COMPLEX SYSTEM FOR COGNITIVE PRODUCTS MODELLING

Jelenka Savković-Stevanović[1], Tatjana Mošorinac[2]

[1]University of Belgrade, Faculty of Technology and Metallurgy,
11000 Belgrade, Karnegijeva 4, Serbia
[2]Oil Refinary Pančevo,Spoljnostarčevačka bb, 13000 Pančevo, Serbia

savkovic@tmf.bg.ac.yu ***(Jelenka Savkovic)***

Abstract

A many number of modelling and simulation systems have been developed to aid in process and product system engineering. In this paper on the model development side, the issues of knowledge representation in the form of systematic composition, ontology, and quantity representation were derived. On the model analysis side issues involving the automatic evaluation and presentation of simulation results. As case studies several networks plant-services-products-markets were used. Simulation was carried out for various distribution centers self organization. Uncertainly materialization objectives were defined and than simulation and evaluation were performed. Input data bases are linked with routines which realized heuristic algorithms and scenarios for customer satisfaction. The results are stored in a database for further use. In the analysis and products planning simulation various models and conditions were included. The cognitive model forecasted the future behavior of the product and services system. This work is illustrated network products management system with decision product design and operation support system interface develop methods, tools, and techniques for developing the overt user interface, user knowledge, help of a facilities, coordinating interface event with its functionality events. The obtained simulation results have shown advantages cognitive models with semantic networks. The obtained results in this paper can be applied in the others domain.

Keywords: Semantic networks, Products manager, Meta models, Interface system.

Jelenka Savković-Stevanović. Full professor, University of Belgrade, Faculty Technology and Metallurgy, Serbia. Education. B.Sc. and M.Sc. degree, University of Belgrade, PhD Thesis Technishe Universitat Berlin (West)&Universit of Belgrade. Research Interest. Chemical Engineering and Process System Engineering; Modeling, Analysis, Synthesis, Design, and Optimization of Chemical Processes; Advanced Numerical Methods, Control and On-line Optimization; Computer Aided Process Operation and Optimization, Design, Safety and Risk analysis; Information System, Data Bases, Expert Systems, Learning Systems; Informatics, Management; Artificial Intelligence, Neural Network and Fuzzy Logic; Biosystems, Bioinformatics Pharmaceutical Engineering etc.. Other Professional Activities**:** over 800 papers, 7 books, patentees in the field, Consultant in many companies, Member of many professional organizations, Reviewer of many journals, S.C Index over 100. She has cited in numerous monographs and list of the first 100 Scientists 2007 by IBC-Cambridge.

1 Introduction

Today, individuals want and need answers quickly. Technology now makes such information accessible, through emails, text messages based upon existing and emerging, commercial business models[1,2].

People with accessibility problems need to know about current products and services that can help them. Often people need to be guided to the solutions by an expert rather than to conduct a passive search themselves. Where current, relevant products exist alongside people who need them, customers and vendors need to make that connection. Where that is not possible, research and development may be needed to develop innovative new solutions relatively rapidly[3].

At present, people often do not know where to go to get the answers that they need. They do not know where to look and that must be followed through sources.

2 Cognitive modelling

Complex modelling is an inductive process used frequently in a controlled task such as design of artifacts or in explaining the behavior of the system [4-6]. Both of analysis and design facts of the modelling enterprise can be characterized by a hierarchical approach that requires working down words through the levels of specificity and synthesizing partial results in to coherent structure called a model.

The knowledge based simulation environment is an expression of some control law or cognitive theory. To the extent that the rule base is derived from set of assumptions about the environment and performance expectations, it is a belief system. However, in the existing form, the goals are not expressed and the underlying assumptions are not evident. Consequently, they are opaque to the analyst and cannot be directly applied to the learning process. When expressed in hierarchical form as shown in Fig.1, the relationship that exist between goals and subgoals provide a basis for relating overall goal based system performance to specific assumptions about the variability and contribution of the supporting subgoals. In this form, the belief system is a full expression of some control theory in that the system's relationships with the environment, as expressed in a set of feasible state conditions, can be related either in overall system performance measures or to be relationships and the subgoals that support them.

Simulation provide a more difficult, albeit realistic, learning environment than he static, strictly associative problems to which learning models have been, typically, applied. Within the simulation, as in real life the learning mechanism must determine from a pattern of recent history led to a state inconsistent with expectations. In such a real world environment, the unique characteristic of reinforcement learning is in assessing the influence of time on the existing inconsistency. In short, because feedback is not always instantaneous, there is no guarantee that the cause of the anomaly was the most recent event. In order to develop such a reinforcement learning model, two credit assignment problems must be resolved:

-How to focus the reinforcement or change on the principal contributors, structural credit assignment,

-How to appropriation reinforcement according to recently, temporal credit assignment.

The classical reasoning mechanisms derived from formal symbolic logic continue to have in

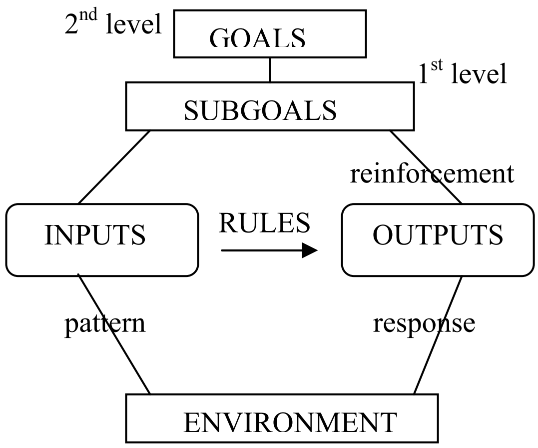


Fig.1 The goal based closed loop

formulating successful problem solving strategies in complex domain.

Research into the development of qualitative or goal based reasoning models is motivated by the desire to overcome these limitations based on an understanding of the causal relationships peculiar to that domain. Because these causal relationships are relatively well known for physical processes qualitative models emphasize these stable causal behaviors. However, current models are resistant to discovering causal relationships for the inconsistent behaviors characteristic of competitive environments or problem spaces involve multiple, competing goals.

These limitations of the current symbolic learning models motivates an alternative approach to provide a more complete theory of memory. Within the contest of adaptive system theory, a small body of research into the use of closed loop connectionist, reinforcement learning models has demonstrated the power of this formalism in learning both symbolic and spatiotemporal relationships. To data however, representation of these models have been limited to problems involving only one system goal, using a dedicated reinforcement channel. In addition, they have not yet been demonstrated in problems of high dimensionality.

3 Service models network

The computer supported work with data bases, modeling and simulation products and processes services can provide management support tools. The network model in Fig.2 shows how do you seek out a new way to create products and design, how do you model life cycle of the center and how do you make history of the project.

The model network can be defined by the following eq.(1).

$$MN = \sum_{i}^{n} M_i < T, P, A, F, E, Q(T), Q(P), Q(A), Q(F), Q(E) > \qquad (1)$$

where

MN -model network, M_i -network unit model, T-set of elements, P- set of syntax rules, A-set of expression, F-set of semantic rules, E-set of uncertainty events, and Q(J),J=T,P,A,E changeable functionality.

In design focuses to users, vendors and accessibility centres. Process and product operation connecting users and vendors based on expert question answering. Questions and answers based upon, and generating, research results and data base reports can be employed. Optimization provides multicriteria services requests, troubleshooting, control and waste minimization. In the process safety analysis model "what if" builds risk allocation model.

The network centre workflow is shown in Fig.2. The model workflow software can be used for the new product quality, the model operation network optimization and generating new data and specified tools. Automatically creates operation models requires based software tool for system identification which claimed to enable users to automatically create high fidelity models of the environment, process and product. System identification is technique that creates model of a operation service from input and output data, eliminating the need for detailed knowledge. The new software automated the service operation, enabling engineers to perform modeling and simulation studies.

Advanced commercial simulation systems also come, with an intelligent user interfaces, which speed the development of error free simulation problems and provide some help.

The model network optimization request maximum flow, minimum cost, concern to assignment problem, the matching and minimum spanning trees, computer implementations and heuristics.

Model operation in the network shows how do you seek out a new way to create services operation, how do you model history databases of manipulation and objects. The model services operation manager is given by the following eq.(2).

In the service operation and control safety models "what if" help to build intelligent management support. They shoot uncertain events E=f{Q(E)} a day to day. It is improves service operation reliability.

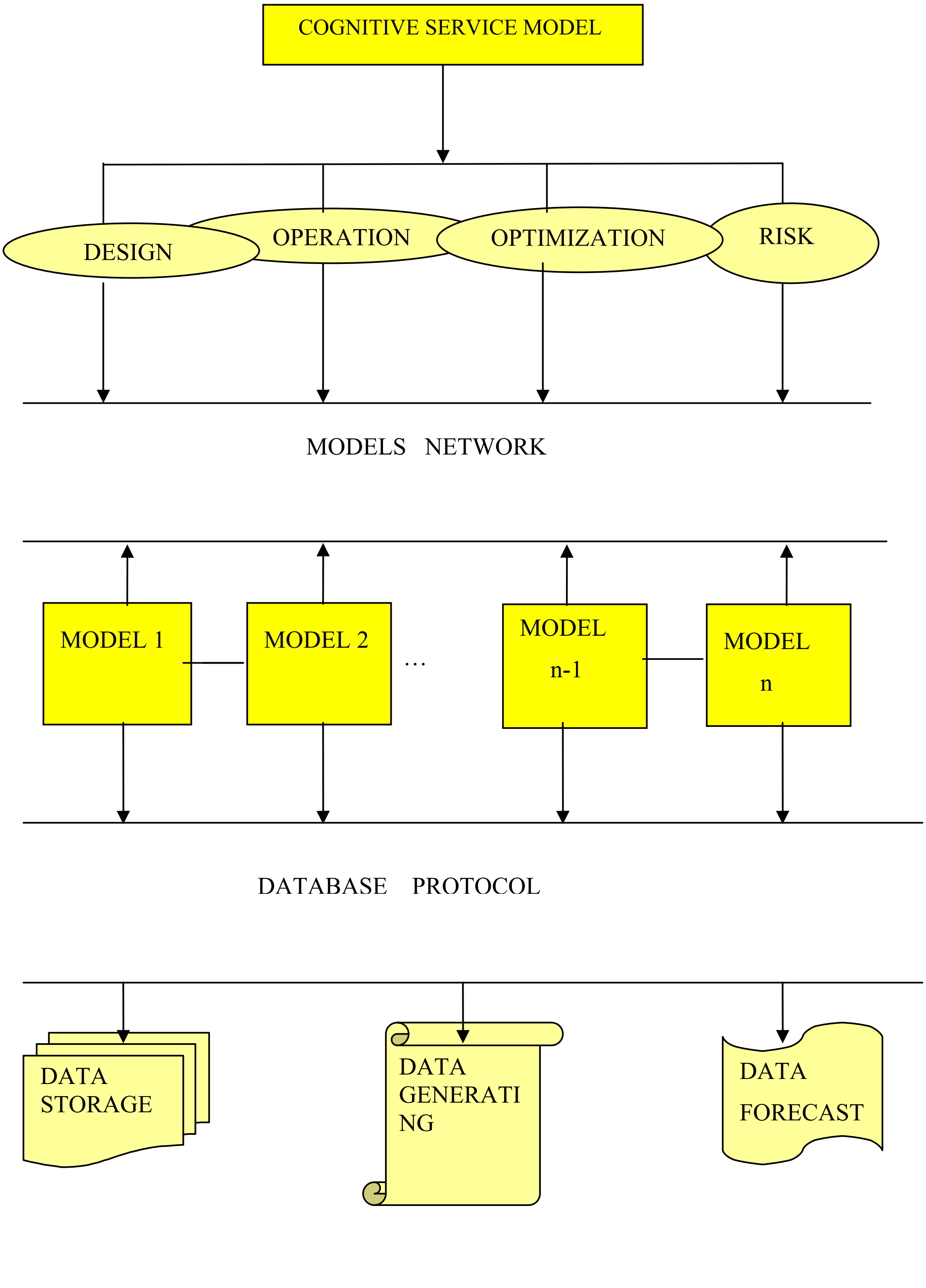


Fig.2 The service network models

$$MO = \sum_{k}^{m} M_k < T, P, A, F, E, Q(T), Q(P), Q(A), Q(F), Q(E) > \quad (2)$$

where

MO -model operation.

Process operation involves analysis of users and vendors, their attributes, simulation behavior and parameters estimation, real time optimization and safety as shown in Fig.3. Optimization provides optimal working conditions, equipment services, troubleshooting, advanced control and waste minimization. However, these will support people decision to prevent abnormal situation, not replace the people. Process safety involves detection process disturbance before they cause significant disruption.

Process operation makes history data base of manipulates object variables. User can make different service databases model.

4 Service decision support system

A model products manager, which shows how do you seek out a new way to create product and how do you model product life cycle, and how do you make products history was developed[3].

These systems will be available to analyze user requirements and performed information processing in the aim objective achieving.

Policy modeling emphasizes formal modeling techniques serving the purposes of decision making. These systems Computer aided products engineering, Computer aided market control, Computer aided manufacturing and Computer aided safety provide distributed computing.

To use models to support decision making is proliferating in both the public and private sectors. Advances in computer technology and greater opportunities to learn the appropriate techniques are extending modeling capabilities to more and more people.

As powerful decision aids models can be both beneficial and harmful. At present, few safeguards exist to prevent model builders or users from deliberately carelessly data, or recklessly manipulating data to further their own ends. Perhaps more importantly few people understand or appreciate, the harm can be caused when builders or users, fail to recognize the values and assumptions on which a model is based or fail to take into account all the groups who would be affected by a model's results.

Simulation models provides a setting for a dialogue about ethics and show the need to continue and define a vocabulary for exploring ethics concerns. It will become increasingly important for model builders and users to have a clear and strong code of ethics to guide them for making the ethical decisions they surely have to face.

Decision support system aimed at helping engineers and managers optimize all phases of the process service operations. Also, decision support system is useful for supervision of process operation, optimization and control as well as development. Some techniques are very important for implementing and evaluating decision support system which expand such diverse areas as computer supported cooperative work, data base management, decision theory, economics, modeling, artificial intelligence, user interface management system and others.

Decision support system principles, concepts, theories and frameworks develop methods, tools, and techniques for developing the underlying functional aspects of a decision support system solver/model management, rule management and artificial intelligence coordinating and decision support system functionality within its user interface.

Decision support interface develop methods, tools, and techniques for developing the overt user interface of a decision support system, knowledge, help facilities, coordinating decision support interface event with its functionality events.

Decision support system impacts and evaluation show economics, measurements, impact on individuals users, multiparticipants users, evaluating and justifying.

5 Model evaluation

The computer supported cooperative work provides explanation based learning systems. As

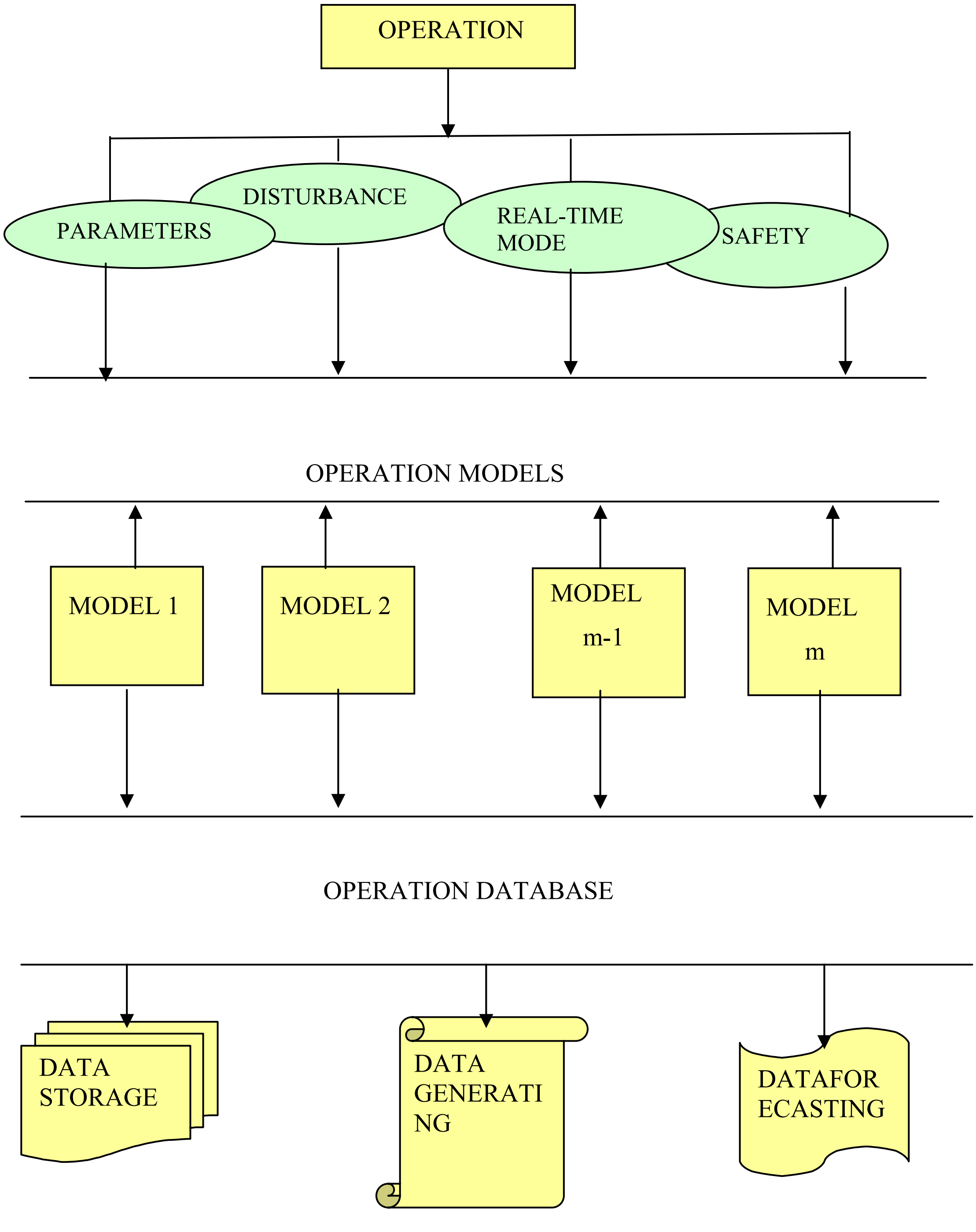


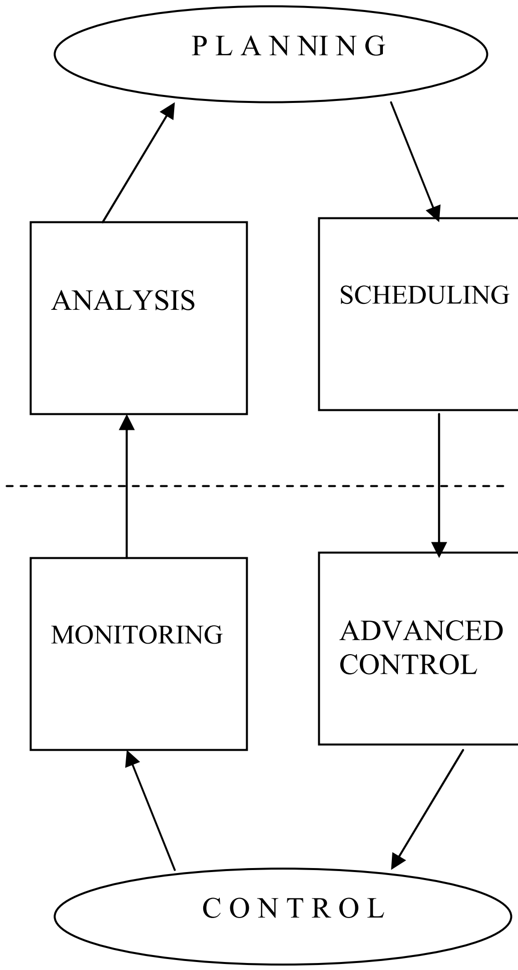
Fig.3 Models operation manager

a cooperative function training is a subsystem within the vendors - users service large organizational system.

When training strategies ensure acquisition of knowledge, skills and attitudes which results in improved performance or safety on the job, the training subsystem makes a positive contribution to organizational goal and effectiveness, so its like a cognitive personalized effectiveness. Performance, then, is the criteria of success in training.

Superior customer support request model evaluation. This future model is called assess and control as shown in Fig. 4.

Assessing



Control phase

Fig.4The evaluation methodology

Asses means:

-uncertainties not currently amenable to mathematical solution,

-people involvement , and

-advanced technologies support people.

Control means:

-must work automatically,

-uncertainties can be handled rigorously,

-people eliminating, and

advanced technologies support automatic operation.

Inherent softness exists in product pieces and forecast demands. In this frame it will throw lots of technology at these uncertainties or soft-areas- expert systems, neural networks, data reconciliation etc.. However, these will support people decision to prevent abnormal situation management, not replace the people.

6 Conclusion

The service models network system which including products and processes design, operation, optimization, safety and decision support system was considered. It will facilitate systematic cooperation amongst members network and between networks, stake holders and agents.

In this way, it will advance common objectives and it will support the continued achievement of the benefits of current work by existing networks. It will strengthen that the ongoing realization of policies.

The networks technology combines simultaneous solution of the models, regression based estimators, expert systems, control algorithms and off line models. Furthermore, models network requires the development of new types of research skills.

Models “what if“ help to build intelligent decision support system and allows engineers to efficiently build advanced applications.

Acknowledgment. The authors wish to express their gratitude to the Fund of Serbia for financial support.

Notation

MP - model network

M_i -network unit model,

MN - model network

MO -model operation

T- set of elements

P- set of syntax rules

A-set of expression,

F-set of semantic rule,

E-set of uncertainty events

Q-changeable function

Index

i-model

n-total network service models

m-total network operations models

7 References

[1] J.Savković-Stevanović Model network for management of the chemical plant, *Comput.Ecol.Eng.**1**,(1)92-101,*2005.

[2] J. Savković-Stevanović, *Process Engineering Intelligent systems*, Chapter3,RAJ, Memphis ,1999.

[3] EU-Project:EUFP6-2005-IST-5, 2.5.11, Inclusion, *»CASPER», Nr. 83590,* participant Nr.11-Faculty of Technology and Metallurgy, University of Belgrade, manager J.Savković-Stevanović.

[4] P.Bourgineand Bernard W.,*Economics and cognitive science*, pergamon Press,1992.

[5] J. Savković-Stevanović, Industrial plant management system, *Bull. Chem.Techol. of Mac.*,**22**, 159-168,2003.

[6] J.Savković-Stevanović, Plant operation management system, *16th Inter. Congress of Chem. and Process Eng.*, Praha,Czech Republic,p. 0833,2004.

[7] J.Savković-Stevanović, Product and process cognitive modelling, *16th Symposium and Seminar on Information and Expert Systems in the Process Industries*,pp.29,Beograd, October 19-20,2005.

[8] J.Savković-Stevanović, An agent traveling simulation, *Comput.Ecol.Eng.*,2(1)8-12,2006.

[9] J.Savković-Stevanović, The plant manager workflow, *Comput.Ecol.Eng.*, 2 (2) 53-58, 2006.

