

**Annual Report of the  
McLeod Institute of Simulation Sciences Hungarian Center**

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**Research Activities & Projects**

The methodological research in applying AI in simulation by using intelligent demons (a special class of high level agents) and Knowledge Attributed Petri Nets (KAPN) is continued. An R&D work has been started to elaborate a further development of KAPNs incorporating also inference engines and intervening actors into the tokens thereby realizing mobile intelligent elements. The implementation of these properties into the CASSANDRA simulation system is in progress and the first results are being published. The application of simulation is aimed at various fields and especially to interdisciplinary, economic and conflict resolving problems.

In the Spring of 2003 we have successfully completed the EU 5<sup>th</sup> framework program Open Framework for Simulation of Transport Strategies and Assessment, where the Hungarian project leader was Prof. Dr. Andras Javor director of MISS/Hungary and coworkers of our Center were participating in the project. In this project the other countries that participated were Spain, France, U.K., Germany and Belgium.

We have been active in a research project lasting 3 years (2002-2004) sponsored by the Hungarian Scientific Research Fund. The topic of the project is: "Investigation of Intelligent – Mobile and Static – Agent Controlled Simulation Methodologies for Multidisciplinary Problem Solving".

We have completed two research projects cooperating with the West Hungarian Research Institute, Center of Regional Studies – sponsored by national funds – dealing with the development of regions.

We intend to mention that we have been invited to participate in a EU project of the 6<sup>th</sup> Framework program the project proposals dealing with the simulation of traffic, which has been submitted. Furthermore we have been invited to participate in a Transatlantic project proposal coordinated by the universities of Chico and Hamburg.

### **Education**

The simulation courses taught by the personal of the Hungarian MISS Center:

At the Budapest University of Technology and Economics:

- Modeling and Simulation in Economy
- Promoting Decision Making and Management by Simulation
- Methodology of Simulation and their Application in Decision Making
- Modeling and Simulation for Decision Making in Economy

There are 6 Ph.D. students working on their thesis at the Hungarian MISS Center. They are actively taking part in the different research projects.

### **Center publications**

Javor, A., Szucs, G.: A Methodology for the Determination of the Models of Soft Systems by Means of Intelligent Agents  
Periodica Polytechnica Social and Management Sciences, Budapest University of Technology and Economics, 11(2003)1, 57-66.

Meszaros-Komaromy, G.: Simulation as a Tool to Promote Decision Making in the Development of Regions  
Periodica Polytechnica Social and Management Sciences, Budapest University of Technology and Economics, 11(2003)1, 45-55.

Csik, B: Simulation of Competitive Market Situations using Intelligent Agents  
Periodica Polytechnica Social and Management Sciences, Budapest University of Technology and Economics, 11(2003)1, 83-93.

- Meszaros-Komaromy, G.: Simulation of the Choice of Bank Offices using a High-Level Petri Net  
EURO/INFORMS 2003 Conference, Istanbul, Turkey, July 6-10, 2003.
- Javor, A., Meszaros-Komaromy, G.: Simulation using Intelligent Mobile Agents  
Summer Simulation Multiconference, Montreal, Canada, July 20-24, 2003. 19-23.
- Szucs, G.: Case-Base Reasoning and Clusteranalysis (in Hungarian)  
Budapest University of Technology and Economics, Department of Information and Knowledge Management, Budapest, 2003. March, 133-144.
- Javor, A.: Intelligent Agents in Simulation  
7<sup>th</sup> International Conference on Informatics 2003, Bratislava, Slovak Republic, November 27-28, 2003. 29-33.
- Szucs, G.: Investigation and Analysis of the Modular Simulation of Urban Transport Models  
Kozlekedestudományi Szemle, Vol. LIII., 2003. October, pp. 385-389. (in Hungarian)
- Szucs, G.: Simulation of Traffic Models with a Flexible Frame-System  
Varosi Kozlekedes, Vol. XLIII., 2003/6, 2003. December, pp. 337-340. (in Hungarian)
- Szucs, G.: Possibility of Integration of General Transport and Traffic Simulators  
Bolyai Szemle, Vol. XII., 2003. No. 4., pp. 49-63. (in Hungarian)
- Szucs, G.: Optimization of Manufacturing Logistic by Simulation  
Logisztika, Vol. IX., No. 2., 2004. March, pp. 41-51. (in Hungarian)
- Szucs, G.: Case-Base Reasoning and Clasteranalysis  
Szervezeti kihivasok – informaikai megoldasok, Budapest University of Technology and Economics, Department of Information and Knowledge Management, Budapest, 2003. March, pp. 133-144. (in Hungarian)
- Szucs, G.: Game Theory and Economics of Asymmetric Information  
Uzlet, folyamat, monitoring, Budapesti Muszaki es Gazdasagtudományi Egyetem, Informacio- es Tudasmenedzsment Tanszek, Budapest, 2003. szeptember, 1-12. (in Hungarian)
- Szucs, G.: Logistic-management using Simulation  
Logisztika, informacimenedzsment, szoftvertechnologia, Budapesti Muszaki es Gazdasagtudományi Egyetem, Informacio- es Tudasmenedzsment Tanszek, Budapest, 2004. marcius, 21-31. (in Hungarian)
- Szucs, G.: Solutions of Cooperative and Non-cooperative Problems by Intelligent Agents in Simulation  
The International Workshop on Modeling & Applied Simulation (MAS2004) I3M Multiconference, Genoa, Italy, October 28-31 2004. (in publication)
- Javor, A., Meszaros-Komaromy, G.: Model Reconstruction of Soft Systems using Intelligent Agents  
EUROSIM 2004, Paris, France (in publication)
- Javor, A.: Postgraduate Education in Simulation Sciences  
Summer Simulation Conference, San Jose, USA (in publication)
- Meszaros-Komaromy, G.: Promoting Decision Making in the Development of Regions; Simulation Case Study  
International Conference of Computational Methods in Sciences and Engineering 2004 (ICCMSE 2004) Vravrona, Greece, 19-23 November 2004 (in publication)

### **Center simulation tools**

The main tool we apply in our research projects as well as in education is the AI controlled simulation system CASSANDRA (Cognizant Adaptive Simulation System for Applications in Numerous Different Relevant Areas) 3.0 we have developed in the recent years. (The CASSANDRA system has been applied in numerous international projects in various fields of application and its main features are outlined in the courses taught as mentioned above.)

Another tool is the PASION simulation system developed at the MISS Center of Mexico and provided by courtesy of Prof. Dr. Stanislaw Raczynski director of the Center.

By the courtesy of Prof. Dr. Bernd Schmidt from the University of Passau we have obtained the simulation system SIMPLEX II as freeware.

Beyond CASSANDRA 3.0 developed by us we have already used the other two software systems as well.

By courtesy of Incontrol Simulation Software BV we have received the student version of their simulation tool Enterprise Dynamics.

The hardware configurations on which our simulation softwares run are PCs and Workstations.

### **Center highlights**

The Center intends to combine basic research of simulation methodologies coupled tightly with applications in various fields. Our approach is that we aim at finding solutions to problems arising in practical problem solving where the existing solutions are inadequate. In the past we have been participating in various projects, that we intend to continue. On the other hand we intend to get the students involved in the research work.

The main area of simulation we are active in is discrete simulation combined with artificial intelligence. The possible field of applications is rather wide. There are however some areas in which we already have been active or intend to be active in the near future. These priority areas are; flexible manufacturing systems, traffic, logistics, conflict resolution, micro and macro economy, development of regions, advising SMEs strategy selection by means of simulation. We are however open to undertake simulation in other application fields as well where our expertise and tools can be applied efficiently.

The direction in which we intend to work is the simulation of ill-defined systems with particular emphasis on economic and multidisciplinary problems. Our approach where we expect new results is the solution of the model reconstruction problem where our demon (agent) controlled simulation system can be applied with success and new

scientific and practical results can be expected. Our first results have already been obtained in the field of the development of regions mentioned already above among the projects.

Budapest, June 4, 2004.

Prof. Andras Javor Ph.D.,D.Sc.  
Director of the Hungarian MISS Center