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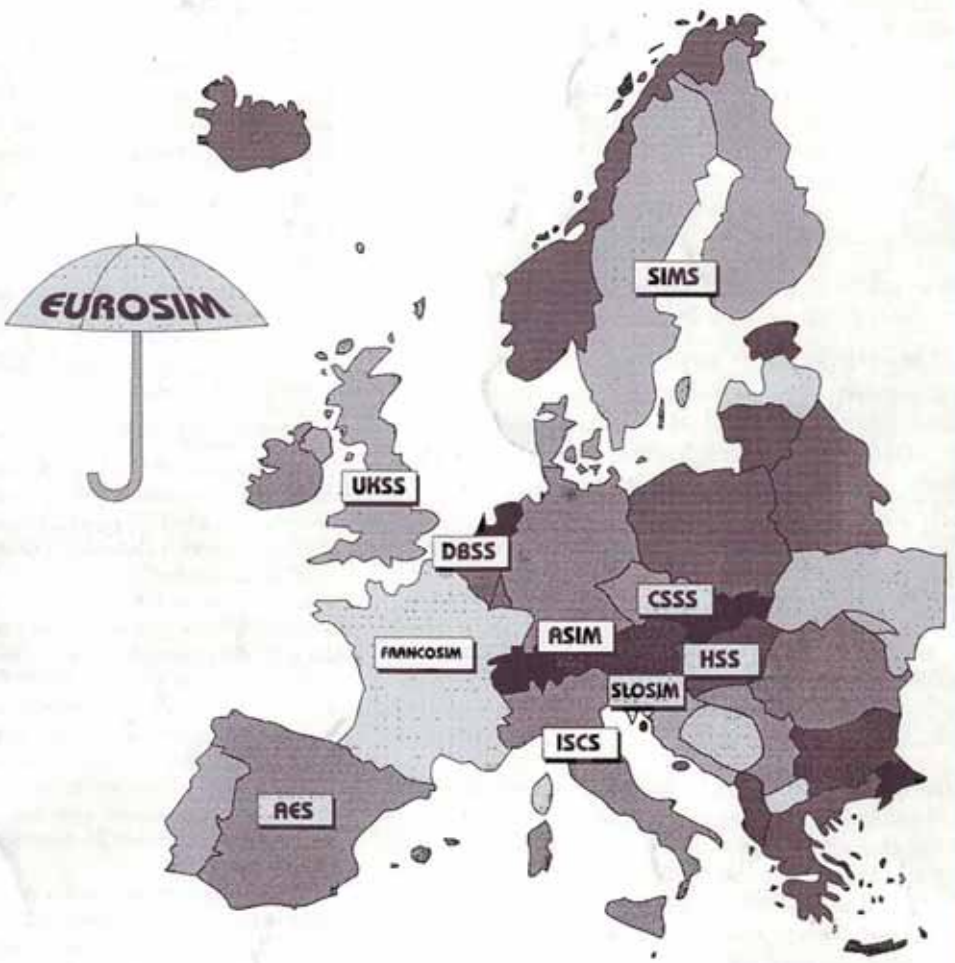

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Readership Information

EUROSIM - Simulation News Europe is published on behalf of EUROSIM (the Federation of European Simulation Societies) three times a year by the "ARGE Simulation News", a non-profit working group. Circulation is 2100. EUROSIM - Simulation News Europe (SNE) is distributed by all member societies to their individual members (as part of the membership services). It is also included in the scientific journal "Simulation Practice and Theory" (SIMPRA).

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If you have any contributions, remarks, suggestions, etc. please contact the editors per mail, fax, or email. For file transfer please use the incoming directory of the ftp-server. Deadline for the next issue will be May 30, 1996.

Editors of the EUROSIM societies, responsible for news and conference announcements of their societies (please contact them if you have contributions concerning a particular society): AES: J. M. Giron-Sierra, ASIM: I. Bausch-Gall, CSSS: M. Alexik, DBSS: J. Zuidervaart, FRANCOSIM: M. Lebrun, HSS: A. Jávor, ISCS: M. Colajanni, SIMS: E. K. Puska, SLOSIM: B. Zupancic, UKSS: R. Cheng (full addresses see societies).

The production of the newsletter is financed by advertisements and grants covering current expenses for editing, running of the editorial office, promotion, maintenance of the EUROSIM WWW server and other editorial expenses.

Editorial

The title page of this issue shows the European map under the EUROSIM umbrella, indicating the present members of EUROSIM.

This issue publishes two reports of the "Special Interest Sessions" organized at EUROSIM'95: summaries and evaluations of the Sessions "Simulation and AI" and "Simulation in Education". This series will be completed in the next issue.

The series on EUROSIM comparisons is continued with the definition of a new comparison. Comparison C8, discrete-event simulation of a Canal-and-Lock System, is a challenge in respect to complex logic and variance reduction capabilities. We have to thank Prof. Schriber from University of Michigan, who developed the model and provided a precise text for the description of this comparison. He also provided a template solution. Readers are invited to solve the tasks given with any tool of their choice. In the future we will put more emphasis on putting the comparisons on our WWW server.

We would like to thank all who have contributed to this issue and are looking forward to continued good cooperation with the editors of the societies, with advertising companies, and with all readers who send us their contributions.

F. Breitenecker, I. Husinsky

Aims and Scope

The journal EUROSIM - Simulation News Europe (abbreviated SNE) publishes information related to simulation. It is distributed to all members of European member societies and to other simulation societies or to individuals.

SNE's aims are: to inform about new developments in simulation methodologies, software and hardware (esp. in Europe) and to report news from European simulation societies and European simulation events.

SNE contains news on EUROSIM, on the EUROSIM societies, on other international simulation societies and groups (and societies from related areas), on European simulation centers, and contains a calendar of events.

Each SNE publishes essays dealing with new developments in a particular area and reports on software and hardware developments. Furthermore, there are book reviews and industry news.

A special series on simulation comparisons (EUROSIM comparisons) gives a comprehensive overview on features and developments of simulation software and hardware, including parallelisation techniques.

General information, parts of the news section and information about the EUROSIM comparisons may be found on EUROSIM/ARGESIM's WWW server (http://eurosim.tuwien.ac.at/).

All contributions are selected and may be edited by the editors of the journal.

EUROSIM News

EUROSIM, the **Federation of European Simulation Societies**, was set up in 1989. The purpose of EUROSIM is to provide a European forum for regional and national simulation societies to promote the advancement of modelling and simulation in industry, research, and development.

EUROSIM members may be regional and / or national simulation societies. Two kinds of membership, full membership and observer membership, are available. At present EUROSIM has eight full members and two observer members: ASIM - Arbeitsgemeinschaft Simulation (Austria, Germany, Switzerland), CSSS - Czech & Slovak Simulation Society (Czech Republic, Slovak Republic), DBSS - Dutch Benelux Simulation Society (Belgium, The Netherlands), FRANCOSIM - Société Francophone de Simulation (Belgium, France), HSS - Hungarian Simulation Society (Hungary), ISCS - Italian Society for Computer Simulation (Italy), SIMS - Simulation Society of Scandinavia (Denmark, Finland, Norway, Sweden), UKSS - United Kingdom Simulation Society (UK). AES - Asociación Española de Simulación (Spain) and SLOSIM - Slovenian Simulation Society (Slovenia) are observer members.

EUROSIM is governed by a **Board** consisting of one representative of each member society. The Board elects officers, who are at present: K. Juslin (SIMS) - president, F. Breitenecker (ASIM) - past president, R. Zobel (UKSS) - secretary, L. Dekker (DBSS) - treasurer.

EUROSIM's journal **EUROSIM - Simulation News Europe** (SNE) publishes information on simulation news in Europe and trends and developments in simulation, including reports of EUROSIM's member societies. **Simulation Practice and Theory** (SIMPRA), EUROSIM's scientific journal, publishes high quality contributions on modelling and simulation.

The next EUROSIM Board meeting will take place in June on the occasion of the HPCN-Conference in Delft, discussing amongst other topics publication strategies, membership, and the EUROSIM'98 Congress.

Letter from the President

Dear simulationists,

The art of simulation comprises a very large number of disciplines of simulation applications. There are users of simulation with a very restricted scope of interest. They are looking for the best possible simulation tools for their specific purpose, or even how to optimise the use of their dedicated tool. The application area may be medicine, electronics, chemistry, thermohydraulics, car designers, training simulator users, you name it, but very often there is synergy that should be made use of. How to get these groups of users together. Perhaps this is also one of the challenges of EUROSIM, our umbrella organisation.

The emphasis is to collect dedicated user groups to the next triennial EUROSIM Congress in April 14-17, 1998 in Helsinki. The congress secretariat will support the arrangement of separate user group meetings during the congress, collect specific participation fees, arrange the participants to same hotel, make reservation of lecture halls, assist with printing matters, or post congress trips. The user group meeting may be of any length, half day to three days, or of any size, 20 to 200 persons.

There are many specialised user groups who have already established regularly organised meetings. Some have already asked for the possibility to have their own meeting under the umbrella meeting, being responsible for their program themselves. The answer was positive, with applause. We already have an extensive user group of training simulators on the list. Users in the field of chemical engineering have expressed their interest. The suppliers of software, hardware, literature have also expressed their interest, as well. Product specific courses may be arranged. There will also be shorter demonstration sessions, in connection with the exhibition.

If you or your organisation are interested to arrange your monthly, annual or even first meeting at the EUROSIM'98 Congress, be sure to inform us in good time on your plans and requirements. Exactly two years before the congress we will put up the tentative timetable, according to information then available. Accordingly the EUROSIM'98 Congress deadline for arrangers of courses or user's group meetings explain their interest, is April 14, 1996, to be sure to fit in the schedule.

The strictly scientific program will include invited lecturers, presentation of thoroughly reviewed full papers, short papers, and poster papers. Tentative session organisers interested to collect sessions within their own area of interest, let us hear from you soon.

Full papers of general interest and invited lectures will be concentrated to the first two days of the congress. The later part the meeting is more devoted for user group meetings and specialised sessions.

After the meeting it will be possible to attend post congress trips: with flight up to northern Lapland, where it is still possible to ski in clean surroundings; with train to Saint Petersburg in Russia with famous art and architecture; with cruising ship on the Baltic to Tallinn, Stockholm, Poland, or Germany.

By explaining your interest and providing us with your contact data, Email, Address, and Fax, you will ensure that you will have fast access to necessary information on EUROSIM'98. You may conveniently use fax: +3580 4566 475, or my email: Kaj.Juslin@vtt.fi.

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A Simulation and Test Automation System for Design Verification and Design Error Analysis, Using Automatic Programming Techniques

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I. Introduction

Simulation at various levels is an essential and commonly used method for verifying the design of digital systems; it also plays an important role in fault simulation and test pattern generation. However, as systems increase in size and complexity, verifying the system becomes very costly, both in time and space. Also, a measure of completeness is not available, except for exhaustive simulation, which is cost prohibitive for large designs.

Nevertheless, simulation is still widely used for verification since it can verify the design under various delay conditions, detect errors introduced when describing the designs, and detect and isolate actual design errors. Simulation is the approach that we have adopted for providing a confidence measure and the related simulation results. The confidence measure for verification is a measure of coverage for a number of simulation patterns, based on the new concept of design error modeling [1] [2]. This is the first approach at providing a confidence measure of simulation patterns along with simulation results.

When implementing a digital logic simulator, one of the most time consuming jobs is the development of the functional model library [3]. To describe a large system, many predefined functional models are required. The accuracy and speed of simulation depend upon the performance of the simulation models. Since manual generation is error prone and time consuming, automatic model generation, using automatic programming techniques, is clearly desirable.

Automatic programming is concerned with methods for selecting programming constructs for specification implementation, how to utilize fragmentary information, how to synthesize code from examples of the desired behavior, and how to utilize domain knowledge [4]. There have been many attempts at developing general purpose automatic programming systems which could generate programs from certain specifications. These have only been successful for some simple examples. However, several successful automatic programming systems have been developed by restricting the application domain [5]. These are called domain specific automatic programming systems. Either, the domain knowledge can be provided by the user as a part of the interactive specification process, or it may initially exist in the system. The way of representing the domain knowledge can be provided by the user as a part of the interactive specification process, or it may initially exist in the system. the way of representing the domain knowledge, and the interaction between the domain knowledge, and the programming knowledge are dictated by the specific application domain.

The SAS, which automates the simulation process, has four major features, which address the problems described above. First, it can be used to build a simulation model library for a new simulator or to upgrade an existing model library. By automating the model generation process, many error prone and time consuming tasks are eliminated. This capability can greatly reduce the design cycle time. Second, it has the capability of developing simulators automatically, using domain specific programming techniques. This allows users who may have limited knowledge in the application domain, to easily develop unique simulators. Third, the system can simulate designs under design error conditions to provide a confidence measure of simulation patterns, which is extremely valuable information, along with the simulation results. This aspect is of particular significance since no other simulation metric presently exists for design errors. Finally, an automated design error pattern generation capability is provided to supplement user provided design error simulation patterns [6].

II. Simulation Automation System (SAS)

The global configuration of the SAS is shown in Fig. 1. The SAS includes several subsystems, i.e.: Preprocessor, AMG, ASD, and DEST. The following sections describe each of these subsystems.

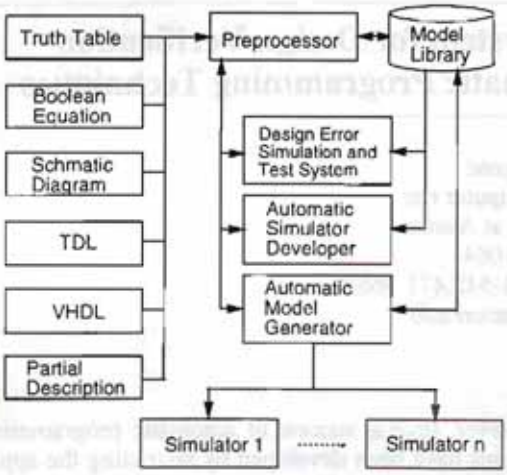

Figure 1: Block Diagram of the SAS

Automatic Element Routine Generator (AERG)

Using the information from the Preprocessor, the AERG synthesized "C" code that represents the model. The AERG can generate various level of combinational and sequential models for multiple logic values. The structure of the AERG is shown in Fig. 2.

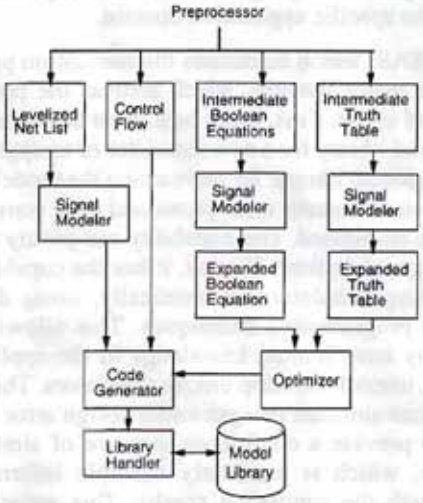

Figure 2: Automatic Element Routine Generator

AMG Results

Results of model generation are shown in Table 1. In this table, the size represents the number of elements used in the model. It includes gate level primitives, PIs, POs, and flip-flops. For example, to generate models of c7552 (with 3513 gates), it took 223.35 seconds. The results show that automatic model generation is efficient, and the model generation time of the AMG is far superior to that of experienced human programmers.

Circuit	Size [elements]	Generation Time [sec]
c432	160	0.68
c499	202	1.12
c880	383	3.35
c1355	546	5.82
c1908	880	13.68
c2670	1269	38.98
c3540	1669	47.33
c5315	2307	102.07
c6288	2416	97.67
c7552	3513	223.35
s208	158 (8 FFs)	0.28
s298	226 (14 FFs)	0.40
s344	235 (15 FFs)	0.68
s349	245 (15 FFs)	0.72
s386	275 (6 FFs)	0.61
s420	317 (16 FFs)	1.02
s444	328 (21 FFs)	0.83
s510	350 (6 FFs)	1.12
s641	567 (19 FFs)	3.38
s713	609 (19 FFs)	3.61
s820	582 (5 FFs)	1.93
s838	632 (32 FFs)	1.90
s953	658 (29 FFs)	3.68
s1196	822 (18 FFs)	5.58
s1238	824 (18 FFs)	5.23
s1423	950 (74 FFs)	9.55
s1488	946 (6 FFs)	7.83
s1494	944 (6 FFs)	7.75
s5378	4326 (179 FFs)	147.62
s9234	7226 (228 FFs)	545.71

Table 1: AMG Results

Also, since the designers need not worry about the details of low level coding, the chance of errors in the design cycle can be reduced significantly.

Automatic Simulator Developer (ASD)

Configuration: The ASD develops simulators which can be used for logic simulation and fault simulation. The global configuration of the ASD is shown in Fig. 3. The ASD includes: user interface, preprocessor generator, post processor generator, model generator, scheduler generator, evaluator generator, and merger.

ASD Results: Using the ASD, some simulators were developed. The results of simulator generation are shown in Table 2, including characteristics of the simulators and simulator generation time (sec). All simulators in Table 2 use default models from (2 to 8 input gates). These results show that automatic simulator development is efficient. For example, it took only 9.534s to develop a 3 value nominal delay simulator with hazard analysis. The simulator generation time using ASD is far superior to the time required by experienced human programmers to develop simulators.

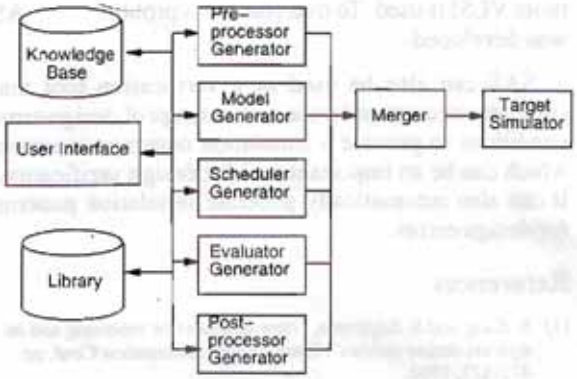

Figure 3: Automatic Simulator Developer

Simulator	Functions	Simulator Generation Time
Logic	3 value, zero delay	9.534 sec
Logic	3 value, hazard analysis	13.142 sec
Fault	Parallel algorithm	11.712 sec
Fault	Concurrent algorithms	12.188 sec
Fault	PPSFP algorithm	11.274 sec

Table 2: ASD Results

Design Error Simulation and Test System (DEST)

The configuration of the DEST is shown in Fig. 4. The scenario for this system is as follows. From the design and the given model specification, the design error model generator generates a set of design errors. In pattern specification, simulation patterns can be provided initially by the user, generated randomly, or generated by the automatic error pattern generator. During the verification process, this pattern specification is continually updated. the design error simulator provides simulation coverage based on design error models for given patterns. The user can decide about the continuation of the verification procedure according to the simulation results and the related confidence measure. After error simulation, if the desired confidence is achieved, simulation is halted. However, if the simulation coverage is not sufficient, or if the user wants to detect specific undetected design errors using the automatic design error pattern generator (AEPG), simulation patterns are generated, and simulation is continued using these patterns. Therefore, higher simulation coverage can be achieved efficiently using this system. Sample results are shown in Table 3.

Design Error Simulation

The design error simulator executes error simulation. Error simulation [2] is the process of simulating a circuit to analyze its operation under various design

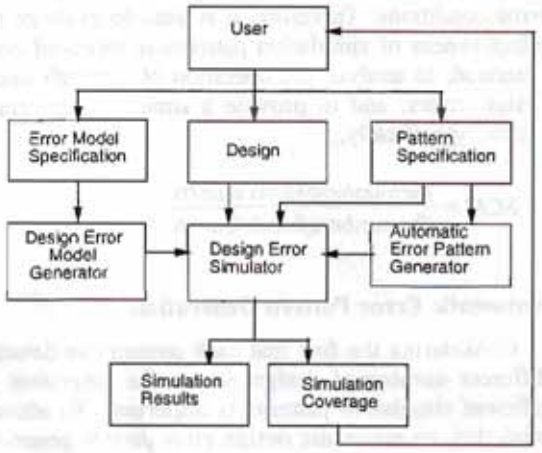

Figure 4: Design Error Simulation and Test System

Circuits	Errors	SCM [%]	SCM Time
16-to-1 Multiplexer	168	97.57	0.11
32-to-1 Multiplexer	344	94.98	0.24
16 bit Adder	208	98.00	0.13
32 bit Adder	416	95.14	0.29
74ls181 ALU	1513	99.67	1.05
c432	2489	97.99	2.15
c499	3012	98.24	3.60
c880	5171	98.36	6.73
c1355	7380	89.30	18.02
c1908	8775	94.21	10.43
c2670	13728	83.78	22.35
c3540	19130	94.88	38.75
c5315	33874	94.94	25.42
c6288	33472	92.46	33.67
c7552	38777	89.34	47.25
s208	1049	42.61	0.15
s298	1976	16.24	5.93
s344	1615	14.61	11.43
s349	1657	15.45	13.23
s386	3045	14.42	4.03
s420	2070	51.93	3.57
s510	3219	24.82	4.20
s526	3978	8.06	16.82
s641	2559	46.89	1.87
s713	3136	51.12	3.10
s820	7393	11.82	7.35
s832	7605	11.49	7.37
s838	4157	52.51	13.62
s953	5211	24.58	5.53
s1196	7402	6.70	10.05
s1238	8236	6.58	10.47
s1423	7189	2.77	25.42
s1488	11397	6.57	9.70
s1494	11585	6.47	9.78
s5378	22896	8.81	34.93
s9234	34535	1.38	397.50

Table 3: Error Simulation Results

error conditions. Therefore, it is used to evaluate the effectiveness of simulation patterns in terms of error detection, to analyze the operation of a circuit under design errors, and to provide a simulation coverage metric; specifically,

$$SCM = \frac{thenumberofdetectederrors}{thenumberofmodelederrors}$$

Automatic Error Pattern Generation

Considering the fact that each pattern can detect a different number of design errors, the derivation of efficient simulation patterns is important. To accomplish this, an automatic design error pattern generator is required. A similar algorithm to that used for generating fault test patterns can be used. The main difference is that the excitation is more difficult and complex, since there are many possible ways to excite design error models.

III. Conclusion

Digital system design and verification becomes more difficult as the size of the system grows and as more VLSI is used. To overcome this problem, the SAS was developed.

SAS can also be used as a verification tool that simulates circuits under the new concept of design error conditions to provide a simulation coverage measure, which can be an important tool for design verification. It can also automatically generate simulation patterns for design errors.

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EUROSIM'95 Special Interest Sessions

The EUROSIM'95 Congress, which took place in Vienna in September 1995, featured several "Special Interest Sessions" with emphasis on specific up-to-date simulation topics. *EUROSIM - Simulation News Europe* publishes reports on these sessions in the issues 15 to 17 (November 1995, March 1996 and July 1996). The editors would like thank the organizers of these sessions for providing the reports.

Modelling and Simulation in Education and Training

This topic was introduced for the first time at the EUROSIM'95 Congress to reflect the increasing role of modelling and simulation in the education process. Thirteen papers were presented in two sessions. They cover a wide range of subjects including the methodology of using simulations and simulation tools in the teaching environment, specialised teaching of simulation and simulation model design, the development of models and simulation tools suitable for training and education purposes, the role of simulation games.

The general pedagogical issues of using modelling and simulation in teaching are discussed in [1]. The emphasis is placed on didactic computer models as means of objective and active teaching and on the importance of the subject of modelling and simulation for teachers.

Aspects of specialised teaching of simulation and simulation model design are discussed in [2], [3] and [4]. The need of teaching students how to create models of a good quality is prioritised in [2]. The authors criticise the traditional event oriented and object oriented model design approaches and advanced an alternative message oriented design methodology. Matlab and Simulink software tools are used in [3] in the design of a case modelling study of an air conditioning pilot plant. This teachware introduces the modelling aspects of a real plant in a course of modelling, simulation and automatic control of dynamic processes. The object-oriented design as a natural approach to modelling is discussed in [4]. The modelling and simulation of a small hydro power station using the object oriented language Oberon illustrates the main authors' points.

The use of educational simulation games is described in [5] and [6]. In the first paper [5] the simulation game DIC_XIM is used to convey a variety of optimisation skills and techniques as well as to instil experience about structures, processes and dynamics of the systems under study. The authors prove that the combination of simulation and mathematical theory is highly rewarding. The simulation game of production control PROST is described in the second paper [6]. The game helps the participants, who are students in information science, mechanical engineering or industrial engineering, to understand the difference between theory of production control and the simulation of a real world company.

The largest number of papers [7-10] was devoted to the development of simulation tools and examples which can be used in different areas of education. The design of demonstrators and courseware used in an introductory course on neural networks is discussed in [7]. Among the demonstrators are Real OCR System Kit, Neural Classificator and Simple Image Processing System. The principles used in the design of GAPTUTOR, an interactive tutorial package which provides an introduction to neural signal analysis are outlined in [8]. An important feature of the package is the interactive simulation facility which allows data files with known properties to be created and used as input to the involved analysis programs. The author of [9] describes the facilities and the principles used in the design of CACTUS, a computer based system to assist the training of senior police officers in development management skills for large public order events. The simulator is based on Behaviour Networks theory and treats small groups of people as discrete objects. In [10] multimedia based tutorials in simulation are described. They combine in a hyperbook textual materials, Matlab simulations and video attachments.

The methodology and the pedagogical aspects of the application of commercial simulation packages in education and training are discussed in two papers. How the introduction of dynamic energy simulation in architectural education can be enhanced by interactive multimedia learning systems and simulation is demonstrated in [11]. Two modelling tools are used in this context: the energy passport program EPASS and the dynamic energy simulation program SUNCODE.PC.

In [12] the authors describe the introduction of commercial semiconductor process and devices simulation tools in a third year semiconductor devices and materials course. The emphasis is on the methodology and the practical problems arising from the combination of fabrication, electrical measurements and TCAD simulation in one laboratory project.

Finally one stand alone paper describes the use of Petri-Nets in modelling the knowledge assessment process [13]. Some other aspects of the penetration of Petri-Nets in the education and the learning process are also discussed.

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[9] Using Agent Based Simulations for Training, R.J. Williams, University of Leeds, United Kingdom

[10] Simulation of a Rotary Dryer with Multimedia. L. Yliniemi and K. Leiviska, University of Oulu, Finland

[11] Dynamic Energy-Simulation in Architectural Education Techware for Bioclimatic Architectural Design, M.G Tuschinski, University of Stuttgart, Germany

[12] A Virtual IC Factory in an Undergraduate Semiconductor Device Fabrication Laboratory. A. Asenov, C.R. Stanley, University of Glasgow, Scotland, United Kingdom

[13] Using Coloured Petri-Nets in Modelling the Knowledge assessment process. An Example involving Simulations on the Sharing of Resources, C.I. Vlad and M. Tertisco, University of Bucharest, Romania

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Simulation and Artificial Intelligence

Nine presentations from eight countries addressing mutual benefits in combining Simulation and Artificial Intelligence were given at the EUROSIM'95 Congress in a special interest session "Simulation and Artificial Intelligence".

In the first paper [1] A. Wildberger discussed three issues: benefits to AI from Simulation, benefits to simulation from AI and benefits to Computer Science from combining of both. Artificial Intelligence deals with the design and implementation of problem solving tools that require intelligence in particular with the study of the computational tools that involve the use of distributed resources: resolution strategies, knowledge, data and skills. The resource intensive nature of discrete-event simulation has led to wide spread research in designing methods for effective executing models, also on parallel and distributed architectures. A Simulation system must provide the means for effective problem handling, allowing for distributed resources allocation and the demands for high performance. It has to present high level of modularity, reflect system's changes with low costs and has the ability to explore concurrent activities. These goals could be met with the application of the AI techniques to the simulation area.

Imports from AI to Simulation have enhanced Simulation techniques to be more effective and feasible. The most obvious and popular have been used to build 'Intelligent Simulation Environments'. They are AI-based envelopes around either Simulation development tools or Simulations themselves. They are intended to advise and assist the user in building, running and interpreting the results of Simulation. Another connection between AI and Simulation can be established when heuristics are included in a numerical algorithm to ensure its convergence or increase its efficiency. Object-oriented programming has been concerned to be the best method for use in software system design. Simulationists have extended this paradigm to create objects, that operate as synthetic processors, or agents. Objects, their classes, have also been used as a method of knowledge representation in symbolic Artificial Intelligence. The approach to envolving objects is a natural extension of the hierarchical inheritance structure of most class and object systems. This combination of techniques from Simulation and AI may make it practical to produce goal-driven, computationally efficient and structurally effective 'Intelligent Simulations'.

Modelling issues were discussed in [2], [4], [6], [7], [8]. A general approach for building hybrid computa-

tional intelligence systems (soft computing) was presented in [4]. The main requirement: integration of various technologies was fulfilled by providing an open and flexible means of modelling and simulation, without setting any constraints on a particular technology or system architecture. The approach uses simulation system objects which lead to a generalized view of Simulation. All objects can be reconfigured during run-time, without any knowledge about the functionality and technology represented by the object.

C^3R System presented in [2] has been developed to derive models on complex systems and use them for control purposes. C^3R constructs a model by simulation of human modelling principles. The approach combines heuristic modelling on the basis of motivation in cognition psychology with practical requirements of process control. The inputs of the C^3R are time series from the technical system. The output of the C^3R is a visualization of the causal dependency relations in form of a causality graph and the functional dependence relations represented by transformation rules.

Another interesting approach to design and develop Simulation environments was presented in [7]. This approach combines distributed artificial Intelligence techniques with that of multi-agent Systems in an integrative software tool for real-time, discrete-event simulation. The system modularity, the agent's autonomy, flexibility and independence cater for the integration of new problem paradigms without effecting the system's structure. A user can easily customize its applications, integrate new resolution methods and making better decisions in the application's design.

Two other papers deal with the approach of agents as well. In [6] authors present the XRaptor System - an object-oriented Simulation tool providing a virtual environment, into which agents may be inserted for evalution of their behaviour. XRaptor is intended for studying of adaptive control mechanisms and emergent artificial life.

A tool for Simulation of artificial life experiments is presented in [8]. The user defines synthetic worlds and mobile agents. The tool simulates their behaviour and visualizes results. This simulator is oriented to the evaluation of control algorithms for autonomous navigation.

A number of interesting applications were presented as well. In [5] the knowledge-based framework was applied to modelling and Simulation of Airport. This complex modelling problem requires a support tool for an effective analysis process, and a consequent optimization. An intelligent web, with its substantial component knowledge-based framework was implemented for this application. It contains an implemented domain-specific knowledge and heuristic profile to support for user's decision making process. An attempt to model and simulate the pultrusion process model, derived from weak correlated laboratory data was reported in [3]. The authors examine mathematical models, various artificial networks (ANN) models and compare them to rule based models. The focussed ANN model, where a closer domain knowledge was used to structure the ANN, performed well. Benefits of OO, mental qualitative/cognitive mapping modelling improved performance. A computer-aided animation system for studying human aspects such as movement and performance by modelling tasks executed by the human skeleton was presented in [9]. The system provides to the user the possibility to describe the animation task in abstract terms. The sequence of required movements and actions is generated by the system. The approach combines planning paradigm, an AI technique to define the animation process with the OO modelling techniques for modelling the animation universe.

The Special Interest Session "Simulation and Artificial Intelligence" has given a deep insight into the current problems and trends of very promising steps in direction of making Simulation more effective and more applicable by including AI techniques. It was enhanced with other spezialized sessions: Genetic Algorithms in Simulation, Fuzzy Systems in Simulation, Neural Nets in Modelling and Simulation and Knowledge Based Simulation.

References:

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[2] "Learning Rules for Modelling Dynamic Systems Behavior" H. B. Keller

[3] "Development & Benchmarking of Pultrusion Process Models: Including Artificial Neural Network, Rule Based and Mathematical". D. T. Wright, D. J. Williams

[4] "Modelling and Simulation of Hybrid Computational Intelligence Systems". E. Thurner, D. Yurtsever

[5] "An Intelligent Support of Airport/Airspace Simulation". O. Babka

[6] "XRaptor: A Synthetic Multi-Agent Environment for Evaluation of Adaptive Control Mechanisms". P. Mössinger, D. Polani, R. Spalt, Th. Uthmann

[7] "Multi-Agent Systems Based Distributed Intelligent Simulation - A Case Study". O. Belo, J. Neves

[8] "Artificial Life in Artificial Worlds". F. Ortega, J. Jerez, F. J. Vico, M. Gonzales, I. M. Conde

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[9] "The knowledge modelling for human skeleton animation: towards a simulation prototype". H. Fourar, A. Koukam, P. Deschizeaux, EUROSIM'95 Late Paper Volume, Eds: F. Breitenecker, I. Husinsky; ARGESIM,Vienna (1995), ISBN 3-901608-01-X

Prof. Dr.-Ing. Helena Szczerbicka, Universität Bremen, Fachbereich 3 - Informatik, Postfach 33 04 40, D-28334 Bremen, Tel: +49-421 218 7389 or 7390, Fax +49-421 2187385, Email: helena@ informatik.uni-bremen.de.

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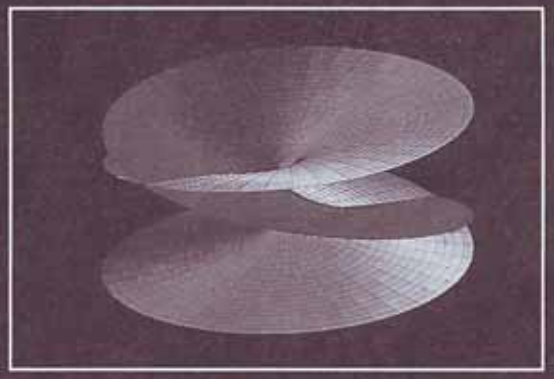

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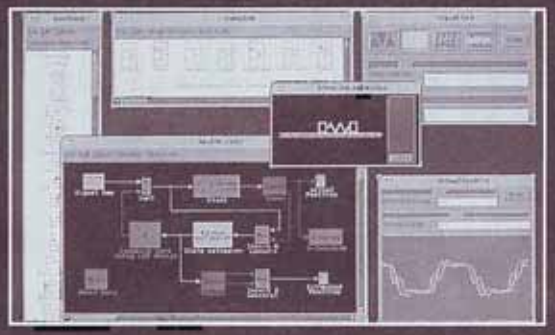

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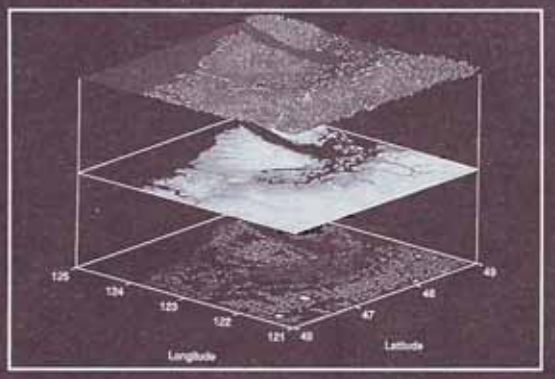
TOOLBOXEN

Anwendungsspezifische Ergänzungen für MATLAB



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ASIM

ASIM (Arbeitsgemeinschaft Simulation) is the association for simulation in the German speaking area. ASIM was founded in 1981 and has now about 680 individual members.

Report from ASIM

ASIM Conference in Dresden 1996

ASIM 96
10. Symposium Simulationstechnik
Dresden, September 16-19th, 1996

The next (German speaking) ASIM conference (*10. Symposium Simulationstechnik*) will be at Dresden from September 16-19th, 1996. It will cover again a broad spectrum of simulation issues. User Group meetings and tutorials will be organized, excursions are planned to several interesting industrial plants in Sachsen and to the well known opera in Dresden.

Interested persons please contact: Prof. Dr.-Ing. W. Krug, DUAL-ZENTRUM Dresden, Gillesstraße 2, D-01219 Dresden, Tel: +49-351 47791-0, Fax: +49-351 47791-99.

ASIM Book Series

The ASIM book series on Advanced Simulation has been restructured. In future it will be published in two different tracks.

- **Track A:** ***Fortschritte in der Simulationstechnik,*** published by Vieweg at Wiesbaden, Germany. Up to now, already 7 books have been published in this series. Several more are planed to appear in the near future.
  Future projects will focus on:
  - Status Reports, presenting the state of the art in simulation within each individualASIM Working Group. These handbooks will be updated according to advances in simulation.
  - Compendiums on simulation with general interest to the simulation community.
  - Proceedings of the annual ASIM symposium.
  - Monographs on simulation
- **Track B:** ***Fortschrittsreport Simulation***, published by ARGESIM at Vienna, Austria. This new publication series will be a forum for
  - Monographs on recent developments (e.g. PhD-thesis),
  - Workshop Proceedings of ASIM Working Groups,
  - Description of simulation tools.

For detailed information or if you are interested to publish in the series, please contact the editors:
Prof. Dr. G. Kampe, Fachhochschule Esslingen, Flandernstr. 101, D-73732 Esslingen, Fax: +49-711-397-3763, Email: Kampe@ti.fht.esslingen.de or
Prof. Dr. D.P.F. Möller (address see below).

The ASIM board will meet again in April. Main subjects of the meeting will be the annual conference, the activities of the working groups and the publication series. Please contact the speaker if any specific subjects should be discussed at that meeting.

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ASIM Meetings to come

April 18-20, 1996: *7. Ebernburger Gespräche* "Advances in Simulation in Medicine, Biologie and Ecologie". Contact: Prof. Möller (address see above).

June 12-13, 1996: Conference of the working group "*Simulation in Produktion und Logistik*" at Fraunhofer-Institute for Materialflow and Logistics, Dortmund, Germany. Contact: Sigrid Wenzel (address see below).

June 14th, 1996: Meeting of the working group "*Verkehrssimulation*" in Zürich-Schlieren. Main subject of the meeting is "*Simulation in der strategischen Verkehrsplanung*". Contact: Hr. Münch (address see below).

September 16-19, 1996: *ASIM 96, 10. Symposium Simulationstechnik* in Dresden. Contact: Prof. Dr. W. Krug (see announcement above).

March 1997: 6. Symposium "*Simulation als betriebliche Entscheidungshilfe*" Braunlage. Contact: Prof. W. Hummeltenberg (address see below).

Meetings with ASIM participation

June 11-12, 1996: Workshop "*Visualisierungsverfahren beim Einsatz der Simulationstechnik in Produktion und Logistik*" at the Fraunhofer-Institute for Materialflow and Logistics, Dortmund, Germany, organized by the working group "*Simulation in Produktion und Logistik*" together with the *GI-Fachgruppe 4.1.4 "Graphische Simulation und Animation"*. Contact: Sigrid Wenzel (address see below).

Working Groups

"Simulationsmethoden und -sprachen für verteilte Systeme und parallele Prozesse"

The working group organized the 1995 workshop "Simulation of distributed systems and parallel processes" at the Fraunhofer Institute IIS/EAS in Dresden on October 23 and 24, 1995. 16 papers were presented to the 31 participants. The full-length German version of the papers will be published as volume 50 of the *ASIM Mitteilungen*. Main topics were the description and performance analysis of parallel systems, parallel and distributed simulation (on transputer nets and workstation clusters, especially for very large and complex systems), and design methods for technical systems with a high degree of parallelism.

Future main working areas of the working group will be:

- description and analysis of parallel processes and distributed systems,
- parallel simulation,
- modelling and partitioning of technical systems for parallel and distributed simulation,
- design methods for parallel and distributed systems.

For details, please contact the speaker.

Speaker: Dr.-Ing. Peter Schwarz, Fraunhofer-Institut IIS/EAS, Zeunerstr. 38, D-01069 Dresden, Tel: +49-351 4640 730, Fax: +49-351 4640 703, Email:schwarz@eas.iis.fhg.de
Vice-speaker: Dr. Hans Fuss, GMD, D-53731 St. Augustin, Tel: +49-2241 14 3125, Fax: +49-2241 14 3006, Email: fuss@cartan.gmd.de

"Simulationssoftware und -hardware"

The 1996 the working group meeting was held on February 27-28 in Ulm (together with the working group "*Simulation technischer Systeme*"). A report will be published in the next issue of SNE.

Speaker: Prof. Dr.-Ing. Dietmar P.F. Möller, TU Clausthal, Institut für Informatik, Erzstraße 1, D-38678 Clausthal-Zellerfeld, Tel: +49-5323 72 2402 or 72 2504, Fax: +49-5323 72 3572
Vice-speaker: Prof. Dr. Felix Breitenecker, TU Wien, Abt. Simulationstechnik, Wiedner Hauptstr. 8-10, A-1040 Wien, Tel: +43-1 58801 5374, Fax: +43-1 587 4211 Email: fbreiten@email.tuwien.ac.at

"Simulation und künstliche Intelligenz"

The working group will meet in March in Ulm. A report of the meeting will appear in the next issue of SNE.

The working group organized a special interest session at Eurosim'95. On page 10 you find a short report on the session.

Speaker: Prof. Dr.-Ing. Helena Szczerbicka, Universität Bremen, Fachbereich 3 - Informatik, Postfach 33 04 40, D-28334 Bremen, Tel: +49-421 218 7389 or 7390, Fax +49-421 2187385, Email: helena@informatik.uni-bremen.de.

"Simulation in Medizin, Biologie und Ökologie"

The next conference of the working group, the 7th Ebernburg Working Conference, titled "Advances in Simulation in Medicine, Biology and Ecology" will be held from April, 18th to April 20th, 1996, at the castle Ebernburg at Bad Münster am Stein-Ebernburg. The main conference topics will be modelling and simulation practice and theory in biomedical/ecological research and the application of soft computing, e.g. fuzzy sets, neural nets, genetic algorithms, evolution strategy. For further information please contact Prof. Möller (address see above).

Speaker: Prof. Dr. Otto Richter, TU Braunschweig, Institut für Geographie und Geoökologie, Langer Kamp 19c, D-38106 Braunschweig, Tel: +49-531 391 5627, Fax: +49-531 391 8170
Vice-speaker: Prof. Dr. Björn Gottwald, Universität Freiburg, Fakultät für Biologie, Schänzlestraße 1, D-79104 Freiburg, Tel: +49-761 203 2891, Fax: +49-761 203 2894

"Simulation technischer Systeme"

The 1996 working group meeting was held on February 25-26, 1996 in Ulm (together with the working group "*Simulationssoftware und -hardware*"). A report about this meeting will follow in the next SNE.

Speaker: Dr. Ingrid Bausch-Gall, BAUSCH-GALL GmbH, Wohlfartstraße 21b, D-80939 München, Tel: +49-89 3232625, Fax: +49-89 3231063, Email: 100564.302@compuserve.com
Vice-speaker: Ewald Hessel, Hella KG Hueck&Co., Abt. EL-R, Werk II, Beckumer Straße, D-59552 Lippstadt, Tel: +49-2941 38 8572, Fax: +49-2941 38 8427, Email: hessel@hella.de

"Simulation in Produktion und Logistik"

The ASIM Working Group "*Simulation in der Fertigungstechnik*" decided to rename its group title. As the subject "*Fertigungstechnik*" has changed its meaning in the last years the name of the group was changed to "*Simulation in Produktion und Logistik*" which corresponds to the actual working contents in a better way.

A Working Group meeting took place at the University of Nürnberg/Erlangen, Germany, on February 22, 1996. In addition to this meeting the Working Group organizes, together with the *GI-Fachgruppe 4.1.4 "Graphische Simulation und Animation"*, a workshop titled "*Visualisierungsverfahren beim Einsatz der Simulationstechnik in Produktion und Logistik*" on June 11-12, 1996 at the Fraunhofer-Institute for Materialflow and Logistics, Dortmund, Germany. The workshop is a forum to discuss different methods and application possibilities of visualization in discrete event simulation.

Following the workshop the Working Group Conference, which takes place every two years, is planned for June 12-13, 1996. Again, the conference location is the Fraunhofer-Institute for Materialflow and Logistics, Dortmund, Germany. The contents of this conference will be similar to the topics of the conference, which was scheduled for March 1995 at the University of Nürnberg/Erlangen, Germany, but had to be cancelled because of insufficient participation. The program will contain different sections concerning simulation technology in organizations, factory segmentation, interpretation methods, and integration aspects of simulation methods in planning and operation.

For detailed information please contact: Dipl.-Inform. Sigrid Wenzel, Fraunhofer-Institut für Materialfluss und Logistik, Joseph-von-Fraunhofer-Strasse 2-4, D-44227 Dortmund, Tel: +49 231 9743 237, Fax: +49 231 9743 234, Email: wenzel@iml.fhg.de

Speaker: Prof. Dr.-Ing. A. Kuhn, Fraunhofer-Institut für Materialfluß und Logistik, Joseph-von-Fraunhofer-Straße 2-4, D-44227 Dortmund, Tel: +49-231 9743 132, Fax: +49-231 9743 234

"Simulation in der Betriebswirtschaft"

The sixth symposium "Simulation for managerial decision support - new tools and approaches in practice" is announced for spring of 1997 at the traditional place in Braunlage. For further information, please contact the speaker.

Speaker: Prof. Dr. W. Hummeltenberg, Universität Hamburg, Institut für Wirtschaftsinformatik, Max-Brauer-Allee 60, D-22765 Hamburg, Tel.: +49-40-41 23-40 23, Fax: +49-40- 41 23-64 41

"Simulation von Verkehrssystemen"

The last session of this working group was on November 29th, 1995 at the "*Institut für Materialfluss und*

Logistik (IML)" at the Fraunhofer-Institut in Dortmund. Multimedia and WWW were, besides the exchange of experiences, the main subjects. The working group plans to use the new media to improve the knowledge about the activities of the working group.

The next meeting will be held on June 14th, 1996 in Zürich-Schlieren at the location of the company Zühlke-Engineering. The subject of the meeting will be "*Simulation in der strategischen Verkehrsplanung*". It is planned to actively contact potential users of this method. Dr. H. Eisenring, president of the *Generaldirektion der SBB (Schweizer Bundesbahnen) a.D.* will actively support and act as patron of this meeting. Further information on this meeting can be obtained from the speaker of the working group or from the local organizer André Graber, phone +41 1 733 6611.

Speaker: Karl-Heinz Münch, SIEMENS AG, Bereich VT2 SYS, Ackerstraße 22, D- 38126 Braunschweig, Tel: +49-531 226 2225, Fax: +49-531 226 4305

GI-Fachgruppe "Informatik in den Biowissenschaften"

The German ministry for research and technology developed a furtherance strategy in the domain of molecular biology, which is based on the computer aided analysis of biomolecular sequences, structures and processes. Several groups support this strategy. The German Society of Computer Science responded to this situation. At the beginning of 1992 they founded a new working group which is called *"Informatik in den Biowissenschaften"* (GI-FG 4.0.2). The goal of this working group is to close the gap between computer science and biology which was emphasized by the ministry of research and technology.

However, this group has already organized different workshops and conferences. The German Society of Computer Science and the University of Leipzig (Department of Medical Informatics) will organize the first **International German Conference on Bioinformatics**, Leipzig, **September 30 to October 2, 1996**.

Major topics: Biological Database Technology, Genome Analysis, Models of Gene Regulation, Models of Pattern and Structure Formation, Formal Languages and DNA, Visualization and Animation of Biological Processes, Molecular Modelling and Protein Design, Metabolic Engineering, DNA Computing, Evolutionary Computing, Self-Organization and Complex Systems, Artificial Intelligence and Complex Systems, Biological Paradigms in Computer Science.
Contact: PD Dr. R. Hofestädt, University Leipzig, Department Medical Informatics, Liebigstr. 27, D-04103 Leipzig, Tel: +49-341 9716100, Fax: +49-341 9716109, Email: ralf@imise.uni-leipzig.de

Ingrid Bausch-Gall

CSSS

The Czech and Slovak Simulation Society is organizing two conferences in the first half of the year 1996. The 30th Spring International Conference "**Modelling and Simulation of Systems**" (MOSYS '96), will be held on April 23rd - 26th, 1996 in the Moravian city Krnov, Czech Republic. The conference has the following topics: * Yesterday Simulation * Information System Modelling * Control System Modelling * Simulation Results Analysis * Simulation Software * Application of Modelling and Simulation * Theory of Modelling and Simulation * Simulation of Large Systems * Simulation in Hydraulics. The chairman of the international organizing committee is Dr. Jan Stefan.

The second event is the 3rd International Symposium ZEL'96 "**Computer Control and Simulation of Railway Transport Systems**", Zilina, Slovakia, to be held on May 29th - 30th, 1996. The symposium has the following topics: * Creation of Timetables * New Concepts of Railway Safety * Simulation of Railway Traffic * Simulation of Networks * Simulation and Control of Railway Vehicles.

Deadline for proposed papers: March 16th, 1996. Deadline for participation: April 1st, 1996. Deadline for delivery of final paper: May 1st, 1996. Chairman is Prof. Dr. Ladislav Skyva (the same address as Mikulas Alexik, email: skyva@frtk.utc.sk).

In autumn there is an International Workshop "**Electronic Computer and Informatics**", to be held on Sept. 26th - 27th, 1996 at the Technical University Kosice, Slovakia. There is a section "Modelling and Simulation of Systems". Chairman of the workshop is Dr. Milan Sujansky, Technical University Kosice, Slovakia.

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Mikulas Alexik

DBSS

General Information

The Dutch Benelux Simulation Society (DBSS) was founded in July 1986 for the purpose of creating an organisation of simulation professionals within the Dutch language area. DBSS has actively promoted creation of similar organisations in other language areas. DBSS is member of EUROSIM and works in close co-operation with the other members and is affiliated with SCS International and IMACS.

Steering Committee:
L. Dekker, Delft University of Technology (Chairman), A.W. Heemink, Delft University of Technology (Vice Chairman), W Smit, AKZO NOBEL (Member), J.C. Zuidervaart, Delft University of Technology (Secretary/Treasurer).

DBSS Membership

Both corporate entities (companies, institutes, etc.) and individuals are welcome to join DBSS as full corporate or individual member. Becoming member of DBSS includes automatically being member of EUROSIM, the overall organisation of European Simulation Societies. DBSS members enjoy reduction of the fees attending the "EUROSIM events" which means congresses, conferences, symposia, workshops etc.

So far members of DBSS received three times a year the EUROSIM newsletter "Simulation News Europe". As an exception for 1996, all members of DBSS will receive volume 4 (6 issues) of the EUROSIM journal Simulation Practice and Theory. The journal also includes the above mentioned newsletter.

In November this year the Steering Committee will contact all their members in order to discuss

- an optional subscription to the EUROSIM journal "Simulation Practice and Theory" at a reduced price offered by the publisher or a
- compulsary subscription, included in the membership fee of DBSS.

The membership fee for 1996 amounts to just dfl. 75,- or bfr. 1400,- for individual and the double for corporate members. Those interested to become a member of DBSS are invited to write to the secretary:

Dutch Benelux Simulation Society
Secretariat: Computing Centre, P.O. Box 354
NL-2600 AJ Delft, The Netherlands
Tel: +31-15 2785698, Fax: +31-15 2783787
Email: Zuidervaart@rc.tudelft.nl
(member of the Editorial Board of SNE)

(Please mention your name, affiliation and address, and indicate whether you are interested in the personal or institutional membership).

The membership fee should be paid to:
Giro account 3582241, J.C. Zuidervaart
Leeuwerikplantsoen 27,
2636 ET Schipluiden, The Netherlands
with the mention: DBSS membership 1996

Past and Coming Events

As most of the members may know, DBSS organised in 1994 in Delft the international EUROSIM Conference "Massively Parallel Processing Applications and Development". Now DBSS is organising a second conference on behalf of EUROSIM in June (10-12) this year, entitled "HPCN challenges in telecomp and telecom; parallel simulation of complex systems and large-scale applications". Detailed information can be found on page 40 of this newsletter and on-line information can be found on world wide web: http://www. twi.tudelft.nl/Conferences/EUROSIM/index.html.

We trust and hope that many DBSS and other individual members of EUROSIM will join this conference.

Future Plans

The Steering Committee of DBSS asks all the members to give more direct support to their society in a.o. proposals for special half/one day meetings; perhaps to create special working groups within the Dutch language area. Please don't hesitate to contact our secretary; let us try together to share expertise in the framework of our society.

J.C. Zuidervaart

FRANCOSIM

FRANCOSIM was created in 1991 and aims to the promotion of simulation in research, industry and university fields. It has members from large French companies and famous Belgian and French universities. Its legal seat and postal address are:

FRANCOSIM, Maison de la Productique
F - 42300 Roanne

Contact in France: M. Lebrun
Phone: +33-77 70 80 80, Fax: +33-77 70 80 81
(member of the Editorial Board of SNE)

Contact in Belgium: Mr. F. Lorenz
Centre Socran, Parc Scientifique
Avenue Prè-Aily, B-4031 Angleur
Tel: +32-41 67 83 75, Fax: +32-4167 83 00

Fees

Individual fee: FF 275.
Group fee: FF 1000, giving right to five names, information and papers being sent to each of them.
Student fee: FF 50, giving right to receive EUROSIM news via the university.

Events to Come

Workshop on **Continuous Event Simulation Systems.** Meetings take place at ESIEE school, Cité Descartes 2, boulevard Blaise Pascal, F-93162 Noisy le Grand, Tel: +33-45 92 65 00, Fax: +33-45 99 66 99. Contact: Prof. Yskandar Hamam.

Théorie et pratique des logiciels de simulation des Mécanismes: Case study with two software packages: ADAMS and IPG MESA VERDE. March 11-15, 1996, Contact: Mr. Fayet, INSA de Lyon, Département Génie Mécanique Construction, 20 av. A. Einstein, F-69621 Villeurbanne cédex, Tel: +33-72 43 83 08, Fax: +33-72 43 85 25.

Symposium on linear bond graph: Date and place to be defined.

Journées 2A-O: November 1966: ESIEE school, Cité Descartes 2, boulevard Blaise Pascal, F-93162 Noisy le Grand, Tel: +33-45 92 65 00, Fax: +33-45 99 66 99. Contact: Alain Carriere.

Bond Graph: un outil pour la modélisation et l'analyse des systemes dynamiques: 12th June 1996. Laboratoire de génie Mécanique, INSA de Toulouse, Complexe scientifique de Rangueil, F-31077 Toulouse, Tel: +33-61 55 97 01, +33-61 55 96 81, Contact: Mr. Jean Charles Mare.

M. Lebrun

HSS

General Information

The Hungarian Member Society of EUROSIM was established in 1981 as an association promoting the exchange of information within the community of people involved in research, development, application and education of simulation in Hungary and also contribute to the enhancement of exchanging information between the Hungarian simulation community and the simulation communities abroad. HSS deals with the organization of lectures, exhibitions, demonstrations, round table discussions and conferences.

Activities

The Hungarian Simulation Society as a co-sponsor participates in the organization of the 10th European Simulation Multiconference of SCS to be held in Budapest, Hungary June 2-6. Prof. A. Javor (Chairman of HSS) is the General Conference chairman of the Multiconference. The Conferences within ESM'96 will be the following:

* Simulation Methodology and AI * Simulation in Economics * Simulation in Electronics and Telecommunications * Qualitative Information, Fuzzy Techniques, and Neural Networks in Simulation * Analytical and Numerical Modelling Techniques * Simulation of Multibody Systems * Modelling the Dynamics of Organizations and Information Systems * Mission Earth * Session for Students

Further information about the 1996 European Simulation Multiconference can be found on WWW under: http://hobbes.rug.ac.be/~scs

Contact Address

Prof. András Jávor, Ph.D., D.Sc.
KFKI Research Institute for Measurement and Computing Techniques
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Phone: +36 1 1699499, Fax: +36 1 1601290
Email: javor@sunserv.kfki.hu
(member of the Editorial Board of SNE)

András Jávor

ISCS

General Information

The Italian Society for Computer Simulation (ISCS) is a scientific nonprofit association of members from industry, university, education and several public and research institutions with common interest in all fields of computer simulation. Its primary purpose is to facilitate communication among those engaged in all aspects of simulation for scientific, technical or educational purposes.

The affairs of the ISCS are directed by a Steering Committee presently consisting of the following persons: Franco Maceri (chairman), Felice Cennamo (vice-chairman), Vincenzo Grassi (treasurer), Mario Savastano (secretary).

Membership

At present ISCS counts 132 members: 6 institutional, 4 honorary, 120 regular and 2 affiliate. Charges per annum are Lit. 30,000 for regular and affiliated members and Lit. 400,000 for institutional members.

At present, ISCS members receive this bullettin "EUROSIM-Simulation News Europe" and can benefit from special discounts on many national and international conferences and workshops that concern simulation. In addition, they can benefit from a reduced subscription rate on the Elsevier journal "Simulation Practice and Theory". For the future, we are studying the possibility to combine the annual charge rate for the ISCS membership and the subscription to the Elsevier journal. We are grateful to ISCS members that will give us their opinion about this opportunity.

Contact Address

For further information or application for membership please contact:

ISCS
c/o Dipartimento Ingegneria Elettronica
Università di Roma "Tor Vergata"
Via della Ricerca Scientifica
I-00133, Roma, Italy
Phone: +39 6 7259.4477 Fax: +39 6 2020519
E-mail: grassi@info.utovrm.it
(member of the Editorial Board of SNE is M. Colajanni)

Activities

The steering committee and some of the ISCS members continue to promote the following activities.

1. The sponsoring of the "***Seminario di Informatica***", a periodic scientific seminar held at the University of Roma "Tor Vergata". Main topics are simulation, performance evaluation, parallel and distributed computing, and high speed networks. In the period from November 95 to January 96 main topics were on load balancing and fault tolerance in distributed systems, concurrent simulation, and parallel virtual machines.

2. The organization and sponsoring of **Summer Simulation Schools** with the aim of extending the knowledge about simulation theory, tools, and applications.

3. The organization of **Working Groups meetings** among ISCS members interested in the same simulation field, in order to provide a forum for presentation of results, exchange of ideas and scientific discussions. At present, the following Working Groups have been established: Simulation in Industry and Management, Simulation in Agriculture and Environmental Sciences, Simulation in Training and in Education, Simulation in Biology and Medicine, Simulation in Electrical Engineering, Concurrent and Distributed Simulation, Software and Hardware for Simulation, Expert Systems and Simulation. ISCS members are warmly invited to promote new Working Groups or to join existing ones.

Contact ISCS secretariat at the address reported above for further information.

Notice to ISCS members: The annual meeting of ISCS members is scheduled to be held in June 1996 in Rome, at the University of Rome "Tor Vergata". On that occasion, we will organize a meeting between members coming from academia and industry. We will accept until the end of March any suggestion coming from ISCS members concerning: 1) proposals for the introduction of additional topics; 2) organization of special sessions containing four/five invited presentations (the ISCS member will be "guest chairman" of the proposed session).

Michele Colajanni

SIMS

Information on SIMS

The Scandinavian Simulation Society, SIMS, has at present nearly 300 members from Denmark, Finland, Norway and Sweden. For 35 years SIMS has served as the regional society in Scandinavia, gathering individuals and organisations involved in simulation. The activities have been concentrated on arranging annual meetings and courses, delivery of information letters, and co-operation at European and international level in the field of simulation.

How to join SIMS

Just send an informal application or recommendation for membership to the SIMS secretariat:

Eija Karita Puska
VTT Energy, Nuclear Energy
P.O.Box 1604
FIN-02044 VTT, Finland
Tel: +358-0-4565036
Fax: +358-0-4565000
Email: eija-karita.puska@vtt.fi
(member of the Editorial Board of SNE)

E.K. Puska

SIMS'96
Announcement and Call for Papers

SIMS'96, the 38th Annual Simulation Conference organised by the Scandinavian Simulation Society will be held at the Norwegian University of Science and Technology, Trondheim, Norway, June 11-13, 1996.

The aim of this conference is to cover broad aspects of simulation and scientific computation, and will thus be of interest for model builders, simulator personnel, scientists, process engineers, mechanical engineers, vendors etc. The scientific programme will consist of technical sessions with submitted and invited papers, and is open for poster sessions and vendor demonstrations.

The conference bears the subtitle "Applied Modelling and Simulation" and the conference themes include, but are not limited to: * Modelling Tools and Techniques * Model and Data Exchange Standardisation * User Interface and Visualisation * Engineering and Training Simulators * Initialisation and Steady State Computation * Integrated Process Design * On-Line Use of Simulation Models * Simulation in Factory Planning * Simulation in Production Management * Modelling and Simulation of Thermodynamics and Fluid Flow * Simulation in Chemical Engineering * Simulation in Control Engineering * Simulation of Mechanical Systems * Simulation of Electronic Systems * Simulation of Marine Systems.

A suitable area will be available for demonstrations and exhibitions during the conference. Vendor demonstrations of commercial simulation systems are welcome, as are poster presentations of simulation activities. For demonstrations, video sessions or exhibitions in general, please use the correspondence address.

The Programme Committee consists of: Siv.ing. Eirik Borgen, SINTEF; Dr.ing. Ernst W. Hansen, SINTEF; Dr.ing. Torleif Iversen, SINTEF; Dr.ing. Ole Langeland, Statoil; Prof. Ole Ivar Sivertsen, NUST; Prof. Sigurd Skogestad, NUST; Prof. Steinar Saelid, Prediktor; Dr.ing. Trond Weberg, Aker Engineering. The Organising Committee consist of: Torleif Iversen, SINTEF and Eva Schmidt, NUST.

Authors should submit an extended abtract of approximately 500 words to the address below by February 17th, 1996. Abtracts will be reviewed by members of the Programme committee, and notification of acceptance or rejection will be sent by March 8th, 1996. (*These deadlines are already passed, but please contact T. Iversen if you want to contribute.*) The conference program and registration form will be published in March 1996. Final versions of accepted papers are due by May 13th, 1996.

The official conference language and the language of the accepted papers is English.

The correspondence address is:
SIMS, c/o Torleif Iversen
SINTEF Automatic Control
N-7034 Trondheim, Norway
Email: Torleif.Iversen@regtek.sintef.no
http://www.itk.unit.no/SINTEF/sims96.html
Tel: +47-73594474, Fax: +47-73594399

SLOSIM

On November 22, 1995 the regular annual assembly of our society was held at the Faculty of Electrical Engineering, Ljubljana with the following agenda: 1. report of the activities in the past period; 2. financial report; 3. report of the supervisory board; 4. plan of activities for the year 1996.

Some items in conjunction with future plans: continuation of group representative meetings (2-3 new groups), co-operation with EUROSIM, SNE, ..., lectures of visiting professors, dissemination of information, co-organization of ERK 96 conference, collecting of new members (also from industry), collecting of sponsors.

Currently SLOSIM has 83 members. Before the assembly there was a presentation of the multimedia group from the Faculty of Electrical and Computer Engineering, given by prof. dr. Sasa Divjak. The presentation focused on the INTERNET possibilities for simulation and animation of natural (primarily electrotechnical and physical) phenomena.

SLOSIM was a cooperative society in the organization of IFAC/IMACS Workshop "Artificial Intelligence in Real-Time Control - AIRTC", which was held in Bled, Slovenia, Nov. 29 - Dec. 1, 1995. The conference was organized by the Faculty of Electrical Engineering, University of Ljubljana, Jozef Stefan Institute and Automatic Control Society of Slovenia.

52 contributions were accepted by the International Programme Committee. The main intention of the workshop was to show the state-of-the-art in the application of artificial intelligence approaches in real-time controland modelling as well as to bring together control, artificial intelligence, and different applicative areas specialists.

There were five regular sessions (Supervisory Control and Fault Detection, Fuzzy Modelling and Control, Expert Systems and Machine Learning in Real-Time Control, Intelligent Control Systems, Artificial Neural Networks for Identification and Control), one invited session (Material Process Design and Control), and one poster session.

Three commercial presentations were organized (INEA enterprise, Slovenia, Digital Equipment Corporation, USA and Wonderware, USA).

Some conclusions: It came out that not only fuzzy control and artificial neural nets are the AI approaches to be used in real time control. Also methods like machine learning will probably give new ideas and possibilities in the investigated area. The same can be concluded for the fault detection which is very perspective for the use of AI methods.

The atmosphere at the Workshop was stimulating. It is worth to say that participants were fascinated by the beauties of Bled and its environment. According to the opinion of the participants the Workshop can be considered a very successful one. The next event foreseen is the Symposium on the same topic in Kuala Lampur, Thailand in 1997.

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(member of the Editorial Board of SNE)

Borut Zupancic

AES

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(member of the Editorial Board of SNE)

UKSS

The Society is undergoing a period of reconstruction, and it is hoped in particular that the participation of industrial, and other practising simulationists, will be encouraged and enhanced. If you are interested in finding out more about the Society or joining, please contact our Membership Secretary, is spearheading this new initiative:

Mr Chris Bowyer,
CAM UK, Beckett House,
14 Billing Road, Northampton, NN1 5AW
Tel: +44-1604 259036/7/8, Fax: +44-1604 230086

For further information about the Society's activities contact the Chairman of the Society:

Dr. Rob Pooley,
email: rjp@dcs.ed.ac.uk,
Fax: +44-131 667 7209
or the General Secretary:
Prof Russell Cheng
email: R.C.H.Cheng@ukc.ac.uk,
Fax: +44-1227 764000
(member of the Editorial Board of SNE)

Russell Cheng

United Kingdom Simulation Society Conference UKSS 97
Keswick Hotel, Lake District, England, 23-25th April 1997
1st Call for Papers

Papers are invited on any aspect of simulation to be presented at a three day event organised for both scientific and cultural interest. The event will be held in the Lake District, an area in England of outstanding natural beauty. The conference venue, the Keswick Hotel is a renovated Victorian hotel within walking distance of the town centre, set in its own very pleasant grounds. Access is easy via Manchester International Airport or London Heathrow/Gatwick and coach or rail to Keswick.

Abstracts (two pages of A4 without figures) are invited on any aspect of simulation and its applications. The following are suggested topics, but papers on other topics are also welcome: Simulation methodology and practice, languages, tools and techniques. Models and modelling tools. Data/object bases. Analysis and statistical tools. Simulators and simulation hardware, training simulators. Integration of simulation with concurrent engineering, integrated design and simulation systems. AI in simulation. Parallel and distributed simulation. Neural networks.

Simulation applications include the following areas: aerospace; electronic circuits and systems; computer networks; business; management; finance; economics; leisure; biology; medecine; public health; manufacturing; planning; control; robotics; measurement; monitoring; energy; safety critical systems; transportation; oil and gas; education and training; military.

Specially welcome are Introductory Tutorials, State-of-the-Art reviews, suggestions for Special Sessions.

There will be an Exhibitions Area.

Accepted papers will be published in the Proceedings of the Conference.

Although a national event, presenters and participants from any country are always welcome, especially EUROSIM member countries, and also North America, the Pacific Rim and elsewhere.

The registration cost, to be confirmed, is exceptional value at 150 pounds sterling for members of EUROSIM Societies (including proceedings, tea/coffee, lunches, get-together and conference dinner). Hotel accommodation costs will be 45 pounds per day.

Abstracts/submissions/proposals to the Programme Chair, Conference Chair or the General Secretary from whom further information is available.

Deadlines:
Abstract (four copies, 2 pages A4): 1st Oct 1996,
Notice of Provisional acceptance: 16th Dec 1996,
Camera Ready Copy and Registration Fee: 3rd Feb 1997

Programme Chair: Prof. Paul Luker, School of Computing Sciences, De Montfort University, Leicester, LE1 9BH, UK, Tel: +44-116 257 7488, Fax: +44-116 254 1891, email: luker@de-montfort.ac.uk

General Chair: Prof Graham Birtwhistle, Div of OR and Information Systems, School of Computer Studies, The University, Leeds LS2 9JT, UK Tel +44-113 243 1751, email: graham@scs.leeds.ac.uk

Classes on Simulation

March 1996

19 ***Parallele Simulation, Simulatorkopplung***. Seminar at TU Vienna
Contact: Prof. Dr. Felix Breitenecker, TU Wien, Abt. Simulationstechnik, Wiedner Hauptstraße 8-10, A-1040 Wien, Tel: +43-1 58801 5374, Fax: +43-1 5874211, Email: fbreiten@email.tuwien.ac.at

20-21 ***Simulink-Kurs***. Munich, Germany.
Contact: BAUSCH-GALL GmbH, Wohlfartstr. 21b, D-80939 München, Tel: +49-89 3232625, Fax: +49-89 3231063, Email: 100564.302@compuserve.com

22 ***Objektorientierte Modellierung mit DYMOLA.*** Munich, Germany.
Contact: BAUSCH-GALL GmbH

April 1996

15-17 CCG Kurs ***Simulation kontinuierlicher Systeme***. Oberpfaffenhofen, Germany
Contact: Carl-Cranz-Gesellschaft e.V., Postfach 11 12, D-82234 Oberpfaffenhofen, Tel: +49-8153 282413, Fax: +49-8153 281345 or Prof. Dr. F. Breitenecker, TU Wien, Abt. Simulationstechnik, Wiedner Hauptstraße 8-10, A-1040 Wien, Tel: +43-1 58801 5374, Fax: +43-1 5874211, Email: fbreiten@email.tuwien.ac.at

17-19 **ACSL Course** (with Joe Gauthier). Kingston Unversity, U.K.
Contact: Rapid Data Ltd., Crescent House, Crescent Road, Worthing, West Sussex, BN11 5RW, UK, Tel: +44-1903 821266, Fax: +44-1903 820762, Email: karin@radata.demon.co.uk

23-24 ***ACSL und Graphics Modeller.*** Munich, Germany.
Contact: BAUSCH-GALL GmbH

24-26 **ACSL Course** (with Joe Gauthier). TU Delft, The Netherlands
Contact: Rapid Data Ltd.

25 ***Objektorientierte Modellierung mit DYMOLA.*** Munich, Germany.
Contact: BAUSCH-GALL GmbH

May 1996

7-8 ***Simulink-Kurs***. Munich, Germany.
Contact: BAUSCH-GALL GmbH

June 1996

11-12 ***MATLAB-Kurs***. Munich, Germany.
Contact: BAUSCH-GALL GmbH

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ACSL Courses

Kingston University (UK)
17-19 April 1996

TU Delft (The Netherlands)
24-26 April 1996

ACSL Graphic Modeller
Graphical programming tool that generates ACSL code by allowing the user to build models in block diagram form or a combination of text and block diagram (see example below).

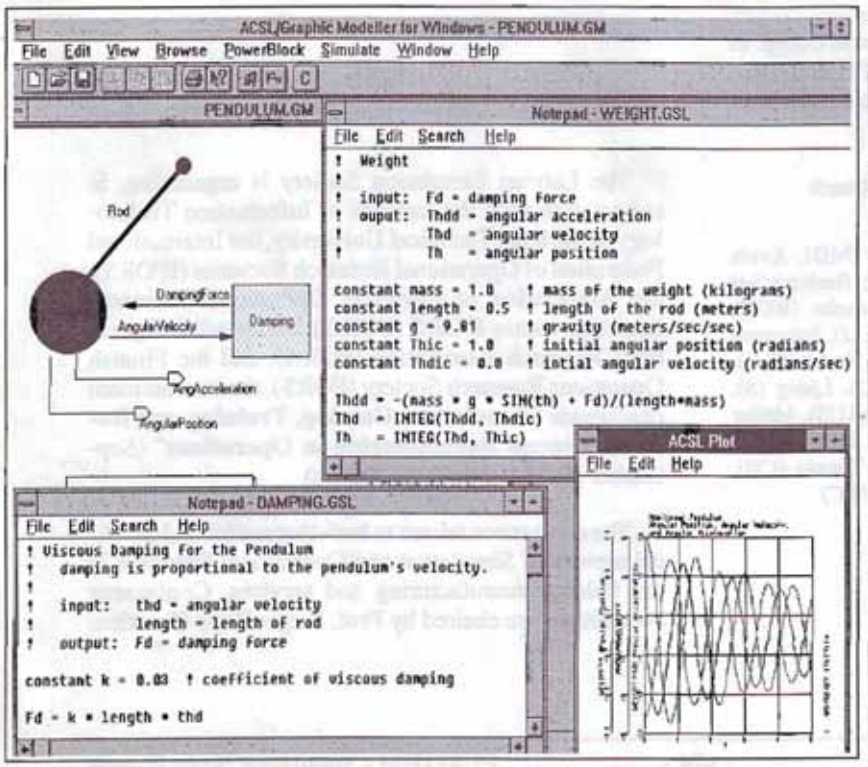
ACSL Vision
Graphical tool which allows animation of ACSL models as well as the creation of *widgets* such as pushbuttons and sliders in order to run a simulation from a control panel.

ACSL Math
Mathematical environment for matrix computation and state-of-the-art 2D and 3D plotting which incorporates a high-level programming language. ACSL Math uses shared memory with ACSL, which means that all variables are available in the same environment for processing.

ACSLrt
Real time applications (hardware-in-the-loop or man-in-the-loop) can be developed using the special functions available in ACSL to interface with I/O cards with ACSLrt.

ACSL Code
C and Ada code generator to be tightly integrated with the Graphic Modeller for block diagram programming and ACSLrt for hardware-in-the-loop testing.

Graphic Modeller Example



For further information, or for a full evaluation, contact us at

RAPID DATA LTD
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The Netherlands
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IMACS

2nd MATHMOD VIENNA

IMACS

February 5-7, 1997
Technical University Vienna, Austria

Scope: All aspects of mathematical modelling of all types of systems are discussed, i.e. of systems which are * dynamic or static * deterministic or stochastic * continuous or discrete * lumped parameter or distributed parameter * linear or nonlinear * or of any other nature. Consequently, a wide variety of formal models will be discussed and the term "mathematical model" will include classical models such as differential or difference equations, Markov processes, ARMA models as well as more recent approaches such as Bond graphs or Petri nets, etc.

Organizer: Division for Mathematics of Control and Simulation at Technical University Vienna

Sponsors: IMACS (Int. Ass. for Maths. & Comp. in Simulation), Division for Mathematics of Control and Simulation at Technical University Vienna and Technical University Vienna.

NOC: F. Breitenecker, I. Troch, F. Urbanek

IPC: Troch (A, Chairperson) Andronaty (MD), Avula (USA), Babary (F), Borne (F), Breedveld (NL), Breitenecker (A), Bulirsch (BRD), Cellier (USA), Chernousko (RUS), Fasol (BRD), Foss (N), Frank (BRD), Furuta (J), Futagami (J), Hanus (B), Juslin (FIN), Kabamba (USA), Karba (SLO), Karnopp (USA), Kheir (USA), Köhne (BRD), Ljung (S), Maffezzoni (I), Marsili-Libelli (I), Matrosov (RUS), Möller (BRD), Murray-Smith (GB), Prasad (USA), Siciliano (I), Skelton (USA), Sugeno (J), Sydow (BRD), Thoma (CH), Tzafestas (GR), Vichnevetsky (USA), Wen (VRC)

Submission of Abstracts: May 1, 1996
Notification of Authors: Sept. 1, 1996
Full Paper due: Nov. 1, 1996

All accepted papers will be published in a Proceedings Volume. The Proceedings (published in the series ARGESIM-Reports, ISBN 3-901608-11-7) will be available at the registration desk. Furthermore, any paper submitted is automatically considered for publication in a special issue of the IMACS journal MCS (Mathematics and Computers in Simulation).

New results can be displayed during a Poster Session. Deadline for poster abstracts is Oct. 1, 1996. Book exhibition and Software Presentation will be provided.

Social Program / Program for Accompanying persons: Get-Together Party, Concert, Heurigen evening, sightseeing tour (only acc. persons).

Conference fees in ATS (payment before and after Novcember 15, 1996): members of IMACS or any cosponsoring society 3500 ATS (3900 ATS), nonmembers 3900 ATS (4300 ATS), students (without lecture) 500 ATS (700 ATS), accompanying persons 1000 ATS (1200 ATS).

All correspondence should be adressed to:

Univ. Prof. Dr. Inge Troch
Technische Universitaet Wien (E114/5)
Wiedner Hauptstrasse 8-10,
A-1040 Wien,
Email: inge.troch@tuwien.ac.at

LSS

The Latvian Simulation Society is organizing, in cooperation with the Institute of Information Technology of the Riga Technical University, the International Federation of Operational Research Societies (IFORS), the Association of European Operational Research Societies within IFORS (EURO), the Swedish Operations Research Association (SORA), and the Finnish Operations Research Society (FORS), the international conference "**Simulation, Gaming, Training and Business Process Reengineering in Operations**" (September 19-21, 1996, Riga, Latvia).

The conference relates to both theoretical and practical aspects of Simulation and Operational Research in the field of manufacturing and services. Conference committees are chaired by Prof. Birger Rapp (Sweden;

Programme Committee) and Prof. Yuri Merkuryev (Latvia; Organizing Committee).

Abstracts (not more than 200 words) should be sent by email to Rigaconf96@IDA.LiU.SE before May 15, 1996, or through the IFORS WWW-pages (http://www.ifors.org).

The official conference language is English. The registration fee is 150 USD for early registrations (before July 15, 1996). In order to have the abstract considered for publication, a prepayment (in the amount of 50 USD) must be made.

Accepted papers could be considered for publication in "International Transactions in Operational Research" (IFORS) and "Automatic Control and Computer Sciences" (Latvian Academy of Sciences) journals (see instructions on the WWW-pages).

Address for correspondence:

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Riga Technical University
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Tel. +371-7-324480, Fax +371-7820094
Email: CONF96@ITLPRO.ITL.RTU.LV
WWW: http://www.itl.rtu.lv/Riga_Conf96

CROSSIM

Croatian Society for Simulation Modelling

18th International Conference ITI '96 (Information Technology Interfaces) June 18-21, 1996, Pula, Croatia

Contact: Branka Radic, University Computing Centre, J. Marohnica bb, HR-10000 Zagreb, Croatia, Tel/Fax: +385-1-518 656, Email: iti@srce.hr, WWW: http://www.srce.hr/iti/

Contact Address:

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Email: vlatko.ceric@x400.srce.hr

ROMSIM

The Romanian Society of Modelling and Simulation

Modelling and Simulation started in Romania 30 years ago. In 1991 ROAMSE - Romanian Association of Modelling and Simulation - was set up, by 40 founding members and 100 joining later on. In 1992 ROAMSE changed into ROMSIM - the Romanian Society of Modelling and Simulation. ROMSIM is a non-profit society, whose purpose is to develop modelling and simulation systems from both theoretical and practical point of view and to gather all the people interested in advanced modelling and simulation techniques in order to establish profitable connections between those who propose methods, models, algorithms, and instruments and those who are working on practical applications.

The Activities of ROMSIM

ROMSIM develops its activities on the basis of a statute, approved by the members of the society. It includes information about the rights and the responsibilities of the ROMSIM members, and about the activities developed by ROMSIM.

The main activities developed by ROMSIM are:

- To ensure profitable scientific links between the members of ROMSIM and between these and other specialists
- To keep the ROMSIM members informed about the scientific activities in their field and to provide professional aid in preparing papers a.s.o.
- To periodically organize workshops in order to give the members the possibility to present their work to a knowledgeable audience
- To support ROMSIM members in publishing their results in different journals
- To organize a ROMSIM library
- To cooperate in scientific conferences organised by other societies

ROMSIM has organized a "Workshop on Modelling and Simulation" in September 1991. It was attended by about 100 people, and over 50 papers were presented. A "Workshop on Simulation and Simulators" in November 1993 was attended by 120 persons. ROMSIM was a sponsor of EUROSIM '95 and encouraged its members to take part in this congress.

Contact: Dr. Florin Stanciulescu,
Research Institute for Informatics,
Averescu Avenue 8-10, RO-71316 Bucharest
Tel: +40-1-6656060-172, Fax: +40-1-3128539,
Email: sflorin@roearn.ici.ro

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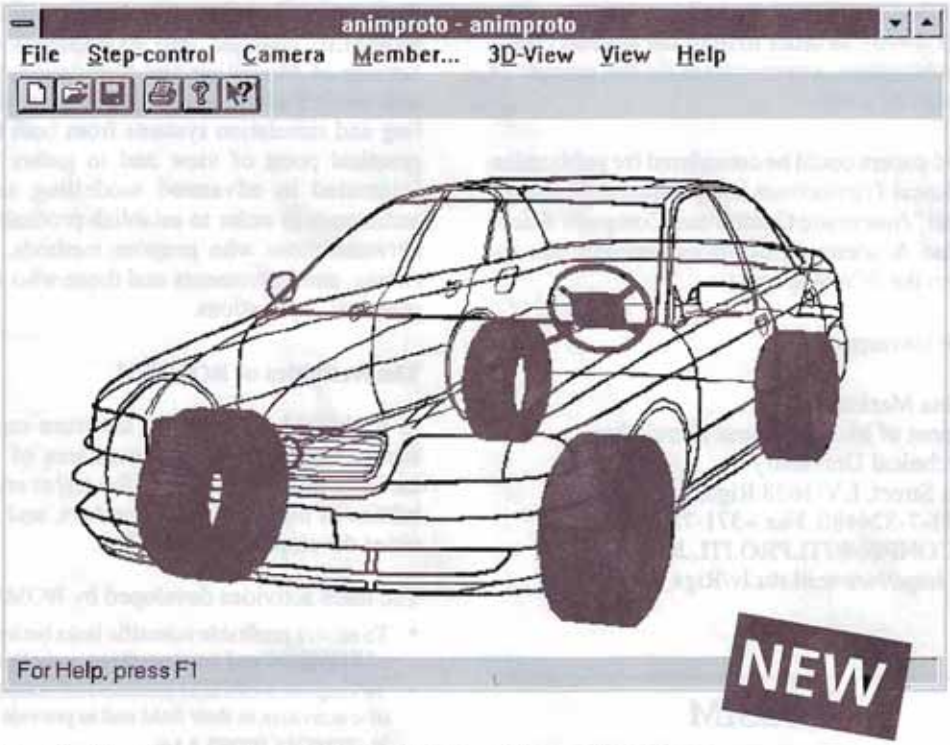

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dSPACE GmbH
Technologiepark 25 · D-33100 Paderborn
Phone.: ++49-5251-1638-0 · Fax: ++49-5251-66529
e-mail: info@dspace.de

dSPACE

Comparison of Simulation Software

EUROSIM - Simulation News Europe features a series on comparisons of simulation software. Based on simple, easily comprehensible models special features of modelling and experimentation within simulation languages, also with respect to an application area, are compared.

Features are, for instance: modelling technique, event handling, numerical integration, steady-state calculation, distribution fitting, parameter sweep, output analysis, animation, complex logic strategies, submodels, macros, statistical features etc.

Seven comparisons have been defined in previous issues of *EUROSIM - Simulation News Europe*, the series will be continued. Furthermore, a special comparison of parallel simulation techniques has been defined. This issue presents the 8th comparison, a discrete model for a Canal-and-Lock System.

Comparison 1 (Lithium-Cluster Dynamics under Electron Bombardment, November 1990) deals with a stiff system of 3rd order. This comparison tests features for integration of stiff systems, for parameter variation, and for steady state calculation. A preliminary summary can be found in SNE 6, November 1992.

Comparison 2 (Flexible Assembly System, March 1991, comments July 1991) for discrete simulation languages compares features for submodel structures, control strategies, and optimization of process parameters. A preliminary evaluation can be found in SNE 4.

Comparison 3 (Analysis of a Generalized Class-E Amplifier, July 1991) focusses on simulation of electronic circuits and requires features for table functions, eigenvalue analysis, and complex experiments.

Comparison 4 (Dining Philosophers, November 1991) is a more general task involving not only simulation but also different modelling techniques like Petri nets. The comparison concentrates on the modelling technique in case of concurrency and on different strategies (priority levels) in case of deadlocks.

Comparison 5 (Two State Model, March 1992, revised July 1992) primarily addresses simulation tools with very high accurracy. It checks integration and state event handling with high accurracy.

Comparison 6 (Emergency Department - Follow-up Treatment, November 1992) addresses discrete simulation languages and tests features for modelling, concepts of availability, and complex control strategies.

Comparison 7 (Constrained Pendulum, March 1993) for continuous simulation languages, checks features for model comparison, state events, and boundary value problems.

Comparison CP1 - Parallel Comparison (March 1994). This type of comparison diffenrent to the others deals with the benefits of distributed and parallel computation for simulation tasks. Three test examples have been chosen to investigate the types of parallelisation techniques best suited to particular types of simulation tasks.

Comparison 8 (Canal-and-Lock System, March 1996) for discrete simulators checks features for modeling complex logic, which has to be verified by deterministic datasets. Also variance reduction capabilities are checked.

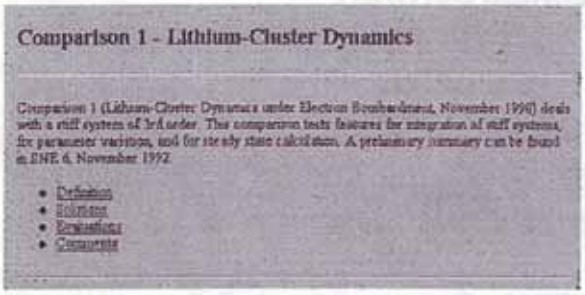
We invite all institutes and companies developing or distributing simulation software to participate in this comparison. Please, simulate the model(s) and send a report to the editors in the following form (on diskette, any word processing format, or per email or transfer to our ftp-server):

- short description of the language,
- model description (part of source code, diagram, ...),
- results of the tasks with experimentation comments, max. 1 page. (For publication in *EUROSIM - Simulation News Europe* all contributions that exceed one page will be modified by the editors to fit into one page.) Reports of solutions of the Parallel Comparison should not be more than one and a half page in length.

We offer to place the full model (source code, graphics, etc.) and additional information on our WWW server. We also invite you to prepare animations. Please send files and additional information in HTML-format.

The definitions of all comparisons, and an overview on the solutions sent in may be found on our WWW - server, direct access with:

http://argesim.tuwien.ac.at/comparisons/



Summaries of the comparisons are presented at conferences and published from time to time in SNE. Overviews on Comparison 1 and Comparison 2 (all solutions, partly extended solutions, model descriptions, source codes and all published summaries) have been published in the series ARGESIM Report (see also page 42). In general in this series textbooks for courses, reports from simulation working groups, etc. will be published.

The following table shows the number of solutions published in each issue of *EUROSIM - Simulation News Europe (SNE)* for the different comparisons.

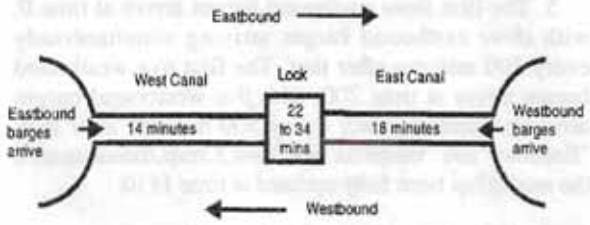
SNE No.	Comparison								
	C1	C2	C3	C4	C5	C6	C7	CP 1	C8
0	Def								
1	5	Def							
2	4	4	Def						
3	4	3	3	Def					
4	1	5	5	3	Def				
5	4	-	1	1	2				
6	-	2	-	2	1	Def			
7	1	2	1	2	-	1	Def		
8	-	1	-	-	-	1	3		
9	-	-	-	-	-	2	3		
10	1	2	-	-	-	2	2	Def/1	
11	2	2	1	-	1	-	-	2	
12	1	-	1	-	-	-	2	3	
13	-	-	-	-	-		3	1	
14	3	-	1	-	-	-	2	-	
15	-	-	1	-	1	-	-	-	
16	1	-	-	-	-	-	1	-	Def/1
Total	27	21	14	8	5	6	16	7	1

Comparison 8: Canal-and-Lock System

The objectives in this discrete comparison are to investigate features for modeling complex logic, to validate logic through use of deterministic data, and to check for variance-reduction capabilities.

The Canal-and-Lock System

The following figure shows a Canal-and-Lock System used by barges moving from one waterway to another. The system is composed of a West Canal, a Lock, and an East Canal.



Eastbound and westbound barges arrive at the Canal-and-Lock System with interarrival times specified in datasets that follow. Barge travel times in the West Canal and East Canal are 14 and 18 minutes, respectively (deterministic as a first approximation). (Barges might spend more time than this in the Canals, however, because of potential delay at the Lock.) After having arrived at the Lock and being next in line to use it, from 22 to 34 minutes are spent by a barge before it has finished using the Lock. Details are given below.

Because the Canals are narrow, barges can move through the system in only one direction at a time. The policy for operating the system is to let up to "Eastmax" barges proceed through the system in the *eastbound* direction, and then let up to "Westmax" barges proceed through the system in the *westbound* direction, and so on. It is not always the case, however, that during a west-to-east cycle there are at least "Eastmax" barges that want to move eastbound through the system, or that during a east-to-west cycle there are at least "Westmax" barges that want to move westbound through the system. The following considerations apply:

1. If there are *no* barges in the system when a barge arrives, then that barge initiates a barge-movement cycle in the direction in which it is headed.

2. A barge-movement cycle ends either when the specified per-cycle maximum allowable number of barges has moved in the direction in question (this is called a "full" cycle), or when the maximum has not yet been reached but there are no more barges waiting to move in that direction (this is called a "partially full" cycle).

3. When a barge-movement cycle ends and there are barges waiting to move in the opposite direction, then a cycle is initiated in that opposite direction.

4. When a cycle ends and *no* barges are waiting to move in the *opposite* direction but there *are* additional barges waiting to move in the *current* direction, then a cycle in the current direction is *freshly initiated*. (In a freshly initiated cycle, the count of barges that have moved through the system during the freshly-initiated cycle is set to zero and then builds up again, potentially reaching the "Eastmax" or "Westmax" value before the direction of movement is potentially changed.)

5. When a cycle ends and there are *no* barges waiting to move in *either* direction, then eventually another barge arrives and consideration 1 above is in effect.

The Lock itself can hold only one barge at a time. Service order for Lock use is first-come, first-served (for the barges currently *in* the Lock-and-Canal System).

Now consider the particulars of barge movement through the Lock. Assume (arbitrarily) that the water level in the West Canal is higher than in the East Canal, so that the Lock is used to *lower* eastbound traffic and to *raise* westbound traffic. Assume the current direction of barge movement is *eastbound*, that an eastbound barge has just moved out of the Lock into the East Canal, and that the next eastbound barge has already arrived at the Lock in the West Canal and is waiting to use the Lock. Then to move this next eastbound barge through the Lock, these steps take place:

1. The water level of the Lock (which has no barge in it) is raised to that of the West Canal. This takes 12 minutes.
2. The next eastbound barge moves into the Lock. This takes 5 minutes.
3. The water level in the Lock is lowered to that of the East Canal. This takes 12 minutes.
4. The barge moves out of the Lock into the East Canal. This takes 5 minutes.

The net effect of steps 1, 2, 3 and 4 is that it takes 34 minutes in this *maximum time* case for this next eastbound barge to *pass through the Lock*.

Now assume in the above scenario that the next eastbound barge hasn't yet arrived at the Lock in the West Canal when its predecessor finishes moving out of the Lock into the East Canal. Assume further that the next eastbound barge doesn't arrive at the Lock until 12 or more minutes *after* its predecessor has moved out of the Lock into the East Canal. Then the unoccupied Lock's water level will already have been raised to that of the West Canal by the time the next eastbound barge

reaches the Lock. The net effect is that it will only take 22 minutes (corresponding to steps 2, 3 and 4 above) in this *minimum time* case for this next eastbound barge to pass through the Lock. (Note the assumption that the Lock-and-Canal System is intelligent enough to change or start to change the water level in the Lock, if necessary, in anticipation of the level at which the next barge will arrive at the Lock.)

Finally assume that in the above scenario, the next eastbound barge arrives at the Lock after its predecessor has moved out of the Lock, but before the re-filling of the Lock has been completed. Then this next barge must wait for the re-filling to be completed. For example, if the predecessor leaves the Lock at time 500 and its successor arrives at the Lock at time 508, then only 8 minutes of Lock-refilling time have gone by and the successor will have to wait 4 minutes before the refilling of the Lock will be completed. As a result, this barge spends a total of 26 minutes (4 remaining minutes for step 1, then the time for steps 2, 3 and 4) passing through the Lock.

The reasoning set forth above is valid by symmetry for westbound traffic.

Task a) The Modeling Assignment

Model the Canal-and-Lock System. Design the model so that various alternative settings of "Eastmax" and "Westmax" and barge interarrival times can be experimented with easily. The model should measure average barge transit times, in minutes, on both a segregated (by direction of traffic movement) and pooled (for traffic movement in both directions) basis. (Barge transit time is defined as the elapsed time between arrival of a barge *outside* the Canal-and-Lock System at one end and its eventual departure from the system at the other end.) What fraction of the model is devoted to expressing the logical complexities of the system?

Task b) Model Validation with Deterministic Data

Several deterministic datasets are provided below, each designed to test various aspects of your model's behavior. Use your model to perform single simulations for the datasets. Compare your model's results with those given in the Appendix. All correctly built models should produce identical results for these datasets.

1. The first eastbound barge arrives at time 0, with one eastbound barge arriving every 108 minutes after that. The first westbound barge arrives at time 54, with one westbound barge arriving every 108 minutes after that. "Eastmax" and "Westmax" are each 1. Simulate until the model has been fully updated at time 1458.

2. The first *two* eastbound barges arrive at time 0, with *two* eastbound barges arriving simultaneously every 210 minutes after that. The first *three* westbound barges arrive at time 88, with *three* westbound barges arriving simultaneously every 210 minutes after that. "Eastmax" and "Westmax" are 2 and 3, resp. Simulate until the model has been fully updated at time 1470.

3. The first eastbound barge arrives at time 0, with one eastbound barge arriving every 54 minutes after that. No westbound barges ever arrive. "Eastmax" and "Westmax" are each 1. Simulate until the model has been fully updated at time 1458.

4. The first westbound barge arrives at time 0, with one westbound barge arriving every 100 minutes after that. No eastbound barges ever arrive. "Eastmax" and "Westmax" are each 1. Simulate until the model has been fully updated at time 1500.

5. The first *three* eastbound barges arrive at time 0, with *three* eastbound barges arriving simultaneously every 500 minutes after that. The first *five* westbound barges arrive at time 200, with *five* westbound barges arriving simultaneously every 500 minutes after that. "Eastmax" and "Westmax" are 2 and 3, resp. Simulate until the model has been fully updated at time 1410.

Task c) Variance Reduction Experiments

The following datasets call for the use of two variance reduction techniques to form interval estimates of expected (or differences in expected) pooled barge transit time. For purposes of estimating the effectiveness of these techniques in the context of this problem, the forming of interval estimates without the use of the variance-reduction methodology is also specified.

1. Consider the case in which barge interarrival times are exponentially distributed, with expected interarrival times of 75 minutes both for eastbound and westbound barges and with "Eastmax" and "Westmax" each set to 5. Form a 90% confidence interval for expected barge transit time on a pooled basis. Base the confidence interval on 100 independent replications, each of duration 14,400 simulated minutes. (Each replication corresponds to 10 simulated 24-hour days.) Assume there are no barges in the system when each replication begins, and that the arrival time of the *first* eastbound barge equals the value sampled from the uniform distribution 15 ± 15 minutes. Assume similarly that the arrival time of the *first* westbound barge equals the value sampled from the uniform distribution 10 ± 10 minutes. (Subsequent barge interarrival times are then exponentially distributed, as indicated above.) Also assume that transient conditions, if any, are negligible.

2. To provide a more balanced set of insights, repeat activity 1 two more times, but change the starting points of the random number generators.

3. Repeat activities 1 and 2, but now use the Antithetic Random Variates (ARVs) variance-reduction metho-

dology, basing the 90% confidence intervals on 50 negatively correlated pairs of replications. (The total number of replications here equals those in activities 1 and 2, so the same amount of simulation effort is involved.) How much narrower are the resulting confidence intervals than the ones produced in activities 1 and 2?

4. For probabilistic dataset 1, it has been proposed that the expected pooled barge transit time could be decreased by setting "Eastmax" and "Westmax" each to 6. Proponents of this approach argue that it takes time waiting for the last barge in a cycle to leave the Canal-and-Lock System before the direction of traffic is potentially changed, and that it is better to write off this time overhead across 6-barge batches than 5-barge batches (whenever a full cycle occurs). Opponents of this approach point out that while the sixth barge in a 6-barge batch is moving through the system, all barges waiting to move through the system in the opposite direction are forced to wait that much longer. Which of these two alternative policies leads to the smaller estimated expected pooled barge transit time? Investigate the answer to this question by forming a 90% confidence interval for the *difference* in the pooled average barge transit times for the two alternatives (subtracting 6-barge pooled average transit times from 5-barge times). Base the confidence interval on 50 pairs of independent replications, each of duration 14,400 simulated minutes. Consider the null hypothesis that the expected waiting time for 5-barge batches is less than or equal to that for 6-barge batches. With the probability of a Type I error set at 0.05 (which corresponds to your 90% confidence interval), can you reject this null hypothesis?

5. To provide a more balanced set of insights, repeat activity 4 two more times, but change the starting points of the random number generators.

6. Repeat activities 4 and 5, but now use the Common Random Numbers (CRNs) variance-reduction methodology, basing the 90% confidence interval on 50 positively correlated replication pairs. (Note that the total number of replications here is equal to those in activities 4 and 5, so the same amount of simulation effort is involved.) How much narrower are the resulting confidence intervals than the ones produced in activities 4 and 5? With the probability of a Type I error set at 0.05, can you reject the null hypothesis that the expected waiting time for 5-barge batches is less than or equal to that for 6-barge batches?

Appendix: Discussion of Deterministic Datasets

In formulating the complex logic behavior the following considerations may be helpful: (1) If an arriving barge detects there are no other barges in the system, it must initiate a cycle. (2) If an arriving barge detects there is an ongoing cycle in its direction of movement, it must enter its first canal if the cycle is not yet full and must wait outside that canal if the cycle is already full. (3) When a barge reaches the Lock, it must determine how long it has to wait before the water in the Lock is at the barge's level. (4) When a barge leaves its second canal, a check must be made to see if the barge is the last in the ongoing cycle; if so, a signal must be set that triggers initiation of a cycle in the opposite direction if appropriate, or initiation of another cycle in its own direction if appropriate, or puts the system into a state of suspension, waiting for the next arrival of a barge.

Dataset 1: Each eastbound cycle (full at one barge) is followed immediately by a westbound cycle (full at one barge), and vice versa. All barges pass through the system in the minimum feasible time of 54 minutes, so the average transit time is 54 minutes. When the simulation ends, the 14th eastbound barge has just left the East Canal, and the 14th westbound barge is just entering the East Canal.

Dataset 2: Each eastbound cycle (full at two barges) is followed immediately by a westbound cycle (full at three barges), and vice versa. Transit times for the first and second eastbound barges in a cycle are 54 and 88 minutes; and for the first, second and third westbound barges in a cycle are 54, 88, and 122 minutes. When the simulation ends at time 1470, the 21st westbound barge has just left the West Canal (7 westbound cycles have been completed, with an average transit time of 88 minutes), and the 15th and 16th eastbound barges are just entering the West Canal (7 eastbound cycles have been completed, with an average transit time of 71 minutes, and the 8th is just beginning).

Dataset 3: Each eastbound cycle (full at one barge) is immediately followed by another eastbound cycle (full at one barge). There are no westbound barges. The transit time for each barge is 54 minutes, so the average transit time is 54 minutes. When the simulation ends at time 1458, the 27th eastbound barge has just left the East Canal, and the 28th eastbound barge is just entering the West Canal.

Dataset 4: Each westbound cycle (full at one barge) is followed 46 minutes later by another westbound cycle (full at one barge). There are no eastbound barges. The transit time for each barge is 54 minutes, so the average transit time is 54 minutes. When the simulation ends at time 1500, the 16th westbound barge is just entering the East Canal.

Dataset 5: Each pair of consecutive eastbound cycles (the first cycle in the pair is full at two barges; the second cycle is partially full at one barge) is followed by a pair of consecutive westbound cycles (the first cycle in the pair is full at three barges; the second cycle is partially full at two barges), and vice versa. Transit times for the first and second eastbound barges in a full cycle are 54 and 88 minutes; and for the only eastbound barge in a partially full cycle is 142 minutes. Transit times for the first, second and third westbound barges in a full cycle are 54, 88, and 122 minutes; and for the first and second westbound barges in a partially full cycle are 176 and 210 minutes. When the simulation ends, the 15th westbound barge has just left the West Canal, and no barges are waiting to enter the Lock-and-Canal System at either end. Average transit time for the 9 eastbound barges that have moved through the system is 94.67 minutes; and for the 15 westbound barges that have moved through the system is 130 minutes.

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Comparison 8 - GPSS/H

Student GPSS/H, Release 3 (1995), was used to model the Canal-and-Lock System of Comparison 8. GPSS/H is a flexible and efficient general purpose simulation language. Models consist of "Transactions" that move from Block to Block, acting out either the flow of entities (barges) or the processing of information/decisions. Experiments are defined with "Control Statements" included as part of the model file.

a) Model Description:

While commonly used GPSS/H Blocks (e.g., SEIZE, ADVANCE, RELEASE) describe the flow of barges, GPSS/H elements such as Logic Switches and GATE and TEST Blocks are used to implement decision making. Block PUTPICs write out trace information for deterministic datasets.

The model consists of about 65 Blocks. About 35% of the model is devoted to expressing the logical complexities of the system.The experiments are described with about 20 Control Statements.

b) Validation with Deterministic Datasets:

The logic of the model was tested with the deterministic datasets. The results match those discussed in the definition. A sample model (configured for Common Random Numbers) is provided on SNE's WWW server (http://eurosim.tuwien.ac.at/sne/).

c) Results and Discussion of Probabilistic Datasets:

GPSS/H supports ARV methodology with RMULT Control Statements. Table 1 shows the six confidence intervals resulting from activities 1, 2 and 3, and grand confidence intervals for the respective sets of three replications. The table indicates the percentage by which use of Antithetic Random Variates reduces the width of the confidence intervals. The reduction ranges from about 20% to 38% and is about 25% for the grand confidence intervals. This is a worthwhile improvement in precision for the modest effort involved in using ARVs.

	Activities 1 and 2	Activity 3 (ARVs)	Decrease in CI
90% Conf Int 1	485.0 ± 43.7	554.2 ± 34.9	20.1%
90% Conf Int 2	506.7 ± 41.0	494.4 ± 25.4	38.0%
90% Conf Int 3	520.3 ± 37.4	480.6 ± 27.4	26.7%
Grand 90% Conf Int	504.0 ± 23.5	509.7 ± 17.5	25.5%

Table 1: 90% Confidence Intervals for Activities 1, 2 and 3

In Table 1, the average barge transit time is about 8 hours. To investigate the effect of randomness, a replication was performed with deterministic barge interarrival times set at 75 minutes, and with the first eastbound and westbound barges arriving at times 0 and 37.5, respectively. The aggregate barge transit time was reduced to 223 minutes, less than 50% of that in Table 1.

Table 2 shows the six confidence intervals resulting from activities 4, 5 and 6 and the grand confidence intervals for the respective sets of three replications. The table indicates the percentage by which the use of Common Random Numbers reduces the width of the confidence intervals. Each reduction is about 89%. This is a dramatic improvement in precision. CRN methodology is supported in GPSS/H by means of RMULT Control Statements.

	Activities 4 and 5	Activity 6 (CRNs)	Decrease in CI
90% Conf Int 1	39.4 ± 71.8	65.5 ± 8.3	88.4%
90% Conf Int 2	62.5 ± 73.6	58.9 ± 7.5	89.9%
90% Conf Int 3	139.0 ± 67.1	54.8 ± 7.4	89.0%
Grand 90% Conf Int	80.29 ± 41.1	59.7 ± 4.5	89.1%

Table 2: 90% Confidence Intervals for Activities 4, 5 and 6

If a 90% confidence interval for the difference in pooled barge transit times (5-barge maximums minus 6-barge maximums) falls entirely above zero, the null hypothesis that the average 5-barge transit time is less than or equal to the 6-barge transit time can be rejected with the probability of a Type I error set at 0.05. Confidence intervals 1 and 2 for activities 4 and 5 in Table 2 include zero, making it impossible to reject the null hypothesis for those simulations. In marked contrast, confidence intervals 1, 2 and 3 for activity 6 are each positioned far above zero and provide strong evidence that changing from 5-barge to 6-barge maximums will decrease the average barge transit time (by about 1 hour). With CRN the merits of the 6-barge maximum stand out sharply, whereas the non-CRN experiments provide inconclusive evidence and set up the need for additional experimentation.

The Table 1 and 2 summaries were produced by writing replication results from the GPSS/H model into ASCII files, then importing them into Excel 5 for analysis with Excel's Descriptive Statistics capability.

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Comparison 1 - 20-Sim

20-Sim is an interactive software package for modeling, simulation and analysis of dynamic behavior of engineering systems, that runs on PC-Windows and SUN-SPARC computers. Models can be specified as bond graphs, block diagrams or as formulas. Hierarchical modeling is supported: Bond-graph / block-diagram models consist of submodels which can contain submodels themselves. Nonlinear model parts can easily be described as equation submodels. Facilities for navigation through the hierarchy are provided for. Essential of 20-Sim is the handling of hierarchically structured block-diagram and a-causal bond-graph models which are entered graphically and automatically processed to simulation models. Simulation runs are handled interactively. Results are shown instantly as a graph, and can also be output to Matlab. This means that the 20-Sim simulator actually is an interpreter of its own assembly language. DAE solvers are included for simulation of stiff systems or systems containing algebraic constraint equations (like algebraic loops). More insight in the results can be obtained using the wireframe animation facility (on the SUN only).

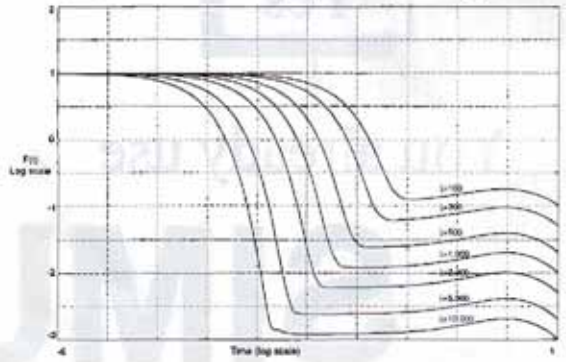
Model description: Despite the graphical modeling facilities for bond graphs and block diagrams, this comparison is specified as an equation main model (listing below, keywords marking different sections printed in bold). Since the 20-Sim simulator does not support logarithmic scales, these need to be specified in the model. Parameter values and further experiment specification are specified interactively in the simulator.

```
class litcl version 1
# Lithium Cluster Dynamics, Comparison 1#
parameters
   real pt
   real kr,  dr, lf, kf, dm
variables
   real ft,  dft, mt, dmt, rt, drt
   real krmf, drr, dmm, kfff
   real logtime, logFt
equations
# Compute the intermediate results
   drr = dr*rt
   krmf = kr * mt * ft
   dmm = dm * mt
   kfff = kf * ft * ft
# The differential equations
   drt =  -drr + krmf
   dmt = drr - krmf - dmm +kfff
   dft = drr - krmf + 2*dmm - 2*kfff - lf*ft + pt
   ft = int(dft)
   rt = int(drt)
   mt = int (dmt)
   logtime = if t > 10e-8 then  log10 (t) else -8
   logFt =  if ft > 10e-10 then log10 (ft) else -10
```

Results task a) Comparison of integration algorithms: The stiff system was simulated over a 10s perod of time, using each of the 4 integration algorithms available in 20-Sim. The Runge-Kutta 4th order method is the classical one; the BDF method is the Backward Differential Formula with variable order (up to 5) and variable step size. Timing was done with the available timing-facility, using a standard Windows timer, having a resolution of about 0.1 s. The table below shows the computation times in seconds for a 90 Mhz Pentium and a 40 Mhz 486 DX with 4 MB ram, for the integration algorithms (different timesteps, in case of BDF different abs/rel errors) with number of model evaluations.

Method	Timestep or Error	# Eval	Pentium	80486
Euler	0,001	10.001	2,1	8,8
Adams Bashfort2	0,0001	100.001	22,8	455
RungeKutta 4	0,001	40.001	3,8	17,3
RungeKutta 4	0,002	20.001	2,0	8,9
RungeKutta 4	0,0025	16.001	1,6	7,3
BDF	0,01/0,001	223	0,1	0,2
BDF	0,001/0,0001	285	0,1	0,3
BDF	0,001/0,000001	301	0,1	0,3

Results task b) Parameter sweep: Multiple run facilities are not (yet) available in 20-Sim. Therefore, the specified sweep of l_f (100-10^4, log scale) must be done by hand. This is not a real problem, since the parameter specification subwindow can stay on the screen while performing the sweep. We used BDF with $10^{-3}/10^{-6}$ as abs/rel error. The indication of l_f values in the figure is added using CorelDraw (using the export features of 20-Sim results (Clipboard, WMF)).



Results task c) Steady state calculation: 20-Sim has no special steady-state finder. The steady state is computed using a large simulation end-time. We used BDF with $10^{-3}/10^{-6}$ as abs/rel error. The results are given below and are clearly within the specified error range. Also the simulation times for both the Pentium and the 80486 are included.

Tend	p	f	m	r	#eval	Pentium	80486
1000	0	10^{-13}	10^{-13}	10^{-11}	264	0,1	0,3
1000	10^4	10	9,99891	999,88	264	0,1	0,3
10.000	0	10^{-20}	10^{-18}	10^{-17}	333	0,1	0,4
10.000	10^4	10	10	1000	333	0,1	0,4

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Comparison 7 - ANA 2.x

Short description: ANA 2.x is a software package for system analysis and simulation of linear, nonlinear and switching systems as well as fuzzy- and artificial neural network systems. Furthermore it can be used for system identification and hardware in the loop applications based on standard PC boards (e.g. Intelligent Instrumentation 40.428W-3). The model description language ANAmdl is equipped with a powerful mechanism for handling time events as well as state events and the model built is supported by the integrated development environment ANAide, which comprises a graphical circuit editor, special editors for artificial neural networks, fuzzy systems and visualization tools. ANA 2.x is developed at the "Institut for Electrical Control Engineering", at the Vienna University of Technology and is available for Windows 3.1, Windows 95, Windows NT, HP-UX 9.x/Motif 1.2 and PC-Linux.

Model description: Each type of block element is defined by an ANAmdl description, which acts as a template if the block is used. This template COMP7-block shows the nonlinear case:

```
BLOCK COMP7;
OUTPUT
  Phi "[rad] angle";
  Omega "[rad/s] angular velocity";
PARAMETER
  l = 1 "[m] length";
  m = 1.02 "[kg] mass";
  d = 0.2 "[kg/s/rad] damping";
  Phi0 = PI/6 "[rad] start angle";
  Omega0 = 0 "[rad/s] start angular velocity";
  lp = 0.7 "[m] distance of pin";
  phip = -PI/12 "[rad] angle of pin";
STATE
  phi "[rad] angle";
  omega "[rad/s] angular velocity";
VAR
  g DISCRETE "gravity";
  ls DISCRETE "shortened length";
  la "actual length";
  state DISCRETE;
SIM
  SWITCH state
  CASE 1:  la = l;  ONRISE phi < phip DO SetState2;
  CASE 2:  la = ls; ONRISE phi >= phip DO SetState1;
  ENDSWITCH
  phi .= omega; omega .= -g/la*SIN(phi) -d/m*omega;
  Phi = phi; Omega = omega;
ENDSIM
PROCEDURE SetState2; // shorten the length
  state = 2; omega = omega*l/ls; STORE ALL;
ENDPROCEDURE
PROCEDURE SetState1; // enlarge the length
  state = 1; omega = omega*ls/l; STORE ALL;
ENDPROCEDURE
INIT
   g = 9.81; ls = l - lp; state = 1;
   phi = Phi0; omega = Omega0;
ENDINIT
ENDBLOCK COMP7;
```

The ONRISE condition is constantly checked to trigger a call to the associated PROCEDURE.

Results task a): The times when the pendulum hits and leaves the pin are as follows (exact recording due to STORE ALL statement):

```
i)  Hits:    0.70345948576217 2.5904179874725 4.5427413901675 6.6487071380538
i)  Leaves: 1.1517797076385  2.9905290566084 4.8674877938643 6.7203641682778
ii) Hits:                    1.7587857852303 3.749058939195  5.8135334132632
ii) Leaves: 0.18737822412985 2.0911953942978 4.0183042019649 5.9416210985364
```

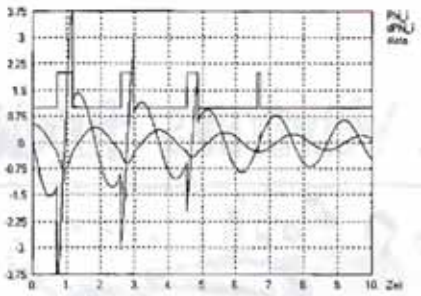


Figure 1:
Phi0 = PI/6,
Omega0=0,
d = 0.2,
Phip = -PI/12

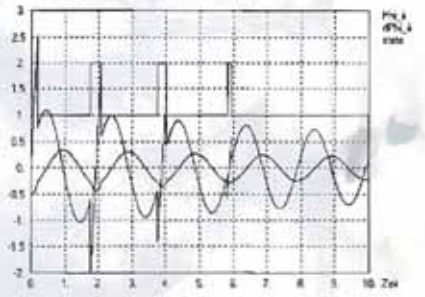


Figure 2:
Phi0 = -PI/6,
Omega0=0,
d = 0.1,
Phip = -PI/12

Results task b): ANA 2.x supports two methods for the comparison of different models. The models may be simulated either in parallel or the result of the simulation can be obtained from a file.

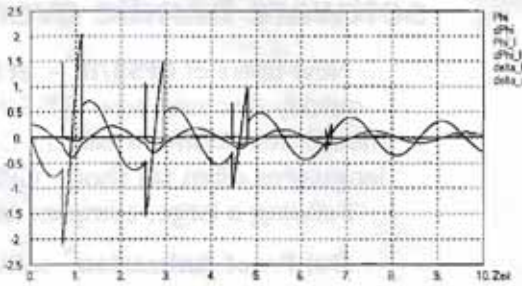


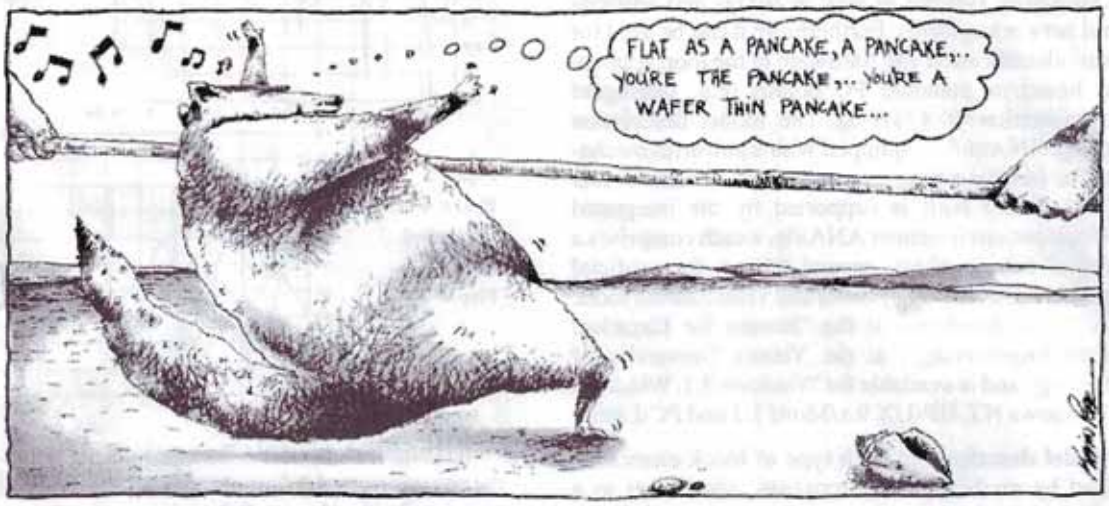
Figure 3: Comparison of linear and nonlinear case

Results task c): ANA 2.x has no special facilities for automatic parameter variation so far but fast variation of the initial parameters is possible by manual interaction. Using state event and simulation precision of 1e-12 the following two obvious solutions can be found in about five minutes manual work: Omega0(1) = 2.29108565016, Omega0(2) = -2.1847008225

The ANA 2.x system is free of charge. The base system can be obtained by anonymous ftp to ftp://ftp.iert.tuwien.ac.at/ana2. Information on our WWW server: http://www.iert.tuwien.ac.at/ana2.

Johannes W. Goldynia, Institute for Electrical Control Engineering, Vienna University of Technology, Gusshausstr. 27-29/375, A-1040 Vienna, Tel. +43-1-58801 5220, Fax +43-1-5058907, email: goldynia@iert.tuwien.ac.at

THE WOLVERINE'S FLEXIBILITY CONTINUES TO AMAZE USERS



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Faculty of Mechanical Engineering, University of Ljubljana, Slovenia

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Laboratory of Experimental Mechanics (**LEM**), Head: Prof. I. Emri, 12 researchers, tel: +386 61 1771-117, fax: +386 61 218-567, email: igor.emri@fs.uni-lj.si

Laboratory of Process Control (**LPC**), Head: Prof. Z. Kariz, 3 researchers, tel: +386 61 1771-213, fax: +386 61 218-567, email: zoran.kariz@fs.uni-lj.si

Laboratory of Electricity and Digital Systems (**LEDS**), Head: Prof. A.Hussu, 2 researchers, tel: +386 61 1771-314, fax: +386 61 218-567, email: alojz.hussu@fs.uni-lj.si

Laboratories activities

The research activities of the LNMS comprise: - numerical methods (FEM, BEM, FDM); - mathematical modelling and numerical analyses of non-linear continuum mechanics, contact mechanics, heat transfer and electromagnetism problems; - computer simulation of complex industrial problems and optimization of technological parameters.

The LEM work is focused on: - fundamental research (constitutive modeling of nonlinear behaviour of time depending materials, characterization and modeling of material functions, characterization of fracture); - applied research and development (development of new measurement methods and measurement systems (computerized measurement of physical values (forces, displacements), computer control of machines and facilities); development of general software, automation of measurement, and other processes; development and design of products, tests of static and dynamic properties of materials and structures); - routine measurements.

The LPC activity comprehends the - mathematical and computer modeling of control systems; - synthesis of (optimal) control systems; - research of water turbine control systems; - study of nonlinear systems stability

The LEDS research activity includes: - writing software routines for solving numerical problems connected to simulations and parameter optimization (gradient, evolutionary, and other methods); - developing a BONK software package for analysis of linear systems described by bond graphs, and a BONDN package for systems including nonlinearities (single and multiple-valued); - modeling and analysis of fuzzy controllers; - modeling of heating systems, development, and analysis of adaptive processes; - modeling of water-hammer , mechanical and electrical systems etc.

Software equipment

The LNMS: FEM codes COSMOS/M, ABAQUS, FORGE2. CAD packages AutoCAD and IDEAS. Software compilers Fortran FTN77, Borland C++.

The LEM: IDEAS, MCS- Nastran, Rheologicon, Tensalum, and Maple V programme packages

The LPC: ANA, MATRIXx, MATLAB-SIMULINK programme packages for control systems analysis and design

The LEDS: C++, Delphi, MathCAD, different assemblers for microprocessors, BONK, and BONDN programme packages for dynamic systems analysis.

Achievements

The LNMS: In the laboratory 25 B.Sc., and 8 M.Sc. theses were done, while 2 Ph.D. theses are to be finished shortly. The members of the laboratory published 1 text book for students and 12 papers in international journals. About their research they reported on 42 international conferences, 53 research and development projects were realized. An international project "COPERNICUS JRP- Computer Aided Process Simulation of Iron Mushy State Forging" is currently going on.

The LEM: 30 B.Sc., 6 M.Sc., and 3 Ph.D. were made. Over 100 papers have been published, mostly in international journals covering the problems of Mechanics of Time Dependent Materials, Experimental Mechanics, and Characterization of Materials. Also a textbook is to be published shortly. The head of this laboratory prof. I. Emri together with prof. W.G.Knauss set up the nonlinear visco-elastic model of stress-strain ralations in "time depending materials" and with Prof. Tschoegl the algorithm for the determination of mechanical spectra . An intense cooperation with the Caltech (Pasadena, California), Friedrich Alexander Universität (Erlangen, Germany), University of Waterloo (Waterloo, Canada), and Technische Universität München (Germany) has taken place.

The LPC : 20 B.Sc., 2 M.Sc, and 1. Ph.D were made here. 15 apers were presented at several international meetings, 2 textbooks have been published. The members of the lab entered into a research cooperation with the University of Waterloo (Ontario, Canada).

The LEDS: Over 10 B.Sc., 2 M.Sc.. More than 50 publications.

Hybrid Environment for Prototyping of Intelligent Supervisory Systems

In this report an attempt is made to integrate two software environments, i.e. Matlab/Simulink and G2 in a consistent way with the goal of providing for a full range of features from pure numerical computation to knowledge based reasoning. The resulting environment is aimed at efficient prototyping of intelligent supervisory systems.

1. Introduction

Traditional CAD systems support mainly one way of information processing, i.e. that based on analytical methods. As such they play an important role, particularly in feedback control systems design. However, in case of supervisory system design they are not flexible enough to accommodate the knowledge-based paradigms, mainly because the traditional model based techniques are inadequate for explanation of supervisory actions. Realization of these tasks stresses the need for rule-based programming which is not encountered in the traditional CAD tools [3,4].

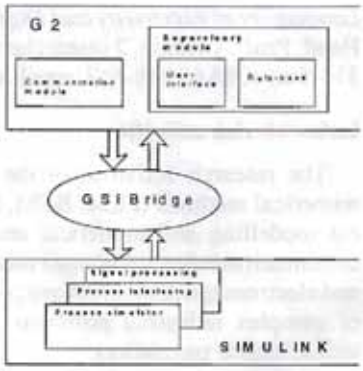
This article reports an attempt towards integration of two powerful tools, i.e. Matlab/Simulink and G2, in a hybrid environment [5]. The former has resulted from rich development in the field of control and simulation during the last decades. On the other hand, G2 represents a strong object - oriented environment, combining knowledge - based techniques with conventional programming techniques [1]. It is quite natural to merge these two environments in a hybrid one in order to allow for simultaneous computational and knowledge processing power.

The environment is intended to support design, development and validation of intelligent supervisory systems both for continuous and batch processes. In its present version, the hybrid environment allows for prototyping of the supervisory control systems only on the simulation level. However, the current configuration of the environment is planned to be extended in order to provide systematic testing of the supervisory systems directly on the pilot plants.

2. Realization of the environment

From the user's point of view the environment is composed of two levels. The lower level functions are addressed to Matlab/Simulink whilst the higher ones are performed within G2. The lower level performs simulation tasks and, when required, interfacing to the real process. Matlab/Simulink module (Fig.1) supports G2 by taking over simulation and exhaustive analytical computational tasks.

All functions that concern rule processing tasks and prototyping of the graphical user interface belong to the higher level. The higher level - addressed to G2 - is composed of two modules: *communication* and *supervisory module*. The first one is general for all G2 applications in which connection with the external world is required. In this module all the specifications and parameters for communication with the GSI bridge are determined. The second one is application specific and performs process supervisory functions. There are two main modules within G2 that serve to accomplish these functions (Fig. 1). The first module is a *rule-base* which consists of a set of rules that serve to analyze data coming from the supervised process, provide decisions about alarms and detect faults. *User interface* is an independent module which is designed to provide interface with the process operator.



The GSI bridge acts as an interface between G2 and Simulink. It is generated by linking GSI libraries, user code and external system API (Application Program Interface). GSI libraries serve for establishing and managing the communication link to G2. All data requests from G2 and Simulink are served by calling the appropriate user code functions that handle those requests. The user code is written in GNU C and is application specific. It acts as an interface between GSI and Simulink. Its main tasks are processing G2 requests and reacting to events in Simulink.

Link between Simulink and GSI bridge is established using S - functions in the Simulink block scheme. This block is based on a program written in C that consists of several functions which provides interaction with Simulink.

Communication protocol between processes and data transfer are realized using BSD socket based Inter Process Communication (IPC) [2]. There are two

sockets created for data transfer between GSI and the simulation process. The first socket is used for giving initial data values for the simulation model and for changing these values from G2 when desired. The second one is used for data values which G2 requires from the external system. Along with the two data sockets there are also two control sockets needed for transferring control signals among processes.

The entire environment is realized on a SUN Sparc10 workstation under Solaris 2.4.

3. References

[1] Arzen, K.E. A: Survey of Commercial Real - time Expert System Environments. Proc. IFAC/IFIP/IMACS International Symposium on AI in Real-Time Control, Delft University of Technology, The Netherlands, pp. 611 - 618, 1992.

[2] Comer et al.: Internetworking with TCP/IP. Vol. III, Client - Server Programming and Applications: BSD socket version. Prentice - Hall International Inc, 1993.

[3] Jobling, C.P.: User Interfaces and the Role of Artificial Intelligence in Computer Aided Control Engineering. In a book: Boulart et al: Application of Artificial Intelligence in Process Control. Pergamon press, 1992.

[4] Verbruggen H.B., A.J.Krijgsman, P.M.Bruijn and R.Jager: Artificial intelligence in Real-Time control., in *Applied Control*, S. Tzafestas, ed., Marcel Dekker, 1993.

[5] Znidarsic, A., D.Juricic, M. Kavcic: Hybrid environment for prototyping of Intelligent Supervisory Systems. Electrotechnical review, Vol.62, No. 3 - 4, pp. 232 - 242, 1995.

Alenka Znidarsic, Dani Juricic, Mateja Kavcic, Jozef Stefan Institute, Dept. of Computer Automation and Control, Jamova 39, SLO-61111 Ljubljana, Slovenia, Email: alenka.znidarsic@ijs.si

Industry News

Simulation Software Designed for Windows 95

In November 1995 Systems Modeling Corporation announced the release of Arena 2.0, simulation software for Windows 95. Arena is the first simulation software package to be designed exclusively for the Microsoft Windows 95 operating system.

Arena 2.0 provides a comprehensive environment for building and animating simulation models in a wide variety of applications. Because version 2.0 is a true 32-bit application, fully compatible with Windows 95 and Windows NT, it incorporates all the powerful and convenient features found in those operating systems.

Contact: Systems Modeling Corporation, The Park Building, 504 Beaver Street, Sewickley, PA 15143, USA, Tel: +1-412 741 377, Fax: +1-412 741 5635

AutoSimulations spins into the World Wide Web

The AutoSimulations Web site provides: product information, customer support from qualified technicians, consulting services from expert engineers, world wide regional sales contacts, product tips and a section for career opportunities within AutoSimulations: http://www.autosim.com

Contact: Karen Stanley, AutoSimulations Inc., 655 Medical Drive, Bountiful, Utah 84010, Tel: +1-801 298 1398 ex. 300, Fax: +1-801 28 8186

Simulation and the IEC publication 555-2

The simulation package CASPOC enables you to model and simulate a power electronics circuit, analog or digital control, electrical machines and behavioral equations of drive systems, components or other devices. Modeling is based on a Spice-like netlist, a block diagram and modeling language such as Pascal or C.

Newly built equipment has to comply to the IEC publication 555-2 concerning the limits on generated harmonics. Caspoc recently includes a new module to test the level of produced harmonics in a simulation and compares them to the IEC 555-2 limit. If the harmonics are exceeding the limit, the redesign of the converter can be done in the simulation.

Student version, tutorial examples and free demo version are available. Prices starting at US$ 60.-

Contact: Simulation Research, P.O.Box 397, 2400 AJ Alphen aan den Rijn, The Netherlands, Tel/Fax: +31-172492353

3-D Animation by dSPACE

dSPACE GmbH has announced a new 3-D animation tool to support its DSP-based development systems for hardware-in-the-loop simulation. To be called "Real/Motion", the 3-D capability has already proven itself as part of a successful project at Audi in Germany. The DSP model computes animation data, transfers it to the animation program and displays the motion in real-time. RealMotion operates under Windows NT.

Contact: dSPACE GmbH, Technologiepark 25, D-33100 Paderborn, Tel: +49-5251 1638-0, Fax: +49-5251 66529, email: info@dspace.de

20-SIM / CAMAS

Controllab Products inc. issues 20-SIM, a software package for modeling and simulation of dynamic systems. The package has been developed at the Control Laboratory of the University of Twente under the name CAMAS, to be the successor of the famous TUTSIM package.

Contact: Controllab Products inc., P.O.Box 217, 7500 AE Enschede, Phone: +31-53-4893096, Fax: +31-53- 4892223, email: clp@rt.el.utwente.nl, www: http://www.rt.utwente.nl/20sim

International Conference
HPCN challenges in telecomp and telecom:
Parallel simulation of complex systems and large-scale applications
10 -12 June 1996, Delft, The Netherlands

Organized by the Dutch Benelux Simulation Society (DBSS) on behalf of EUROSIM. Topics are High Performance Computing-developement, High Performance Computing and Simulation- applications, High performance Networking, Multi Processor Communication Structures and Systems.

Programme

Apart from the invited lecturers aprroximately 90 papers will be presented. Registration is possible on Monday, 10 June 1996 from 8.00 - 9.30, the programme will start at 9.30 hrs. A reception at the Old Town Hall will also be held on 10 June and on 11 June an optional conference dinner will be organized.

Invited Lecturers

C.H. Cap, Switzerland: Large networks of workstations: the mythical poor man's supercomputer?
J.W.M. Kummeling, The Netherlands: The importance of a mechatronic approach
E. Shapiro, United States of America: The metamorphosis of the supercomputer
E. Shapiro, United States of America: Survey lecture presenting the overall HPCN picture of the topics highlighted during the Delft Eurosim 1996 conference
T.E. Tezduyar, United States of America: High performance computing in flow simulations
D.O. Williams, Switzerland: A review of wide-area aspects of high performance networking

Special Items

During the conference a special session - High Performance Computing in Environmental Modelling - is devoted to an important problem of society: the preservation of our environment and especially the role HPCN can play. HPCN has reached the point where engineers and applied scientists can now develop and apply complex environmental models.
Information on this Workshop Prof.Dr.Ir. A.W. Heemink, Delft University of Technology, Dept. of Applied Mathematics and Informatics, Mekelweg 4, 2628 CD Delft, The Netherlands. Telephone +31 15 2785813, Telefax +31 15 2787209, E-mail: a.w.heemink@math.tudelft.nl

NOWESP Workshop

Thursday, 13 June 1996, 9.30 - 17.00 hrs. the NOWESP workshop will take place, which can be seen as a continuation of the special session. Participation in this workshop only is possible. NOWESP (North West European Shelf Project) is a project of the MAST II programme of the EU. One of its tasks is to gather data on various transport processes on the entire European Continental Shelf, which includes the North Sea and The Channel. Another task is to start the development of a new generation numerical flow and transport models by exploiting the possibilities of massively parallel processing. Especially for the densely populated countries around the North Sea, the modelling of the transport of pollutants and the simulation of pollution reduction scenarios are becoming more and more important in view of the growing awareness of damaging effects.

Exhibition

There will be an exhibition, both commercial and scientific, during the whole conference. If you are interested to take part in this exhibition, please contact Congress Office ASD.

Information

Second/Final Announcement The Second/Final Announcement has been mailed in January 1996, including a.o. the provisional programme and a registration form. If you have not received this brochure, please contact the conference bureau.

On-line Information: http://www.twi.tudelft.nl/Conferences/EUROSIM/index.html or http://eurosim.tuwien.ac.at/conferences/

Information and Correspondence:
Congress Office ASD,
P.O. Box 40, 2600 AA Delft, The Netherlands
Tel: +31 15 2120234, Fax: +31 15 2120250
Email: HPCN-Eurosim@TUDelft.nl

Book Review

Control and Optimization,
B. D. Craven, Chapman and Hall 1995,
ISBN 0-412-55890-4, x + 193 pages

"Many questions of optimization, and optimal control, arise in management, economics and engineering" (start of the preface) - this book tries to present a systematical theory of optimal control, in relation to a general approach to optimization, applicable in other contexts as well.

In the first two chapters the ideas and backgrounds of optimization are briefly sketched and some introductory optimal control models are discussed.

Chapter 3 and 4 deal with the mathematical basis: convexity, linearization and multipliers, and optimality conditions for control problems (including Pontryagin's maximum principle). Chapter 5 presents some worked examples of control problems. Up to this point the book deals with analytical methods and tools for optimization. Chapter 6 gives a good insight into (numerical) algorithms for optimal control. It starts with "However, many optimization problems - including most optimal control problems - involve nonlinear functions", and with sketching the problems arising with numerical algorithms: distinction between global and local optima, convergence and convergence rate, discretization, sensitivity analysis. The chapter discusses in detail New-ton's method, descent methods, conjugate gradient algorithms (including different implementations as Fletcher-Reeves and Polak-Ribiere), Quasi-Newton algorithm, line search, penalty methods, augmented Lagrangian algorithm, quadratic programming, sequential quadratic algorithm, projected gradient. Furthermore, Bang-bang control, iterations using Pontryagin's principle, and problems with non-smoothness are discussed. The closing chapter 7 presents a proof of Pontryagin's maximum principle, which can be understood also by "non-experts".

The book is mainly intended as introduction to optimal control and optimization for graduate students, and for teaching. Chapter 6 (discussed above in more detail) makes it interesting also for simulationists, who have to deal with optimization problems and/or with optimal control in continuous models.

F. Breitenecker, Technical University Vienna

Calendar of Events

April 1996

18-20 *7. Ebernburger Gespräche ASIM-AK-Treffen "Simulation in Medizin, Biologie und Ökologie.* Bad Münster, Germany
Contact: Prof. Dr.-Ing. T. P. F. Möller, Institut für Informatik, TU Clausthal, Erzstraße 1, D-38678 Clausthal Zellerfeld, Germany, Tel: +49 -5323 722504, Fax: +49-5323 723572, Email: MOELLER@vax.in.tu-clausthal.de.

23-25 **MOSYS '96** Modelling and Simulation of Systems. Krnov, Czech Republic
Contact: Jan Stefan, Comp. Science Dept., FEI VSB-Tech. University, tr. 17. listopadu 15, CS - 708 33 OSTRAVA Poruba, Czech republic,

May 1996

22-27 **GA+ES 96** Genetic Algorithms and Evolutionary Simulation. Yalta, Ukraine
Contact: GA+ES 96, 20, Stromynka Street, 107076 Moscow, Russia, Tel/Fax: +7-095 9171719, Email: eg@glorioz.msk.su.

29-30 **ZEL '96** Computer Control and Simulation of Transport Systems. Zilina, Slovak Republic
Contact: Mikulas Alexik, VSDS - KTK, Velky Diel, SQ - 010 26 ZILINA, Slovak republic, Tel:+42 - 89 - 54042, Fax:+42 - 89 - 54806e-mail: alexik@frtk.utc.sk.

June 1996

02-06 **ESM 96** European Simulation Multiconference. Budapest, Hungary
Contact: A. Jávor, KFKI Research Institute for Measurement and Computing, P.O.Box 49, H-1525 Budapest, Tel: +36-1-1699499, Fax: +36-1 1601290, Email: javor@sunserv.kfki.hu.

10-12 **HPCN96** HPCN challenges in telecomp and telecom: parallel simulation of complex systems and large-scale applications. Delft, The Netherlands
Contact: Congress Office ASD, P.O. Box 40, NL - 2600 AA Delft, The Netherlands, Tel: +31 15 2120234, Fax: +31 15 2120250, Email: HPCN-Eurosim@TUDelft.nl.

11-13 **SIMS'96** 38th Annual Simulation Conference. Trondheim, Norway
Contact: Torleif Iversen, SINTEF Automatic Control, N-7034 Trondheim, Tel: +47-73594474, Fax: +47-73594399, Email: Torleif.Iversen@regtek.sintef.no, http://www.itk.unit.no/SINTEF/sims96.html.

11-12 ***Workshop "Visualisierungsverfahren beim Einsatz der Simulationstechnik in Produktion und Logistik".*** Dortmund, Germany
Contact: Sigrid Wenzel, Fraunhofer-Institut f. Materialfluss und Logistik, Joseph-von-Fraunhofer-Str. 2-4, D-44227 Dortmund, Tel: +49-231 9743 237, Fax: +49-231 9743 234, Email: wenzel@iml.fhg.de.

14 ***Meeting of the ASIM Working Group "Verkehrssimulation".*** Zürich-Schlieren, Switzerland
Contact: H. Mnch, SIEMENS AG, VT2 SYS, Ackerstr. 22, D-38126 Braunschweig, Tel: +49-531 226 2225, Fax: +49-531 226 4305.

18-21 **ITI'96** ITI'96 - 18th International Conference "Information Technology Interfaces". Pula, Croatia
Contact: Branka Radic, University Computing Centre, J. Marohnica bb, HR - 41000 Zagreb, Tel: +358-1-518-656, Fax: +358-1-518-656, Email: iti@srce.hr, http://www.srce.hr/iti/.

July 1996

01-05 **ICMMB '96** 9th International Conference on Mechanics in Medicine and Biology. Ljubljana, Slovenia
Contact: A. Kregar, Cankarjev dom, Cultural and Congress Centre, Presernova 10, 61000 Ljubljana, Slovenia, Tel: +386 61 1767 133, Fax: +386 61 217 431.

08-10 **CESA'96** IMACS International Conference on Computational Engineering in Systems Applications. Lille, France
Contact: Prof. P. Borne, Ecole Centrale de Lille, 59651 Villeneuve D'Ascq Cedex, France, Tel:+33-20-33-53-28, Fax: +33-20-33-56-99, Email: pborne@ec-lille.fr.

21-25 **SCSC'96** Summer Computer Simulation Conference. Portland, Oregon
Contact: SCS International, P.O. Box 17900, San Diego, CA 92177, USA, Tel: +1-619 277 3888, Fax: +1-619 277 3930, Email: scs@sdsc.edu.

September 1996

10-12 **Workshop "Advanced System Simulation"**. Zabreh na Morave, Czech Republic
Contact: Jan Stefan, FEI -VSB TU, tr. 17. listopadu, 708 33 Ostrava Poruba, Czech republic, Email: Jan Stefan@vsb.cz.

16-19 **ASIM 96** 10. Symposium Simulationstechnik ASIM. Dresden, Germany
Contact: Prof. Dr. W. Krug, DUAL ZENTRUM Dresden, Gillesstraße 2, D-01219 Dresden, Tel: +49-351 47791 0, Fax: +49-351 47791 99.

19-21 **Simulation, Gaming, Training and Business Process Reengineering in Operations**. Riga, Latvia
Contact: Dr. Galina Merkuryeva, Riga Technical University, 1, Kalku Street, LV-1658 Riga, Latvia, Tel: +371-7324480, Fax: +371-7820094, Email: CONF96@ITLPRO.ITL.RTU.LV, WWW: http://www.itl.rtu.lv/Riga_Conf96.

30-October 2
GCB '96 German Conference on Bioinformatics. Leipzig, Germany
Contact: R. Hofestdät, Universität Leipzig, Inst. f. Medizinische Informatik und Statistik, Liebigstr. 27, D-04103 Leipzig, Email: ralf@imise.uni-leipzig.de.

October 1996

24-26 **ESS'96** European Simulation Symposium. Genova, Italy
Contact: Philippe Geril, SCS European Simulation Office, University of Ghent, Coupure Links 653, B-9000 Ghent, Tel: +32-9-2337790, Fax: +32-9-2234941, email: philippe.geril@rug.ac.be, WWW: http://hobbes.rug.ac.be/~scs/.

December 1996

08-11 **WSC 96** 1996 Winter Simulation Conference. Coronado, CA, USA
Contact: J.J. Swain, University of Alabama, Dept. Industrial and Systems Engineering, Huntsville, AL 35899, USA, Tel: +1-205 895 6749, Fax: +1-205 895 6733, Email: jswain@ebs.330.eb.uah.edu.

February 1997

05-07 **2nd MATHMOD** IMACS Symposium on Mathematical Modelling. Vienna, Austria
Contact: Prof.Dr. Inge Troch, Techical Univ. Vienna, Dept. Simulation Technique, Wiedner Hauptstr. 8-10, A-1040 Vienna, Austria, Tel: +43-1-58801-5367, Email: Inge.Troch@tuwien.ac.at.

March 1997

6. Symposium "Simulation als betriebliche Entscheidungshilfe". Braunlage, Germany
Contact: Prof. Hummeltenberg, Universität Hamburg, Inst. f. Wirtschaftsinformatik, Max-Brauer-Allee 60, D-22765 Hamburg, Tel: +49-40 41234023, Fax: +49-40 41236441.

April 1997

23-25 **UKSS'97** United Kingdom Simulation Society Conference. Keswick, U.K.
Contact: Prof. G. Birtwhistle, The University Leeds, School of Computer Studies, Leeds LS2 9JT, UK, Tel: +44-113 243 1751, Email: graham@scs.leeds.ac.uk.

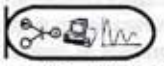
August 1997

25-30 **15th IMACS World Congress**. Berlin, Germany
Contact: Prof.Dr.A. Sydow, GMD FIRST, Rudower Chaussee 5, D-12489 Berlin, Tel: +49-30 67045610, Email: sydow@prosun.first.gmd.de.

April 1998

14-17 **EUROSIM '98** EUROSIM '98 European Simulation Congress. Helsinki, Finland
Contact: Kaj Juslin, VTT Automation, P.O. Box 1301, FIN-02044 VTT, Tel: +358-0 4566 422, Fax: +358-0 4566 475, Email: Kaj.Juslin@vtt.fi, http://eurosim.tuwien.ac.at/.

An extended version of the calendar of events can be found on WWW: http://eurosim.tuwien.ac.at/conferences/.



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Congress EUROSIM'95 - Software Products and Tools	F. Breitenecker, I. Husinsky 3-901608-02-8
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EUROSIM Comparison 2 - Solutions and Results	F. Breitenecker, I. Husinsky 3-901608-08-7

EUROSIM - Simulation News Europe

Scope: Information on simulation activities, membership information for European simulation societies, comparisons on simulation techniques

Editors: *F. Breitenecker, I. Husinsky ARGE Simulation News*

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