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Abstract: Article discusses the simulation as an efficient scientific method of problem solving in industrial practice. It creates an overview of the simulation program means used in industrial practice and creates an overview of tools for discrete, continuous, and combined.

1 Introduction

The basic principle of simulation is based on a simplified representation of the real system. Simulation model describes only the major properties of the real system. After verifying the validity and verification of the simulation model is implemented a set of simulation experiments. In experiments are proposed various improvements of simulated system and is determined their impact on the modelled system. To improve properties of the real system is chosen and applied the best variant obtained from simulation. Simulation not obtain direct optimal solution, it is a support tool for testing different variants and obtain the impact of decisions on the real system. When evaluating the results of the simulation to be aware of it that results of simulation are probably values [1], [2].

2 Properties of the simulation model

An important property of the simulation model is that it must to have the same configuration changes over time. That mean, that all activities that are carried out in a particular desired order should be maintained also in the creation of a model for the simulation [3], [4].

The model for computer simulation becomes at the final form a computer program, which should capture the structure of the modelled system, its dynamics and its probabilistic nature [6], [7].

The advantage of simulation before experimentation with real system is mainly that is much cheaper, more flexible, safety, does not affect the ongoing production process. Simulation also has some disadvantages which are related to a description of the main problems with decision rules, quantification of variables, selection boundaries and limits of the system, etc.

Classification of models

Models it is possible to classify and sort by many criteria. One of the primary classification is broken by the means used to define them. The image (Figure 1) is a detailed breakdown of models that pursues the branch leading to the simulation and optimization models.

That division of model is only one of many possible. It should be noted that the breakdown at lower levels can be repeated. Dynamic model which belong under the mathematical model does not automatically mean that every dynamic models must be also mathematical model.

The phases of the simulation process are [5], [8]:

1. Definition object of knowledge, definition, selection subjects from the environment, resp. determined requirements for object,
2. Definition simulated system of object, determination of the level from which the object is observed and studied,
3. Creation of the current ideas about the simulated system and its motion, i.e., formulation of hypotheses of object, resp. processing of system design and identification of used subsystems,
4. Creation of a simulation model, design and implementation of the model,
5. Verify the accuracy of the simulation model, verify that the model represents the current vision of the simulated system and its motion,
6. Verify the veracity of the simulation model, verify whether designing the system meets the

defined requirements and can be practical implemented.
7. Exploitation validated simulation model for forecasting, optimization of projected.

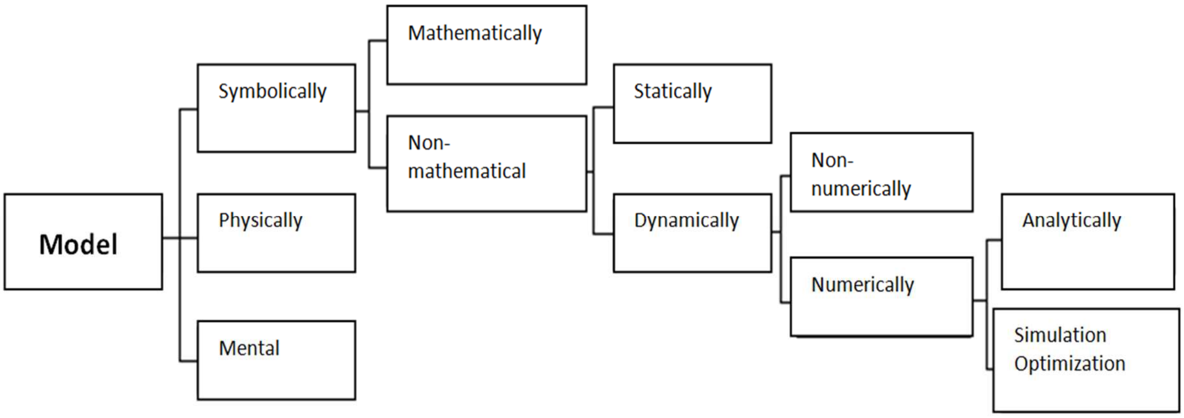

Figure 1 Classification of models

Further is processed brief overview of the tools that can be used for simulation. Since the object of interest is the only computer simulation, this report includes only means of simulation software. The creators of computer simulation models have three alternatives program funds [2], [9].

3 Languages

1) General programming languages

General programming languages today are a vast number. The best known of these include C, C ++, Java, C #, Pascal, Fortran, and others. Their big advantage is flexibility. Experienced programmer with their help is able to create any model of any structure and behaviour. The disadvantage, however, is the difficulty of programming. Virtually none of them offers any pre-built means for creating simulation modules. Their use is therefore very time-consuming and the outcome is uncertain. Currently they are used minimally.

2) Simulation programming languages

Simulation programming languages have evolved from general programming languages supplementing them with structure and appropriate means for creating simulation models [10], [11]. It can be quite misleading to label this group as "programming languages".

Most of these products are in the form of Visual Interactive Modelling System (VIMS) and their appearance and way of operating is so much more akin to a category of computer games as a programming language. This name is historically affected, because in the beginning were actually programming languages. Even today, most of these tools have opportunity to interface with general programming languages or have simulation language as an integral part. A significant disadvantage of these products is their price, which reaches thousands of euros.

Although the impact of general programming languages for developing simulation programming languages is predominant, one can also find the opposite effect. E.g. simulation programming language SIMUL first introduced programming of object and management by events. This technique has been two decades later received in the general programming languages and still prevails in the approach to programming.

3) Other languages and programs

For some types of simulation tasks, it is possible to use other languages and programs [12], [15]. This may be due to their ease of use and price. As an example may serve tasks, that can be solved by Monte Carlo method in MS Excel spread sheet. There are other extensions to these spread sheets such as RISK from company Palisade for risk analysis. A separate spread sheet is Crystal Ball created by Oracle, which is a general tool suitable for predictive modelling, forecasting, Monte Carlo simulation and optimization.

Another example of these resources is various mathematical and technical computing systems such as MATLAB and SIMULINK from a MathWorks. This however at present it offers many simulation possibilities that it can be included in the first group above simulation languages.

4 Tools of Simulation

Simulation may divide to by nature of changes in the model [5], [13], [14]:

- discrete, discontinuous - examines the state of the system in discrete, discontinuous time intervals, intervals can be defined by the time at which some change of the system or event happens, use: manufacturing, services, business processes, complex systems,
- continuous - examines the state of the system continuously, depending on the model simulation is divided into: deterministic, stochastic - deterministic simulation results is determined at the time t0, stochastic results is determined in probability, use: biology, chemistry, control systems, economics, electronics,
- combined.

Tools for discrete simulation:

- ARENA from Rockwell Automation is a general simulation language especially for industrial applications and business process reengineering. It is part of the larger groups of ARENA to support management decision-making. In the simplest basic version only supports discrete simulation, but higher versions also support continuous and combined simulation.
- SLX, GPSS / H from Wolverine Software Corporation. These are two separate products. Both are general simulation tools for discrete simulation. GPSS is the oldest simulation languages at all. SLX is a newer product that extends the capabilities of GPSS (such as hierarchical building of model, object-based approach, new modules etc.).
- PROMODEL from a Promodel Corporation. It is designed for assessment, planning and design of production, storage, logistics and other operational and strategic needs.

From the same company has also produced other simulation products that focus on a specific area utilization:

- MEDMODEL is designed for simulation in healthcare.
- Service MODEL designed for the area of services.
- Clinical Trials Simulator to simulate clinical trials.
- Portfolio Simulator for analysis and portfolio optimization.
- Project Simulator for creating scenarios in Microsoft Project.
- Process Simulator which enables us to carry out simulations in Microsoft Visio.
- ED Simulator the field of medical emergency services.
- SIMPROCESS the company CACI Products Company. It is designed to simulate business processes. Integrates mapping process, discrete simulation and activity-based costing.
- SIMSCRIPT III by these companies CACI Products Company. It is an object-oriented simulation language for discrete and continuous simulation models. It is intended for programmers.
- SIMUL8 from a SIMUL8 Corporation. It is intended primarily for business process modeling.
- WITNESS from the Lanner Group. It is intended primarily for simulation and optimization of production, set of service and logistics systems. The program comes in two versions: Manufacturing Performance Edition for simulation of manufacturing processes and the Service and Process Performance Edition for the area of services. These variants are functionally identical, the difference lies only in different terminology, and another set of pre-built components. Additional expansion accessories include for example Witness Visio, which enables interconnect Witness with Microsoft Visio product.

Tools for continuous simulation

- STELLA from a ISEE Systems. It is intended for simulation of natural and social areas.

Tools for combined simulation

- ARENA from Rockwell Automation.
- EXTENDS from the company Imagine That - it allows continuous simulation, discrete event simulation, agents, linear, nonlinear and mixed simulation of general processes.

Conclusion

Application of simulation as a scientific method, especially in manufacturing practice, represents efficiency and savings in the implementation of various projects. Using it are gathered knowledge and information on the investigational system and its elements, the behaviour of the system and outputs from simulated variants in a computerized form. Results of the simulation are then applied to a real system to improve its properties.

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