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Simulation News Europe

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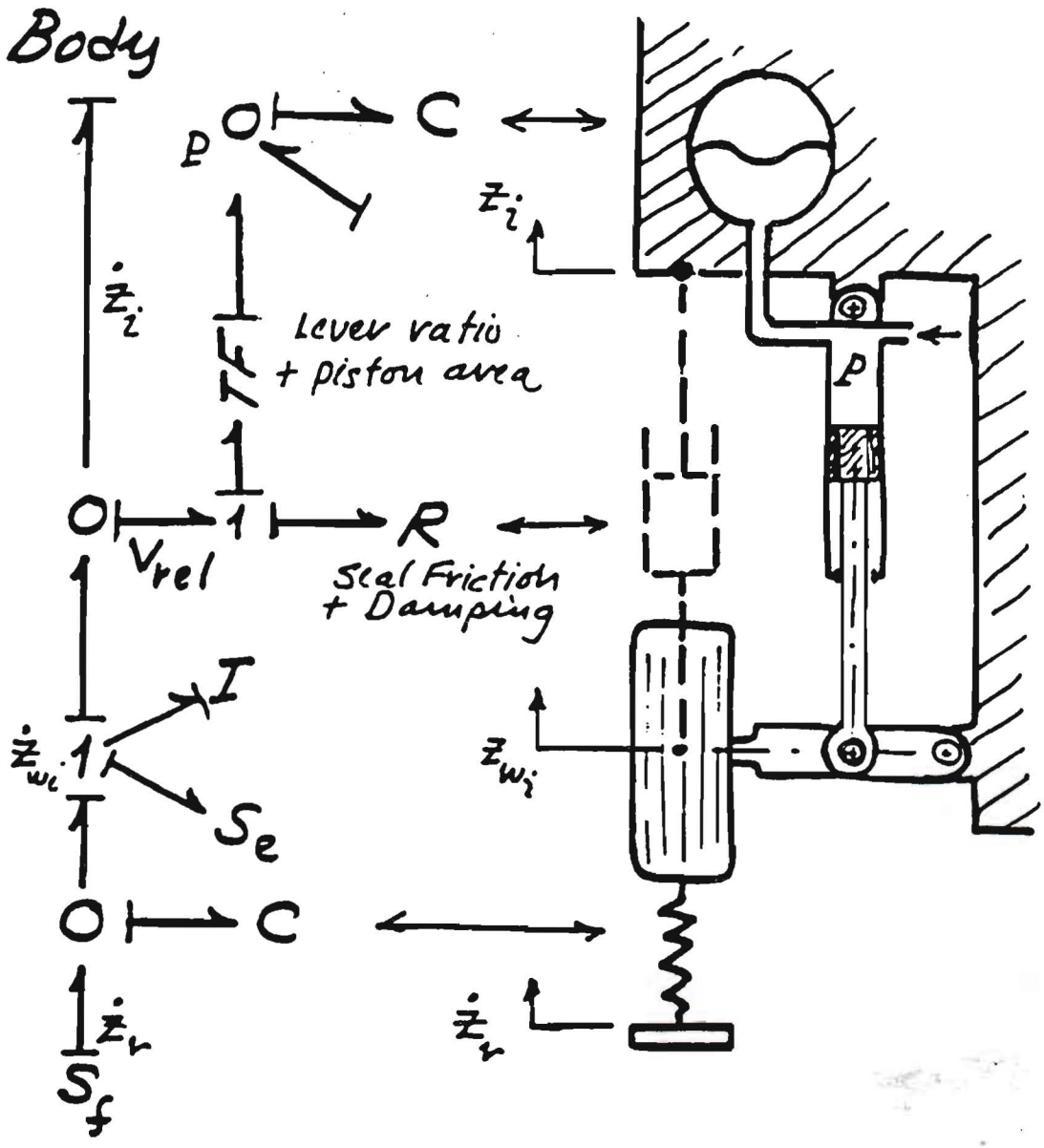

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Readership Information

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 2000. EUROSIM - Simulation News Europe is distributed by all member societies to their individual members (as part of the membership services). In order to promote the idea of simulation in Europe, EUROSIM - Simulation News Europe is distributed to institutions, libraries, and specific persons dealing with simulation, furthermore to simulation groups in the former East European countries. These activities are possible through advertisement sponsoring. For extra copies, product announcements, advertisements, and other organisational affairs please contact the editors.

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Mrs. Irmgard Husinsky

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Editorial Board of the European Simulation Societies:

Editorial

We started the newsletter **EUROSIM - Simulation News Europe** in November 1990 and it appeared regularly with three issues a year. The idea is to promote simulation in Europe by publishing information related to simulation. All member societies of EUROSIM, The Federation of European Simulation Societies, distribute **EUROSIM - Simulation News Europe** to their members as part of their membership services. A lot of information on the activities of these societies is spread via this newsletter.

EUROSIM - Simulation News Europe has been produced at the Technical University of Vienna, by F. Breitenecker and I. Husinsky as editors. We are maintaining contacts, we do promotion and advertising, we edit the incoming contributions and do the layout ourselves using desktop publishing equipment. Up to now the newsletter was also printed in Vienna and we sent the copies to the different societies.

We are happy to announce that beginning with the next issue **EUROSIM - Simulation News Europe** will be published by Elsevier Science Publishers and will also be included in the new scientific journal "Simulation Practice and Theory". We have been asked to continue our work as editors, producing the contents of the newsletter in Vienna as before. You will observe a change in the format of the newsletter. There will be a new title page and we will have to restrict the number of pages per issue.

Regarding the contents of the newsletter we will continue to publish essays on simulation, reports from EUROSIM member societies, reports from international societies, presentations of simulation centers, industry news, book reviews, discussion forum, a calendar of events, etc. and advertisements. A main point will remain the software comparisons, having been very popular up to now.

We would like to take the opportunity to express our thanks to all who contributed once or regularly to our newsletter and helped to make it a success. Especially we thank the members of the Editorial Board of the European Simulation Societies for their regular inputs and are looking forward to continued good co-operation. Also we appreciate the support by the Technical University of Vienna where we can use valuable resources.

Readers are encouraged to send us their comments. Deadline for the next issue will be May 24, 1993.

F. Breitenecker, I. Husinsky

The title page illustration was provided by Prof. Karnopp who contributed an essay on Bond Graph Modeling. It shows bond graph modeling of a mechanical system (elements of an active hydropneumatic suspension).

EUROSIM - Simulation News Europe

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

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AESOP

EUROSIM, the Federation of European Simulation Societies was initiated 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.

The following national and regional simulation societies founded EUROSIM: ASIM - Arbeitsgemeinschaft Simulation (Austria, Germany, Switzerland), DBSS - Dutch Benelux Simulation Society (Belgium, The Netherlands), FRANCOSIM - Société Francophone de Simulation (Belgium, France), ISCS - Italian Society for Computer Simulation (Italy), SIMS - Simulation Society of Scandinavia (Denmark, Finland, Norway, Sweden), UKSS - United Kingdom Simulation Society (UK). President is Prof. F. Breitenecker (ASIM).

News from the Board of EUROSIM

On February 26/27 a meeting of the EUROSIM Board and also the Editorial Board for the announced EUROSIM journal "Simulation Practice and Theory" took place in Delft, the Netherlands.

During the EUROSIM Board meeting according to the bylaws Prof. F. Maceri retired as President of EUROSIM, and as new President Prof. F. Breitenecker was elected. Prof. L. Dekker and Dr. A. Zobel were re-elected as Treasurer and Secretary of EUROSIM, respectively, for a final period.

Prof. Dekker was confirmed as editor-in-chief of the journal "Simulation Practice and Theory", Mrs. Husinsky and Prof. Breitenecker as editors of the newsletter "EUROSIM - Simulation News Europe".

Mrs. Dekker was appointed as secretary to the Board continuing her good work.

Furthermore a discussion took place on the future organization of congresses, conferences and other events. The preliminary conclusions were:

The major event of EUROSIM is the EUROSIM Congress (ESC) organized by one of the member societies on behalf of EUROSIM addressing the whole spectrum of modelling and simulation.

Other regional or international conferences continue to be organized by member societies and are now also considered as EUROSIM conferences. They may address a special topic or cover the general field of modelling and simulation.

Smaller specialized meetings such as working groups and workshops organized by member societies may also now be called EUROSIM events. In addition, to encourage other groups, their events related to modelling and simulation may also, at the discretion of the EUROSIM Board, be announced as EUROSIM events after receiving permission of the EUROSIM Board.

Up to the present time, EUROSIM may co-sponsor simulation conferences of any type organized by related societies. For the future a more formal arrangement in a form of co-operation agreements between EUROSIM and other societies is being sought.

As previously announced, the next EUROSIM Congress will be organized by ASIM and will take place in Vienna, September 1995. Provisionally the succeeding congresses will be organized by SIMS and FRANCOSIM. For further details of EUROSIM congresses, conferences and EUROSIM events see the calendar of events in this newsletter issue.

Following the inauguration of the Savastano Award for the best paper in simulation of electronic and electrical engineering EUROSIM intends to establish a program of awards in simulation. These might be, for example, a conference best paper, a young persons award, or an award for outstanding contribution to simulation.

For organisational reasons member societies were asked to nominate their Board representation. Furthermore, applications from several societies for membership have been received and were discussed. Of these the Czech and Slovak Simulation society is under active consideration for membership in the near future.

In relation to future expansion of the Board the question of eligibility for new membership was discussed in relation to the existing bylaws. Furthermore a proposal to include the past president as a member of the EUROSIM Board will be put to the member societies for their consideration.

The next EUROSIM Board meeting will take place during the UKSS 1993 EUROSIM conference, as well as a meeting of the Editorial Board of the journal.

In the following meeting of the Editorial Board of the new journal "Simulation Practice and Theory" chaired by Prof. L. Dekker, editor-in-chief, first Mr. van Drunen from Elsevier Publishers gave an overview of the Elsevier company and strategy. Elsevier merged with Reed Publishers being now the second largest scientific publisher in the world and covering now professional and commercial aspects.

It was announced, that the first issue of the EUROSIM journal "Simulation Practice and Theory" will be published in June for July distribution. This issue will include the newsletter "EUROSIM - Simulation News Europe", which will be printed also separately for the member societies as before. For the details of the journal see advertisement on the back cover of this newsletter.

The member societies and individuals are encouraged to contribute to the journal. In particular, new work of significant interest for simulationists will be welcomed, but authors of recent good conference papers are also encouraged to consider enlarging such papers to a full journal contribution.

The Interplay of Modeling and Simulation Using Bond Graphs

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Abstract

Bond graphs are particularly useful in developing mathematical models of complex engineering systems in which components involving a variety of forms of energy interact to form a dynamic system. Electronically controlled systems almost always involve electrical and mechanical interactions but it is common to also find that hydraulic, pneumatic, thermal, chemical or other effects are involved in the overall system.

Such systems can hardly be designed and optimized without the help of computer simulation. The mathematical model to be simulated is, however, far from fixed since engineers recognize that all models are to some extent approximations of reality and are willing to modify the model to remove difficulties which might appear in the carrying out of the simulation.

Bond graph techniques, particularly causal analysis, aid in finding a useful balance between model complexity and computational simplicity.

Accuracy, Verifiability and the Concept of a Model

Having been involved in simulation from analog computer times through the punch card times to the present, it has come to my attention that engineers, mathematicians and computer scientists often have very different concepts of the fundamental problems of simulation. Many engineers, in industry particularly, come to feel that mathematicians and computer specialists invent difficulties in simulation to study which actually have practically no significance. Mathematicians, particularly in academia, feel in their hearts that engineers probably are often happy with simulation results which in fact are greatly in error. The computer scientists may agree that the situation is presently not good but are sure that the new hardware and software products to be introduced within the next few months will make everything better.

The rapid increase in computing power available to the average user of simulation and the advent of user friendly simulation programs has made it possible for engineers to design and optimize complex dynamic systems but nagging questions about the accuracy and reality of simulation results remain.

The ideal case in which simulation results can be verified against at least some partial experimental results is, in my experience, more the exception than the rule. Standard pro-ducts which evolve slowly over time can certainly be optimized using simulation models verified through comparison with experience on previous versions of the products, but to my mind, simulation has most to contribute in the preliminary design of conceptually new systems. The simulation is supposed to expedite the design of a proof of concept prototype and only at a much later stage would it be possible to do any detailed verification studies. Quite often in later stages of the design, entirely new simulations are carried out in parallel with prototype experiments so that the initial simulation is never verified.

How can it be that unverified simulations which may in some mathematical sense be very inaccurate can yet be used fruitfully in the design of innovative new products and systems? The answer I think lies in the concept of a model of a system. The system to be modeled may exist in whole or in part or may only have the potential to exist. In any case the model will only attempt to represent partially and in approximation the behavior of the real or potentially real system. For any system, there is a wide range of models which could produce a useful insight to the system behavior (as well as a wider range of models which would produce misleading results). In this sense it is clear that a somewhat inaccurate simulation of the equations of a useful model is better than a very accurate simulation based on equations from a poor model.

Engineers are rarely concerned with very accurate solutions to differential equations. What they really want is fairly accurate solutions to equations which represent some aspects of the real system. A good engineer will often change his model repeatedly to try to determine which parts of the model are important and which parts are not relative to the questions he has about the real system.

It is certainly interesting and important to test numerical methods and simulation programs for speed and accuracy using a fixed model or set of equations. No one wants to make decisions based on results dominated by numerical errors. But it is also important to recognize that extreme accuracy in the simulation of one of many tentative models is of no great interest either. In many cases it is more important to be able to vary models easily than to achieve high accuracy for a single model.

Bond Graph Modeling of Engineering Systems

The technology which has grown up around the bond graph as a means of representing models of physical dynamic systems can make a contribution to the development of suitable models based on simulation of a series of tentative models. Although bond graphs may be seen as generalized circuit graphs or even as compactly coded block diagrams, they have some unique features which allow an analysis of the mathematical structure of a model even before parameters, constitutive laws or equations have been written.

The details of how bond graph models are developed, analysed and processed into forms useful for simulation are given in a number of textbooks - for example Karnopp et al., 1990 - and are the subject of research papers numbering in the thousands. Here I would just like to emphasise the so-called causal analysis as it relates to simulation.

Any bond graph model is based on energy storage, dissipation and lossless transfer which makes it easier to produce models which are rational in the sense that physical laws are not disobeyed than if equations or dynamic relations are combined in a less organized fashion (Karnopp, 1988). Once a bond graph model has been developed, causal strokes can be added according to a fixed Sequential Causal Assignment Procedure either by hand or by a computer program (Granda, 1990; Rosenberg, 1990).

The result is a structural study of how the various constitutive laws will organize to form the equivalent state equations. This can be accomplished before the detailed constitutive relations have been decided upon.

The results are shown in Table 1 and relate to possible difficulties which may arise if a simulation is attempted. When bond graphs are used, the state vector $\bar{x}$ is composed of generalized energy variables (momenta and displacements) and the input variables in the $\bar{u}$ vector are power variables (efforts and flows) from sources.

State Equation Forms:

1. $\dot{\bar{x}} = \bar{f}_1 [\bar{x}, \bar{u}(t)]$, explicit differential equations
2. $\dot{\bar{x}} = \bar{f}_2 [\bar{x}, \dot{\bar{x}}, \bar{u}(t)]$, implicit differential equations
3. $\dot{\bar{x}} = \bar{f}_3 [\bar{x}, \bar{y}, \bar{u}(t)], \bar{y} = \bar{f}_4 [\bar{x}, \bar{y}, \bar{u}(t)]$, algebraic loops - differential algebraic equations
4. $\dot{\bar{x}} = \bar{f}_5 [\bar{x}, \dot{\bar{x}}, \bar{y}, \bar{u}(t)], \bar{y} = \bar{f}_6 [\bar{x}, \dot{\bar{x}}, \bar{y}, \bar{u}(t)]$ implicit differential algebraic equations

Results of Sequential Causal Assignment Procedure:

1. Causality is determined on each bond. No derivative causality is required.
2. Derivative causality on some energy storing elements is required.
3. Arbitrary causality must be imposed on some bonds to complete the procedure.
4. Some derivative causality must be imposed and some arbitrary causality is required to complete causal assignment.

Table 1: State Equation Forms Detectable from the Bond Graph Model Structure using the Sequential Causal Assignment Procedure

For nonlinear systems particularly, there are major differences in difficulty of simulation among the four categories of equation forms shown in the table. The first form is suitable for use with general purpose simulation programs such as ACSL (ACSL, 1991). The other forms generally require a numerical iteration process to determine the state derivatives at each integration step. Although special programs exist to handle all forms of state equations, whenever algebraic relationships have to be solved numerically while integration is proceeding, the user can expect even more problems in getting reasonable results than those which arise when the explicit form of category 1 is involved.

The important point is that using causal analysis on a bond graph model, one can predict immediately what the form of the state equations will be independent of the details of the constitutive laws of the elements of the system. It is also easy to see how the model could be modified to eliminate the algebraic difficulties associated with catagories 2 to 4. The model may be simplified by neglecting some effect, by combining elements in a so-called field (Karnopp, 1992) or by adding dynamic elements to enforce constraints. The last idea seems questionable since it appears to eliminate algebraic problems by creating higher order explicit differential equations which are numerically stiff. However, the degree of stiffness is under the control of the modeler and physical intuition can often be used to decide how stiff the system needs to be. For example, it has been argued that traditional multi-body system models which produce equations in categories 2 to 4 are better replaced with models leading to category 1 equations where rigid constraints are enforced approximately with dynamic elements (Zeid and Chung, 1992). The arguments are not just on the basis of computational efficiency but also on the basis of modeling modularity.

Conclusions

I don't want to argue that there are no difficult simulation problems which can't be avoided by some trick. Rather I want to emphasise that in large segments of engineering, models and mathematical problems they may impose on simulation are by no means fixed. Sometimes a quick but relatively inaccurate solution serves to conclude whether a design concept should be pursued further or not. At other times the engineer may be willing to modify his model if this will aid him in coming to a useful simulation quickly. This is the great utility of a program such as CAMP-G which allows the drawing of a bond graph on a screen and provides an instant causal analysis. The user knows immediately whether the CAMP-G produced input file for ACSL or other simulation program can in principle run or not. With little effort, one can see the effect of model changes on the structure of the implied state equations. What cannot be relegated to the computer is the development of realistic parameters and the final judgement of the simulation results. Intelligent and experienced human beings are still necessary to sort sense from nonsense in simulation results.

References

Karnopp, D.C, D.L. Margolis and R.C. Rosenberg 1990. System Dynamics: A Unified Approach, Second Edition, John Wiley & Sons, Inc., New York, New York, USA.

Granda, J. 1990. "CAMP-G Users Manual". Mitchell and Gauthier Assoc., Concord, MA, 01742, USA.

Rosenberg, R.C. 1990. The ENPORT Reference Manual. Rosencode Associates, Lansing, MI 48906, USA.

ACSL Reference Manual. 1991. Mitchell and Gauthier Assoc., Concord, MA, 01742, USA.

Zeid, A., and C.-H. Chung. 1992. "Bond Graph Modeling of Multibody Systems: a Library of Three-dimensional Joints". Journal of the Franklin Institute, v. 329, n. 4, pp 605-636.

Karnopp, D.C., 1988. "Is a Foolish Rationality the Hobgoblin of System Dynamics?". ASME Publication DSC - Vol.8, Automated Modeling in Design, pp 49-54.

Karnopp, D.C., 1992. "An Approach to Derivative Causality in Bond Graph Models of Mechanical Systems", Journal of the Franklin Institute, v. 391, n. 1, pp. 65-75.

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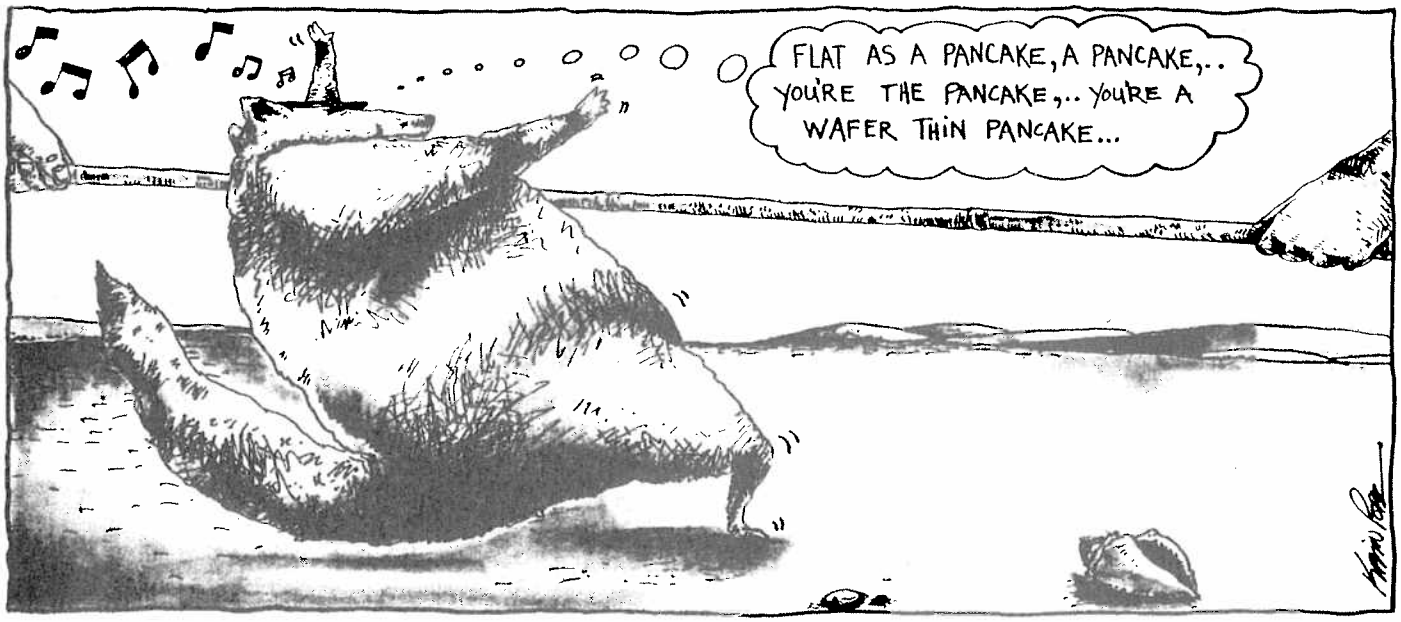

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ASIM

ASIM (Arbeitsgemeinschaft Simulation) is an association for simulation in the German speaking area. ASIM was founded in 1981 and has now about 650 individual members.

Reports from ASIM

The last meeting of the ASIM board was on November 16th, 1992 in Frankfurt. Main discussion points were the Capri conference, the activities of the working groups, cooperation with GI and ITG, financing of ASIM activities and ASIM conferences to come.

As agreed with GI, one of the volumes of the journal *it+ti* will be dedicated to simulation. Prof. Tavangarian will edit this for ASIM. Persons interested to subscribe *it+ti* for a reduced price (DM 42,00 per year) are asked to contact Dr. Bausch-Gall (address see below).

Furthermore every ASIM member is invited to publish in the newly founded journal "Simulation Practice and Theory". This is the main scientific journal of EUROSIM. The first volume will be published this year. Please contact Dr. Bausch-Gall, if you are interested to submit a paper to this journal.

At the Capri congress ASIM offered to organize the next EUROSIM conference and nominated Prof. Breitenecker of TU Vienna as EUROSIM president for the years 1993-1995. Prof. Breitenecker is currently vice-speaker of ASIM. Prof. Breitenecker and Mrs. Irmgard Husinsky will organize the next EUROSIM Congress at TU Vienna. They already have experience in organizing such events. Vienna seems to be furthermore an excellent place, especially if we take into account the open boundaries to the Eastern European Countries.

The next meeting of the board will be on April 30th, in Frankfurt. Main point of discussion will be the ASIM conference in Berlin (Sept. 1993). Please contact Dr. Bausch-Gall, if you want the board to discuss a specific subject.

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ASIM Meetings to come

April 22-23, 1993: Meeting of the working groups "*Simulation und künstliche Intelligenz*" and "*Simulationssoft- und -hardware*" in Karlsruhe. For more information contact Dr. J. Krauth.

September 28-30, 1993: *8. Symposium Simulationstechnik* in Berlin. This is ASIMs 1993 German speaking conference. For more information contact Mr. Ralf-Peter Schäfer, GMD-First, Rudower Chaussee 5, Geb. 13.7, O-1199 Berlin, Tel.: +49-(0)30 6704 2867, Fax: +49-(0)30 6704 5610.

September 1994: *9. Symposium Simulationstechnik* in Stuttgart.

September 1995: EUROSIM Congress in Vienna.

Reports from the Working Groups

Working Group "Simulationsmethoden und Sprachen für parallele Prozesse"

Speaker of the working group: Dr. Hans Fuss, GMD-I1, Postfach 1240, W-5205 St. Augustin 1. Tel: +49-(0)2241/14-0, Fax: +49-(0)2241/14-2889, E-mail: fuss@gmd.de

Working Group "Simulationssoftware und -hardware"

See also working group "*Simulation und künstliche Intelligenz*".

Speaker of the working group: PD Dr. J. Halin, ETH Zürich, Institut für Energietechnik, Clausiusstrasse 33, CH-8092 Zürich. Tel: +41-(0)1/256-4608, Fax: +41-(0)1/262-2158

Working Group "Simulation und künstliche Intelligenz"

The next workshop will be organized together with the ASIM working group "*Simulationssoftware und -hardware*" in Karlsruhe on April 22 and 23, 1993. We will concentrate on optimization problems and techniques, but any other presentations or problem statements contributing to the relation of simulation and artificial intelligence are welcome, too. The workshop language is German, but English presentations are also possible. Please direct your application or any inquiries about this workshop to:

Dr. H. Szczerbicka, Inst. f. Rechnerentwurf, Postfach 6980, W-7500 Karlsruhe 1, Tel. +49-(0)721/608-4216.

Speaker of the working group: Dr. Johannes Krauth, BIBA, Bremer Institut für Betriebstechnik und angewandte Arbeitswissenschaft, Postfach 33 05 60, W-2800 Bremen 33. Tel: +49-(0)421/218-5531, Fax: +49-(0)421/218-5510.

Working Group "Simulation in Medizin, Biologie und Ökologie"

Speaker of the working group: Prof. Dr. Dietmar P.F. Möller, TU Clausthal, Institut für Informatik, Erzstr. 1, W-3392 Clausthal-Zellerfeld, Tel. +49-(0)5323/722402 or 722504, Fax +49-(0)5323/723572

Working Group "Simulation technischer Systeme"

The 10th workshop was organized on March 8 and 9, 1993 at Erlangen-Nürnberg University by the Institute for Control Engineering. The ACSL user group met on March 8th.

Speaker of the working group: Prof. Dr.-Ing. Gerald Kampe, FHT Esslingen, Flandernstraße 101, W-7300 Esslingen. Tel: +49-(0)711/3511-3740 or 3741

Working Group "Simulation in der Fertigungstechnik"

The sixth ASIM-workgroup conference was held on 10th and 11th of February, 1993 in Aachen, Germany. "Simulation and Industrial Systems Operation" being the main topic of the event, especially a practical application oriented exchange of experience concerning the utilisation of simulation in everyday's plant operations and new aspects of utilising simulation for manufacturing control were emphasised. Additionally a separate set of events treated the discussion of costs vs. benefit aspects of simulation technology. The conference proceedings (330 pages including 17 articles and an introductory contribution by Prof. Eversheim) is published by "*gfmt-Gesellschaft für Management und Technologie*", München, Germany. 120 experts exchanged their experiences at this conference. Special contributions were made by 11 exhibiting organisations, who provided a complete overview covering the state of the art technology in manufacturing systems. Exceptionally fruitful was the dialogue between users and developers right in front of the screens of the exhibited simulation tools.

Succeeding the conference, a workshop was held. The speaker, Prof. Dr.-Ing. A. Kuhn announced the completion of a guideline to simulation technology, a manual for "Applying Simulation in Production and Logistics". This manual, which addresses potential users of simulation in particular and which enables an insight into the extent and the facets of using simulation in manufacturing systems, will be presented to the public during an event to be held at the Fraunhofer Institute for Material Flow and Logistics in Dortmund, Germany on June 17, 1993. Interested representatives of industry and press will be invited.

In order to obtain an invitation and a program of the event, please contact: Dipl.-Inform. S. Wenzel, Fraunhofer-Institute for Material Flow and Logistics, Joseph-von-Fraunhofer-Straße 2-4, W-4600 Dortmund.

Speaker of the working group: Prof. Dr.-Ing. A. Kuhn, Fraunhofer-Institut, IML, Emil-Figge-Straße 75, W-4600 Dortmund 50. Tel: +49-(0)231/9743-130, Fax: +49-(0)231/9743-211

Working Group "Simulation in der Betriebswirtschaft"

The working group organized its "*4. Symposium Simulation als betriebliche Entscheidungshilfe*" in Braunlage on March 15-17, 1993, now for the first time as ASIM working group. Subjects of the conference were: Methods and Tools, Software and Hardware support, Applications.

Speaker of the working group: Prof. Dr.-Ing. W. Hummeltenberg, Universität Hamburg, FB Wirtschaftswissenschaften, Bundesstraße 55, W-2000 Hamburg 13. Tel: +49-(0)4123-4023, Fax: -49-(0)4123-5535

Working Group "Simulation von Verkehrssystemen"

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I. Bausch-Gall

DBSS

General Information

In Europe there are several examples of regional simulation societies, covering a geographical area of a common language. One of those, DBSS, is grouping the Dutch speaking simulation people from the Benelux countries. DBSS is a member society of EUROSIM (Federation of European Simulation Societies).

DBSS has as primary goal to promote the advancement of systems simulation. In this respect the Society will actually promote the following:

- the study of systems, models and modelling (continuous, discrete and mixed systems); deterministic, stochastic and probabilistic systems; systems from specific disciplines; they all belong to the domain of interest;
- the development and application of methodological concepts, methods and algorithms with respect to systems, models, modelling, experimenting and tools:
- the development of hardware and software simulation tools and the advancement of their applicability.

To accomplish the above goals DBSS shall:

- stimulate the organization of meetings in the domain of systems simulation; in these local meetings the emphasis will be in informality and information exchange;
- activate the organization of conferences, symposia, workshops, courses;
- furnish information to the members about the state-of-the-art as well as advancements and activities in the domain of simulation of systems;
- co-operate with societies active in the domain of simulation;
- use other legal means which may serve meeting the goals of the society.

DBSS is closely co-operating with the other member societies of EUROSIM.

Moreover, for already many years, DBSS has affiliation agreements with IMACS (International Association for Mathematics and Computers in Simulation) and SCSi (Society for Computer Simulation International).

DBSS-Membership

Individuals (in particular Dutch speaking ones) and institutes etc. from the Benelux countries, active in the field of simulation, can become DBSS-member. Membership fee (per annum) is in 1993:

- personal member:
  50 guilders or 900 Belgium francs
- institutional member:
  100 guilders or 1800 Belgium francs

Those interested to become a member of DBSS are invited to write to the acting secretary:

Dutch Benelux Simulation Society
Secretariat: Computing Centre, P.O. Box 354,
2600 AJ Delft, The Netherlands,
Tel. +31-(0)15-785698, Fax +31-(0)15-783787.

(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 1993

DBSS-members receive "EUROSIM-Simulation News Europe" and can benefit in many cases from special discounts on conferences, meetings, organized by DBSS or other member societies of EUROSIM, IMACS and SCSi.

Meetings planned

A one day meeting will be organized in April 28th, 1993, about "Technical and Vocational Training and Simulation Practice in Relation with Education".

The symposium will be held in the Dish Hotel, Kanaalweg 3, Delft, The Netherlands.

Speakers are a.o.: H. Mijnarends, Hogeschool Rotterdam & Omstreken; A. Poldervaart/J. Terhoeve, Hogeschool Rotterdam & Omstreken; J.D. van der Meulen, Hogeschool Arnhem; J. Andriessen, Hogeschool Arnhem; R. Boetes, Hogeschool Heerlen; P. Ypey, Hogeschool Heerlen; W. de Valk, Hogeschool Eindhoven; R. Pijlgroms, Hogeschool Amsterdam.

For more detailed information, please contact the DBSS secretariat or ir. F.J. Pasveer, HR&O, G.J. de Jonghweg 4-6, 3015 GG Rotterdam, Tel. +31-(0)10-4366244.

DBSS plans to organize - in co-operation with AKZO and the Delft University of Technology - an international symposium on: Massively Parallel Processing, Applications and Development. The provisional date for the symposium is June 21/23th, 1994. Information can be obtained at the DBSS-secretariat (see address above).

J.C. Zuidervaart

FRANCOSIM

FRANCOSIM, Association francophone de Simulation, aims to the promotion and development of simulation techniques in the French speaking community. Its activity is mainly centered in the Industrial, Educational and Research fields. For now, its members are French and Belgian and it has not yet got into the Swiss and Canadian territory!

Membership

FRANCOSIM is registered in the French Sous-Prefecture in Roanne as a non-profit making organization. The annual fee for the year 1992/93 is FF 275.

Contact Address

For further information, please contact

N. Sarles, M. Lebrun
Société IMAGINE

at its legal seat:

Maison de la Productique
Esplanade Diderot
F - 42300 Roanne, France
Tel. +33-77 70 80 80, Fax: +33-77 70 80 81

Events to come

We are now very busy organizing the **Bond Graph School** which is going to take place in Roanne on March 22 - 26.

Prof. Margolis from the University of California, Davis, Prof. Jean Thoma from Switzerland, Mrs. Dauphin from the Ecole Centrale de Lille, M. Scavarda from the INSA in Lyon and M. Lebrun from the University Claude Bernard in Lyon are going to speak about the Bond Graph theory. The field of application discussed will be mainly Mechatronics but also mechanical, hydraulic and thermodynamic systems will be reviewed.

Simulation of Continuous Systems

A new group has been organized within FRANCOSIM, focusing on continuous system simulations. Its objectives are to gather information about the continuous simulation techniques and tools and to disseminate this information within FRANCOSIM and EUROSIM. Its first tasks will be to elaborate some benchmark to check simulation software features and performance and to establish a catalogue of commercially available continuous simulation software. The group warmly thanks readers of EUROSIM - SNE who can provide information about these topics.

Meetings: The first meeting took place at ESIEE-PARIS, the 5th of February 1993. The next meeting will take place at ESIEE-PARIS, the 23rd of April, 1993. Another meeting is also planned for the 25th of June, 1993.

Contact: Mr. Yskandar Haman, ESIEE
2, Boulevard Blaise Pascal,
F - 93162 Noisy-le-Grand Cedex, France
Tel: +33-1-45 92 66 11, Fax: +33-1-45 92 66 99

F. Lorenz

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 ISCS are directed by a Steering Committee presently consisting of the following persons:

G. Iazeolla	(chairman)
F. Cennamo	(vice-chairman)
V. Grassi	(treasurer)
M. Colajanni	(secretary)

Membership

At present ISCS counts 131 members: 6 institutional, 4 honorary, 119 regular and 2 affiliate.

Charges per annum are Lit. 30,000 for regular and affiliated members and Lit. 400,000 for institutional members.

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
Tel.: +39 6 725944.77 (.78/.86)
Fax: +39 6 2020519
E-mail: IAZEOLLA@IRMIAS.BITNET

Activities

ISCS is devoting most of its efforts to the organization of **Performance '93** (16th IFIP W.G. 7.3 International Symposium on *Computer Performance Modelling, Measurement and Evaluation*). This international conference, one of the most important in the performance evaluation field, will take place in Roma, from September 29 through October 1, 1993.

Topic areas include

1) Performance evaluation of:

Communication networks, Memory systems, Computer system architecture, Operating systems, Database and transaction processing systems, Parallel algorithms, Distributed systems, Parallel systems, Fast packet switching, Real-time systems, Fault tolerant systems, Scientific computers, File and I/O systems, Telecommunication systems, Interconnection networks, Very high speed networks.

2) Methodological or theoretical work in:

Concurrent simulation, Reliability analysis, Fast simulation, Stochastic models of computer systems, Model verification and validation, Teletraffic and network management, Performability modelling, Workload analysis and program optimization, Performance optimization.

Moreover, the two days before the conference sessions (September 27 and 28) are entirely devoted to Tutorials on performance evaluation.

The site chosen for the conference is in the heart of Rome and is, in its own right, a very suggestive place. Indeed, the conference will be housed in a historical building, whose spacious rooms and shady courtyards provide a picturesque setting. Many of the main attractions of the city (such as Colosseum, Roman Forum, the Capitol and Palatino hills) are within walking distance, and several comfortable hotels are available in the vicinity of the conference site.

For further information please contact:

Dr. Bruno Ciciani
Dipartimento Ingegneria Elettronica
Università di Roma "Tor Vergata"
Via Ricerca Scientifica
I-00133, Roma, Italy
Tel.: +39-(0)6-72594478
Fax: +39-(0)6-2020519
Email: PERF93@irmias.bitnet or
TUCCI@tovvx1.ccd.utovrm.it

Furthermore, also in 1993, ISCS will organize and sponsor the "Seminario di Informatica", a periodic scientific seminar held at the University of Roma "Tor Vergata". Main topics of the lectures are simulation, performance evaluation, and parallel and distributed computing.

ISCS intends to promote some Working Group meetings among 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.

Notice to ISCS members:

Unfortunately, there are still members who did not pay their membership fee for 1992 up to now.

We kindly but urgently request you to pay your fee as soon as possible on the C/C postale n. 44616001, Italian Society for Computer Simulation. Otherwise we are obliged to interrupt the sending of any material from ISCS, including this bulletin.

M. Colajanni

SIMS

The Scandinavian Simulation Society, SIMS, has about 250 members from Denmark, Finland, Norway and Sweden. For more than 30 years SIMS has served as the regional simulation society in Scandinavia, gathering individuals and organizations 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 ?

If you or some of your Nordic colleagues are interested in simulation but are not yet a member of SIMS, then just send an informal application or recommendation for membership to the SIMS secretariat:

E.K. Puska
Technical Research Centre of Finland
P.O.Box 208 (Tekniikantie 4)
SF-02151 Espoo, Finland
Tel.+358 0 4561
Fax+358 0 456 5000
Email:puska@vtydic.vtt.fi

SIMS'93 Preliminary Program

The 35th SIMS Conference will be held on June 9-11, 1993, at Kongsberg College of Engineering in Kongsberg, Norway.

The aim of this conference is to cover broad aspects of simulation and scientific computation. It will thus be of interest for model builders, simulation personnel, scientists, process engineers, mechanical engineers, vendors, etc. A technical visit will be organised.

A large area will be available for demonstrations and exhibitions during the conference. A number of vendor demonstrations of commercial simulation systems are expected, as are poster presentations of simulation activities, commercial, non-commercial and student work. For demonstrations, video sessions or exhibitions in general, please contact the organising committee.

Conference Venue

The conference will take place at Kongsberg, 80 km west of Oslo. The official headquarters and venue for the sessions will be Kongsberg College of Engineering.

Kongsberg has a long tradition as a mining and industry town. The mining and refinement of silver, along with the production of silver coins, were the cornerstone activities of the town for more than 300 years. For long periods this served as an important national source of finances.

In spite of today's general trend, Kongsberg now experiences another boom period based on modern technology and high competence. The active development groups within the companies of Kongsberg have created products that are frequently asked for on the international market.

The citizens of Kongsberg have strong relations to the past, a fact that is reflected in The Norwegian Mining Museum, The Royal Mint Museum and The Ski-museum. Clean nature is never far away, tempting with vacation activities like fishing, mountain hiking, canoeing, etc.

The program of SIMS'93 will offer you a flavour of both past and present. Of course you are welcome to stay here for more than just the conference days.

Programme Committee:
Steinar Sflid, Norsk Hydro — Bernt Lie, SiT
Magne Hillestad, Statoil — Ole Ivar Sivertsen, SINTEF
Ole Langeland, Statoil — Jan Ola Strandhagen, SINTEF
Torleif Iversen, SINTEF

Organising Committee: Stein Ringstad, KIH; Odd Falmyr, Statoil; Torleif Iversen, SINTEF

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

Opening / Closing: The opening session starts at 09.00, Wednesday. The conference closes with a late lunch on Friday at about 13.00.

Social Events:
Wednesday 7pm: Get Together in The Kings Mine (+7°C, Wear warm clothing);
Thursday 7pm: Conference dinner in The Smelting House. If there is sufficient interest, we will organise guided tours for accompanying persons.

Registration Information: Registration deadline is May 10, 1993. The final registration takes place at Kongsberg College of Engineering, June 9 from 08.00.

Conference fee: NOK 2400
Authors and members of SIMS: NOK 2200
Any registration after May 10: NOK 2900
The fee includes proceedings, lunch and coffee during the conference, a Get Together reception with authentic Norwegian food and a conference dinner
Students fee incl. proceedings and coffee only: NOK 500
Accompanying person's fee incl. social events: NOK 500
SIMS membership: NOK 200 per year

Accommodation: Grand Hotel and Gyldenloeve Hotell are located in the center of Kongsberg, within a 20-minute walk to the conference site. Rooms including breakfast can be reserved at a conference discount. Early reservation is recommended.

Programme

Jubilation paper:
SIMS through 35 Years (Peer Martin Larsen, DTH)

Tools and Technology

Invited paper: Towards a New Standard for Modelling and Simulation Tools (Sven Erik Mattsson, Lund Institute of Technology)

Object-Oriented Modeling and Automatic Formula Manipulation with Dymola (Hilding Elmquist, DynaSim AB)

Modular Integration (Torleif Iversen, SINTEF)

Modelling and Simulation in CADAS (Tor Ivar Eikaas, SINTEF)

On-line Power Plant Simulation with APROS (Eija Karita Puska, Markku Hänninen, VTT and K. Porkholm, IVO International Ltd.)

Developing Simulation Models with the MS-Windows Based Authoring Tool WinSim (Magne Myrtveit, Modell-Data A.S)

Physical Level Modeling and Simulation of Multi-disciplinary Systems (Timo Yli-Pietila, VTT and Herman Mann, Katholieke Univ. Leuven)

Using SIL for Linearizing Dynamic Models (Niels Houbak, DTH)

GTRAN - A Graphical Modelling Tool for a Block-Structured Simulation Environment (Seppo Lahtinen and Ilkka Alatalo, ABB StroembergPower Ltd.)

VHDL in Practical Design (Oeystein Ra, Kongsberg College of Engineering)

Network Level Optimization for Mobile Networks (Erkki Laitinen, University of Jyvdskild)

Control Applications

Simulating the Dynamics of an Adsorption Column with Limited Measurements of State using Artificial Neural Networks (Abhay Bulsari and Seppo Palosaari, Lappeenranta Univ. of Techn.)

Application of Artificial Neural Networks for Fuzzy S imulation of a Chemical Reactor (Abhay Bulsari and A. Kraslowski, Lappeenranta Univ. of Techn.)

Linguistic Simulation in Process Control (Esko K. Juuso, University of Oulu)

Applied Control of a Distillation Column. Dynamic Simulation as a Development and Evaluation Tool (Ivar Halvorsen, SINTEF)

Process Identification in On-Line Optimizing Control, an Application to Heat Pump (Christian Svensson, NTH)

Process Applications

Leak Detection - A Computer Algorithm (Morten Hyllseth, Fantoft Prosess A/S)

Flowsheet Simulation for Fault Detection and Process Monitoring in a Fertiliser Plant (Olav Aaker, TIT)

Object Based Process Models as a Basis for an Operator Support System (Are Mjaavatten, Norsk Hydro)

Simulation of Troll Separator Train(Petter Waldussen, Norsk Hydro)

The Nelson Operator Training Simulator (Bjoern Andersen, Norcontrol)

Application of an Object Oriented Approach to Mechanistic Modelling of a Distillation Plant (Raimo Baerman, Helsinki Univ. of Tech., Kaj Juslin, VTT and Raimo Laakso, ALKO Ltd.)

Steady-State Power Plant Simulator as a Tool in Power Plant Processes (Jyrki Holappa, Imatran Voima Oy)

Mechanical Systems

The Multidiscipline Design Concept for Mechanisms (Ole I. Sivertsen, SINTEF/NTH)

Detailed Modelling and Dynamic Simulation of Deployment of the Unforlable Reflector UMA (Lars E. Bjoerset, NFT)

Efficient Design of Machines and Mechanisms by Multidiscipline Simulation and Use of Sensitivity Optimization Capabilities (H. P. Hildre and R. H. Sellesbakk, NTH.

Modal Analysis of Elastic Mechanisms (Terje Roelveg, SINTEF and Ege X. Walxen, NTH.)

Control of a Simple Satellite with a Flexible Beam (Per Norman Oma, NTH)

Simulation and Model Test of Advanced DP-Strategies for Shuttle Tankers (Bugge T. Jensen, DMI, Carsten Dahl, DHI and Henrik Nedergaard, LicEng.)

Factory Planning and Production Management

Simulation in Manufacturing (Jan Ola Strandhagen, SINTEF)

Two Heads are better than One (Eva Victorson, SYSTECON and Christopher Dealy, AT&T ISTEL)

Simulation for Business Modelling (Benny Madsen, SIMOS)

A Practical Approach to Operative Simulation in Manufacturing (Eirik Borgen, SINTEF)

Simulation in the Danish Post Office (Mads Gustavsen and Soeren Andersen, DPO)

NALLADS Simulator - A New Way of Training Air Defence (Thor Hukkeles, Micro Processor Systems)

Experiences in Use and Experiment (Oddvar Solum, Postens godsprosjekt)

Distributed Parameter Systems

Invited paper: Flow Simulation Around Land, Sea and Space Vehicles (Helge Noerstrud, NTH)

Modelling and Simulation of Ring Furnace for the Baking of Carbon Anodes (Oeyvind Gundersen and Jens G. Balchen, NTH)

Quality Prediction and Controllability Analysis in E-PVC Production (L. Hansen and B. Lie, TIT)

Dynamic Simulation of the Flow Phenomena in a Continuous Kaymyr Steam/Liquor Phase Digester based on Conservation Laws (Finn A. Michelsen and Bjarne Foss, NTH)

Catalytic Fluidized Bed Reactor Models Applied on a Pilot Plant (Freddy Krogh, SINTEF SI)

Matrix Formulation of Stochastic Transient Potential Flow Problems (Bela A. Szentivanyi, Hungarian Academy of Sciences)

Correspondence Address:

SIMS
c/o Torleif Iversen
SINTEF Automatic Control
N-7034 Trondheim, Norway
Tel.: +47-7594474
Fax: +47-7594399
Email: torleif@itk.unit.no

E.K. Puska

UKSS

The next meeting of UKSS will be concerned with "Real Time Simulation and Simulators". It will be held on 13th May at the Trinity Centre, Science Park, Cambridge.

Plans for the UKSS Conference (UKSS 93) are progressing well. Full details may be found in the conference announcement below.

The conference will also host the next meeting of the EUROSIM Board and the Editorial Board of the EUROSIM journal. The annual general meeting of UKSS will also take place during UKSS 93.

Information about UKSS membership and other events may be obtained from:

Mrs. E. Rimmington
Computing Centre
Watts Building
University of Brighton
Moulsecomb, Brighton BN2 4GJ
Tel.: +44 273 600 900

It is intended that more details of the UKSS Conference Programme will appear in the next issue of EUROSIM - Simulation News Europe.

D. Murray-Smith

United Kingdom Simulation Society Conference UKSS 93

Keswick Hotel, Lake District, Cumbria, U.K.

13-15 September 1993

2nd Call for Papers

A EUROSIM Member Society Event, co-sponsored by SCSI

Papers are invited on any aspect of simulation to be presented at a three day event organized for both scientific and cultural interest. The event will be held in Lakeland, one of the most beautiful parts of England. Access is easy via Manchester International Airport or London Heathrow/ Gatwick and coach or rail to Keswick. The conference venue is a recently renovated Victorian Hotel within walking distance of the town centre. There is ample space for exhibitors in the Garden Room where coffee is served right outside the main lecture room.

Cultural activities include local lakeland history; fell walking in the beautiful hills; boat trips on Derwent Water which also features wind surfing and canoeing, all within walking distance of the hotel.

Please send abstracts by 16th April 1993 to:

Dr. R. Zobel, Dept. of Computer Science,
University of Manchester, Oxford Road,
Manchester M13 9P1, U.K.,
Tel: +44 61 275 6189,
Fax: +44 61 275 6236,
Email: rzobel@cs.man.ac.uk

Abstracts (two pages of A4 without figures) are invited on any aspect of simulation and its applications. The following list of suggested topics is a guide, but papers on other topics are also welcome:

Simulation methodology and practice, languages, tools and techniques (continuous, discrete and mixed). Models and modelling tools. GUIs and data/object bases. Analysis 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, performance.

Simulation applications. Aerospace simulation, including man/hardware-in-the-loop. Simulation in electronic circuits and systems, computer systems and networks. Leisure industry. Business applications, management, finance, banking, economics. Environmental simulation. Simulation in emergency systems, biology, medicine and public health. Simulation in manufacturing, planning, process simulation, robotics, control systems, measurements and monitoring. Plant simulators. Energy and safety critical systems, transportation, oil and gas industries. Simulation in education and training. Military simulation and simulators.

Although this conference is a national event, presenters and participants from any country have always been very welcome. Naturally, the conference language is English, which is also the language of most international simulation events. Vistors are especially welcome from EUROSIM member countries, in addition to North America, the Pacific Rim and elsewhere.

Members of EUROSIM Societies, SCSI, JSST, CSSC will be offered the reduced rate of registration fee. Simulationists from Eastern Europe may be offered special rates. A variety of accommodation is available. Details of registration fee and accommodation will be sent to intending participants.

Deadlines:

Abstract (four copies, 2 pages of A4): **16th April, 1993**

Notice of provisional acceptance: **15th May, 1993**

Camera ready paper and registration fee: **1st July, 1993**

CROSSIM

CROSSIM (The Croatian Society for Simulation Modelling) was founded in March 1992 in Zagreb. CROSSIM is a non-profit society with the following main goals: promotion of knowledge, methods and techniques of simulation; establishment of professional standards in simulation; development of education and training in simulation; organization of professional meetings and publishing in the field; co-operation with similar domestic and international institutions. CROSSIM sent a letter of intention to EUROSIM with a request to become a full member of the EUROSIM federation in June 1992. We are expecting a positive answer without further delay. The Society is also in the process to become an affiliation institution with SCS (The Society for Computer Simulation, USA).

Membership

The annual membership fee is equivalent to 8 German marks for regular members, and 2 German marks for students. CROSSIM currently has 42 individual members.

Contact Address

Professor Vlatko Ceric
Chairman of CROSSIM
Faculty of Economics, University of Zagreb
Kennedyjev trg 6, 41000 Zagreb, Croatia
Tel: +38 41 231 111, Fax: +38 41 235 633
E-mail: vlatko.ceric@uni-zg.ac.mail.yu

Activities

- Organizing a simulation seminar which is regularly held at the Faculty of Economics, University of Zagreb.
- Co-operation in founding of the new international journal *Computing and Information Technology*, to be launched from 1993 (including computer modelling topics). *Anybody interested in receiving information about the journal may contact the CROSSIM Chairman.*
- Work on several scientific projects in discrete and continuous simulation, and applications of simulation in such diverse fields as engineering, economy, medicine, ecology etc.
- Publications (one simulation textbook in Croatian in press, papers in international and domestic journals and conference proceedings).
- Co-organizing the 15h International Conference *"Information Technology Interfaces" ITI '93*, to be held in Pula, Croatia from 15-18 June 1993. The conference traditionally has a strong simulation session. Two invited lecturers in the field of simulation will be Prof. Axel Lehmann (University of Bundeswehr, Munich) and Prof. Ivan Futo (Faculty of Economics, Budapest). *Anybody interested in receiving the Call for Papers or other information about the conference may contact the CROSSIM Chairman.*

V. Ceric

AES

AES, Asociación Espanola de Simulación (Spanish Simulation Society), was formally established on May 21, 1992 in Málaga. Its primary goal is to facilitate communication and co-operation between spanish groups and individuals interested in simulation. Other aims are to increase contacts with the international simulation community and to promote the use of simulation in industry.

Steering Committee

At present, there is a temporary steering committee responsible for conducting AES activities and promotion. It consists of the following persons: Antoni Guasch, José Maria Girón and Jesús Criado.

Activities

Last fall, a one day meeting was carried out in Madrid to examine the use, needs and experiences of simulation in inudstries as well as the state-of-the art in research centres and academia. The goal was to identify specific interest areas in which AES can play an active role. The meeting was sponsored by the Directorate of Robotics, Control and Industrial Processes of the Spanish Ministry of Industry. As a result of this meeting, AES has asked for a sponsorship of the Ministry of Industry to promote the use of modeling in simulation techniques in the spanish industry.

Next summer a series of Simulation Seminars will be held in Avila, sponsored by AES.

Membership

The annual fee for regular individual members is 5,000 ptas., for institutional school members it is 20,000 ptas. and for institutional industrial members it is 50,000 ptas.

Contact Address

AES, Asociación Espanola de Simulación
Universitat Politecnica de Catalunya
Departamento d'ESAII
Avgda. Diagonal 647, 2na. Planta
E-08028 Barcelona, Spain
Tel: +34-3-4016544, Fax: +34-3-4016600
E-mail: aes@esaii.upc.es or albornoz@esaii.upc.es

A. de Albornoz

Hungarian Simulation Group, IMACS/Hungary

A Hungarian Simulation Society is being set up at the moment. Information may be obtained from:

Prof. Dr. András Jávor
Chairman of IMACS/Hungary
KFKI Institute for Measurement and Computing Techniques
P.O.Box 49, H - 1525 Budapest
Tel: +36 1 1699499, Fax: +36 1 1695532

CSSS

The division of Czechoslovakia did not influence the CSSS (Czech&Slovak Simulation Society) because it is a regional scientific non-proft association of Czech and/or Slovak speaking simulationists as well as those of foreign nationality living permanently on the territory of the Czech or Slovak Republic, and also legal subjects of non-political nature active in the field of simulation on the territory of the Czech or Slovak Republic.

Contact Addresses

For information please contact:

Milan Kotva
Zeleny pruh 32
14700 Praha 4 - Branik, Czech Republic
Tel: +42 2 7992145 (office), +42 2 464179 (home)
Fax: +42 2 7992318

or in the Slovak Republic

Mikolas Alexik
VSDS -KTK
Velky diel
01026 Zilina, Slovak Republic
Tel: +42 89 54042, Fax: +42 89 54806
Email: Alexik@uvt.utc.cs

Activities

On November 9-11, 1992 the 8th Prague Symposium on Computer Simulation in Biology, Ecology and Medicine was held in Prague (see EUROSIM - Simulation News Europe, No. 6, November 1992). The Proceedings of the Symposium containing 30 contributions are now available for DEM 50 at the above mentioned address (please mail an order to this address and pay directly to account No. 230354-058/0800 at Spolek pro simulaci systemu, Ceska sporitelna, a.s. Stefanikova 17, 15000 Praha 5, Czech Republic).

M. Kotva

Information from the Slovak Republic

The Slovak Simulation Group currently has about 30 members from various parts of Slavakia (Bratislava, Zilina, Kosice, Nitra). The group is working together with the Czech Simulation Group as CSSS.

This year we are preparing the event "Modeling, Simulation and Control of Systems", which will be held on October 12 - 14, 1993 at Sulov (Zilina). The conference will cover all aspects of applied simulation in industry and especially simulation for control in transport and communications for the following topics: Modelling Tools, Simulation Tools and Technology, Factory Simulation and Automation, Simulation in Control Engineering, Simulation of Electronic Systems, Simulation and Control in Transport Applications, Simulation and Control in Communications, Simulation in Education, Simulation in Economy.

The conference is open for poster sessions and exhibitions. Demonstrations of commercial simulation systems are particularly welcome. The official conference language is English and Slovak or Czech. Participants from outside the Slovak republic or the Czech republic are also welcome. Deadline for abstracts is June 15, 1993.

Sulov is located 15 km west of Zilina in the hills and is easily reached by car or bus. It is known as a touristic village with nice stones called "Sulovske skaly". Possible vacation activities are mountain tours and hiking. For more information about the conference or about the Slovak Simulation Group please contact Mikulas Alexik.

M. Alexik

SCS

WSC '92 celebrates Twenty-five Years of Progress

The Twenty-Fifth Anniversary Winter Simulation Conference (WSC) was held December 13-16, 1992, at the Crystal Gateway Marriott Hotel in Arlington, Virginia, U.S.A. The central theme of WSC '92 was the celebration of twenty-five years of progress in the field of simulation, and by many criteria, the conference was one of the largest and most successful in WSC's history. Total paid attendance was 733, including 62 attendees based outside the United States; this was the highest WSC attendance since 1971.

Featuring 154 full-length technical papers, 5 panel discussions, and 22 software/modelware tutorials, the program set a new record for the number of presentations. A co-ordinated sequence of Introductory Tutorials, Advanced Tutorials, and State-of-the-Art Reviews attracted many attendees. In addition there were sessions on Analysis Methodology, Modeling Methodology, Manufacturing Applications, Health Systems Applications, Military Applications, and General Applications. The WSC '92 Proceedings set another record, totaling well over 1400 pages.

The Exhibit Area was very popular with attendees, and it also set WSC records for the numbers of vendors represented and booths sold. Demonstrations of the latest simulation software and hardware were available, as well as examination copies of numerous simulation books and periodicals.

The celebration of WSC's silver anniversary commenced with a four-part Keynote Address surveying the past, present, and future of WSC as well as the field of simulation. WSC '92 General Chair Robert C. Crain began by outlining the origins of WSC and its "Early Years" (1967-1974), a period in which the structure and traditions of the conference were formed. Joseph M. Sussman of MIT began the Keynote Address by reviewing the evolution of simulation and WSC over the past twenty-five years. Next Thomas J. Schriber of The University of Michigan discussed WSC's "Renaissance Period" (1976-1985) in which the conference was reestablished and its traditions were reinforced. James O. Henriksen of Wolverine Software Corporation then summarized WSC's "Coming-of-Age Period" (1986-1992) in which both the conference and the field of simulation reached maturity as professional activities. Stephen D. Roberts of North Carolina State University concluded the Keynote Address by assessing the prospects for the future of these activities.

Immediately after the Keynote Address, WSC's General and Program Chairs from the period 1967-1974 participated in a special Twenty-Fifth Anniversary Panel Discussion moderated by WSC '92 Program Chair James R. Wilson.

The following individuals made presentations: Harold G. Hixson ('67 General Chair); Julian Reitman ('67 Program Chair, '68 General Chair); Philip J. Kiviat ('69 Program Chair, '70 General Chair); Michel Araten ('70 Program Chair, '71 General Chair); and Joseph M. Sussman ('71 Program Chair, '73 General Chair). Also contributing to the Proceedings article on the Twenty-Fifth Anniversary Panel Discussion were Arnold Ockene ('68 Program Chair, '69 General Chair) and Austin C. Hoggatt ('73 Program Chair).

Copies of the WSC '92 Proceedings may be obtained from the following sponsoring societies: Association for Computing Machinery (ACM); The Institute of Electrical and Electronics Engineers (IEEE); and The Society for Computer Simulation, International (SCS). For information on next year's WSC, contact EPIC Management, 8720 Red Oak Blvd., Suite 224, Charlotte, NC 28217, U.S.A., Tel: +1-(704) 529-1725, FAX: +1-(704) 525-2880.

Jim Wilson, WSC '92 Program Chair

ESM 93, European Simulation Multiconference, Lyon, France, June 7-9,1993

Venue: The 1993 European Simulation Multiconference will this year take place in Lyon, an old Gallo Roman city, renowned for its delicious food, right in the middle of Beaujolais country. The official headquarters and venue for the 1992 ESM will be L'Ecole Normale Superieure de Lyon. This high-tech school with its innovative architecture will certainly provide the conference participants an event to remember.

Scientific Program: The 1993 European Simulation Multiconference will bring together six individual conferences. Papers for presentation at the conference and for publication in the Conference Proceedings have been invited on the following subjects: Simulation Methodology and Practice, Simulation in Economics, Simulation in Aerospace, Simulation in Transport and Traffic, Simulation in Environmental Systems and Global Climate Modelling, Simulation in Parallel and Distributed Processing.

For further information please contact: The Society for Computer Simulation International, European Simulation Office , c/o Philippe Geril, University of Ghent, Coupure Links 653, B-9000 Ghent, Belgium, Tel/Fax: +32.91.234941, E-Mail: scsi@biomath.rug.ac.be

IMACS

1. MATHMOD VIENNA

1. MATHMOD VIENNA

1. MATHMOD VIENNA

1. MATHMOD VIENNA

February 2-4, 1994
Technical University Vienna, Austria

Scope: All aspects of mathematical modelling of all types of systems, including systems which are * dynamic or static * deterministic or stochastic * continuous or discrete * lumped parameter or distributed parameter * linear or non-linear * 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.

The scope of the topics to be discussed will include modelling theory * general aspects of modelling incl. modelling methodologies * modelling for/by simulation * qualitative modelling and associate learning networks in modelling * methodologies for model validation * guidelines for setting up models (checklist) * model simplification and order reduction including software for model reduction * automation of modelling and software supporting modelling * applications in engineering, natural sciences, biotechnology, biology, medicine, sociology, econometrics, etc. * relations between model type and problem solution (pre-determination of solution by modelling approach) * education in modelling

Deadlines: Submission of Abstracts: **May 1, 1993**, Notification of Authors: **September 1, 1993**, Full Paper due: **November 1, 1993**

All correspondence should be adressed to: Univ.Prof. Dr. Inge Troch, Technische Universitaet Wien, Wiedner Hauptstrasse 8-10, A-1040 Wien.

EC Special Interest Group "Simulation in Europe"

Involvement of the EC Special Interest Group "Simulation in Europe" in ESS93 European Simulation Symposium (Delft, The Netherlands, October 25-28, 1993)

There are signs of a rapidly increasing awareness that good and efficient simulation can save VERY much money in industrial processes and activities. The point is what is "good and efficient simulation". The time is come to generate and implement ideas about "Simulation of the future: new concepts, new tools and new applications". This is one of the major reasons that roughly one year ago the EC Special Interest Group "Simulation in Europe" (SiE) has been established. Special Interest Groups are Working Groups in the framework of the EC ESPRIT program to promote specific areas in Information Technology. In the meantime, current domain of problems have been analyzed and several novel activities have been initiated. Since it is one of the goals of SiE to disseminate knowledge and new understanding, it is obvious that SiE tries to be involved in European Simulation Conferences. The forthcoming 1993 European Simulation Symposium will be the first conference in which SiE takes active part by organizing special activities: A "MUST" FOR THE SIMULATIONIST.

ESS93 in Delft

The European Simulation Symposium series (ESS) is now in its fourth year. The previous ESS92 was held in Dresden and attended by 165 participants. ESS93 is organized and sponsored by the Society for Computer Simulation International SCS, and co-sponsored by the EC Special Interest Group "Simulation in Europe" (SiE).

ESS93 is hosted by Delft University of Technology, the second largest technical university in Western Europe with 12 Faculties, a teaching and research staff of 1400, a support staff of 2400, and 13000 students. The university belongs to the leading technical universities of Europe.

Scientific Program ESS93

The 1993 SCS European Simulation Symposium is structured around four major themes:

1. Dynamic Modelling and Information Systems

- dynamic modelling of information systems
- CAD, CAM, CIM, CIME, CAE systems
- simulation and scheduling
- concurrent engineering techniques

2. Multimedia Systems and Virtual Reality

- multimedia, hypermedia, data compression / fusion
- virtual reality techniques and applications
- simulation in education and training
- simulation in entertainment and gaming

3. High-Performance Computing and Simulation

- parallel methods in (continuous, discrete) simulation
- software tools for simulation on parallel and distributed hardware - applications of simulation on parallel and distributed hardware - simulation of (massively) parallel processes, neural networks

4. New Trends in Methods and Tools

- methods and techniques in simulation
- (object-oriented) simulation software tools, advanced environments - DBMS, AI and neural networks in simulation
- iconics, animation, graphics, scientific visualisation

Simulation in EC Projects

Under the control of the Special Interest Group SiE sessions will be organized dealing with simulation in EC ESPRIT and DELTA projects. These will be included as separate sessions in the above tracks.

In each of the 4 tracks invited lectures will be presented by international experts. In addition, two invited plenary lectures are scheduled: Henk G.Sol (the Netherlands): Dynamic modelling of information systems; Ben Delaney (USA): The relation between simulation, virtual reality and multimedia technology.

Monday afternoon, an OPEN meeting of the ESPRIT Special Interest Group "Simulation in Europe" (SiE) will be held. Discussion topics will be, among others, methodologies, standards, interfaces, ease of use, advanced environments, high-performance simulation, and simulation in EC projects.

Abstract submission / Correspondence

Extended abstracts of the papers (two pages typewritten without drawings and tables) are due to arrive IN QUADRUPLICATE at the SCS European Office BEFORE APRIL 15, 1993.

Correspondence address:

The Society for Computer Simulation International
European Office, c/o Philippe Geril
University of Ghent
Coupure Links 653, B-9000 Ghent, Belgium
Tel/Fax: +32 91 234941, E-Mail: scsi@biomath.rug.ac.be
(or from April '93 E-mail: scsi@fland.rug.ac.be)

Eugene J.H. Kerckhoffs (Gen. Conf. Chair)
Alexander Verbraeck (Progr. Chair)
Ghislain Vansteenkiste (SiE Chair)

Book Reviews

This section provides readers with detailed information on new books on modelling and simulation. Books are reviewed in detail. Because of the scope of this newsletter also non-english books are reviewed. We ask our readers the following:

- If you are the author of a book or know an author please send the book to the editors to be reviewed (ask the author to send the book).
- If you have studied a new book please send a detailed review to the editors.
- If you are willing to review a book please contact the editors to set up a review staff.

Hartmut Bossel "Modellbildung und Simulation" ("Modelling and Simulation") (in German)

Friedr. Vieweg & Sohn Verlagsgesellschaft mbH,
Braunschweig/Wiesbaden, 1992.
400 pages, with program disk.

The subtitles explain the aim and the purpose of the book. First, it deals with "concepts, methods and models for the behaviour of dynamic systems". Second, it is a "textbook for teaching and working with simulation software".

The author tries to open modelling and simulation also to people not familiar with the mathematical background of state space notation and differential equations. Consequently he uses the graphic modelling approach via System Dynamics, which turns out to be very useful together with the software offered with the book. But the author also gives an overview about the mathematical principles of modelling and simulation of dynamic systems, but as result of the modelling and simulation procedure (and not as requirement).

Chapter 1 is an introduction to the aim and the purpose of modelling and simulation and defines the principle terms, e. g. system, dynamic behaviour, hierarchy, models, modelling concepts, simulation model, etc.

Chapter 2 starts with basic modelling introducing the concepts of System Dynamics. First the ideas of Forresters' world model are discussed and formulated in terms of the qualitative causality diagram of action and reaction. Furthermore the concepts of the causality diagram of action and reaction are presented and analysed qualitatively.

Chapter 3 shows how a qualitative causality diagram can be reformulated as quantitative diagram with submodels and selection of states (levels); as example the world model is reformulated. Furthermore a quantitative model for a pendulum and for a predator-prey system is developed.

Chapter 4 presents the SIMPAS - simulation system (system on the disk) with the most important features. In the following the models for the pendulum and for the predator-prey system are implemented and analyzed with simulation (parameter variation, equilibrium point, sensitivity analysis, etc.).

Chapter 5 discusses advanced experimentation with the test models. First a reduced world model is implemented and analyzed by means of different scenarios and results of simulations are compared. Then optimization features are discussed within the predator-prey model and features for (optimal) control are sketched within the pendulum model.

Chapter 6 presents a collection of examples, the so-called 'system zoo'. Three groups of examples try to show all phenomena of (nonlinear) dynamics. Each example (on the disk within the simulator SIMPAS) is discussed with description, use, structural and behavioural features, critical values for parameters, reference solution (simulation), proposals for experiments. The first group consists of models with one state variable (various growth processes), the second group consists of models with two state variables (various growth and predator-prey systems, simple mechanical systems). The third group offers models with three or four state variables; the models are generalized predator-prey systems, chaotic dynamic behaviour and mechanical systems.

Chapter 7, the last chapter, gives an overview on the mathematical background for the models presented. It starts with state space desription, numerical integration, linearization and equilibrium points. After discussion of special features of linear models (matrix and vector operations, eigen values, etc.) the behaviour and the stability of systems are summarized: linear systems without and with input, nonlinear systems (attractors, etc.).

The textbook has to be highly recommended for teaching modelling and simulation in undergraduate courses and courses where students are not familiar with the mathematical background. But the book has to be recommended also as introduction into continuous modeling and simulation, especially in the area of ecology.

F. Breitenecker

Jack Kleijnen, Willem van Groenendaal "Simulation - A Statistical Perspective"

John Wiley & Sons, Chicester, 1992
ISBN 0-471-93055-5 x + 241 pages

This book addresses readers who wish to acquire a basic knowledge of simulation, especially of discrete simulation. It gives a survey of problems that can be analysed by means of simulation, especially problems in economics, business administration, management sciences, operations research, and mathematical statistics. Furthermore, the book shows how to analyse simulation results and discusses the efficient design of simulation experiments.

Chapter 1 is an introduction to simulation, giving some definitions and simple examples (macro-economic models, inventory models, management games, basic statistics, etc.).

Chapter 2 deals with random numbers. After a mathematical definition of random numbers and a survey on techniques for generating random numbers (e. g. dice throwing) different mathematical techniques for pseudo-random number generation are discussed. Furthermore tests for pseudo-random number generators are presented and subroutines for pseudo-random numbers from NAG and IMSL.

Chapter 3 deals with sampling from non-uniform distributions. First a table look-up algorithm for discrete distributions is discussed, then the inverse transformation method for continuous distributions. In the following distributions related to the exponential distribution, the normal distribution and related distributions, multivariate distributions and the rejection method (applied to normally distributed variables) are sketched.

Chapter 4 presents economic and corporate models showing the use of simulation in the scientific disciplines of economics and business administration. First macro- and micro-economic models and corporate models are presented, then the modelling method of System Dynamics is introduced.

Chapter 5 deals with OR models. After a discussion about advantages and disadvantages of fixed versus variable time increments some analytical results on the economic order quantity and the re-order point of inventory models are given; in the following inventory models with stochastic demand and stochastic lead time are presented. The chapter concludes with queuing models and miscellaneous models, including combined continuous/discrete event models.

Chapter 6 gives an overview on simulation software. First a simulation package for parallel servers is presented, which introduces the principles of (discrete) simulation software. The following survey of simulation software sketches briefly different classes of simulation software: simulators for communication networks (RESQME, Q-PAS, NETWORK, COMNET); simulators for manufacturing processes (SIMFACTORY, XCELL+, WITNESS, ProModelPC, 'Taylor', FLEXSIM); simulation languages (GPSS, SIMSCRIPT, SLAM, SIMAN, SIMULA).

Chapter 7 is an introduction for the later chapters showing how simulation can be applied in mathematical statistics. In this chapter the use of Monte Carlo simulation in mathematical statistics is reviewed, dealing with regression models, ordinary least squares, estimated weighted least squares, corrected least squares and case studies. The following two chapters are new in textbooks on (discrete) simulation. The author develops methods for analysing the results of both deterministic and stochastic simulations and for the design of simulation experiments based on (variance) analysis of the previous simulation results.

Chapter 8 introduces a metamodel concept which is used for analysis of simulation results. These metamodels are based on regression analysis of the input/output behaviour of the investigated model.

Chapter 9 summarizes the classical experimental design and presents other methods such as screening and response surface methodology.

Chapter 10 tries to answer the question how long a simulation should run in order to get accurate answers. The chapter first deals with terminating models, then with non-terminating steady state models; furthermore variance reduction techniques are discussed. Chapter 11 gives some information on verification, chapter 12 sketches relevant literature.

The preface of the book says "This book is based on nearly twenty-five years of experience in teaching simulation to students in management sciences. During the last few years this course has also been taught to students in information sciences,... The simulation course is taught during 13 sessions of 90 minutes each..." So the primary purpose of this book is clear - it is an excellent textbook for lectures in the field of discrete simulation (the authors offer also a disk with a collection of exercises for the book). But it also has to be recommended for readers who wish to acquire basic knowledge of discrete simulation and applications.

F. Breitenecker

This section is intended to inform readers about new simulation products and activities from companies related to simulation. Companies are invited to send contributions (10 to 20 lines) to be published here to the editors of EUROSIM - Simulation News Europe.

SIMUL_R for OS/2 and Windows NT

The simulation system SIMUL_R for continuous, discrete and combined systems is now available for the new 32-bit operating systems of the PC-world: OS/2 2.0 and Windows NT (the latter as pre-release, the official SIMUL_R 2.32 / Windows NT 1.0 will be available, when Windows NT is released officially).

The benefits of these versions are:

- increased performance (no more address computations), up to 20% for the same computer, with simulation runs and/or high resolution animations,
- 'unlimited' model size, like Megabyte arrays, without performance loss.

The new versions are fully compatible to all other versions of SIMUL_R (source, command, desktop, data file, plot data file, animation and image compatibility).

For information contact: SIMUTECH, Hadikgasse 150, A-1140 Vienna, Austria. Tel.: +43-(0)222-894 75 08; Fax: +43-(0)222-894 78 04.

Xmath - The First Integrated Mathematical Graphics Software for DEC VAX/VMS Workstations under POSIX/MOTIF

Xmath is the first mathematical analysis tool for DEC VAXstations to combine interactive colour graphics, a programmable colour graphics, a programmable graphical user interface, a fourth generation scripting language and an extensive IEEE-standard numerical functionality in an easy-to-use windowed interface. Furthermore Xmath is the first software developed in C++ for DEC's new POSIX operating system layer to fully take advantage of the MOTIF interface library.

Users can create and interactively modify a variety of 2D and 3D plots, interact with Xmath an MathScript, an object-oriented, fourth generation language designed for numerical problem solving, and extend and customize the Xmath environment by developing their own commands and functions in MathScript, C or FORTRAN. The programmable graphical user interface allows to develop and run interactive design tools from the Xmath environment. These tools can create and manipulate objects built from the Motif widget set without the need for software development in a low level language such as C or C++.

DEC's POSIX for VMS greatly reduced the efforts to be put into porting Xmath from UNIX to VMS allowing to replace UNIX-specific features with similarly functional POSIX features whereby preserving the design of the software.

Contact: Uwe Westermeier, Gabriele von Rüden-Kemeth, TEDAS Control Systems Software GmbH, Universitätsstr. 51, D - 3550 Marburg/Lahn 2, Tel: +49-(0)6421 9103 0, Fax: +49-(0)6421 9103 99.

ProModel Distributor in Italy

Following the agreement reached with RAMSES in November to market ProModel in France, we are now very pleased to announce that an agreement has been reached with ITALCONTROL SISTEMI in Rome to market ProModel in Italy.

ITALCONTROL SISTEMI are well established as suppliers of systems to the manufacturing industry and have already been able to introduce the benefits of ProModel to several major manufacturers in Italy, and will be providing full customer support and training services from their offices in Via Castel di Leva, Rome.

Roberto Gaist and Stefano Derme of ITALCONTROL SISTEMI were impressed by the simplicity of ProModel and the speed at which models can be built and these were key factors in their decision to market ProModel.

ProModel is the leading simulation system in the USA and some of the world's top companies who are already benefiting from ProModel include Boeing, General Electric, Ford, IBM, Hewlett Packard, Sony, DuPoint, Amoco, Westinghouse, Goodyear, Caterpillar, and many others.

There are also many Universities and Polytechnics around the world who find that the simplicity of ProModel makes it an essential part of their Manufacturing courses for engineers and senior managers in Industry.

Companies interested in becoming ProModel distributors or who wish to find out more about ProModel should contact Production Modeling Corporation of Europe, Barclays Venture Centre, University of Warwick Science Park, Sir William Lyons Road, Coventry CV4 7EZ, England, Tel: +44-(0)203 693485, Fax: +44-(0)203 690185.

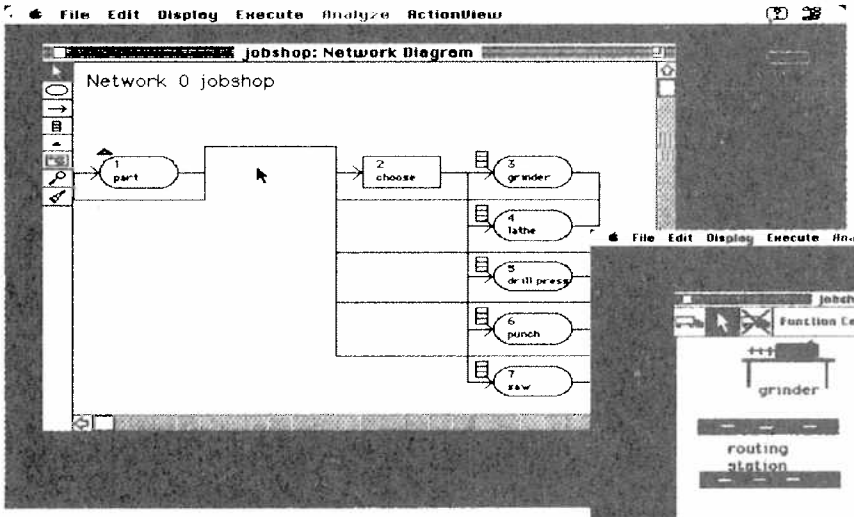
Micro Saint

MICRO ANALYSIS & DESIGN INCORPORATED

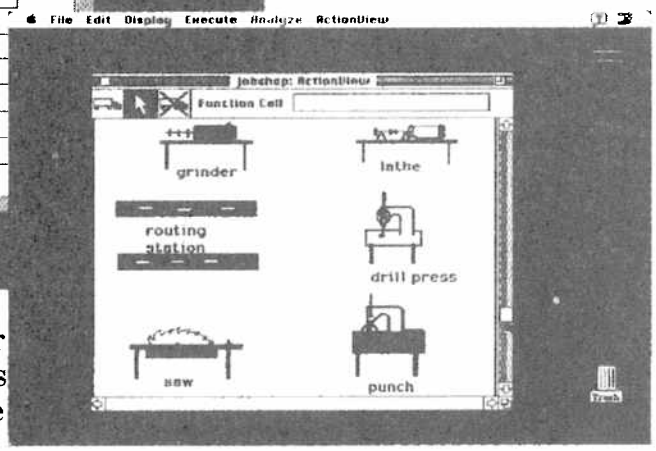
MicroSAINT is the first comprehensive simulation system that's available for the platforms - Windows, DOS, Macintosh and UNIX.

It can handle just about any simulation challenge you face. In fact, our users create everything from large models of manufacturing, assembly and materials handling systems to service industry processes such as banking, hospitals, transportation and food service.

MicroSAINT with ActionView allows you to create pictorial representations of your models.



Moving icons on a custom designed or scanned-in background provide a realistic presentation tool.



You will never need to write code or compile. By interacting with menus and windows you can quickly create complex models.

You can also modify models as they run, allowing you to try new solutions, look at more alternatives and solve the problems at hand.

So open a window of opportunity and close the door on complicated programming. Contact us today and we promise to show how easy and effective simulation modeling can be. For more information and free demonstration diskettes, please contact:

Rapid Data Ltd, Crescent House, Crescent Road, Worthing, West Sussex, BN11 5RW, UK, telephone +44 (903) 202819 or fax +44 (903) 820762.

RAPID DATA

Simulation Activities at the Riga Technical University

Main simulation centres in Latvia are the Riga Technical University and the Latvian University. The following is a survey of simulation activities at the Riga Technical University. Those at the Latvian University will be reviewed in the next issue.

Simulation activities at the Riga Technical University traditionally are concentrated at the Faculty of Automation and Computing Techniques. Several groups are working here in various fields of simulation theory and practice. For instance, Associate Prof. Dr. Juri Tolujev has about 15 years of experience in performing simulation projects with GPSS. Currently these groups are consolidated into the Department of Modelling and Simulation, being headed by Associate Prof. Dr. Yury Merkuryev.

Let's consider main directions of its activities.

1. Simulation of various types of systems. The whole range of simulation projects was/is performed, using both simulation languages (GPSS V, GPSS/PC, SIMAN/ Cinema) and general purpose languages (Pascal, C, Visual BASIC). Following are several examples of such projects:

- A general simulation model of the manufacturing system, being served by a team of workers (Dr. Juri Tolujev; both GPSS/PC and Pascal versions are available);
- A simulation model of the disaster medicine, being aimed to plan and evaluate the medical care to victims of disasters: earthquakes, traffic and technological accidents, and other catastrophic situations with mass casualities (Dr. Juri Tolujev and Dr. habil. Arkady Gandz (Latvian Academy of Medicine); GPSS/PC, dBASE III);
- A simulation model to schedule operations of the fishing-fleet (Dr. Juri Tolujev; GPSS/PC);
- A simulation model of economic aspects of Latvian Health Insurance Medicine (Dr. Yury Merkuryev; Visual BASIC);
- A simulation model of the typical technological process in chemical industry (Dr. Yury Merkuryev and Dr. Hannu Toivonen (Swedish University of Turku, Finland); SIMAN/Cinema).

2. A simulation methodology for discrete manufacturing systems (for instance, organization of large simulation projects, utilization of data bases, interactive interface, animation) (Dr. Juri Tolujev).

3. Knowledge-based simulation (Dr. Yury Merkuryev and Dr. Galina Merkuryeva). A user-friendly knowledge-based simulation system with graphical interface is under development.

4. Optimization of simulation models (Dr. Yury Merkuryev). The goal is to define optimization algorithms, which are the most suitable for optimization of parameters of simulation models in various typical situations.

5. Correlated iterative optimization of simulation models (Prof. Dr. habil. Leonard Rastrigin). Here correlation between random variables, being generated during optimization operations, is controlled. This correlation is aimed to increase efficiency of the optimization procedure.

6. Modelling of educational processes (Prof. Dr. habil. Leonard Rastrigin). Models being developed are used in the educational system ASOLIJA. It assists in studying foreign languages from the PC. Its various commercial versions are available (for instance, for English or German speaking students, studying Russian; for German speaking students, studying English, and vice versa). Audio support is also available.

7. Computer-aided instruction course in discrete-event simulation (Dr. Yury Merkuryev, Dr. Juri Tolujev, Prof. Dr. habil. Leonid Novicky, Dr. Vjatcheslav Shitikov). Currently 3 first lessons for the following topics are available:

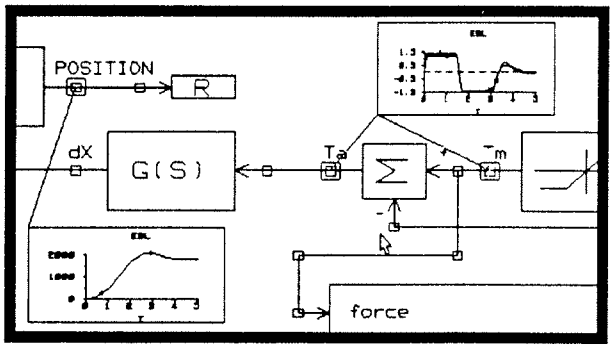
- General principles of discrete-event simulation;
- Queueing systems and their parameters;
- How to collect input data for GPSS-based simulation models

Finally, the department of Modelling and Simulation is much interested in contacts with regard to educational activities in the simulation area: curricula, course programms, text-books, software, etc.

Those interested in scientific and educational co-operation please don't hesitate to contact us. All kinds of collaboration are welcome!

Yury A. Merkuryev, Department of Modelling and Simulation, Riga Technical University, Kalku Street No. 1, LV - 1658 Riga, Latvia,
E-mail: Yury.Merkuryev@f10.n495.z2.fidonet.org

ESL: THE LANGUAGE OF SIMULATION



With over seven years development maturity, ESL is **THE** simulation language for advanced applications.

Developed with the support of the European Space Agency and used on several advanced projects, ESL offers a full range of simulation facilities.

Whatever your process, if it can be modelled, it can be simulated by ESL.

* Advanced language features for handling continuous mathematical models with discontinuities.

* Advanced graphical interface for generating simulation models and displaying results.

* Interpretive running for checking, or compiled Fortran 77 code for optimum performance.

* Hardware support includes PC-AT, SUN and DEC workstations, IBM RS6000, VAX, Prime and Gould Minicomputers.

* Low cost evaluation copies available.

* Regular seminar and training course programme.

* Alternative textual or pictorial block model definition.

For more information contact:-

Dr J L Hay

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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.

The idea has become quite successful. Here we would like to thank all the authors who took the challenge and the time, solved the problems, documented them and sent in their contributions. It should be noted that in this issue we are able to welcome the 50th contribution to this series!

The following comparisons have been defined:

Comparison 1: Lithium-Cluster Dynamics under Electron Bombardment, November 1990

Comparison 2: Flexible Assembly System, March 1991, comments July 1991

Comparison 3: Analysis of a Generalized Class-E Amplifier, July 1991

Comparison 4: Dining Philosophers, November 1991

Comparison 5: Two State Model, March 1992, revised July 1992

Comparison 6: Emergency Department - Follow-up Treatment, November 1992

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

SNE No.	Comparison					
	C1	C2	C3	C4	C5	C6
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
Total	19	16	10	8	3	1

It is planned to terminate comparisons that have been existing for quite some time one by one. We will continue to define new comparisons. Please find in the following for each comparison some comments on contents and expiration date.

Comparison 1 (Lithium Cluster Dynamics) addressed all kinds of simulation software and will end in July 1993. Up to now 19 solutions have been sent in, an evaluation can be found in Number 6, November 1992. A final summary will be prepared for the end of 1993.

Comparison 2 (Flexible Assembly System) resulted in 16 solutions. This comparison will expire by the end of 1993. A preliminary evaluation can be found in Number 4, an updated version will be prepared.

Comparison 3 (Analysis of a Generalized Class-E Amplifier) focussed on simulation of electronic circuits resulting in up to now 10 solutions. A preliminary evaluation is being prepared, the comparison will end in July 1994.

Comparison 4 (Dining Philosophers) is a more general task involving not only simulation but also different modelling techniques like Petri nets. Up to now 8 solutions have been sent in, the comparison will continue to run.

It turned out that **Comparison 5** (Two State Model) takes more into account a very high accuracy computation than state events. For this comparison we would need a few more solutions, especially examples which concentrate on the switching points rather than on the high accuracy. This type of solutions would complement the sophisticated solutions already published which feature high accuracy. This will broaden the aspect of the comparison, including both solutions requiring high timing accuracy and those where switching points is regarded as of more practical significance.

Comparison 6 (Emergency Department - Follow-up Treatment) is quite a new comparison, it started in the previous issue.

Due to the general strategy (two comparisons a year, one continuous, one discrete) this issue introduces a **new continous comparison** which addresses all kinds of simulation software.

For the next issue we plan to define a more general comparison which will be intended to test different possibilities of parallelization and vectorization of simulation tasks.

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 e-mail):

- short description of the language
- model description (source code, diagram, ...)
- results of the tasks with experimentation comments max. 1 page A4

For publication in EUROSIM - Simulation News Europe all contributions that exceed one page will be modified by the editors to fit into one page.

We also invite you to prepare demo programs, test versions, and animations on diskette and to make them available for interested persons. Please send diskettes to the editors first.

EUROSIM - Simulation News Europe Editors

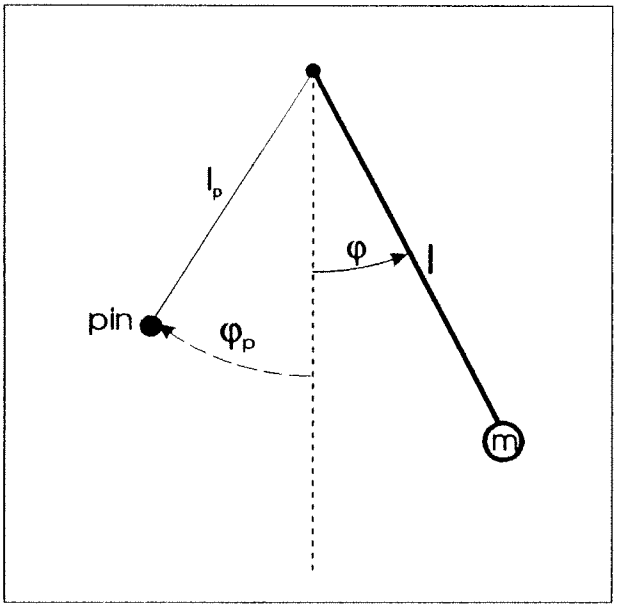
Comparison 7: Constrained Pendulum

This comparison tests features of simulation languages regarding state events, comparison of models, and parameter variation. The system under investigation is a constrained pendulum.

The motion of the pendulum is given by the equation

$$m\,l\,\ddot{\varphi} = -m\,g\,\sin\varphi - d\,l\,\dot{\varphi}$$

where φ denotes the angle measured in radians counter-clockwise from the vertical position. The parameters m and l characterize the pendulum with mass m and length l, d is a damping factor.



If the pendulum is swinging, it may hit a pin positioned at angle φ_p with distance l_p from the point of suspension. In this case the pendulum swings on with the position of the pin as the point of rotation and the shortened length $l_s = l - lp$.

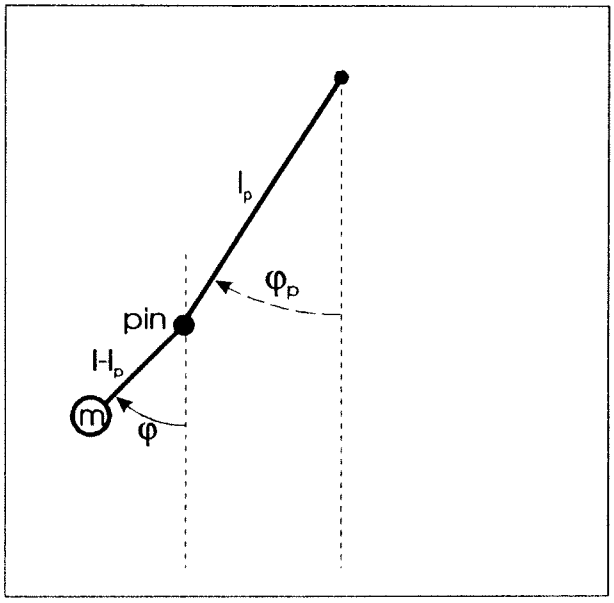
Note that the angular velocity $\dot{\varphi}$ is defined now with respect to the new point of rotation; therefore the angular velocity $\dot{\varphi}$ is changed at position φ_p from $\dot{\varphi}$ to $\dot{\varphi}\frac{l}{l_s}$.

The above equations remain valid.

If the pendulum swings back and passes φ_p, the pendulum behaves as before with length l, and the angular velocity $\dot{\varphi}$ is changed at φ_p from $\dot{\varphi}$ to $\dot{\varphi}\frac{l_s}{l}$, and so on.

General parameters for the following tasks are

$m = 1.02$, $l = 1$, $l_p = 0.7$ ($l_s = 0.3$), $g = 9.81$



Task a): Simulate the motion of the pendulum with the following initial conditions and plot φ over t:

i) $\varphi_o = \frac{\pi}{6}$, $\dot{\varphi}_o = 0$, $d = 0.2$, $\varphi_p = -\frac{\pi}{12}$, $t \in [0,10]$

ii) $\varphi_o = -\frac{\pi}{6}$, $\dot{\varphi}_o = 0$, $d = 0.1$, $\varphi_p = -\frac{\pi}{12}$, $t \in [0,10]$

(the pin is left of the pendulum)

Task b): The equations can be linearized giving the linear model

$$m\,l\,\ddot{\varphi}_L = -m\,g\,\varphi_L - d\,l\,\dot{\varphi}_L$$

Implement the linear model and compare the results of non-linear and linear model by plotting φ and φ_L together and the deviation over t for

$\varphi_o = \varphi_{Lo} = \frac{\pi}{12}$, $\dot{\varphi}_o = \dot{\varphi}_{Lo} = 0$,

$\varphi_p = -\frac{\pi}{24}$, $d = 0.2$, $t \in [0,10]$.

Indicate, whether the language permits comparison of sequential simulation runs of the different models, or whether the two models must be run simultaneously as a single simulation.

Task c): For

$$\varphi_o = \frac{\pi}{6},\ \varphi_p = -\frac{\pi}{12},\ d = 0.2$$

determine the initial angular velocity $\dot{\varphi}_o$ so that the maximum angle of the shortened pendulum φ reaches exactly $-\pi/2$. Indicate experimentation commands or model changes for automatic or manual variation of initial angular velocity $\dot{\varphi}_o$.

F. Breitenecker

Comparison 1 - TUTSIM

Description of TUTSIM

TUTSIM is a block-oriented simulation system with some equation oriented aspects. It supports a wide range of analog and discrete blocks for system modelling and control. In addition there are blocks for Bondgraph models in this simulation system. Some Studies in the frequency domain may be made by the TUTFFT task. TUTSIM was developed at the Twente University of Technology in The Netherlands and is now supported and distributed by: Meerman Automation, Postbus 15, 7160 AC Neede, The Netherlands, Tel. +31-5450-93901, and for North America and Canada: TUTSIM Products, 200 California Avenue # 212, Palo Alto, CA 94306, USA .

TUTSIM runs on IBM-PC/XT/AT and PS/2 compatibles. The mathematic coprocessor 80x87 is supported, but not necessary. Supported graphic boards are Hercules, IBM CGA, IBM EGA, IBM VGA and SVGA.

Model description

The model was set up by TUTSIM's own interactive editor TUTEDIT, which automatically starts at each simulation session, except you have a predefined model on disk. All defined symbols (left hand side of the equations below) may be accessed by TUTCALC, the simulation part of TUTSIM, which follows after TUTEDIT.

```
F=PLOT[f]
    PLOT number          : 1.00000
    Minimum              : 0.000000
    Maximum              : 2.50000E-2
dmrdt=1[(1.00000E-1*f*f)-m]          ;dm/dt + dr/dt
drdt=1[(m*f)-(1.00000E-1*r)]         ;dr/dt
f=INT[-drdt-(2.00000*dmrdt)-         ;f(t)
    (1.00000E+3*f)]
    Initial value        : 9.97500
m=INT[dmrdt-drdt]                    ;m(t)
    Initial value        : 1.67400
r=INT[drdt]                          ;r(t)
    Initial value        : 8.49900E+1
t=TIME[]
    Time step DELTA      : 5.00000E-4
    End time             : 1.00000E+1
```

Results

All simulation runs were made on an 16 MHz 386-SX-AT with a Cyrix-Coprocessor, which is compatible to the Intel 80387-SX.

a) Computing time depending on the two different integration algorithms available on TUTSIM

TUTSIM has two different integration algorithms with fixed stepsize:
- Adams-Bashfort second order (INT)
- Euler (EUL)

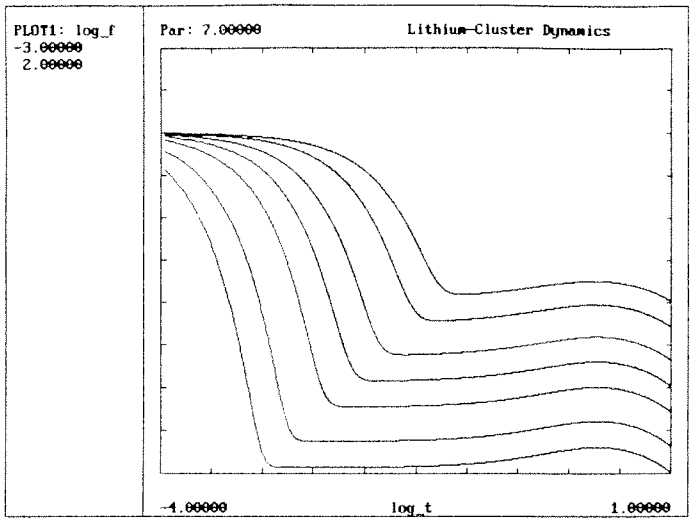
The algorithm is selected within TUTEDIT by selecting the block for the integration (INT or EUL). The simulation time was measured with linear spacing of t-axis und f(t)-axis. During simulation run a VGA-plot was drawn with 500 simulation points on the screen.

algorithm	maximum stepsize	simulation time
INT	5E-4	49 sec
EUL	5E-4	44 sec

b) Paramater variation of l_f

For the parameter variation l_f was defined as a function table [100, 200, 500, 1000, 2000, 5000, 10000] with a variable as input. TUTCALC can vary the parameter value via this input during an automatic multirun.

To get a logarithmic plot, two LOG-blocks were added.



c) Steady states

For calculation of steady states, the derivations of the differential equations have to be set to zero. The result are 3 algebraic equations with the state variables at the left hand side:

$$r = k_r mf / d_r$$
$$m = (d_r r + k_f f^2 - k_r mf) / d_m$$
$$f = (d_r r + 2d_m m - k_r mf - 2k_f f^2 + p) l_f$$

To avoid algebraic loops, m and f are defined by ADL (Algebraic delay) blocks. The table below shows the results for p=0 during 5 iteration steps:

n	m	r	f
0.000000	1.67400	1.66982E+2	9.97500
1.00000	9.95006	-1.64695	-1.65521E-2
2.00000	2.73973E-5	5.45208E-6	1.99001E-2
3.00000	3.96013E-5	-9.66588E-12	-2.44080E-8
4.00000	5.95750E-17	4.71849E-23	7.92026E-8
5.00000	6.27305E-16	-7.12279E-33	-1.13546E-18

and for p=10000:

n	m	r	f
0.000000	1.67400	1.66982E+2	9.97500
1.00000	9.95006	9.93359E+2	9.98345
2.00000	9.96692	9.96689E+2	9.99997
3.00000	9.99993	9.99987E+2	9.99993
4.00000	9.99987	9.99987E+2	1.00000E+1
5.00000	1.00000E+1	1.00000E+3	1.00000E+1

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Comparison 2 - POSES

Short description of POSES V4.3

The simulation system POSES (*Prädikat-Transition-snetz-Orientiertes-Simulations und Entwurfs-System*) developed by the Technical University Chemnitz and implemented in version 4.3 by GPC mbH Chemnitz allows modelling and simulation based on extended predicate transition nets. Extensions to predicate transition nets are (fix or stochastic value dependent) time consumpting transitions, free matching expressions on arcs, additional boolean conditions for transition concession, special access mechanisms for predicates (ram, lifo, fifo, fiforam, liforam), logical token generating interrupts and so on.

The models have to be specified by using the POSES-language. In this language the user has to define data structures for tokens and predicate types like in the programming language PASCAL. Also the net structure with all necessary arc expressions has to be defined in this language.

The POSES-Editor, Compiler, Linker and Generator are in a POSES-development shell including tools to create independent executable simulation programs. Nearly all pa-rameters (consumption time, capacities, priorities, tokens, states, lifeness, trace parameters, ..) of the modelled net elements can be defined or changed by the user during experiment sessions.

By using high level Petri nets the abstraction level for modelling and simulation depends only on the user's selection. Global and detailed aspects are possible in the same model. Moduls of ready-made net substructures are also useful.

POSES offers the inclusion of user-defined PASCAL or C routines. In this way POSES is also a simulation environment to develop a test control software on a level chosen by the user. POSES applications are simulation services for plant and warehouse logistics, organisation, computer communication and control software development problems.

Model description

The full net model is segmented into 8 equally structured net modules. Buffer components like B1, B2, the rest buffer behind work station B2', input shift Sx and output shift Sy are modelled by predicates. All work stations Ax, all transportation flows into B1, B2, B2' are modelled by time consumpting transitions. The pallets flowing through the system are represented by data tokens containing a record structure like a work order paper. Depending on the data state of these records the control mechanism is implemented as conditions and matching masks in arc expressions.

Experimentation Results

The results of the simulation are given in the table:

Number of pallets	total throughput	average throughput time [s]
15	1454	282
16	1455	302
17	1454	322
18	1457	341
19	1459	360
20	1462	380
21	1457	420
22	1460	424
23	1462	438
24	1440	465
25	1439	485
40	1440	785

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Comparison 2 - EXAM

1. A description of EXAM

The general purpose system EXAM is intended to support all stages of simulation process: the model description, the experiment description and the simulation itself. In accordance with this EXAM contains two separate frames: Model Description Frame (MDF) and Experiment Description Frame (EDF). In order to apply EXAM to a definite area, one needs to put necessary modules (reflecting the main features of the process) to a special library. Because of the modular concept, the simulation model can be represented as a hierarchy of elements linked to each other. MDF makes it possible to view and modify both structure of the model and any parameters of elements (including procedural ones) without any reprogramming. EDF enables to include any standard or non-standard methods and combine them to design complex experiments which can be carried out even with several models.

The base language for EXAM is object-oriented Turbo Pascal. EXAM has an interactive shell, working under MS-Windows 3.0 or its higher versions, which is intended to give the user the possibility to describe models and experiments without knowledge of any programming and mathematics.

2. Model description

In order to illustrate the possibilities of EXAM, we used two representations of the model. The general scheme of these models is the same in both cases and is shown in Figure 1, which is actually a representation appearing on the screen during the work in MDF. In both cases EXAM was extended with a set of necessary modules, based on the internal mathematical model (aggregative one). In the first representation each element shown in Figure 1 was built from a single module describing the dynamics of the station as a whole. Different elements are obtained from the module by specifying its parameters. In the second representation each element from Figure 1 is actually a subsystem consisting of several other elements, describing the dynamic of the station, see Figure 2. The links between the elements in both cases reflect both pallets flow and artificial information signals related to possible blocking of the belts.

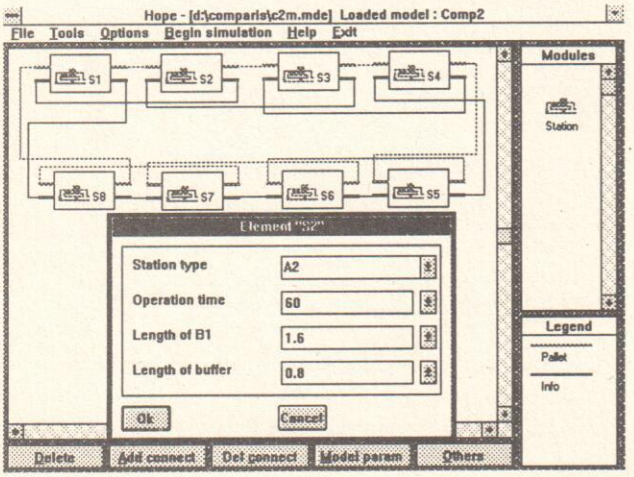

Figure 1

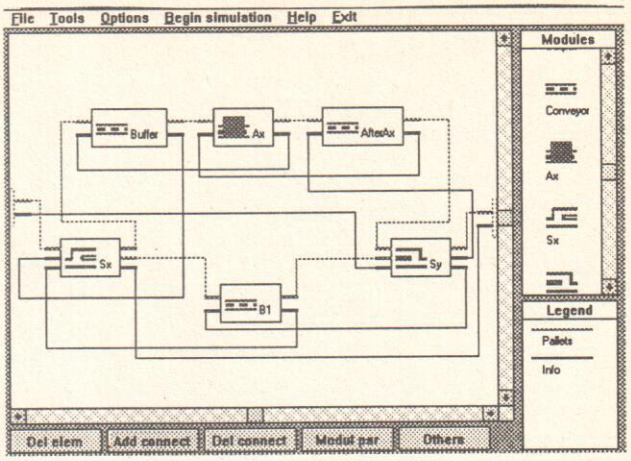

Figure 2

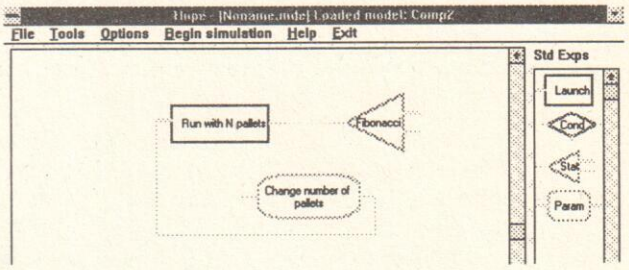

Figure 3

3. Results

In order to illustrate the work of EDF, we organized an optimization of the system by Fibonacci's method, using the objective function $Q = c_1T_1 + c_2T_2$, where $c_1 = 1$, $c_2 = -1/400$ (actually, they have been taken arbitrarily), T_1= total throughput, T_2= average throughput time. A general scheme of the experiment is shown in Figure 3. The steps of the optimization for the first model are collected in the table:

Number of pallets	T_1	T_2
34	1411	693.756
21	1409	429.674
13	1155	323.922
26	1410	532.318
18	1396	371.190
23	1411	470.103
20	1404	409.519
22	1410	449.886
21	1409	429.674

The optimal number of pallets is 21. The results for the second model are very close to those for the fist one (the differences are only due to the randomness of the initial states). So, we omit them.

4. Technical Data

The above model was run on an IBM AT 386/387 compatible computer operating at 20 MHz. The total run time at each step of optimization took from 0.5 to 3 min (depending on the number of pallets and, therefore, on the number of events).

For information and comments, please contact Prof. Dr. Vladimir Kalashnikov, Institute of System Analysis, Russian Academy of Sci., 9, Prospect 60 let Oktjabrja, 117312 Moscow, Russia; Fax: +7-095-9382209; Telex: 411237 POISK, E-mail: person@vniisi.uucp.free.msk.su

Comparison 3 - DESIRE/X

DESIRE/X is a new simulation system capable of solving 1500 ordinary differential equations in scalar and/or matrix form on Sun SPARCstations running OPEN WINDOWS (i. e. UNIX with XWindows graphics). Dynamic systems desrcibed by up to 1500 differential equations can be combined with multiple neural networks with over 20,000 synapses. One-line declarations can define entire arrays of fuzzy-set membership functions for control-system simulations. A large screen-editor window permits editing even while simulations run. Even large programs compile directly into memory in under 0.1 sec to permit truly interactive modelling.

Comparison Problem 3 requires substantial computation accuracy. Double-precision calculations were used (DESIRE/X is implemented in ANSI C). For good resolution, we programmed successive simulation runs for each cycle. The final values of each run were used as initial values for the next run. For the time plot, display 2 plots values for consecutive simulation runs on the same plot. For the phase-plane plot, display 0 suppresses plotting for 4 cycles to suppress plotting the initial transient; display 1 then turns the plot on.

A variable-step 4/2 Runge-Kutta integration rule seemed to give the best results. Compilation, directly from the OPEN WINDOWS screen editor into the computer memory, takes less than 0.05 sec, so that no noticeable delay is perceived. A 5-cycle window plot (Fig. 1) was then produced in 41 sec on a 40-MHz SPARCstation IPX under OPEN WINDOWS 3. Figure 1 was reproduced on a personal computer VGA display since we had no printer on the SPARCstation. The actual display is in color; the small rectangles at the bottom of the display are color keys.

```
-- EUROSIM PROBLEM No. 3
-- L,C scaled to measure time in microseconds
-----------------------------------------------------
VDC=5 |  RL=52.4
L1=79.9 |  C2=17.9E-03 |  L3=232 |  C4=9.66E-03
LL1=1/L1 |  CC2=1/C2 |  LL3=1/L3 |  CC4=1/C4
TRF=1.0E-09
t1=5.0 |  t2=t1+TRF |  TMAX=2*t1 |  tmax=5*t1
base=5.0E-02 |  slope=(1.0E+06-1.0E-02)/TRF
-----------------------------------------------------
irule 4 |  --      variable-step Runge-Kutta 4/2
DT=1.0E-09 |  DTMIN=1.0E-11 |  ERMIN=1.0E-11
-----------------------------------------------------
display N15 |  display C15 |  -- display colors
NN=150
scale=25
-----------------------------------------------------
t0=-tmax |  --                  offset for xy  plot
drun  |  display 2
for i=1 to 4 |  t0=i*t-tmax |  t=0 |  drun |  next
-----------------------------------------------------
DYNAMIC
-----------------------------------------------------
R=base+slope*(t-lim(t-TRF)-lim(t-t1)+lim(t-t2))
VL=x3*RL |  RI=x2/R |  --              for display
d/dt x1=(VDC-x2)*LL1
d/dt x2=(x1-RI-x3)*CC2
d/dt x3=(x2-VL-x4)*LL3
d/dt x4=x3*CC4
--
vl=VL+0.5*scale |  ri=50*RI-0.5*scale
tt=t+t0
dispxy tt,vl,ri
```

Fig. 2. Complete DESIRE/X program generating the time plot in several successive simulation runs (**drun** calls).

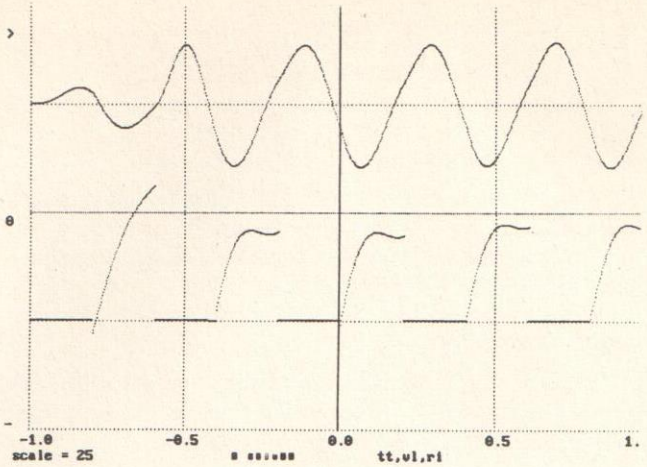

Fig. 1

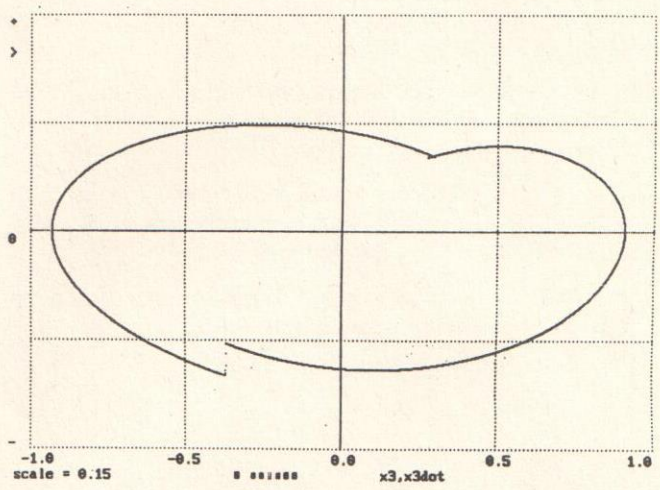

Fig. 3

```
-----------------------------------------------------
VDC=5 |  RL=52.4
L1=79.9 |  C2=17.9E-03 |  L3=232 | C4=9.66E-03
LL1=1/L1 |  CC2=1/C2 |  LL3=1/L3 |  CC4=1/C4
TRF=1.0E-09 |  t1=5 |  t2=t1+TRF
base=5.0E-02 |  slope=(1.0E+06-1.0E-02)/TRF
-----------------------------------------------------
irule 4 |    --    variable-step Runge-Kutta 4/2
DT=1.0E-09 | DTMIN=1.0E-11 | DTMAX=0.0E-10 | ERMIN=1.0E-11
TMAX=10 |  NN=15000
-----------------------------------------------------
display N15 |  display C15 | --        display colors
scale=0.15
display 0
for i=1 to 4 |  drun |  t=0 |  next
display 1
drun
-----------------------------------------------------
DYNAMIC
-----------------------------------------------------
R=base+slope*(t-lim(t-TRF)-lim(t-t1)+lim(t-t2))
VL=x3*RL |  RI=x2/R |  --              for display
d/dt x1=(VDC-x2)*LL1
d/dt x2=(x1-RI-x3)*CC2
x3dot=(x2-VL-x4)*LL3
d/dt x3=x3dot
d/dt x4=x3*CC4
--
dispxy x3,x3dot
```

Fig. 4. This program suppresses the runtime display for the first 4 simulation runs (display 0) and then produces a phase-plane plot.

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Comparison 4 - POSES

The POSES Software

A short description of the POSES software system and the modelling philosophy with hogh level Petri-nets is given in the Comparison 2 solution (flexible assembly system), page 31.

Model description

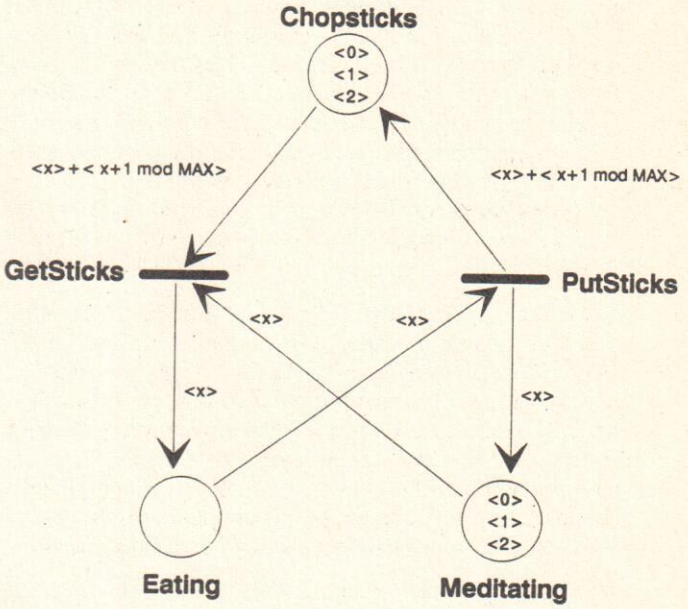
The cover of EUROSIM Simulation News Europe (November 1991) shows a simple Petri-net for the discussed problem of thinking and eating philosophers.

The model shows a condition-event net. Much more compressive net definitions are coloured nets and predicate-transition nets. Often such net models are evaluated by folding of simple net structures.

An especially nice example for such an evaluation result is the predicate-transition model of the given condition-event net like shown in the figure.

This model structure is independent of the number of philosophers and sticks. These are parameters set by a start situation of the token vector over all predicates.

A POSES-model description of this net ist given in the following POSES programming sequence:




```
system      Philosoph;

const       MAX             = 5;
type        Nr              = 0.. (MAX-1) ;
            BufferType      = ram [MAX] of Nr;
var         x               : Nr;
buffer      Meditating      : BufferType (<<0>>+<<1>>+<<2>>+<<3>>+<<4>>) ;
            Chopsticks      : BufferType (<<0>>+<<1>>+<<2>>+<<3>>+<<4>>) ;
            Eating          : BufferType;

net         GetSticks(in    Meditating [<<x>>],
                            Chopsticks [<<x>> + <<x mod MAX + 1>> ]
                    out     Eating [<<x>>]);

            PutSticks(in    Eating [<<x>>]
                    out     Meditating [<<x>>],
                            Chopsticks [<<x>> + <<x mod MAX + 1> >]);

end         Philosoph
```

For a model behaviour in which a philosopher tries to get one stick first and only after he succeeded the philosopher tries to get the other stick the model structure has to be changed. The access to both sticks has to be divided into two single following transitions.

Such a new model consists of the predicates:

Meditating, Waiting_For_Next_Stick, Eating and Chop-Sticks.

Transitions are:

Get_Left_Or_Right_Stick, Get_Other_Side_Stick, Put-Sticks.

Remarks

On a notebook (386SX, 20 MHz, no coprocessor) the POSES simulator needs 4,23 ms to fire one transition of this model. Because of backtracking fails (firing try for a transition without concession) it needs only 3.37 ms per try.

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Comparison 4 - NETLAB

1. The System

NETLAB is a software package for the design, simulation and analysis of Petri-Nets (state-/transition-nets) which is especially suitable for beginners in Petri-Net theory. It consists of three main programs, a graphical editor and two analysis modules that use a graph-theoretical and an algebraic analysis method. NETLAB operates on IBM-AT compatible computer systems with a VGA graphics adapter and display and a Microsoft Mouse. The program menus and the 35 page manual are written in German.

NETLAB provides an easy to use interface with pull-down menus which will usually be operated with a mouse. Net data are transferred between different modules via a dedicated database.

2. Implementation of the Application Example

At the start of a NETLAB session the user has to edit the desired net structure and the net properties. For this purpose the net editor EDINET provides a very simple way of entering places, transitions and connecting arcs. If necessary, further information as place capacity, transition delay time, arc-weight or comments can be added. Finally the initial net marking has to be determined. At this point, it is already possible to get a first impression of the net behaviour by firing activated transitions and watch the tokens flow through the net.

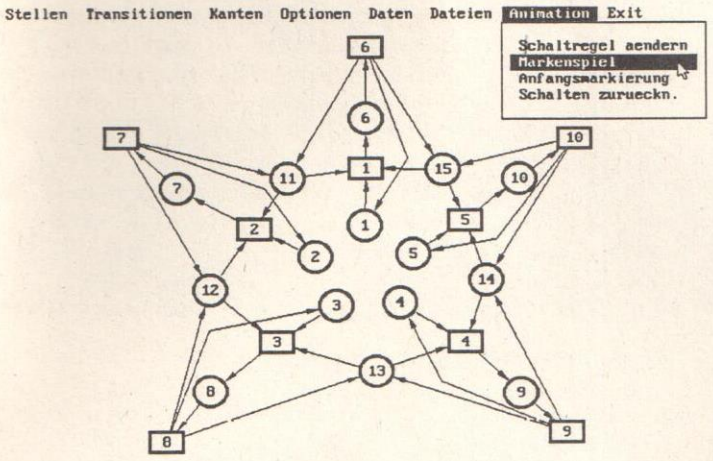

Figure 1: NETLAB editor screen

Fig. 1 shows the editor screen for the philosopher's example. All places and transitions are labelled with integers. Information of certain net nodes can be obtained by simply clicking on the node. If the Petri-Net is completed it can be saved in the database. Afterwards the module can be closed.

After this procedure, the desired net can be analyzed with the modules INVARI or ANALYSE. INVARI calculates the place- and transition-invariants of a Petri-Net which determine characteristic sets of places/transitions. For the philosopher's example this respectively leads to the place-invariants in Fig. 2. Here the invariants 1 to 5 denote the philosophers 1 to 5 with their meditating and eating states. The other invariants refer to the internal couplings in the system which arise from the concurrent use of chopsticks by two adjacent philosophers.

```
!IS1 !   !0!          !1!          !0!          !0!          !0!          !0!
!IS2 !   !0!          !0!          !1!          !0!          !0!          !0!
!IS3 !   !0!          !0!          !0!          !1!          !0!          !0!
!IS4 !   !0!          !0!          !0!          !0!          !1!          !0!
!IS5 !   !0!          !0!          !0!          !0!          !0!          !1!
!IS6 !   !0!          !1!          !0!          !0!          !0!          !0!
!IS7 !   !0!          !0!          !1!          !0!          !0!          !0!
!IS8 ! = !0! + P1     !0! + P2     !0! + P3     !1! + P4     !0! + P5     !0! +
!IS9 !   !0!          !0!          !0!          !0!          !1!          !0!
!IS10!   !0!          !0!          !0!          !0!          !0!          !1!
!IS11!   !0!          !0!          !0!          !0!          !0!          !0!
!IS12!   !0!          !0!          !0!          !0!          !0!          !0!
!IS13!   !0!          !0!          !0!          !0!          !0!          !0!
!IS14!   !0!          !0!          !0!          !0!          !0!          !0!
!IS15!   !0!          !0!          !0!          !0!          !0!          !0!

!IS1 !                !0!          !0!          !0!          !0!          !0!
!IS2 !                !0!          !0!          !0!          !0!          !0!
!IS3 !                !0!          !0!          !0!          !0!          !0!
!IS4 !                !0!          !0!          !0!          !0!          !0!
!IS5 !                !0!          !0!          !0!          !0!          !0!
!IS6 !                !1!          !0!          !0!          !1!          !0!
!IS7 !                !1!          !1!          !0!          !0!          !0!
!IS8 ! = ... + P6     !0! + P7     !1! + P8     !1! + P9     !0! + P10    !0!
!IS9 !                !0!          !0!          !1!          !0!          !1!
!IS10!                !0!          !0!          !0!          !1!          !1!
!IS11!                !1!          !0!          !0!          !0!          !0!
!IS12!                !0!          !1!          !0!          !0!          !0!
!IS13!                !0!          !0!          !1!          !0!          !0!
!IS14!                !0!          !0!          !0!          !0!          !1!
!IS15!                !0!          !0!          !0!          !1!          !0!
```

Figure 2: Place-invariants for the philosopher's example

ANALYSE calculates the set of reachable markings i.e. the reachability tree for a given initial marking. In contrast to the results obtained by means of invariants, the conclusions derived from this analysis depend on the initial marking of the Petri-Net. Thus the influence of certain initial conditions can be tested. The graph-theoretical analysis also provides information on "critical" transitions. These are transitions which, under a certain marking, lead into deadlocks. Furthermore the analysis denotes activator or deactivator markings for critical transitions.

NETLAB provides an easy way to model and analyze discrete systems by means of Petri-Nets. Future developments will primarily concentrate on a completely new implementation of NETLAB for MS-Windows 3.x and a programming and control interface to conventional PLCs.

For information or comments please phone, fax or write to Dipl.-Ing. Stefan Wintz, Institut für Regelungstechnik der RWTH Aachen, Steinbachstr. 54, D-5100 Aachen, Tel. : +49-(0)241-80-7506, Fax: +49-(0)241-874687.

Comparison 6 - SIMUL_R - SIMUNIT

1. The Language: SIMUL_R (see comparisons 1 to 5) is a compiling simulation language for continuous and discrete systems, the discrete part is called PROSIMUL_R. The system offers graphical and textual modelling, using one or more models in one simulation program. Examinations are done by using menus and/or a strong runtime interpreter. SIMUNIT is the unit (dimension) module for SIMUL_R, which is used here to specify different time units within one model.

2. The Model: Some additional (but near-to-reality) assumptions have been made to the problem description of comparison 6: for instance the plaster room has its own queue - patients entering the waiting area again have to queue at the end of the queue (fifo) for task a).

The following SIMUL_R model shows the usage of units. The array stations_of_patient contains the next station a patient must go to; MOVE or SEIZE destinations between brackets are called "indirect station access" and specify an arbitrary expression for a station number (in the sequence defined by the STATIONS statement). A macro has been used to model the CWs because they only differ in the distribution parameters for task a). #A(i) are user definable entity attributes, #SI(0) contains the type of the entity (0-3), #SI(2) the priority (0,1,...). #WATCH() computes statistics for the processing time of the patients, taking a new value, each time a patient reachs this command.

```
UNIT s, min = 60*s, hour = 60*min;                    " define units "
PROCESS Eurosim6, 250 {          " title, at most 250 entities "
    STATIONS Arrival, Registration, Waiting_Area, CW1, CW2, ...
            CONSTANT p_patient_group[4] = { 0.35, 0.20, 0.05, 0.40 } ;
                              " probabilities of patient types "
    CONSTANT int stations_of_patient [4,5] = {
            X_raying_queue, Waiting_Area, Exit, 0, 0,
            Plaster_Room_queue, Exit, 0, 0, 0, X_raying_queue,
            Plaster_Room_queue, X_raying_queue, Waiting_Area,
            Exit, Exit, 0, 0, 0, 0 } ;
                              " for each type, the list of stations "
    CONSTANT TASK = 1;  " type of task to be performed (1,3) "
...
    EXTERN [min] t;                  " time has unit min "
...
DYNAMIC {                            " model "
    Arrival {
    CREATE_DIST exp_dis(0.3), mdiscr_dis(4,&p_patient_group[0]),250;
    #A(0) = t;                       " save time of income - 'time stamp' "
            #FIFO;  #SEIZE(Registration) ; MOVE Registration; } ;
    Registration, 1 {  DELAY_DIST triang_dis ( 0.2, 0.5, 1.0);
            #FREE() ; #A(1) = -1;                    " step count "
            MOVE Waiting_Area; } ;
    Waiting_Area {  #A(2) = SWI ( discr_dis(0.60)==0, CW1, CW2);
            " select one of the casualty wards and store in entity attributes "
            DELAY_TIME [hour]8; " don't enter CW before 8 o'clock "
            #FIFO ; #SEIZE(((int)#A(2))); " indirect SEIZE and MOVE "
            MOVE ((int)#A(2)); } ;
    #define CW(#num,a,b,c) #
            CW#num #, 2 {        " macro for both CWs "
            DELAY_DIST triang_dis ( #a, #b, #c);
            #FREE()  #A(1) = #A(1)+1;
            MOVE (stations_of_patient[#SI(0),(int)#A(1)]);
            " move to station, depending on type of entity and step " } ;
    #endm
            #CW(1, 1.5, 3.2, 5.0)   " call macros for CW1 and CW2 "
            #CW(2, 2.8, 4.1, 6.3)
    #end
    X_raying_queue { #FIFO ; #SEIZE(X_raying) ; MOVE X_raying; } ;
    X_raying,2 { DELAY_DIST triang_dis ( 2.0, 2.8, 4.1);
            #FREE() ; #A(1) = #A(1)+1;
            dest = stations_of_patient[#SI(0),(int)#A(1)];
            IF TASK!=3 || dest!=Waiting_Area, move_em;
            " set priority high for patients going to Waiting again, if task 3 "
            #SI(1) = 1; :move_em MOVE (dest); } ;
    Plaster_Room_queue { ...                          "see X-ray queue"
    Plaster_Room,1 { ...
    Exit {     " compute statistics for overall treatment time "
            treat_t = t - [min]#A(0);
            #WATCH(treat_t,mean,vari,mini,maxi)
                              " compute statistics for each patient type "
            GOTO (#SI(0)) type_0, type_1, type_2, type_3; ...
    :leave_em ready=ready+1;      " increase ready count "
    LEAVE; } ; TERMINATE ready=250;  " terminate, if all are ready " } }
```

For task c) (TASK=3) the priority is set at station X_raying. For task b) we only have to change the station Waiting_Area: adding a DO-block with some C-statements, setting a LOGICAL variable doctors_changed according to the count_wait_CW2 variable (the count of patients waiting for CW2). Futhermore the CW-macro must be changed at the DELAYing time statement. The selection of one of the two doctors is done automatically by PROSIMUL_R's first_cap-function, which returns the currently free capacity (in this case doctor), of the current station:

```
Waiting_Area { #A(2) = SWI ( discr_dis(0.60)==0, CW1, CW2);
    DELAY_TIME [hour]8;
    DO { /* doctors' switching, if destination is CW2 and counts are
            as described */
            if (#A(2)==CW2) { count_wait_CW2++;
            if (count_wait_CW220) doctors_changed=TRUE;
            else if (count_wait_CW25) doctors_changed=FALSE; } }; ...
#define CW(#num,a,b,c,d,e,f,fact) #
    CW#num #, 2 { #SI(9)=first_cap(CW#num #);
            " select the free of the two doctors , treatment delay, if first
            doctor selected and doctors changed use other distribution "
            (with factors) "
#endm
```

3. Results and Conclusions: The following results (table, tt = treatment time, in minutes) are based on the mean of 20 simulation runs for each task (about 4 seconds on a PC 486 per run). All values are minutes. The task c) priority ranking shows only little benefit (deviation of 79.7 to 74.8), although the overall treatment time per patient becomes better. Naturally the treatment time for group 1) and 3) patients can be decreased, this one for the "simpler cases" 2) and 4) increases. Task b) (exchanging doctors) increases treatment time, because the queue for CW2 if longer than 20 patients most of the time, and the unexperienced doctor - now in CW1 - let patients wait for a much longer time.

(mean of 20 simulation runs):	task a)	b)	c)
last patient leaves at (o'clock)	13.42	14.27	13.45
mean of tt per patient	173	184	159
std. dev. of tt per patient	79.7	93.0	74.8
mean of tt for one of type 1) pat.	234	251	163
mean of tt for one of type 2) pat.	142	146	158
mean of tt for one of type 3) pat.	247	261	177
mean of tt for one of type 4) pat.	125	145	155

To get a benefit from task c) the distribution (60 percent) to CW1 and CW2 and/or the doctor exchange bounds (5,20) should be changed. The doctors should start to work at 7.30! Furthermore, SIMUL_R's discrete optimization algorithm DOPTCONPAR can be used to reach an optimal priority schedule (each time changing the priority of a patient, when he/she leaves a station).

For information and comments, please phone or fax or write to SIMUTECH, Hadikgasse 150, A-1140 Vienna, Austria. Tel.: +43-(0)222-894 75 08; Fax: +43-(0)222-894 78 04.

Classes on Simulation

April 1993

19-23 ***Simulation kontinuierlicher Systeme*** (in German), CCG-Lehrgang, Munich, Germany.
Contact: Carl-Cranz-Gesellschaft, Ges. f. technisch-wissenschaftliche Weiterbildung, Flugplatz, W-8031 Oberpfaffenhofen, Tel: +49-(0)8153 28444, Fax: +49-(0)8153 281345

20-22 **CACI Comnet II.5 Training Course**, Camberley, U.K.
Contact: CACI Products Division, MECC Business Center, g. Martinolaan 85, 6229 GS Maastricht, The Netherlands, Tel: +31 43 670780, Fax: +31 43 670 200

20-22 **CACI Simfactory II.5 Training Course**, Maastricht, Netherlands
Contact: CACI Products Division, MECC Business Center, g. Martinolaan 85, 6229 GS Maastricht, The Netherlands, Tel: +31 43 670780, Fax: +31 43 670 200

21-23 **Modelling & Simulation Shourt Course (ACSL)**, Eastbourne, U.K.
Contact: Rapid Data Ltd., Crescent House, Crescent Road, Worthing, West Sussex BN11 5RW,U.K.

May 1993

3-4 ***Schulung "Grundlagen zum Entwurf geregelter Systeme"***, Marburg, Germany
Contact: TEDAS Control Systems Software GmbH, Universittsstr. 51, D - 3550 Marburg/Lahn, Tel: +49-(0)6421 9103 0, Fax: +49-(0)6421 9103 99.

5-7 ***Schulung "MATRIXx-Einführung"***, Marburg, Germany
Contact: TEDAS Control Systems Software GmbH, Universittsstr. 51, D - 3550 Marburg/Lahn, Tel: +49-(0)6421 9103 0, Fax: +49-(0)6421 9103 99.

11-12 ***Echtzeitregler-Seminar***, HdT, Essen, Germany
Contact: TEDAS Control Systems Software GmbH, Universittsstr. 51, D - 3550 Marburg/Lahn, Tel: +49-(0)6421 9103 0, Fax: +49-(0)6421 9103 99.

11-13 **CACI Simscript II.5 Training Course**, Camberley, U.K.
Contact: CACI Products Division, MECC Business Center, g. Martinolaan 85, 6229 GS Maastricht, The Netherlands, Tel: +31 43 670780, Fax: +31 43 670 200

17-19 **CACI Network II.5 Training Course**, Maastricht, The Netherlands
Contact: CACI Products Division, MECC Business Center, g. Martinolaan 85, 6229 GS Maastricht, The Netherlands, Tel: +31 43 670780, Fax: +31 43 670 200

24-28 **Mathematical Modeling and Digital Computer Simulation of Engineering and Scientific Systems**. Zurich, Switzerland
Contact: Dr. J. Halin, ETH Zurich, Clausiusstr. 33, CH-8092 Zurich, Switzerland, Tel: +41 1 256 4608, Fax: +41 1 262 2158

24 ***Seminar "CASE Extensions"***, Marburg, Germany
Contact: TEDAS Control Systems Software GmbH, Universittsstr. 51, D - 3550 Marburg/Lahn, Tel: +49-(0)6421 9103 0, Fax: +49-(0)6421 9103 99.

25 ***Seminar "RT/Fuzzy"***, Marburg, Germany
Contact: TEDAS Control Systems Software GmbH, Universittsstr. 51, D - 3550 Marburg/Lahn, Tel: +49-(0)6421 9103 0, Fax: +49-(0)6421 9103 99.

26 ***Seminar "RT/Expert"***, Marburg, Germany
Contact: TEDAS Control Systems Software GmbH, Universittsstr. 51, D - 3550 Marburg/Lahn, Tel: +49-(0)6421 9103 0, Fax: +49-(0)6421 9103 99.

June 1993

17-18 **SIMUSOLV Modeling Course**, Karlsruhe, Germany
Contact: Rapid Data Ltd., Crescent House, Crescent Road, Worthing, West Sussex BN11 5RW,U.K.

September 1993

15-17 **Modelling & Simulation Shourt Course (ACSL)**, Eastbourne, U.K.
Contact: Rapid Data Ltd., Crescent House, Crescent Road, Worthing, West Sussex BN11 5RW,UK.

Calendar of Events

April 1993

12-16 IMACS/IFAC 2nd Intern. Symposium on **Mathematical and Intelligent Models in System Simulation.** Brussels, Belgium
Contact: Secretariat of the MIM-S 93 Symposium, c/o Lab. d' Automatique, CP 165 - U.L.B., av. F.D. Roosevelt 50, B-1050 Brussels, Tel: +32 2 650 2613, Fax: +32 2 650 2677

19 **ACSL User Conference**. London
Contact: Tony White, Middlesex University, Mechanical Engineering Dept., Bounds Green Road, Middlesex, London N11 2NY, Tel.: +44-(0)81 362 5212.

22-23 ASIM Workshop ***"Simulation und Künstliche Intelligenz"***. Karlsruhe, Germany.
Contact: H. Szczerbicka, Universität Karlsruhe, Institut für Rechnerentwurf und Fehlertoleranz, Postfach 6980, D - 7500 Karlsruhe, Tel: +49-(0)721 608 4216, E-mail: helena@ira.uka.de

28 DBSS Meeting: **Technical and Vocational Training and Simulation Practice in Relation with Education"**. Delft, NL
Contact: F.J. Pasveer, HR&O, G.J. de Jonghweg 4-6, 3015 GG Rotterdam, The Netherlands, Tel.: +31-(0)10 4366244.

May 1993

4-6 **CACI International Simulation Conference 18**, Maastricht, NL
Contact: S. Mukherjee, CACI Products Division, Suite 11, Coliseum Business Centre, Watchmoor Park, Riverside Way, Camberley, Surrey GU15 3YL, Tel: +44 276 671671, Fax: +44 276 670677

7-9 **ITEC 93**, Concurrent Engineering. Wembley, U.K.
Contact: SCS International, c/o Philippe Geril, The European Simulation Office, Coupure Links 653, B - 9000 Ghent, Belgium. Tel/Fax: +32-91-234941, E-Mail: scsi@biomath.rug.ac.be

13 UKSS Meeting: **Real Time Simulation and Simulators**. Cambridge, U.K.
Contact: Mrs. E. Rimmington, Computing Centre, Watts Building, University of Brighton, Moulsecomb, Brighton BN2 4GJ, U.K., Tel.: +44 273 600 900.

June 1993

1-4 **5th Symposium on Modelling and Simulation of Systems MOSIS '93**. Olomouc, Czech Republic
Contact: Jan Stefan, Chairman of MOSIS 93, Technical University of Ostrava, Department of Computer Science, tr. 17. listopadu, 708 33 Ostrava, Czech Republic

7-9 **ESM 93. European Simulation Multiconference**. Lyon, France
Contact: SCS International, c/o Philippe Geril, The European Simulation Office, Coupure Links 653, B - 9000 Ghent, Belgium. Tel/Fax: +32-91-234941, E-Mail: scsi@biomath.rug.ac.be

9-11 **35th SIMS Conference**. Kongsberg, Norway.
Contact: Torleif Iversen, SINTEF Automatic Control, N-7034 Trondheim, Norway, Tel.: +47-7594474, Fax : +47-7594399, Email: torleif@itk.unit.no

15-18 **15th International Conference "Information Technology Interfaces" ITI '93**. Pula, Croatia
Contact: Branka Radic, University Computing Centre, J. Marohnica bb, 41000 Zagreb, Croatia, Tel: +38 41 518 656, Fax: +38 41 518 451,E-Mail: branka.radic@uni-zg.ac.mail.yu

16-18 **QUARDET '93**. 3rd IMACS International Workshop on Qualitative Reasoning and Decision Technologies. Barcelona, Spain
Contact: Roser Piera, Facultat d'Informatica de Barcelona, Dept. MAII (UPC), c/Pau Gargallo 5, E - 08028 Barcelona. Tel: +34 3 401 69 22, Fax: +34 3 401 70 40, E-mail: nuria@ma2.upc.es

July 1993

19-21 **Summer Computer Simulation Conference '93**. Boston, USA.
Contact: Dr. Joel M. Schoen, SCSC'93 Committee, The MITRE Corporation, 202 Burlington Road, Bedford, MA 01730-1420, USA. Tel: +1 617.271.2230, Fax: +1 617.271.5173, E-mail: jms@mitre.org

August 1993

23-25 **1st Copenhagen Symposium on Computer Simulation in Biology, Ecology and Medicine**. Copenhagen, Denmark
Contact: Philippe Geril, SCS European Simulation Office, Coupure Links 653, B - 9000 Ghent, Belgium. Tel/Fax: +32-91-234941, E-Mail: scsi@biomath.rug.ac.

September 1993

13-15 **United Kingdom Simulation Society Conference UKSS 93**. Lake District, U.K.
Contact: Dr. R. Zobel, Dept. of Computer Science, University of Manchester, Oxford Road, Manchester M13 9P1, U.K., Tel: +44 61 275 6189, Fax: +44 61 275 6236.

20-22 ***Fachtagung: Petri-Netze im Einsatz für Entwurf und Entwicklung von Informationssystemen***. Berlin, Germany
Contact: Prof. Dr. Gert Scheschonk, C.I.T. Communication and Information Technology GmbH, Ackerstr. 71-76, D - 1000 Berlin 65

20-22 **World Transputer Congress**. Aachen, Germany
Contact: Dr. R. Grebe, DeTAG, Inst. f. Physiologie, RWTH Aachen, Pauwelstrasse, W-5100 Aachen, Germany, Tel.: +49 241 8088822, Fax: +49 241 875992.

28-30 **ASIM 93. 8. Symposium Simulationstechnik**. Berlin, Germany.
Contact: R-P. Schäfer, GMD-First, Rudower Chaussee 5, O-1199 Berlin, Tel: +49-(0)30 6704 2867, Fax: +49-(0)30 6704 5610.

29-October 1
Performance 93. Roma, Italy.
Contact: Dr. Bruno Ciciani, Dipartimento Ingegneria Elettronica, Universita di Roma "Tor Vergata", Via Ricerca Scientifica, I-00133 Roma, Italy, Tel: +39-(0)6 72594478, Fax: +39-(0)6 2020519, Email: PERF93@irmias.bitnet

October 1993

12-14 **Modeling, Simulation and Control of Systems**. Sulov, Slovak R.
Contact: Mikulas Alexik, VSDS - KTK, Velky Diel, 01026 Zilina, Slovak R., Tel.: +42 089 54042, Fax: +42 089 54806.

17-20 1993 IEEE/SMC International Conference on Systems, Man and Cybernetics. **Systems Engineering in the Service of Humans**. Le Touquet, France
Contact: IEEE/SMC, LAIL Ecole Centrale de Lille, Boulevard Paul Langevin, BP 48, F-59651 Villeneuve d'Asqu Cedex, France, Tel: +33 30 33 53 53, Fax: +33 20 33 54 99

25-28 **ESS 93. European Simulation Symposium**. Delft, The Netherlands.
Contact: SCS International, c/o Philippe Geril, The European Simulation Office, Coupure Links 653, B - 9000 Ghent, Belgium. Tel/Fax: +32-91-234941, E-Mail: scsi@biomath.rug.ac.b

December 1993

12-15 **1993 Winter Simulation Conference**. Los Angeles, USA:
Contact: Edward C. Russell, Russell Software Technology, 1735 Stewart St., Santa Monica, CA 90404, Tel: +1 310 453 2927, Fax: +1 310 829 6760.

February 1994

2-4 **1. MATHMOD VIENNA**. Vienna, Austria.
Contact: Prof. I. Troch, Technische Universität Wien, Wiedner Hauptstr. 8-10, A-1040 Wien.

June 1994

21-23 **Massively Parallel Processing, Applications and Development**. EUROSIM Conference, Contact: DBSS

September 1994

ASIM 94. 9. Symposium Simulationstechnik. Stuttgart, Germany.

September 1995

18-22 **EUROSIM Congress**. Vienna, Austria