

Computer Modeling and Simulation

Naqib Daneshjo¹

Abstract. Modelling and Simulation is a discipline for developing a level of understanding of the interaction of the parts of a system, and of the system as a whole. The level of understanding which may be developed via this discipline is seldom achievable via any other discipline. A simulation is the manipulation of a model in such a way that it operates on time or space to compress it, thus enabling one to perceive the interactions that would not otherwise be apparent because of their separation in time or space. A model is a simplified representation of a system at some particular point in time or space intended to promote understanding of the real system.

Keywords: Computer system, Simulation, Modelling, Information Technology, CAD/CAM

1. Introduction

Modelling as a method of cognition has long-time/age long history. Man tried all sorts of means (verbal description, graphic display, use of mathematical symbols, physically and technically implemented models) to describe things in his environment and the phenomena observed by him.

Models expressed, showed a significant features of real systems - objects.

In engineering practice there is always a pair of model - a real system. From this perspective, models are divided into two groups:

- Models, which allow you to analyse a real system. They allow specifying and clarifying our ideas of an existing system.
- Models resulting from development and design (if the task concerns the synthesis of design and construction). This activity is usually supported by computer technology. Thus we speak about methods of design automation, construction, manufacturing etc. For example, CAD, CAP, CAM, etc.

Each scientific and technical discipline has its specific problems in creation of models. It should always be based on thorough (physical, chemical, biological, social etc.) knowledge of the concerned branch of business. In our approach we will emphasize in particular that the ultimate goal is to implement models using computer aided equipment or computers. The computer thus enables to implement full or partial model showing the system studied or projected. Therefore the concept of a computer model or computer-aided system. Process of experimentation with the model is called simulation.

Simulation experiments allow the search for alternatives and appropriate parameters of the projection system, eventually allow correction or completion of knowledge of the analysed system.

2. Methodological approach to modeling and simulation

Based on task solving experience and model property verification, the methodological procedure in general was attained (as shown in the scheme in Fig. 1)

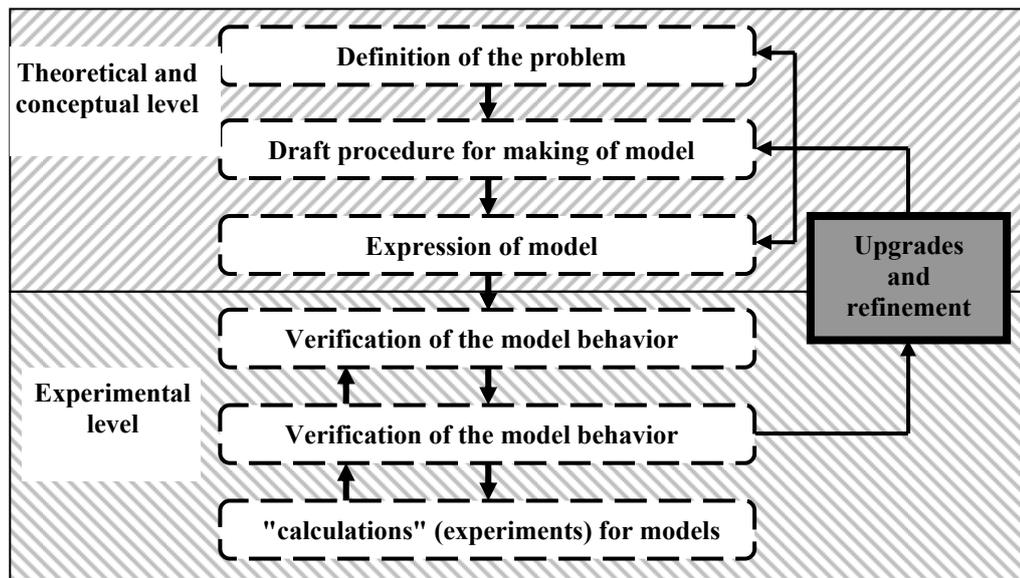


Fig.1: Methodological approach for modelling and simulation

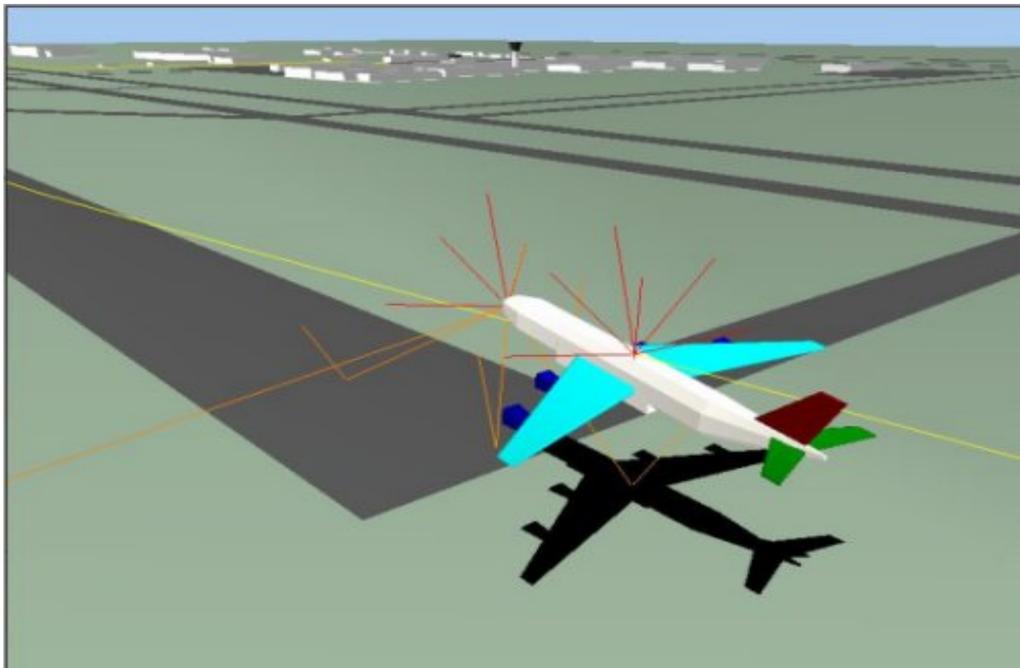


Fig. 2: Visualization of an aircraft [9]

Definition of the problem specification (implemented after consultation with experts in the subject field) implies:

- definition of dynamic variables entering the balance of considerations,
- indication of inputs, outputs and states of the model,
- the structure of model (links determination),
- model relevance definition and the limits for each variable.

In the design stage of the model development process, the experimentation strategy for models and its systematic expression are defined. Diagrams are the product of the process.

In the model representation stage a decision on how to program the model is made, while taking into consideration programming language, data views and their inputs and outputs.

The model behaviour verification stage is a quality stage to evaluate the trends of dynamic variables, their dependence on initial conditions, the validity of the limited space coordinates etc.

In the phase of calculations (experimentation) on models calculations are made, followed by the result printing, optionally with their graphics processing. Variable courses are being tested. The verification is done by software testing and control examples.

Comparison of models and real object (system) correlation is performed in the stage of decision on the success and new knowledge gaining. Respective/proper experimentation with the model (simulation) takes place which results in the new knowledge acquisition.

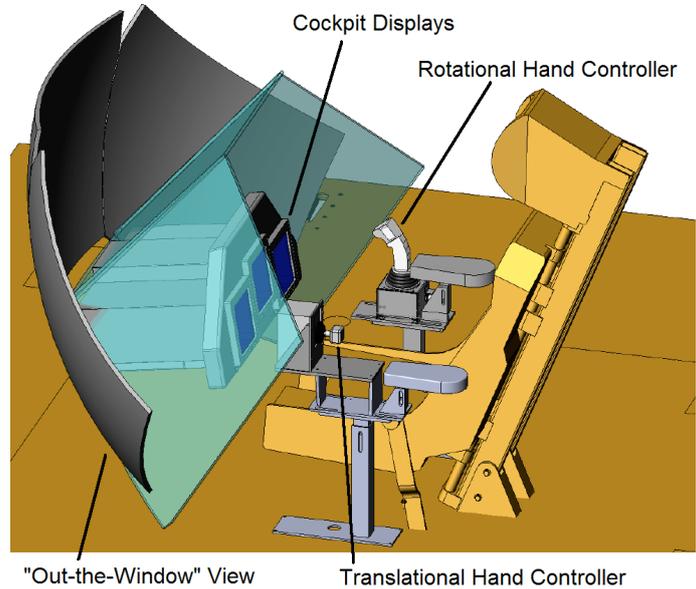


Fig. 3: Simulator cockpit layout [8]

3. What is the aim of modeling and simulation

Modelling and simulation technique depends on:

- development, which as a separate science and engineering disciplines,
- development of mathematical methods,
- progress in those disciplines in which the models are formulated,
- development of new technical, particularly computer equipment,
- development of programming language resources.

Virtually all areas of modelling can be focus to the objectives and the means defining projects computer systems (Fig. 4).

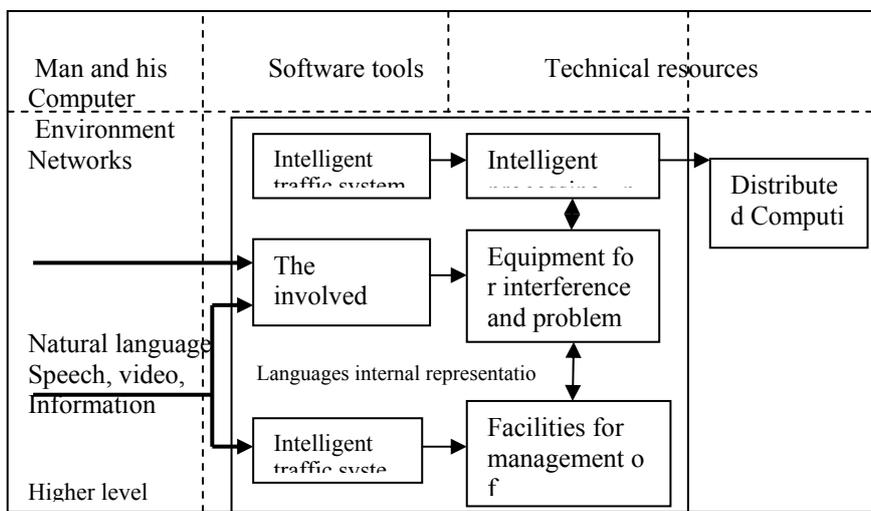


Fig. 4. Functional structure of a computer system

4. Conclusion

Development in artificial intelligence allows the process of creating new elements system with its surroundings, but especially with the man – role/task investigator. The following is required:

- development of simulation software tools that enable intelligent processing of man -investigator with a computer system, with the aim of problem specification and problem solution in the dialogue with a computer (not programming),
- inference mechanisms that allow automatic acquisition of new knowledge,
- knowledge base and management systems, with the possibility of connecting to large and distributed databases,
- connection of the system to superior organized computer network or the distribution of calculations into its own computer network.

5. References

- [1] J. Noha, K. Balko: Preparing Transparencies for a Presentation. 14 No 9, 1994, p. 211 – 243.
- [2] J. Hlubeňová, O. Líška, D. Hlubeň: Metodika výberu simulačného programu. In: Principia Cybernetika '09 : konferencia katedier a ústavov automatizácie a kybernetiky strojnícckých a technologických fakúlt a univerzít Českej republiky a Slovenskej republiky: 2.-4.9.2009, Herľany, SR. – Košice: TU. 2009 S. 09-1-09-6. - ISBN 978-80-553-0249-2
- [3] A. Pauliková: Modelovanie dynamických systémov pracovného prostredia technologickej prevádzky, habilitačná práca, Košice. 2008. - 166 s.
- [4] G. Ižariková: Matematické modelovanie pracovných priestorov výrobných prostriedkov a systémov. In: *Transfer inovácií*. č. 14 (2009), s. 181-184. ISSN 1337-7094
- [5] J. Mihalíková, D. Hlubeň, S. Rovňákov: Automatizácia v elektroenergetike. In: Automatizácia a riadenie v teórii a praxi ARTEP 2009. Košice: TU, 2009. S. 46-1-46-4. ISBN 9788055301464
- [6] OLARU, A., OLARU, S.: Research of the global dynamic compliance and the viscose global dynamic damper coefficient of the industrial robot. In: Annals of DAAAM for 2006 & proceedings of the 17th International DAAAM Symposium "Intelligent Manufacturing & Automation: Focus on Mechatronics & Robotics". Vienna, DAAAM International 2006. ISSN 1726-9679. ISBN 3-901509-57-7.
- [7] VARGA, Ladislav - HLUBEŇ, Daniel: Meracie metódy v elektroenergetike / - 1. vyd - Banská Bystrica : PRO - 2010. - 175 s.. - ISBN 978-80-89057-26-9.
- [8] <http://www.aviationsystemsdivision.arc.nasa.gov/publications/2010/BilimoriaGNC2010Final.pdf>
- [9] http://www.google.sk/images?q=Modeling+and+simulation&hl=sk&prmd=ivnsb&ei=c4lwTeLTD8y6hAf7m-start=10&sa=N&oi=image_result_group&sa=X