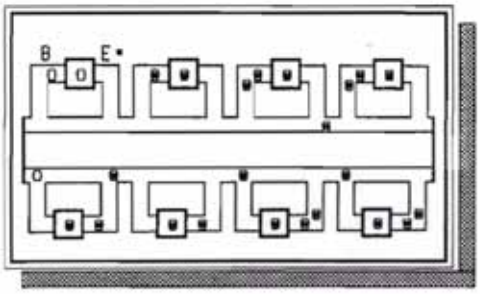
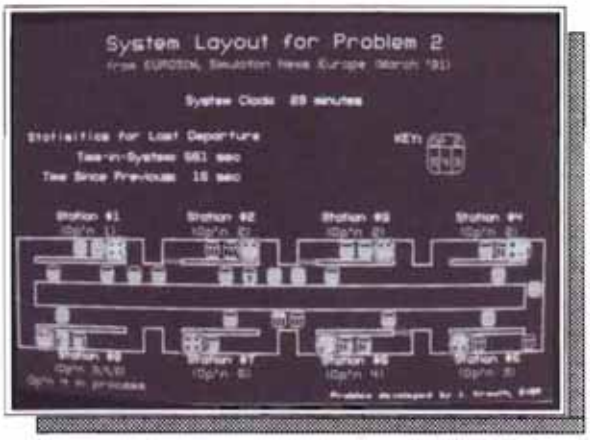
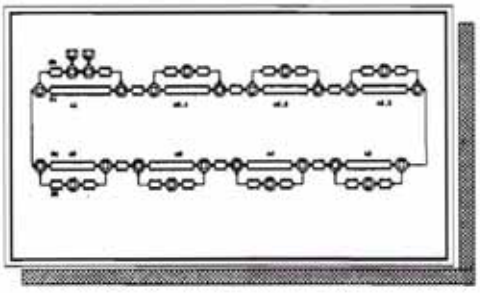
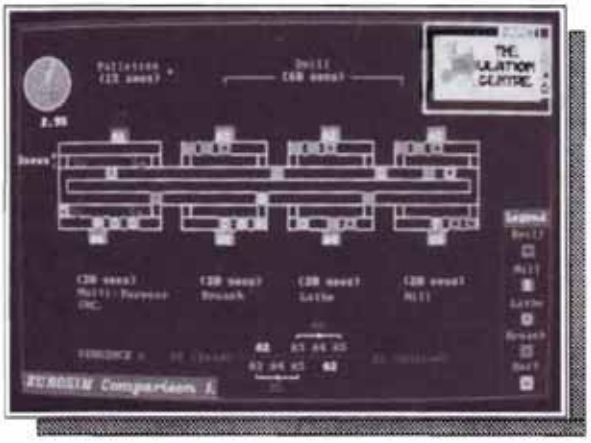
EUROSIM
Simulation News Europe

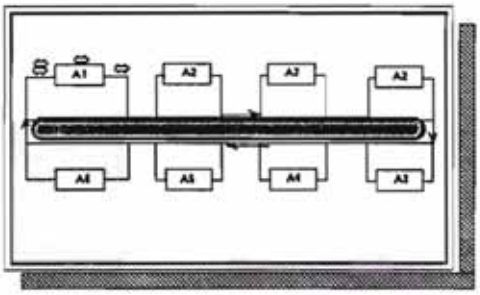
Number 4 A European Forum on Simulation Activities March 1992











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Readership Information

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Mrs. Irmgard Husinsky

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Editorial Board of the European Simulation Societies:

Editorial

Due to the numerous contributions from our readers, escpecially for the software comparisons, and the big interest of advertising companies this issue has again become quite comprehensive.

First the activities of EUROSIM, the umbrella organization for European simulation societies, are briefly sketched. European simulation societies report on their activities and provide special information for their members. We are glad to hear about the foundation of the Croatian Simulation Society and about growing activities in the Czech&Slovak Simulation Society.

Our regular sections inform about international societies, book news, industry news, and simulation centers. Quite interesting is a summarizing study on simulation activities in the former GDR.

This issue starts with a new section "Book Reviews". If you know new books on modelling and simulation please contact the editors. For more information see also page 24.

You will find quite a lot of solutions to the software comparisons in this issue. We are happy that so many readers responded to our challenge. The author of comparison 2 made a preliminary evaluation of the solutions published up to now. The last comparison (dining philosophers) is reflected not only in software solutions but also in theoretical investigations. A new comparison is introduced, testing the features of continuous simulation software in handling state-dependent changes of the model. You can still send in solutions for the previous comparisons, there are several software tools that have not yet been introduced.

The back cover announces the EUROSIM '92 congress in Capri, being the official triennial congress of the European simulation societies. We hope to see you there.

Thanks go to all authors who contributed to this issue.

All readers are kindly invited to send letters, comments, suggestions or contributions to one of the editors. Deadline for the next issue will be June 15, 1992.

F. Breitenecker, I. Husinsky

EUROSIM - Simulation News Europe

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

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

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Address: c/o Computer Center, Technical University of Vienna, Wiedner Hauptstraße 8-10, A-1040 Wien

SIMPLE++

"Next Generation of Simulation Software"?

"SIMPLE++ marks the next Generation of Simulation Software" was said by many visitors during the first public presentation from 21st - 29th January 1992 on the IFM '92 (International Fair of Logistics) in Basel, Switzerland. The very positive response is based on significant enhancements in productivity, user-friendliness, application-variety and implementation-technique seeing SIMPLE++.

SIMPLE++ is the right solution if simulation is needed in industry and research. Special features are offered for the manufacturing industry. SIMPLE++ covers all applications in Production, Materialflow, Transportation and Logistics. SIMPLE++ is available on all popular workstations with UNIX/X-windows, PC´s with SCO-UNIX/X-windows and Apple Macintosh with AUX. Several customers have bought SIMPLE++ already. It is safe to buy SIMPLE++ because solid concepts of the successful predecessor SIMPLEmac are used in a refined and generalized way.

Main Features of SIMPLE++

- fully object-oriented
- implemented in C++
- powerful graphical user-interface
- integrated, non-procedural enviroment (e.g. modelling simultanesly to animation)
- complete set of basic-elements to build user-definable application-elements without programming
- graphical definition of control-structures
- decision-tables and/or control-language
- separation of material- and information-flow
- powerful and flexible information-management
- inheritence, hierarchy
- sensor-actor-concept
- interfaces: ASCII-files, CAD, DBMS

SIMPLE++ was developed by AESOP and the Fraunhofer-Institute for Production and Automation (IPA-FhG), both in Stuttgart, Germany.

Wanted !! Business-Partners Wanted !!

Would you like to sell and/or provide simulation-services with SIMPLE++ ?
We are seeking Business-Partners in two categories:

Your Profile in Sales & Marketing

- experience in the successful selling of complex application-software to the manufacturing-industry
- Simulation Software extends/ completes your current product-portfolio (e.g. Object-Management, CAD/CAM, Planning and Control of Production, Warehouse/Logistic-systems)
- several people in sales or acquisition
- UNIX-platform for product demonstration

Your Profile in Simulation-Services/Studies

- engineering/consulting company planning Production-, Materialflow-, Warehouse-, Logistics-Facilities
- Simulation knowledge is available or will become an attractive business for growth or diversification
- you may use other simulation-software
- at least one dedicated person for simulation
- UNIX-platform for using SIMPLE++

If you do not have a similar profile to that described above or you are not actually interested in a new relationship please forward this offer to appropriate addresses or just give us a hint. Thank you !

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EUROSIM News

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. Maceri (ISCS).

The map of Europe is changing dramatically. Therefore EUROSIM tries to contact new simulation groups in different countries and to motivate them to join EUROSIM. If your group is interested please contact the editors.

Report on EUROSIM Board Meeting

On October 12 and 13, 1991, a meeting of the EUROSIM board was held in Menton, Cote d'Azur. Present were Mr. Breitenecker and Mr. Halin (ASIM), Mr. Dekker (DBSS), Mr. Laret (FRANCOSIM, only part of the meeeting), Mr. Maceri and Mr. Savastano (ISCS), Mr. Juslin (SIMS, only part of the meeting), Mr. Zobel (UKSS). On the first day of the meeting Mr. van Drunen from North Holland was present. Therefore first the plans for the new journal "Journal of Simulation - Theory and Practice" and for the newsletter "EUROSIM - Simulation News Europe" were discussed.

The president opened the meeting. The first topic was the new journal and the newsletter. Mr. Breitenecker handed out an overview with three possibilities concerning the printing of the newsletter. The conclusion of the discussion was that there will be a separate newsletter three times a year, as up to now. The newsletter will be printed and distributed by a publisher if the publisher (North Holland) makes a suitable quotation. The contents of the newsletter will also be included in the scientific journal.

Furthermore it was agreed that distribution of the newsletter to East European countries, to specific persons and institutions (for promotion) should be carried on. The editors are responsible for the contents, also for the advertisements. Up to now the profit from the advertisements is used for promotion (copies for East European countries, for special persons, institutions and libraries, etc.).

The draft of the contract for the scientific journal was discussed in detail. A lot of points have to be changed. The first issue of the journal should appear in autumn 1992 (EUROSIM congress). Further discussions concerned editor in chief, editorial board, etc.

The bylaws for EUROSIM are nearly ready now. Mr. Zobel will check the english version and send it to the societies as soon as possible.

A lot of time was allowed for the EUROSIM congress in Capri. Mr. Maceri reported on the preparations. Up to now there are ten interesting exhibitors, a lot of abstracts were sent. In the following the board discussed on invited speakers, who will be invited officially by the president. This congress will be the main event of EUROSIM for this year. See also announcement on the back cover of this issue.

A part of the scientific committee was planned to meet in December to review the first abstracts. The local organising committee is preparing interesting social events.

Further points of discussion were relations to other societies, the new status of UKSS, and others.

The next board meeting was scheduled for December.

From left to right: Mr. Dekker, Mr. Zobel, Mr. Juslin, Mr. Savastano, Mr. Halin, Mr. Breitenecker, Mr. Maceri

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 ASIM board met on December 16th, 1991 in Frankfurt to discuss open subjects. 12 of the currently 14 board members were present. Dr. Abeln of GI joined us for the discussion of the co-operation of ASIM and GI.

Main subjects of the meeting were: Reports by the speakers of the working groups; Prof. Hummeltenberg gave a detailed report on the foundation of the working group "*Simulation in der Betriebswirtschaft*", planned activities and co-operation with DGOR. Further points of discussions were the *ASIM-Jahresbericht 1991*; next issue of EUROSIM - Simulation News Europe; EUROSIM congress in Capri, 1992; publications and organizational and financial affairs.

We are still in the process of founding a working group "*Simulation von Verkehrssystemen*". Prof. Baron of Universität Dortmund currently prepares a first meeting. Invitations to this meeting will be mailed to all members of ASIM. Please contact Dr. Bausch-Gall if you are interested in this working group.

The next meeting of the board will be on April 2nd in Berlin. Please contact a board member if you think a subject should be discussed at that next meeting.

Contact Addresses

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Switzerland:
PD Dr. Jürgen Halin
ETH Zürich, Institut für Energietechnik
Clausiusstrasse 33, CH-8092 Zürich
Tel: +41-(0)1/256-4608, Fax: +41-(0)1/2623973 or 2520192

Address change of board members

New address: Prof. Dr. Dietmar Möller, TU Clausthal, Institut für Informatik, Erzstraße 1, W-3392 Clausthal-Zellerfeld, Tel: +49-(0)5323/722402, Fax: +49-(0)5323/723572

New phone number: Prof. Dr. Dj. Tavangarian, Tel: +49-(0)2331-987-4410 or -4411, Fax: +49-(0)2331-64373.

ASIM Meetings to come

March 9-10, 1992: Meeting of the Working Group "*Simulation technischer Systeme*" at Universität Paderborn. For more information contact Prof. G. Kampe.

March 26-28, 1992: 5th Ebernburg Working Conference. For more information contact Prof. D.P.F. Möller (address see above) or Prof. O. Richter at TU Braunschweig, Institut für Geographie und Geoökologie, Langer Kamp 19c, W-3300 Braunschweig, Tel. +49-(0)531/3915627.

April 27-28, 1992: Meeting of the Working Group "*Simulationsmethoden und Sprachen für parallele Prozesse*" in Dresden. For more information contact Dr. Hans Fuss.

May 7-8, 1992: Meeting of the Working Group "*Simulation und künstliche Intelligenz*" in Dortmund. For more information contact Dr. J. Krauth.

September 1992: Conference on "*Simulation und Verstehen*" in Aachen, organized by the Working Group *Simulation in der Fertigungstechnik*. For more information contact Prof. Dr. A. Kuhn.

September 28-30, 1993: *8. Symposium Simulationstechnik* in Berlin. This is ASIMs 1993 German speaking conference. For more information contact Mr. Peter Schäfer, DAIMLER-BENZ AG, Forschungsinstitut, Alt-Moabit 91b,W-1000 Berlin 21. A first call for papers can be obtained as well from Dr. Bausch-Gall.

Other meetings with ASIM participation

August 25-28, 1992: 4th International Symposium on Systems Analysis and Simulation. For more information see page 16.

Information from GI

ASIM as organisation is a member of *Fachbereich 4* of the *Gesellschaft für Informatik* (GI), the German Association for Computer Sciences. ASIM is the so called *Fachausschuss 4.5 Simulation* (ASIM). More information on GI and membership in GI can be obtained from Dr. Bausch-Gall.

Fachbereich 3 and *Fachbereich 4* contribute together to the journal it + ti (*Informationstechnik und Technische Informatik*) published by the Oldenbourg Verlag. ASIM will contribute to this journal.

Reports from the Working Groups

Working Group "Simulationsmethoden und Sprachen für parallele Prozesse"

Next meeting will be on April 27-28, 1992.

Speaker of the working group: Dr. Hans Fuss, GMD-F1, Postfach 1240, W-5205 St. Augustin 1. Tel: +49-(0)2241/14-2778, Fax: +49-(0)2241/14-2889.

Working Group "Simulationssoftware und -hardware"

The meeting in February had to be cancelled, due to lack of participation.

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 on simulation and AI will be held on the 7th and 8th of May.

Speaker of the working group: Dr. Johannes Krauth, BIBA, Bremer Institut für Betriebstechnik und angewandte Arbeitswissenschaft, Postfach 33 04 40, W-2800 Bremen 33. Tel: +49-(0)421/22009-43, Fax: +49-(0)421/22009-79

Working Group "Simulation in Medizin, Biologie und Ökologie"

The 5th Ebernburg Working Conference, Advanced Simulation in Medicine, Biology and Ecology to be held from 26th to 28th March 1992 at the old castle of Ebernburg, Bad Münster am Stein-Ebernburg.

Topics of the workshop are: Theory of dynamic nonlinear systems, modelling, simulation and identification of medical, biological and ecological systems and processes, knowledge based methods, neural nets, fuzzy-set theory, case studies, education.

Speaker of the working group: Prof. Dr. D. Möller, TU Clausthal, Institut für Informatik, Erzstr. 1, W-3392 Clausthal-Zellerfeld, Tel. +49-(0)5323/722402.

Working Group "Simulation technischer Systeme"

March 9-10, 1992; Meeting of the Working Group at Paderborn University. Sessions will be: Reports from the Institute of Control Theory (Prof. Dörrscheidt); research and development projects in the HELLA company; simulation of electrical circuits; papers of ASIM members. On Monday morning meetings of SPICE and ACSL user groups are organized.

Speaker of the working group: Prof. Dr.-Ing. Gerald Kampe, FHT Esslingen, Flandernstraße 101, W - 7300 Esslingen. Tel: +49-(0)711/394-258 or 266

Working Group "Simulation in der Fertigungstechnik"

Speaker of the working group: Prof. Dr.-Ing. A. Kuhn, Fraunhofer-Institut, IML, Emil-Figge-Straße 75, W-4600 Dortmund 50. Tel: +49-(0)231/7549-130, Fax: +49-(0)231/7549-211

Working Group "Simulation in der Betriebswirtschaft"

The board of the working group will meet early in March this year to discuss future activities. Please contact the speaker of the working group for further information.

Speaker of the working group: Prof. Dr.-Ing. W. Hummeltenberg, Universität Hamburg, FB Wirtschaftswissenschaften, Bundesstraße 55, W-2000 Hamburg 13. Tel: +49-(0)40/5123-4023

DBSS-Membership

Individuals (in particular Dutch speaking ones) and institutes etc. from the Benelux countries, interested or active in the field of simulation, can become DBSS-member. Membership fee (per annum) is in 1992

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

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 SCS.

Contact Address

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

ir. J.C. Zuidervaart
Rekencentrum. Delft University of Technology
P.O. Box 354
2600 AJ Delft, The Netherlands

(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.

If you changed address or your address is incomplete, please inform the acting secretary.

If you are interested to contribute in future activities of DBSS or if you have ideas in this respect, please contact the acting secretary.

Do you have information for 'EUROSIM-Simulation News Europe', please send it to the acting secretary.

Events in the Foregoing Period

Symposium "Computer Graphics, Animation and Monitoring"

About 30 participants, including speakers, attended the DBSS symposium "Computer Graphics, Animation and Monitoring". It took place at the accommodation of the Dish Hotels at October 30th 1991 in Delft. The invited speakers of the symposium came from industry, companies, as well as from research institutes.

After the welcome speech of J.C. Zuidervaart, the treasurer of DBBS, the symposium could be started. Hereafter follows a list of speakers with the titles of their lectures:

- *The use of dynamic modelling and animation for building information systems*, A. Verbraeck, Faculty of Technical Information and Mathmatics, Delft University of Technology.

- *Use of computer graphics and computer animation in the solution of logistic problems*, R.Th. van der Ham, ECT (Europe Combined Terminals), Rotterdam.
- *High performance graphics in industrial applications*, M.M. Lee, Arcobel bv, Oss.
- *Energy savings with computer monitoring and mechatronics*, H. Mijnarends, HR&O, Rotterdam.
- *Total transparancy in SCADA systems with factory link*, W. Leuvering, Technical Service, Den Bosch.
- *Scientific visualization*, J.J. van Wijk, ECN Visualization Centre, Petten.

The manufactories Arcobel bv, Silicon Graphics and Technical Service had their exhibition stands during the whole symposium.

Those who are interested in the contents of one or more lectures please contact: S.W. Brok, Faculty of Applied Physics, Lorentzweg 1, 2628CJ Delft, The Netherlands, e-mail fred@ph.tn.tudelft.nl.

Symposium "Parallel Computing"

The symposium "Parallel Computing" took place January 16th, 1992, Dish Hotel Delft.

In the morning session, various aspects and experiences with respect to the parallelisation of applications have been discussed. In the afternoon session the theme was around the development of a parallel programming environment.

The morning session focussed on the parallelisation of the large-scale finite element software package DIANA. Four speakers presented their experience and the results from the practice of parallelising a complex software package.

Ir. Ger Kusters gave an introduction about the software package DIANA. DIANA is a general-purpose 3-D finite element (FEM) software package, developed by TNO-BOUW. It has been used for a wide range of industrial and engineering applications, such as building constructions, mechanics etc. He gave an overview on the activities and the results around the parallelisation of this large software package (consisting of approximately 500.000 statements).

Ir. Onno Bootsma presented the design towards a distributed data-organisation. In order to obtain portability of the parallel software, the "virtual shared storage" model is applied to bridge the gap between shared-memory and distributed-memory architectures. This distributed data-organisation in combination with domain decomposition makes parallel I/O possible.

Ir. Martin van Gijnzen discussed the experiences with a parallel element-by-element solution algorithm. The Preconditional Conjugate Gradient method (PCG) is the (most) popular iterative method for solving very large systems of linear equations. A PCG algorithm with element-by-element preconditioner has been implemented in DIANA. The characteristics with respect to parallelisation and vectorisation have been discussed and some experimental results have been presented.

Ir. Hai-Xiang Lin (the organiser of this symposium) presented a methodology for parallelising finite element computations applied to the FEM software package DIANA. In order to free the user (e.g. a mechanical engineer) from the burden of parallelisation, a three-phase preprocessing is applied before the parallel execution. He described a parallel direct solver PARASOL for solving large sparse matrix systems. Experimental results show that PARASOL is very efficient both in terms of vectorisation and parallelisation. For large problems, linear speed up and an efficiency of up to 95% have been obtained on a Convex C240.

In the afternoon session the development of a parallel programming environment has been discussed..

Dr.ir. Henk Sips presented an overview of the ParTool project: Developing an integrated parallel programming environment. As shown in the morning session that parallelisation of applications at the present still requires considerable efforts, there is an urgent demand of a parallel programming environment. He described the architecture of this integrated parallel programming environment. It consists of application modeling, a high level parallel programming language Booster, performance modeling and a scheduler.

Dr.ir. Maarten van Steen presented a model for developing parallel applications based on transactions. He discussed the problems arisen from the use of conventional models of competing processes in the specification and implementation of parallel programs. Traditionally these models of competing processes have been successfully applied to operating systems and database management systems. However, these models are in conflict with the requirement in parallel data processing for "cooperation" instead of "competition". He presented a new programming model called Vista for the specification of parallel applications.

Drs. Edwin Paalvast discussed the problems of parallel languages at the present. Under the title "programming for parallelism and compiling for efficiency", he emphasized that parallelism and efficiency are two equally important aspects. He presented a new high level parallel language Booster and discussed the annotation features of Booster for efficiency in parallel execution. He also compared the Booster approach with Fortran and other new language developments.

For more information about one of the topics, the reader can contact the DBSS secretariat.

FRANCOSIM

FRANCOSIM, *Société Francophone de Simulation* (French Speaking Simulation Society), aims to the promotion and development of simulation models, tools and methods as well as related techniques, in all human activities and notably in industry, research and education, and this especially in the international French speaking community.

Board of Directors

The board of directors is composed as follows:

Michel Lebrun	President delegated
Ir. Francis Lorenz	Vice-President
P. Guerin	Treasurer

Membership

At present FRANCOSIM has 50 registered members. The annual charge is FF 250.

Contact Address

For further information or application for membership, please contact Mrs. Fourneyron or Mr. Lebrun at the legal seat:

FRANCOSIM
c/o Maison de la productique
Esplanade Diderot
F - 42300 Roanne, France
Tel. +33-77 71 20 00
Fax: +33-77 72 52 99 (Mrs. Fourneyron)
Tel. +33-77 70 80 80
Fax: +33-77 70 80 81 (Mr. Lebrun)

Organization

FRANCOSIM wishes to have a sector-divided functioning with working groups. Each sector of activity will have an independent functioning inside the association.

Today two sectors of activities have come to existence:

- Simulation of production systems
- Simulation of multibodies

We hope that other interests will appear among the members of FRANCOSIM to develop other sectors of activities very soon.

Meetings to come

Simulation of production systems

A one-day conference will be held in Paris on 9th April 1992 on "Simulation, a helping tool for workshop piloting". This meeting aims at presenting industrial experiences in the use of the simulation tool for workshop piloting.

For further information please contact:

Eric Marcon
I.U.T. de maintenance industrielle
Centre universitaire Mendès France
F-42300 Roanne
Tel: +33-77 44 89 28

Multibodies simulation

A three-day seminar on "Computational methods in multibody system dynamics" will be held on May 4th to 6th, 1992 in Roanne.

We invited Dr. Führer (DLR Germany), Prof. Wittenburg (Universität Karlsruhe, Germany), and Dr. Yen (CADSI, USA), well-known specialists of the equations of multibody system dynamics and its numerical handling.

This meeting aims at helping the participants to consider the difficulty of the numerical handling of motion equations in multibody system simulation software.

For further information please contact:

Marc Alirand
Société IMAGINE
Maison de la productique
F-42300 Roanne
Tel: +33-77 70 80 80

Code generators

A one-day workshop on "*Simulation - Outils Modernes de Développement*", co-organized by FRANCOSIM and AIM, will be held on October 29th, 1992 in Liège. It aims at establishing the state-of-the-art in simulation code generators. Most of the speakers come from industry.

For further information please contact:

Mme Lacrosse
AIM
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Tel: +32-41 22 29 46

ISCS

General Information

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

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

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

To the Steering Committee belong also F. Maceri and S. Tucci.

Membership

At present, the membership situation is the following: 117 members, 9 of which are institutional and 4 are honorary, 102 are regular members and 2 are affiliate ones.

Charges per annum are Lit. 20,000 for regular and affiliated members and Lit. 350,000 for institutional members.

Contact address

For further information or application for membership, please contact:

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Fax: +39-(0)6-2020519
E-mail: IAZEOLLA@IRMENEA.BITNET

Activities

On November 28, 1991 the annual meeting of ISCS was held in Rome. During the meeting the following activities were discussed and promoted:

1. After the preparation phase, which was carried out during 1991, the constitution of Working Groups reached its final step, consisting in the actual definition of the Working Groups and in the appointment of the Working Group chairmen. The Working Groups were defined on the basis of the answers received by ISCS members during the preparation phase. The final list, with the names of the respective chairmen, is as follows:

- Simulation in Industry and Management (Dr. Stefano Gatteschi)

- Simulation in Agriculture and Environmental Sciences (Dr. Roberto Semenzato)
- Simulation in Training and in Education (Prof. Salvatore Tucci)
- Simulation in Biology and Medicine (Dr. Giovanni Pacini)
- Simulation in Electrical Engineering (Dr. Mario Savastano)
- Concurrent and Distributed Simulation (Prof. Lorenzo Donatiello)
- Software and Hardware for Simulation (Dr. Paolo De Gaetano-Polverosi)
- Expert Systems and Simulation (Prof. Rinaldo Michelini)

The goal of these Working Groups is to facilitate contacts among people interested in the same simulation field, by organizing regular meetings and promoting exchange of information and ideas. People (even outside ISCS) interested in the activity of one or more of the aforementioned Working Groups are kindly asked to contact ISCS at the address reported above.

2. The promotion of Summer Simulation Schools was extensively discussed. The goal of these schools should be to promote and extend the knowledge about simulation and its use. To this end, they should be mainly addressed to graduate and PhD students or young researchers working both in industry and academica.

3. The ISCS, under request of Prof. S. Tucci (general chairman of the congress and chairman of the working group "Simulation in Training and in Education"), is sponsoring the congress DIDAMATICA '92, wich will take place in Campobasso, from April 22nd to April 24th, 1992. The congress is devoted to the presentation of hardware and software tools developed as an aid for education and training. One of the sessions of the congress will be entirely devoted to the use of simulation in education.

4. An Italian section of *McLeod Institute* has been instituted at CNR-IRSIP, Napoli. The headquarter of McLeod Institute is at California State University, Chico, CA, USA. Other Italian sections of McLeod Institute may be instituted. People interested may contact the ISCS chairman.

The ISCS is currently involved in the organization of the **4th European Simulation Congress, EUROSIM '92**, which will take place in Capri, Italy, from September 29th through October 2nd, 1992. See also back cover of this issue.

SIMS

Information on SIMS

The Scandinavian Simulation Society, SIMS, has about 260 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 somebody of your Nordic colleagues are interested in simulation but not yet a member of SIMS, then just send an informal application or recommendation for membership to the SIMS secretariat:

M. Hänninen
Technical Research Centre of Finland
P.O.Box 208 (Tekniikantie 4),
SF-02151 Espoo, Finland
Tel: + 358 0 4561, Fax + 358 0 456 5000

SIMS members are encouraged to be more active in updating their addresses and in paying their membership fees.

SIMS 92 Simulation Conference
Simulation of Chemical and Power Plant Processes,
June 10-12, 1992

The Conference is organized by SIMS, Technical Research Centre of Finland and Lappeenranta University of Technology.

Topics of interest include, but are not limited to: Modeling of physical phenomena and process components, Verification and validation of models, Engineering simulators, Training simulators, Man-machine interaction, Calculation of thermophysical properties.

The Simulation Conference is aimed to simulator personnel, modelers, researchers, software developers and engineers from chemical industry, power plant utilities, vendors, research organizations and universities.

The registration form of the SIMS 92 conference will be mailed to SIMS members in the near future. For more information please contact the conference secretariat.

Program Committee: Prof. H. Kalli (Lappeenranta University of Technology), Mr. E. Patrakka (Teollisuuden Voima Oy), Mr. U. Linden (Imatran Voima Oy), Mr. K.I. Keskinen (Neste Oy), Dr. I. Turunen (Kemira Oy), Dr. S. Kaijaluoto (Technical Research Centre of Finland), Mr. M. Hänninen, secretary (Technical Research Centre of Finland)

Conference Secretariat: M. Hänninen, Technical Research Centre of Finland, P.O.Box 208 (Tekniikantie 4), SF-02151 Espoo, Finland, Tel: + 358 0 4561, Fax + 358 0 456 5000.

UKSS

The next UKSS meeting will take place in Edinburgh on Tuesday 5th May. The topic will be concerned with object oriented methods in simulation and the local organizer is Rob Pooley of the Department of Computer Science, University of Edinburgh. Further details will be available in the near future.

Other meetings are planned including one on VLSI system simulation. This particular topic is one which has not been the subject of any previous UKSS (or UKSC) one-day meetings and we hope that by organizing a meeting with this theme those with specialist interests in the simulation of electronic devices and systems will become aware of the activities of the Society.

Suggestions for other one-day meetings are always welcomed by the Committee. Any ideas should be sent initially to the Chairman, Richard Zobel, at the address below.

Members of the UKSS Committee (both past and present) are involved in the organization of the European Simulation Multiconference ESM92 which will take place at York during the period June 1-3, 1992. The General Conference Chairman is Professor John Stevenson of the University of Bradford while Dr. Richard Zobel is the General Programme Chairman. The response to the call for papers has been encouraging. Subjects covered within the Multiconference are Simulation Methodology and Practice, Simulation in Aerospace, Simulation in Society, Simulation of Electronic Circuits and Systems, Simulation in Energy and Industrial Simulation and Simulators. Futher details can be obtained from

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

The UKSS Committee is starting to make plans for the 1993 UKSS Conference. This will take place in the second half of 1993 and one possible venue is Windermere. Further details will be available soon.

Any enquiries regarding UKSS shuold be addresses to:

Dr. Richard N. Zobel
Chairman UKSS
Department of Computer Science
University of Manchester
Oxford Road
MANCHESTER M13 9PL
United Kingdom

or

Mrs. E. Rimmington
UKSS Membership Secretary
Computer Centre
(Watts Building)
Brighton Polytechnic
Moulsecoomb
BRIGHTON BN2 4JG
United Kingdom

CROSS
Croatian Simulation Society

Due to the war against Croatia, which has not yet ended, research activities in our simulation community are still below their usual intensity. Some of the researchers are mobilized in the Croatian Army for more than four months, while some of the others are supporting Croatia in various ways.

The key simulation research project in Croatia, started in 1991 and led by the author of this notice, is "**Simulation Modelling of Dynamic Systems by Computers**" including eight researchers. The aim of this project is to synchronize and concentrate research in this field, and to enable the use of its results in research and applications in a number of different disciplines. Research topics of the project are: conceptual discrete simulation models, continuous simulation of population dynamics, simulation of active data bases operating on parallel computers, communication of simulation with data bases, optimization in simulation, regression metamodelling of simulation output, Monte Carlo simulation in statistics, simulation and artificial intelligence, simulation modelling of flexible manufacturing systems etc.

The operations research community in Croatia succeeded in an extraordinary short period of only a few months in organizing the **1st Operations Research Conference in Croatia.** The conference was held late in 1991, including a few dozen of attendances (and a simulation session, however). It will become the regular annual conference, possibly trying to evolve into a regional international conference.

The 14th International Conference "**Information Technology Interfaces**" **ITI '92** will be held in Pula (peaceful Istrian part of the country) from **September 15-18, 1992.** The conference is organized by the University Computing Centre in Zagreb, and co-organized by several international University institutions. International Program Committee Chairman is Prof. Vlatko Ceric, Faculty of Economics, University of Zagreb. The conference has the traditionally strong simulation section, with at least one internationally recognized invited lecturer in the simulation field. **Deadline for papers is June 1st, 1992.** Propositions on tutorials, workshops, presentations etc. are welcome. All simulation theoreticians and practitioners are cordially invited to attend the conference.

Last but not least, the initiative group has met in Zagreb on 18th February 1992 and decided to establish the Croatian Simulation Society (CROSS). This will both intensify the exchange of information and contacts inside the Croatian simulation community and simultaneously enable more intensive contacts with the international simulation community.

Any information about the CROSS society may be obtained from:

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

CSSS
Czech&Slovak Simulation Society

CSSS (formerly CSSC - Czechoslovak Systems Simulation Club) was founded in 1990 and has now about 60 individual members. CSSS took up some of the undertakings once organized by the Technical Section for Systems Simulation of the Committee for Applied Cybernetics and Informatics (which was the part of the then Czechoslovak Scientific and Technological Society) and modified them for the present conditions and claims. This is the case of the Prague International Symposium on Simulation of Systems in Biology and Medicine, which will be held in modified form in November 1992.

SiSy b/e/m 92 - 8th Prague Symposium on Computer Simulation in Biology, Ecology and Medicine, November 9-11, 1992, Prague, Czech and Slovak Federative Republic.

Organized and sponsored by Czech&Slovak Simulation Society and Society for Computer Simulation International, co-sponsored by EUROSIM and Czechoslovak Academy of Sciences.

Symposium Sections:

Computer Simulation in Biomedicine
chair: E. Mosekilde (Denmark),
co-chair: Z. Wünsch (CSFR)
Computer Simulation of Health Care & Services Systems
chair: E.N. Chigan (WHO),
co-chair: F. Hauser (CSFR)
Computer Simulation in Ecology
chair: S.E. Jorgensen (Denmark),
co-chair: M. Straskraba (CSFR)
Workshop: Simulation Theory and Methodology in Non-Technical Applications
chair: M. Kotva (CSFR)

Only original papers written in English, which have not previously been published elsewhere, will be accepted.

Deadlines and requirements:

Extended abstracts (one to two pages, in duplicate) before April 30th, 1992. Notification of acceptance or rejection before May 31st, 1992. Camera ready copies of accepted papers before July 31st, 1992.

Registration fees:

BF 7000 for authors, members of simulation societies and participants preregistered before July 31st, 1992. Registration at the conference itself will be BF 8000. Registration fees include one copy of the proceedings, coffee breaks, lunches and the social event.

Conference Co-ordination and Receiver of Abstracts:

Milan Kotva, Zeleny pruh 32, CS-147 00 Praha 4, Czechoslovakia; Tel: +42.2.7992145; fax: +42.2.763211 or +42.2.7992318.

General Chair:

Milan Straskraba, Biomathematical Laboratory of Czechoslovak Academy of Sciences, Branisovska 31, CS-375 05 Ceske Budejovice, Czechoslovakia; Tel: +42.38.817; fax: +42.38.40698 (Ceske Budejovice) or tel: +42.2.2358905; fax: +42.2.2358923 (Prague).

The symposium will immediately follow ESS 92, the European Simulation Symposium (Simulation and AI in Computer Aided Techniques), hosted by the Dresden University of Technology, November 6-8, 1992. The transfer from Dresden to Prague will be organized within the social programme of the Dresden Symposium on November 8th.

For further information on the Dresden Symposium please contact SCSI, European Simulation Office, c/o Philippe Geril, University of Ghent, Coupure Links 653, B-9000 Ghent, Belgium (tel/fax: +32.91.234941).

The **North Moravian Seminar on Modelling and Simulation of Systems** represents another traditional Czechoslovak undertaking, which has a 26 years long record. The organizers announced that this seminar will be held as the 5th International Symposium on Modelling and Simulation of Systems MOSIS'93 on May 17-20, 1993 in Olomouc, an old historical town in the center of Moravia. The Symposium will be aimed at the presentation of recent developments on modelling and simulation of systems, both theoretical and applied.

Topics of the Symposium: Real-time Simulation, New Algorithms for Simulation, Modelling and Simulation for Neural Networks, Methods and Implementations in Modelling and Systems Simulation, Simulation in AI / Communications Systems / Medicine / Biology / Ecology / Business / Automatic Control etc.

Submitted papers will be selected on the basis of a one page abstract which should include full mailing address, key words and state clearly the main contribution of the paper. Abstracts are due to arrive in triplicate at the organizers before May 31st, 1992. The symposium is organised by the House of Technology, c/o J. Kupka, Marianske nám. 5, CS-709 28 Ostrava, Czechoslovakia. All correspondence and submission of papers should be addressed to Jan Stefan, General Chair of MOSIS'93, Department of Computer Science, Technical University of Ostrava, tr. 17. listopadu, CS-70833 Ostrava, Czechoslovakia.

Milan Kotva
Zeleny pruh 32
CS - 147 00 Praha 4
Tel: +42 2 7992145, Fax: +42 2 763211

SCS
The Society for Computer Simulation

The Society for Computer Simulation in Europe has over the last couple of months been looking into the long term planning of SCS activities in Europe. A planning which will focus more on the European nature of our membership. It will address the needs and wants of these members on a greater scale and try to increase the value of a European Membership. For example, SCS is now actively co-sponsoring TEMPUS programmes, and other European ventures in that area are in the offing.

Long term planning is also a term we find in the vocabulary of the European members, where conference organization is concerned. As a result of members coming forward, SCS now has established up to 1995 a timetable for its European Simulation Multiconferences and European Simulation Symposia, which will take us from Switzerland, to Spain, to Russia, to Czechoslovakia and to The Netherlands.

It has also set in motion the setting up of specialized workshops like on Concurrent Engineering. The first of which will be held in 1993 in June and which will be repeated on a yearly basis in conjunction with CERC in the USA.

From March onwards the SCS European Office will also represent, in its official capacity as secretariat, the International Building Performance Simulation Association. The aim of the SCS European office will be to enlarge the group of people actively involved in the use of simulation in the building industry on a worldwide scale. Building on the success of the 1991 IBPSA Building Simulation Conference in Nice, the office will take the initiative to repeat the event in 1993. Here we are very privileged to cite the input of official participation in the form of the Electric Power Research Institute, the Gas Research Institute, the US Department of Energy, BEPAC, Electricité de France, Gaz de France, CSTB, and the Commission of the European Communities (DG XII and Joint Research Centre). All of which will ensure a certain form of cross fertilization of ideas with the SCS members.

Our present activities are mainly centered upon the 1992 ESM in York, where some 170 abstracts were accepted for publication. The largest groups at the conference will cover: Simulation Methodology, Simulation in Electronics and Circuit Design and Industrial Simulation and Simulators. This year it is very apparent that the main thrust of research accross the board of the Multiconference falls within the field of robotics and training as many papers deal with robot simulation. It's also nice to see that in the field of Aerospace

Simulation a lot of presentations come from the European Space Agency, ESA.

At the moment we are receiving abstracts for the 1992 European Simulation Symposium in Dresden. The cut-off date was March 1st. One of the main points of interest there will be the first meeting of simulationists active in the field of concurrent engineering. This represents for the European Office the stepping stone for the Concurrent Engineering workshops.

Where the inner workings of the office are concerned, they will center entirely on the upgrading of existing hardware and software and of establishing new services for those people connected to electronic mail. More on this will be published in a later article.

Next to the official meeting in Ghent (European Simulation Symposium), there was a very active meeting of European SCS members. The meeting attended by members from the UK, The Netherlands, Belgium, Germany, Czechoslovakia and Latvia covered all of the above, plus initiated several activities, which will become apparent to European members in the near future. The main goals of the meeting were to run the European Operation as a quality office, offering professional services to its European members.

Where the US is concerned close links have been forged by SCS with the Defense Modeling and Simulation Office (DMSO) of the US Armed Services. This office, set up last year, has set as its task the evaluation, analysis, R&D, and education and training of military personnel. In July (1991), SCS President Carl Malstrom, appointed Dr.Dale Pace (The John Hopkins University, Applied Physics Lab.) as the DMSO Liaison for SCS. Several SCS members are presently involved with DMSO's initial planning process through the organizations for which they work. As DMSO expands its activities, co-operation between DMSO and SCS is expected to increase, especially in the areas of simulation standards and methodology.

In the US office, some new people have joined the organization. They are Hildy Linn (publications manager), Debra Ann Jackson (accountant), Mary Monteleone (Member Services) and Brenda Carter (Administrative Assistant).

At present SCS is looking for material which will provide a historical perspective for a special column to run through our 40th Anniversary year. Furthermore, if you still want to submit an abstract for the 1992 SCSC in Reno, you can still do so. Just contact for the latter and former SCS in the US, on 619.277.3888 (phone), 619.277.3930 (fax) or stockton@sdsc.bitnet (E-mail).

For further information on the above please contact:

SCSI
European Simulation Office
c/o Philippe Geril
Univ.of Ghent
Coupure Links 653
B-9000 Ghent, Belgium.
Tel/Fax: 32.2.91.23.49.41
E-mail: SCSI@biomath.rug.ac.be

IMACS

4th International Symposium on Systems Analysis and Simulation

August 25 - 28, 1992, Berlin, Germany

Sponsored by IMACS, International Association for Mathematics and Computers in Simulation

Co-Sponsors: International Federation of Automatic Control (IFAC), Federation of European Simulation Societies (EUROSIM), Gesellschaft für Mathematik und Datenverarbeitung (GMD/FIRST), International Institute for Applied Systems Analysis (IIASA), Arbeitsgemeinschaft Simulation der GI (ASIM)

The conference is focused on common methods and tools of modelling and simulation in systems analysis of real problems in different areas.

Topics

- **Modelling**: Theory of discrete systems, theory of continuous systems, qualitative theory, decision support systems, modelling (decomposition, model reduction, model fitting), multiobjective optimization, methods of optimization and control, methods of knowledge processing for systems analysis.
- **Simulation**: Simulation of discrete systems, simulation of continuous systems, parallel simulation, special hardware report, software support (graphics etc.), simulation environment.
- **Complex systems analysis for environmental problems**: Pollution of air, water, soil; ecosystems modelling
- **Complex systems analysis for industrial automation**: Basic problems, manufacturing systems and CIM-structures, robotics automation of continuous industrial systems.
- **Complex systems analysis in other application fields:** Applications to agricultural systems, to economic systems, to energetic systems, to medial health care and biological systems.

Conference Place: Technical University Berlin

Last minute papers (abstract) should be sent to the organizing committee. About 6 keynote papers and 200 papers in sessions and workshops will be presented.

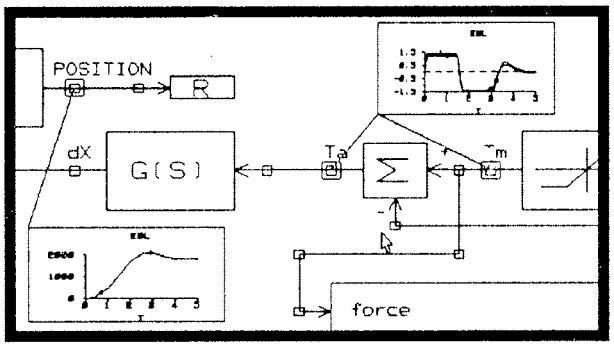
Additional workshops are dealing with environmental systems, atmospheric modelling and the question: How can Industry Benefit from Array-Based Logic?

Information:

for Scientific Program: GMD - Research Institute for Innovative Computer Systems and Technology, Prof. Dr. A. Sydow, Hardenbergplatz 2, W - 1000 Berlin 12, Germany, Tel.: +49-30 25499-101, Fax: +49-30-25499-172

for Organization: Secretary of the WGMA in the Chamber of Technology, Mrs. Bahn, Clara-Zetkin-Str. 115-117, P.O.B. 1315, O - 1086 Berlin, Germany, Tel.: +37-2 2265-218, 2265-304, Fax: +37-2 2265-256, 2265-296

ESL: THE LANGUAGE OF SIMULATION



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Activities in Modelling and Simulation in the New Federal States of Germany

The New Federal States are those countries which were founded on the territory of the former GDR after the union of Germany in 1990. The New Federal States are: Brandenburg, Mecklenburg/Vorpommern, Sachsen-Anhalt, Sachsen, and Thüringen.

Already in the former GDR's past, numerous teams have worked in the field of modelling and simulation. They achieved excellent results and products during this time - today internationally accepted.

Because of the GDR's restrictions of travelling and contacts to persons in foreign countries, e.g. Western Europe, the United States, and other countries, which had been applied to most of the simulationists, it was impossible to present their results personally and to establish and maintain scientific contacts. Only very few persons - the so-called travel cadres - who were selected primarily by political standards and only secondly by their scientific merits received permission to go abroad. It was that group of persons who attended the work-shops and conferences in countries outside the former socialist countries.

Thus, an exchange of experiences and working results, which is necessary for an innovative scientific work, was suppressed; most of the simulationists were excluded from an intensive co-operation on an international scale.

Fortunately, this is now over, once and for all. The union of Germany at last put an end to this unbearable state. Today, close contacts already exist between most of the simulationists of Germany and Europe. The scientific co-operation is increasing more and more.

This paper gives some information in order to correct the one-sided opinion concerning the research and results in simulation which was spread by those travel cadres abroad. Another aim of this paper was to improve the knowledge of each other and to make the "simulation landscape" in the New Federal States more transparent. Some first facts about the research groups, specialists in the field of modelling and simulation, and their working results are summarized here.

In this context, simulation is defined as a problem solving method. Using this method, the problem can be solved by simulation experiments with the system model instead of performing experiments with the real system.

Using a questionnaire, I asked various simulationists in the New Federal States to obtain up-to-date information about their present activities.

The first results are published in this issue of "EUROSIM Simulation News Europe". This presentation will be continued in following issues.

These questions were sent to all working groups and scientists at universities, technical colleges, and institutes of the former Academy of Sciences. It was assumed that all of them have been working in this field for a long time. All simulationists who received a questionnaire were selected by Prof.Dr. G.Schwarze and myself, using personal knowledge as well as the information from the "*Fakultätentag Informatik of Germany*".

The industry-related simulationists were not included because the process of restructuring the industry in the New Federal States does presently not allow to receive data with certain reliability.

All of the persons included into this interview have used computer simulation tools and methods to solve problems and/or developed and implemented computer simulation systems. The questionnaire was sent to about 30 simulationists and research teams. 20 answers were received up to now. With only one exception, no answers were received from those simulationists who once belonged to the institutes of the former Academy of Science.

The questions included name and address of the institute and the working group, leader and members of the team, their research and working fields, results, special application of modelling and simulation in problem solving, publications in 1991/1992, and education at university level.

The main activities of simulation take place at the Technical Universities of Dresden, Chemnitz, and Magdeburg; the Universities of Rostock, Humboldt University of Berlin, and Technical College of Leipzig.

Modelling and Simulation is an important part of the curriculum of computer sciences in the New Federal States of Germany.

Technical University of Dresden

a) Institute of Feinwerktechnik, chair: Technique of Construction; Doz.Dr.E.Seydel, 3 co-workers. Start 1970: interactive simulation system ERS (IBM360/370). Simulation of roboter driving and other driving systems. System USAN5 in connection with a model bank, FEM.

b) Faculty of Computer Sciences; WG Control Systems. Prof. Dr. habil. Martin Frank, 3 co-workers. Start 1970: Simulation applications based on GPSS. System TOMAS for simulation of manufacturing systems. Theoretical and practical research of architectures of discrete simulation systems. Object-oriented architectures. Integration into CIM systems.

c) Faculty of Computer Sciences; Inst. of Operating and Communication Systems. WG Performance evaluation. Doz.Dr.habil. K.Irmscher, 5 co-workers. Start 1977: Development, implementation and application of computation systems and tools for perfomance evaluation of computer systems and LAN's. Systems BNETD, LANEX, DIMPES based on the queueing theory.

d) Institute of Hydrobiology; Doz.Dr.habil. F.Recknagel. Start 1976: Development, implementation, and application of simulation systems and expert systems for water protection. Coupling of expert and simulation systems. Knowledge-based interfaces.

e) Institute of Manufacturing Informatics; chair: Modelling/Simulation. Prof.Dr. habil. W. Krug, 8 co-workers. Start 1971: CAE and product modelling, multiple oriented simulation systems. Development, implementation, and application of simulation systems (e.g. MOSAIK). Simulation of manufacturing systems.

University of Rostock

a) Dept. of Computer Sciences; research group of Modelling and Simulation. Prof.Dr.sc. R. Grützner, 4 co-workers. Start 1977: modelling/simulation of computer and control systems. Implementation of Petri-net-oriented simulation system MARS. Simulation of ecological systems, dyn. systems with feedback.

b) Dept.of Biology; WG Theoretical Ecology; Doz. Dr.habil. U.Vietinghoff; 2 co-workers. Start 1972: Application of simulation systems for biological and ecological systems; simulation of Baltic-Sea subsystems. Automatical measurements for the verification of biological models.

Technical University of Chemnitz

a) Institute of Electrical Engineering; chair: High Performance Electronics. Prof. Dr. habil. Manfred Kronberg, 4 co-workers. Start 1985: modelling/simulation of electrical moduls (e.g. Thyristors); simulation of electrical networks. Development and implementation of simulation tools.

b) Research group: Manufacturing Planning and Simulation. Doz.Dr.habil. Chr. A. Schumann, 2 co-workers. Start 1990: simulation of manufacturing and logistic systems.

c) Institute of Computer Sciences. Doz.Dr. Köchel. Modelling and simulation of discrete processes; reliability and queueing theoretical research; stochastical and dynamical optimization.

Technical University of Magdeburg

Institute of Simulation and Graphics; Prof. Dr. habil. P.Lorenz, 9 co-workers with complex independent working and research tasks. Start 1971: modular simulation systems; object-oriented simulation; simulation, visualization and computer animation. Modelling of the stress of individuals in the working process.

Technical College of Leipzig

a) Department of Automation, Institute of Control and System Theory; Prof. Dr. habil. H. Ehrlich, 2 co-workers. Start 1985: logical and dynamical systems and their modelling concepts, simulation systems for dynamical subsystems with variable structures (system SIZU).

b) Institute like a). Doz.Dr.habil. G.Stein, 3 co-workers. Start 1968: control systems with a variable structure. Combination of CAD systems with teachware systems for the design of control systems. Implementation of simulation tools for the analysis of such systems.

c) Institute of Process Control, WG: Modelling; Dr. R.Müller and one co-worker. Start 1985: real-time simulation for the prediction of process behaviour and for an early fault recognition. Implementation of interactive simulation tools (ISIKS/V. 4.2.). Distributed simulation tools.

Humboldt University of Berlin

a) Department of Computer Science, Institute of Software, Research group: Systems Analysis; Prof. Dr. habil. G. Schwarze, 7 co-workers. Start 1964: development of tools and methods for the analysis of distributed systems using of formal specification languages (SDL). Object-oriented specification, C++ and process-oriented simulation.

b) Computer Center; Dept. of Mathematics. Dipl. Phys. Bernd Wagner. Discrete and continuous simulation systems; GPSS, SIMDIS; application of simulation for industrial tasks, e.g. special manufacturing systems.

Central Institute of Cybernetics Berlin

Institute of Ecosystem Research; Dr. V.Wenzel and co-workers. Start 1978: development and implementation of the system SONCHES. Applications of SONCHES for problem solving in ecological systems. 1992 it will be improved.

Important results are also presented by:

- Friedrich Schiller University, Jena. Faculty of Mathematics. Dr.D.Schulz
- College for Architecture and Construction, Weimar. Faculty of Mathematics and Computer Sciences. Dr.habil. Georg Hohmann
- Technical College of Zwickau, Zwickau, Department of Electrical Engineering. Dr.M. Schulze.
- Technical College of Ilmenau, Ilmenau. Dept. of Economics. Doz.Dr. K.Gröpler

More detailed information on all the research groups will be given in the next issues.

Prof. Dr. Rolf Grützner, University of Rostock, Dept. of Computer Sciences

Simulation Activities in the PDDC Group within the Department of Chemical Engineering at the Technical University of Denmark

The Process Design, Dynamics and Control (PDDC) Group within the Department of Chemical Engineering at the Technical University of Denmark has been involved in dynamic simulation of chemical processes for more than 20 years. The dynamic modelling, process identification and associated experimental work centers around three pilot plants: a laboratory scale fixed bed reactor with or without reactant recycle, an industrial scale heatintegrated distillation column and an industrial continuous fermentation pilot plant.

The PDDC Group studies the impact and limitations of design on process dynamics and the relationships between process design and control system design for systems such as heatintegrated distillation columns with sidestreams and heterogeneous azeotropic distillation columns. Current work involves dynamic analysis and simulation over wide operating regions and the design of robust and/or adaptive controllers to be applied over wide operating regions.

The PDDC Group has developed a tool for qualitative modelling of dynamical systems based on operating process knowledge called DYQUID - **DY**namic **QU**antity **I**nteraction **D**iagram. This tool may be used to develop model structures of the state space or AR(MA)X type for use in on-line process identification and multivariable, even adaptive, control system design. For the latter task a tool called MIMOSC - Multiinput, Multioutput Selftuning Controller - has been developed and used in several successful experiments.

Futher information may be obtained from

Professor Sten Bay Jorgensen, The PDDC Group, Department of Chemical Engineering, Technical University of Denmark, DK-2800 Lyngby, Denmark

Industry News

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.

ProModel, the market leading manufacturing simulation system in the USA, is now available in Europe. ProModel is used by many of the world's leading companies to model all types of production and material handling facilities. Pro Model's engineer-friendly approach to model building, flexibility and price makes it ideal for engineers who need results quickly.

ProModel has an Automatic Model Build facility to speed up model construction, statistical tabular and graphical reports produced automatically for easy interpretation, unique Schedule optimization feature for production planning and scheduling, and Multiple replication summary reports for running different model configurations. These provide extra statistical information including confidence intervals to show the effect of different scenarios on the simulation results.

ProModel is marketed in Europe by Production Modeling Corporation Of Europe (PMCE), from their UK headquarters. PMCE are actively seeking to appoint distributors for ProModel in Europe, who will provide marketing, support and training services locally. Companies interested in becoming ProModel distributors or who wish to find out more about ProModel should contact PMCE at the address below.

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 410156.

Software blends CAE technologies

Mechanical Dynamics Inc. has released Version 6.0 of its Automatic Dynamic Analysis of Mechanical Systems (ADAMS), a software product line used to develop 3-D models of mechanical systems that contain moving parts, and to analyze and simulate the operating performance of the systems.

Version 6.0 encompasses 14 integrated programs and modules. It also introduces realtime kinematics capability and integration with other CAE technologies. Kinematics allows designers and engineers to develop software prototypes of mechanical system product concepts and to interactively move the system around in 3-D to examine different design approaches.

The new product contains interfaces between the ADAMS mechanical simulation toolset and CAD, finite-element analysis (FEA), control system design and photo-realistic visualization technologies.

ADAMS is supported on most engineering computers, including Unix workstations from HP, Digital, IBM, Silicon Graphics and Sun.

In Europe the TEDAS GmbH, Marburg/Germany, and her subsidiaries are marketing and supporting ADAMS. They welcome any questions on further information.

TEDAS GmbH, Universitätsstr. 51, D-3550 Marburg/ Lahn 2, Tel: +49-(0)6421 26077, Fax: +49-(0)6421 22296.

Discussion Forum

This section is intended to stimulate discussion between readers. We repeat the initiative started in the last issue, a discussion on simulation results. Please formulate your opinion on this topic and send it to the address given below. Reactions that are of general interest will be summarized and published in the next issues. Furthermore we invite all readers to start another discussion by sending a letter to the editors.

Wanted: Unexpect Results
or: Simulation or Common Sense: Who is right?

Probably every practitioner in the field of simulation has already faced the following situation: He has modelled a system using a computer based simulation tool, and after running it he realizes that the results are completely different from what common sense would expect. Now what to do?

On one hand everybody knows that it is very easy to build erroneous models, but on the other hand the dynamic behaviour of complex systems is not easily understood by common sense, and at least unexperienced users are likely to make wrong predictions. In fact even experts do so, and this is the reason why simulation is used at all. Nevertheless, the conflict is there and requires a solution other than just to say "The computer always is right". What we need is a method to show where the error is. To our knowledge no formal procedure exists, so for the moment we have to learn by examples.

We would therefore invite readers to send us examples of cases where you have faced this situation, and how you have solved it. And we are interested in both solutions: the simulation results were wrong, or the results expected by the user were wrong. (I do not say this implies the other part is right, it may as well be wrong, too). If we can find a number of good examples where simulation has proven the opinion even of experts wrong, we can use these examples to demonstrate the power of simulation and to create a wider market for it. The other examples may help us to improve further simulation practice, which may in the end also lead to an increased demand. So please share your experience; send a description of your model, the calculated and the expected results, and tell us how you have come to a conclusion. Please direct your answer to

J. Krauth, BIBA, Bremer Institut für Betriebstechnik und angewandte Arbeitswissenschaft, Postfach 33 05 60, W - 2800 Bremen 33.

Classes on Simulation

In this section professional classes on simulation and modelling will be announced. Please send information on classes to be published here to the editors.

March 1992

17-19 **Modellierung und Simulation mit SPICE** (in German), Munich, Germany.
Contact: BAUSCH-GALL GmbH, Wohlfartstr. 21b, W-8000 München 45, Tel: +49-(0)89 3232625, Fax: +49-(0)89 3231063

23-25 **Modellierung und Simulation mit ACSL** (in German), Munich, Germany.
Contact: BAUSCH-GALL GmbH, Wohlfartstr. 21b, W-8000 München 45, Tel: +49-(0)89 3232625, Fax: +49-(0)89 3231063

April 1992

8-10 **Modelling & Simulation Shourt Course** (ACSL), Eastbourne, UK.
Contact: Rapid Data Ltd., Crescent House, Crescent Road, Worthing, West Sussex BN11 5RW,UK.

May 1992

18-22 **Simulation kontinuierlicher Systeme** (in German), Oberpfaffenhofen, Germany.
Contact: Carl-Crantz-Gesellschaft e.V., Flugplatz, W-8031 Oberpfaffenhofen, Tel: +49-(0)8153 28 413, Fax: +49-(0)8153 28 1345

18-22 **Mathematical Modelling and Digital Computer Simulation of Engineering and Scientific Systems.** Zurich, Switzerland
Contact: Dr.H.J. Halin, ETH Zurich, Clausiusstr. 33, CLT C1, CH-8027 Zurich, Tel: +41-1 256 4608, Fax: +41-1 262 2158

September 1992

14-16 **Modellierung und Simulation mit ACSL** (in German), Munich, Germany.
Contact: BAUSCH-GALL GmbH, Wohlfartstr. 21b, W-8000 München 45, Tel: +49-(0)89 3232625, Fax: +49-(0)89 3231063

23-25 **Modelling & Simulation Shourt Course** (ACSL), Eastbourne, UK.
Contact: Rapid Data Ltd., Crescent House, Crescent Road, Worthing, West Sussex BN11 5RW,UK.

Giorgio Savastano Award

EUROSIM, the Federation of European Simulation Societies institutes the Giorgio Savastano Award to honour the memory of its first President, Prof. Giorgio Savastano.

The award will be made to the author (or the authors) of the best paper published by June 30, 1991 in the field of Simulation in Electrical Engineering. Young researchers, no more than 33 years old on June 30, 1991, can participate in this competition. Only papers published in journals with referees will be taken into consideration.

Authors interested have to submit one copy of the paper by March 31, 1992 to the EUROSIM President:
Prof. Franco Maceri, Dipartimento di Ingegneria Civile, Università di Roma "Tor Vergata", Via della Ricerca Scientifica, I - 00173 Roma, Italy

After June 30, 1992 the appointed commission will review the papers and will assign the award. The winning author will be invited guest to the ESC'92 Congress.

Book News

This section will present new books and journals on simulation. Editors and publishers are invited to send short announcements to be published here to the editors of EUROSIM - Simulation News Europe.

Systems Analysis/Modelling/Simulation (Journal of Mathematical Modelling and Simulation in Systems Analysis)

The journal will be published by Gordon and Breach Science Publishers, S.A., and its associated company, Harwood Academic Publishers, from January 1, 1992. It has existed since 1984 and was published by Akademie-Verlag GmbH.

The journal is devoted to art and techniques and applications of modelling and simulation in systems analysis. Systems analysis is an interdisciplinary activity. Articles will be published on systems analysis and systems theory, model-ling and mathematical models and tools for decision and control, computer simulation systems, modelling and simulation in environmental protection, macroeconomics, agricultural production, regional planning, biosciences, traffic control, large engineering systems, resources distribution, management systems etc.

An editorial board with experts from the European countries, the USA, and Canada assists the editor.

Papers should be sent to: Prof. Dr. Achim Sydow (editor), GMD - Research Institute for Innovative Computer Systems and Technology, Hardenbergplatz 2, W-1000 Berlin 12, Germany

Orders should be sent to: Scientific & Technical Book Service Ltd., P.O. Box 90, Reading RGI 8JL, England

Book Reviews

This section will provide readers with detailed information on new books on modelling and simulation. The books will be reviewed in detail. Because of the scope of this newsletter also non-english books will be 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.

F. E. Cellier "Continuous System Modeling"

Springer-Verlag, New York (1991), 755 + xi pages.
ISBN 0-387-97502-0 Springer-Verlag New York Berlin Heidelberg
ISBN 3-540-97502-0 Springer-Verlag Berlin Heidelberg New York

This book describes systematically and methodically the modeling of continuous processes. Together with the book "Continuous System Simulation" it gives an introduction into the modeling and simulation giving a comprehensive overview on the state-of-the-art in this area.

The book is a highly computer-oriented textbook. Software tools and conceptual tools implementing various methodologies are introduced, together with applications. Each chapter concludes with homework problems, suggestions for term projects and open research questions. Consequently, the book addresses on the one side students and teachers involved in simulation and modeling, on the other side it serves as comprehensive reference for modeling and simulation practitioners.

Chapter 1 gives an overview on the importance of modeling and simulation and introduces the basic terminology. The author follows well known concepts (Zeigler, Korn) in defining modeling and simulation. He separates strictly between modeling and simulation ..."Modeling is the art of capturing physical and other phenomena in a mathematical language" ... "Simulation is the art of applying mathematical descriptions of stimuli to the mathematical description of the system and performing manipulations on these mathematical descriptions in such a way that model behaviour is being extracted that resembles the system behaviour that we would experience if we were to apply the real stimuli to the real system".

Chapter 2 summarizes the primary concepts of state-of-the-art simulation software, introducing e.g. DARE-P, DESIRE, ACSL.

Chapter 3 and 4 deal with modeling concepts in the classical areas of simulation, electrical engineering and mechanical engineering - using Kirchhoff's law and Newtons law (up to Euler equation, Lagrangian and Hamiltonian).

Chapter 5 deals with modular and hierarchical modeling. Advantages and disadvantages of simulation software for modular and hierarchical modeling are discussed (macros, submodels, implicit descriptions, etc.), shortcomings are demonstrated. The modeling language (modeling preprocessor) DYMOLA is introduced, which provides for true modular modeling. DYMOLA is a red line in this book, it is used in several chapters for high level modular modeling.

Chapter 6 shows advanced concepts of electronic circuit modeling. The features of SPICE, the most common circuit simulator, are compared with a DYMOLA approach to this area.

Chapter 7 introduces the concept of bond graph modeling. After a survey on existing bond graph software the implementation of bond graph descriptions into DYMOLA is presented.

Chapter 8 deals with modeling of thermodynamics (conduction, convection, radiation) , chapter 9 with modeling of chemical reactions, both using partly bond graph modeling.

Chapter 10 deals with population dynamics. The important concepts of competition and co-operation are discussed, briefly the phenomenon of chaos is sketched (bifurcations of the discrete logistic equation).

Chapter 11 presents the methodological modeling tool "System Dynamics". After an overview on the concepts and the former used DYNAMO, the modeling software STELLA, also based on System Dynamics, is discussed. The advantages of STELLA are tested in implementing Forrester's world model.

The following chapters, more research oriented, discuss interfaces between modeling, simulation and artificial intelligence. Chapter 12 is an introduction to qualitative simulation. As software tool QualSim, a MATLAB toolbox, is used, comparisons with QSIM are briefly sketched. Inductive reasoning is discussed in chapter 13, the software tool SAPS (and SAPS-II, a MATLAB toolbox) is introduced. Chapter 14 deals with artificial neural networks and genetic algorithms. After an introduction to the description of artificial neural networks and artificial neural engineering networks and applications (pattern recognition of characters) MATLAB-like software implementations are discussed. As modeling and simulation tool DESIRE/NEUNET (Korn) is presented.

The last chapter (chapter 15) discusses automated model synthesis. The author distinguishes five levels: classical simulation models, object-oriented modeling, system entity structure (SES), generalized SES, goal-driven pruning. The cable reel problem tries to give insight into application of these concepts.

The author concludes "According to my judgement, this text presents the most comprehensive account of modeling methodologies for continuous systems currently available.... In this text, major emphasis has been placed on unifying the terminologies.... I hope that this text, besides providing students with an easily digestable overview of continuous system modeling techniques, may stimulate further work in this fascinating research area and will also prove of use to the accomplished practitioner". - It has to be agreed.

F. Breitenecker

B.Page "Diskrete Simulation - Eine Einführung mit Modula-2"

(B. Page "Discrete Simulation - Introduction with Modula-2) (in German)
Springer-Verlag Berlin Heidelberg (1991), 422 + xiii pages
ISBN 3-540-54421-6

This textbook (Springer Lehrbuch) introduces design, modeling, implementation, validation, and simulation of discrete systems. It is a textbook for students and teachers in the area of discrete simulation, summarizes also the author's experiences of many courses in modeling and simulation at the University of Hamburg. But it addresses also simulation practitioners interested in a comprehensive introduction into the methodology and implementation of discrete simulation.

For implementation of the concepts the structured high level language Modula-2 was chosen, which takes into account the modern principles of software engineering (modularity, data abstraction, portability), resulting in the simulation engine DESMO (**D**iscrete Event **S**imulation in **Mo**dula-2).

Chapter 1 introduces the concepts of systems, models and simulation, also from the view of system theory.

Chapter 2 deals with the elements of discrete (simulation) models. First the author distinguishes the different approaches for modeling of discrete processes: event scheduling, process interaction, transaction flow. After an overview about the components of event-oriented models typical models and their implementations (examples) are presented. Of big interest is the following discussion of "event-oriented approach versus process-oriented approach", shown within an assembly system model.

Chapter 3 deals with the implementation of (discrete) models in Modula-2. First requirements for implementation of models are specified, then the realization with Modula-2 is discussed (modularity, memory allocation, statistical reports, event chains, queues, distributions). The chapter closes with the implementation of an example in a Modula-2 simulation environment.

Chapter 4 offers an introduction into statistics for discrete simulation. First the principles of generation of pseudo random numbers (uniform distribution) are briefly sketched. In the following the transformation of the uniformly distributed random numbers into distributions of other types is discussed, a portable random number generator in Modula-2 is presented.

Especially in discrete simulation, experiment planing and experiment evaluation and interpretation are very important. These aspects are discussed in the following, including correlations, Chi-Square test, confidence intervals, etc.

Chapter 5 deals with model validation and model documentation. The author reports on validation of the conceptual model, on model verification and on operational model validation, including plausibility tests and sensitivity analysis.

Chapter 6 deals with simulation software for discrete processes. First the author classifies simulation packages, simulation languages and simulation systems, where he defines a simulation system as a "software system which supports the three tasks modeling, experimenting (with the model) and analysis of results". The chapter closes with a discussion on the structure of simulation systems and gives an example (DYNAMIS).

Chapter 7 presents DESMO (Discrete Event Simulation in Modula-2). DESMO supports primarily the process-oriented approach in discrete modelling, but especially for teaching purposes also the other approaches are supported. DESMO is based on Modula-2. In the following the features of DESMO for modeling within these different views are presented. Furthermore features for deadlock recognition are discussed.

The last chapter (chapter 8) gives an overview about modern trends: object-oriented modeling, modeling and artificial intelligence (knowledge based simulation etc.), expert systems, qualitative simulation.

The first appendix offers modeling and simulation tasks for training (exercises, projects), the second shows simulation programs in Modula-2, the third documents the DESMO simulator. The fourth appendix shows different implementations of the jobshop model (event-oriented, process-oriented, transaction-oriented, activity oriented) and of other models.

This book has to be highly recommended for teaching in discrete simulation.

F. Breitenecker

G. Schwarze "Digitale Simulation"

(G. Schwarze "Digital Simulation) (in German)
Akademie-Verlag Berlin (1990), 276 pages
ISBN 3-05-5500606-2

This book addresses scientists of all disciplines who want to use digital simulation for problem solving. The book is based on cybernetics, system theory and system analysis, it reflects the long year experience of the author in this area.

The first chapter deals with the basic terms of modeling and simulation. Based on system theory the terms system, process and model are defined, a subchapter explains the distinction between modeling and simulation.

Chapter 2 deals with abstract models. The author starts with the system theory based definition of a model, where

the "time" and "process variables" are introduced. After discussing stationary, transient and also chaotic behaviour the author concentrates on classical descriptions: linear differential equations, transfer functions, nonlinear differential equations, followed by an overview on the advantages of blockoriented descriptions. For discrete processes difference equations, event-oriented approaches and finite automata are discussed. A further subchapter deals with Petri nets as description method.

Chapter 3 deals with the process of modeling itself. Starting with methodological aspects model validation and model acceptance are discussed (robustness, sensitivity, etc.). An overview about application-oriented modeling and software support concludes this chapter.

Chapter 4 discusses experimentation with a model (experiment planning, model analysis, optimization, etc.).

Chapter 5 deals with software tools for modeling and simulation. First classical programming languages and their extensions for simulation purposes are discussed. In the following concepts for simulation systems (modeling, experimentation, result analysis) are investigated. The following subchapters present application-oriented simulation software, developed mainly in the former GDR (also compared with other simulation systems): SONCHES for ecological systems (based partly on concepts of System Dynamics), DISIP and DIGSIM (able to handle partial differential equations), TOMAS for assembling processes (submodels, event- and process-oriented), BNETD/KOMPLEX, ATLANTIS and SATURN for simulation and analysis of computer systems (BNETD/KOMPLEX - based partly on PASCAL - simulates the efficiency of computer systems and networks, ATLANTIS - based on SIMULA - for simulation support of design, implementation, testing and analysis of distributed software systems, SATURN - partly based on SIMULA - does "Simulative and Analytical Throughput Utilization and Response Time Notification"), SIMDIS-(2) for simulation of discrete processes (powerful control commands for experiment control), SIMFOR for discrete event simulation (FORTRAN-based), DEMOS-M2 for discrete process-oriented simulation (based on Modula-2), SIM-SKR for continuous simulation (blockoriented description, powerful simulation engine, a translator precompiles the SIM-SKR-description into FORTRAN, the runtime environment is linked, etc.). A subchapter on Petri nets concludes this chapter, where the MARS-system is introduced. This system simulates models based on M-nets (extended Petri nets).

Chapter 6 gives a short overview on new developments.

Chapter 7 (the appendix) shows program examples for most of the fore-mentioned simulation systems or simulation languages. These examples allow insight into features and efficiency of the simulators.

This very interesting book offers in the first part a system theoretic view of modeling and simulation, from methodology to application. The second part gives an interesting overview on development of simulation software in the former GDR. Some of the presented software tools have been internationally accepted.

F. Breitenecker

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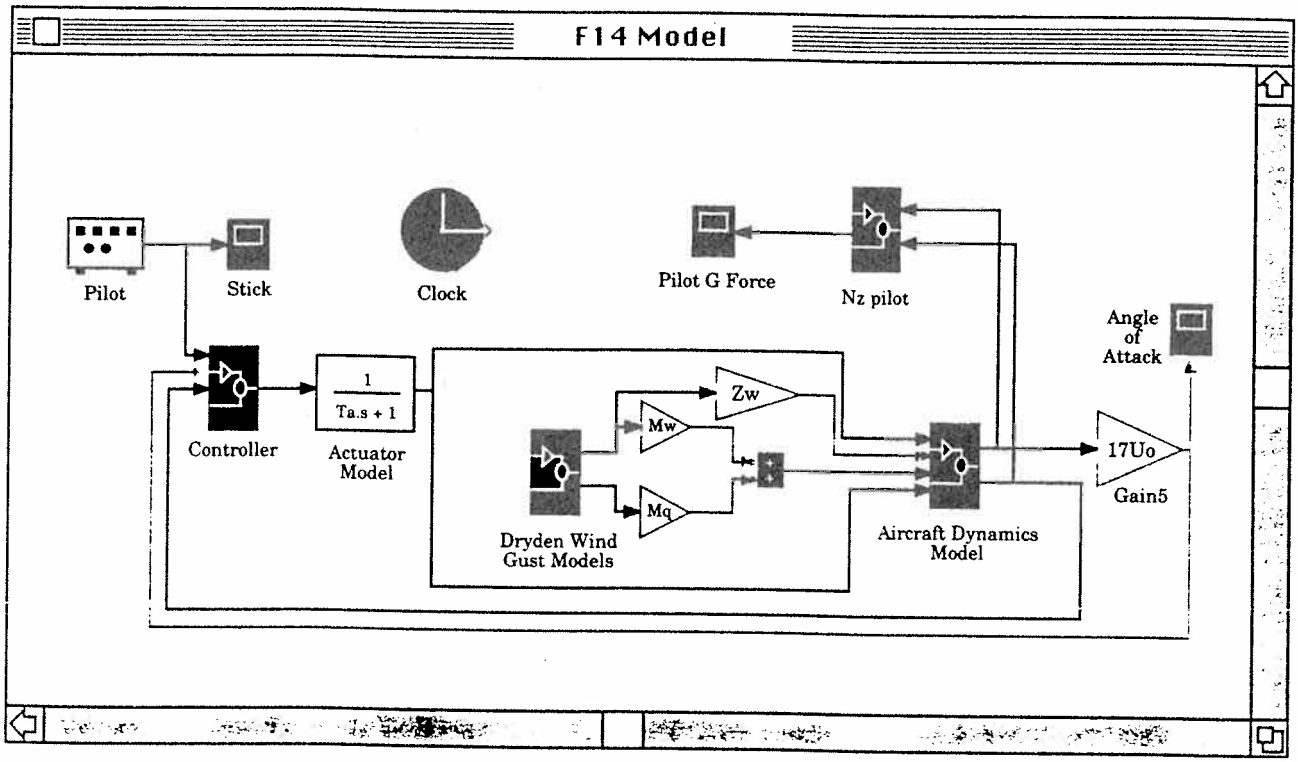

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PROMODEL INCREDIBLY SIMPLE.....SIMPLY INCREDIBLE

EUROSIM - Simulation News Europe started 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, shall be 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.

Up to now each issue of EUROSIM - Simulation News Europe introduced a new comparison, continuous and discrete examples alternatively:

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

Comparison 2: Flexible Assembly System, March 1991

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

Comparison 4: Dining Philosophers, November 1991

If you have an idea for a model to be compared in different simulation languages please contact the editors.

We invite all institutes and companies developing or distributing simulation software to participate in this comparison. Solutions of comparisons 1, 2, 3, and 4 described in the previous issues will still be published.

Please, simulate the model(s) and send a report to the editors in the following form (on diskette, any word processing format):

- 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. It is planned to publish collection booklets of the comparison solutions, containing also extended contributions and all figures.

We also invite you to prepare animations and demo runs on diskette and to make them available for our readers.

Comparison 5: Two State Model

In many engineering problems simulation models turn up to be discontinuous. That is, the solution itself is continuous, but either the first or higher order derivatives have jumps. Discontinuities may occur either at specific time points or when certain conditions are satisfied.

When a discontinuity has been passed, not only the model may be changed, but also the function that determines the location of the discontinuity. Consequently, if this discontinuity is not correctly modelled and determined, respectively, the results may go wrong qualitatively.

This example tests the ability of the simulator to handle discontinuities of the forementioned type in a satisfactory way. The problem is as follows

$$dy_1/dt = c_1 * (y_2 + c_2 - y_1)$$

$$dy_2/dt = c_3 * (c_4 - y_2)$$

This ODE system is essentially a simple linear stiff problem with exponential decays as analytical solution. One of these is a very rapid transient, and the stationary solution of the slow decay varies from the two states of the model. This actually "drives" the model (and the discontinuity).

Parameters c_1 and c_3 remain unchanged during simulation: $c_1 = 2.7E+6$, $c_3 = 3.5651205$.

The model operates in two states:

c_2 is 0.4 and c_4 is 5.5 when the model is in state 1 (also the initial state). The initial values are $y_1(0) = 4.2$ and $y_2(0) = 0.3$. The model remains in state 1 as long as $y_1 < 5.8$. The choice of c_2 and c_4 ensures that y_1 will grow past 5.8.

When the model switches to state 2, parameters c_2 and c_4 change to $c_2 = -0.3$ and $c_4 = 2.73$. The model remains in state 2 as long as $y_1 > 2.5$. When passing this instance the model switches back to state 1; the choice of c_2 and c_4 ensures that this will happen.

The time interval is 0 to 5.

The tasks to be performed are:

a) Plot y_1 as function of time.

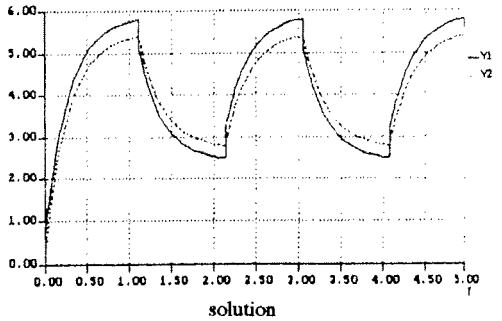
b) Printout the time for every located discontinuity and the final value $y_1(5.0)$.

c) Repeat question b) for the true relative accuracy varying between 10^{-6}, 10^{-10}, 10^{-14}.

Analytical solution values can be found, so for comparison we state that the last discontinuity occurs at time 4.99999774742 and the $y_1(5.0)$ value should be approximately 5.1016. If the last discontinuity is not located, the previous ones are not found with adequate accuracy. The value of $y_1(5.0)$ also reflects the accuracy of the locations of the discontinuities and any value between 5.8 and 5.1 can be expected.

d) Change the state 2 parameter values of c_2 to 1.3, c_4 to 4.33 and the condition to $y_1 > 4.1$ and rerun a) and b) with a true relative accuracy of 10^{-11}.

Niels Houbak, Technical University of Denmark, Laboratory for Energetics, Building 403, DK-2800 Lyngby.



solution

Comparison 1 - DESIRE

DESIRE/387, DESIRE/387 for AT clones and the newer DESIRE/X are direct-executing dynamic-system simulation packages which compile readable, screen-edited programs directly into memory in a small fraction of a second, so that there are no annoying translation delays. Programs admit up to 1500 state variables and can be in matrix form. DESIRE/NEUNET and DESIRE/X also solve neural-network programs.

For smooth integration with a logarithmic time scale, we replaced each given differential equation

dx/dtime = expression with dx/dt = expression*tt

where

$$tt = \ln(10)*10^{(t+to)}$$

is the time, and the new independent variable

$$t = \log(\text{time}) + t_o$$

produces a logarithmic time scale shifted by any desired amount t_o.

In our graphs, $t_o = 3$, so that

the abscissa marker 0 corresponds to time = 0.001
the abscissa marker 2 corresponds to time = 0.1
the abscissa marker 4 corresponds to time = 10

The program listings and graphs below are direct EGA screen prints obtained with a personal computer; VGA output is also available. If you need more elaborate graphs, you can make programmed or command-mode calls to commercially available graph-plotting programs without leaving DESIRE.

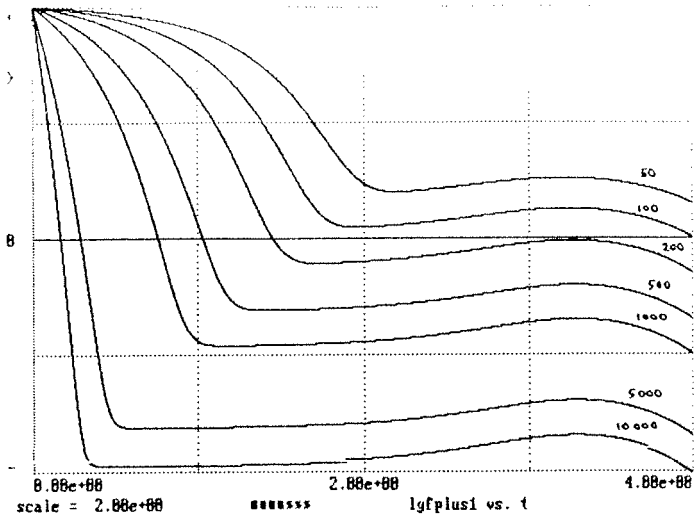
The time taken to produce the first curve on CRT was

14 sec on a cache-less 16 MHz 80386/7 (Toshiba 5100)
30 sec on a 12-MHz 80286/7 AT clone
2.2 sec on a 40 MHz SUN 4c workstation (XWindow graphics)

With display turned off, these computation times decreased to 10 sec, 22 sec and 1.7 sec, respectively. 14 different integration rules can be selected. Gear integration produced results more quickly than fixed- or variable-step Runge-Kutta methods in spite of the fact that the latter are written in assembly language individually optimized for the 80386/7 and 80286/7, while the Gear routine is in PASCAL. The entire SUN program is written in C.

```
--                                   EUROSIM COMPARISON PROBLEM 1
-------------------------------------------------------------------
ln10=ln(10) ¦  loge=1/ln10
kr=1 ¦  kf=0.1 ¦  dr=0.1 ¦  dm=1 ¦  --          coefficients
f=9.975 ¦  m=1.674 ¦  r=84.99 ¦  --          initial values
p=0
-------------------------------------------------------------------
irule 15 ¦  ERRMAX=0.00001 ¦  --              GEAR integration
t0=3 ¦  --                                shift log time scale
TMAX=1+t0 ¦  NN=6000 ¦  DT=0.000001 ¦  scale=2
-------------------------------------------------------------------
lf=50 ¦  drunr  ¦  display 2 ¦  --                 run and reset
lf=100 ¦  drunr  ¦  lf=200 ¦  drunr  ¦  lf=500 ¦  drunr
lf=1000 ¦  drunr  ¦  lf=5000 ¦  drunr  ¦  lf=10000 ¦  drun
-------------------------------------------------------------------
DYNAMIC
-------------------------------------------------------------------
A=kr*m*f-dr*r ¦  --              we precompute these for speed!
B=kf*f*f-dm*m
tt=ln10*(10^(t-t0)) ¦  --                logarithmic time scale
--
d/dt r=A*tt ¦  d/dt m=(B-A)*tt
d/dt f=(p-lf*f-A-2*B)*tt
-------------------------------------------------------------------
lgfplus1=loge*ln(f)+1 ¦  dispt lgfplus1
```

program listing



results (direct EGA screen prints)

G.A. and T.M. Korn Industrial Consultants, Rt 1, Box 96C, Chelan, WA 98816, USA.

Comparison 2: Preliminary Evaluation

Issues 2, 3, and this one of EUROSIM - Simulation News Europe contain a number of reports on tests of simulation tools applied to a test example described in issues 1 and 2 (Simulation of a Flexible Assembly System, Comparison 2). Some of the tools reported so far have produced results of remarkable conformity, whereas others are so different that we assume the model description has not been sufficiently precise. It is known to us that the colleagues who used Micro Saint had a different understanding of the operation time of station A1 (Load/Unload) than we had: They assumed 15 sec for loading and 15 sec for unloading, whereas we meant 15 sec for both operations. i.e. 7.5 sec each (cf. issue 2, p. 26), therefore their numbers are very different from the majority. Probably other ambiguities have led to other strongly deviating results (SIMAN, TOMAS, SLAM II, PS SIMDIS). It would be interesting to know what these ambiguities were, but it would also be interesting to know why no two tools have produced precisely the same results. Some of them are very close to each other. It seems that the authors have had the same understandig of the system, but that the software tools work a little bit different somehow. We will try to explain some of these little differences in a later issue. The following table shows the findings for twenty pallets in the system:

Tool	Total throughput	Average throughput (time in sec)
PS SIMDIS	1384	-
DOSIMIS	1408	436.9
SIMAN	919	627.6
SLAM II	1082	400.0
Micro Saint	-	603.0
SIMUL_R	1405	409.5
GPSS/H	1409	409.2
CASSANDRA	1415	410.7
DESMO	1408	408.0
TOMAS	884	623.8
SIMPLE-mac	1439	400.2
WITNESS	1439	409.3

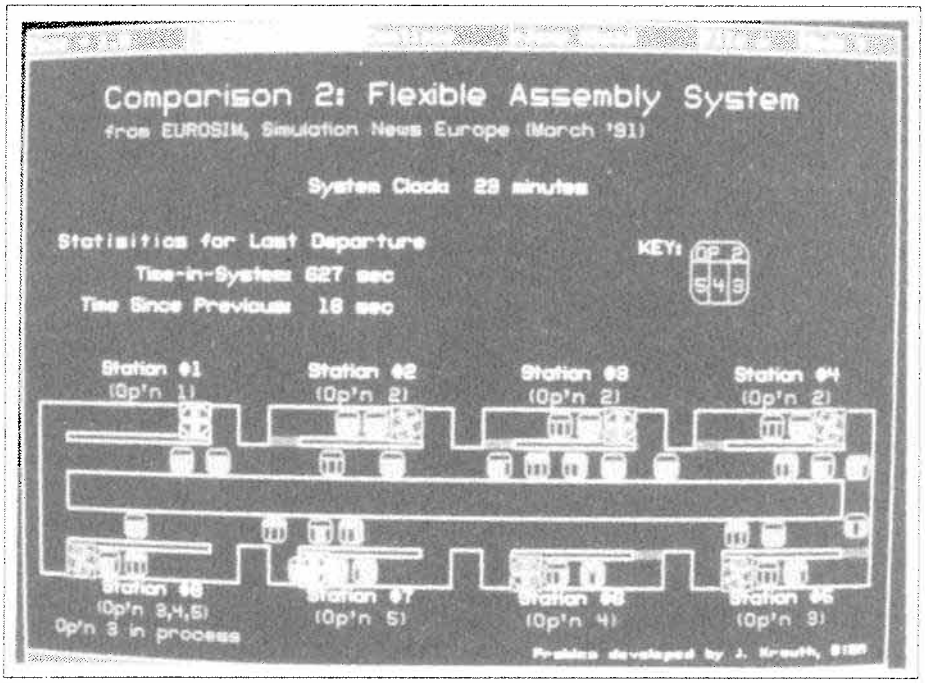
This summary does not intend to close the comparison. Further contributions are still welcome. We would however encourage every colleague who intends to test another tool to contact us in case of any questions concerning the definition of the test model. One of the reasons why we chose this model was that it allows to check two features of discrete event simulation systems that we consider very important for the simulation of complex production systems:

- the possibility to define and combine submodels (the model consists of 8 slightly different submodels!)
- the method to describe complex control strategies

Unfortunately most of the contributions we received so far do not discuss these topics. So no evaluation of such properties of tools is possible at the moment. Maybe future contributions will include some remarks on these points, too.

We want to thank all the authors for their interesting reports and hope to receive more!

Contact: J. Krauth, BIBA (Bremer Institut für Betriebstechnik und angewandte Arbeitswissenschaft), Postfach 33 05 60, D-2800 Bremen 33, Tel: +49-421-22 009 51 Fax: +49-421-22 009 79.



Animated GPSS/H comparison model,
available from Wolverine Software Corporation, 4115 Annandale Road, Annandale, Virginia 22003-2500 USA

The editors also received an animation diskette of the comparison 2 SIMAN model from The CIMulation Centre in England (see title page of this issue), comparison solution published in EUROSIM - Simulation News Europe, Number 2, July 1991, page 29.

Comparison 2 - CASSANDRA

The Simulator

CASSANDRA (Cognizant Adaptive Simulation System for Applications in Numerous Different Relevant Areas) 2.1 - developed in the Institute for Measurement and Computing Techniques of the Hungarian Academy of Sciences - is a universal kernel system based internally on an object oriented structure utilizing primarily numerical Petri Net elements for its model representation. This approach ensures a realistic structural and non-procedural view of the systems investigated.

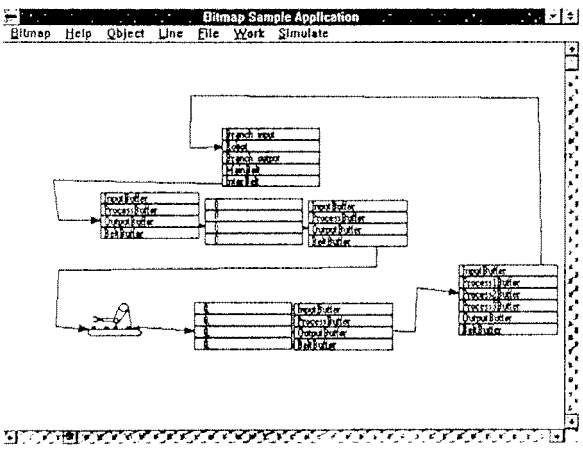
CASSANDRA 2.1 enhances the effectivity of simulation by automating the control of simulation experiments as well as the goal oriented reconstruction of the model structures using AI attributed *demons*.

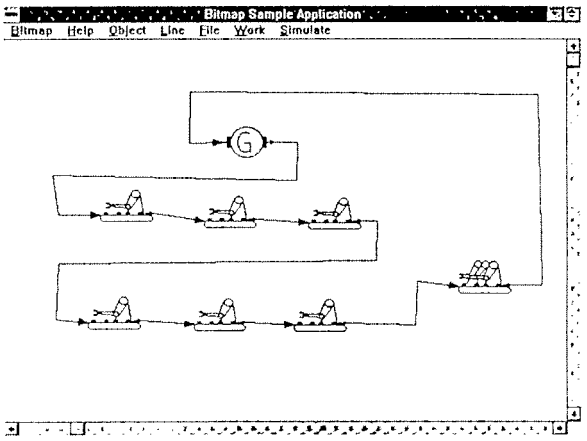
The simulator provides for an easy extension into problem oriented, specialized and user friendly tools for various fields by means of extending it with application field specific higher level building elements and I/O communication layers.

In our case CASSANDRA 2.1 was extended with a set of macro elements (as robots, conveyor belts etc.) based on the internal PN elements for simulating FMS models. Beyond that an experimental user interface layer for the given field has been developed by TU Wien and the Simulation Project Center in Wiener Neustadt under the supervision of Prof. Dr. Felix Breitenecker. The extension of the kernel system by this specific I/O layer was given the codename IGENJA.

Model Description

The model was run on a 80386/387 AT type system under MICROSOFT WINDOWS 3.0. The model building blocks consisted of various robots with their respective conveyor belt segments and shifting parts according to the example that had to be modelled. The resources could examine the constraints corresponding to the order of operations to be performed on the workpieces which were checked. The figure illustrates the graphic description of the model in the IGENJA system. The models in the system could be assembled graphically from user level model elements of the system library that were transformed automatically into the internal PN representation.





Results

The final results of the simulation experiments are given in table 1.

Number of pallets	total throughput	average throughput time [s]
10	1039	277.9
15	1374	313.3
20	1415	410.7
25	1417	517.9
30	1417	629.1
35	1416	691.6
40	1415	838.5
45	1418	866.8
50	1379	1029.3
55	deadlock	
60	deadlock	

Remark: data collected from the 120th to the 600th minute.

Beyond the above results the IGENJA system provides the animation of the changes in the state of the model during simulation run enabling thereby a good overview of the operation of the system investigated.

For information and comments, please phone or fax or write to:

Prof. Dr. A. Jávor, KFKI Research Institute for Measurement and Computing Techniques of the Hungarian Academy of Sciences, H-1525 Budapest, P.O.Box 49, Hungary, Tel: +36-1 1699499, Fax: +36-1 1553894

Comparison 2 - DESMO

1. The DESMO Software

Background:

The simulation package DESMO, developed at the informatics department of Hamburg University, was inspired by the process style DEMOS system in Simula (G.M. Birtwistle) adopting the entity approach for simulation objects. The DESMO user can import a wide range of simulation functions into his model program, which is written in the base language Modula-2. Modula-2 with its comprehensive language kernel allows for well structured and readable, safe and efficient simulation programs on PCs offering features such as strong typing, modularization with separate compilation and interface checking, information hiding and access protection, respectively.

Package Functionality:

DESMO offers, next to event scheduling and process interaction functions, contructs for modelling on a higher level of abstraction (above processes) allowing for a more problem oriented and therefore more convenient implementation of simulation models. These synchronization mechanisms are: *Resource competition* with mutual exclusion (i.e. entity resource requests), *producer/consumer relations* of entities, *direct co-operation* of entities (master/slave relations), and *conditional waiting* of entities.

Semi automatic statistics, collection and graphical display of simulation time series data, trace and debug facilities, consistency and deadlock checks as well as extensive reporting are available.

Technical Data:

Implemented in LOGITECH Modula/TopSpeed Modula on IBM PC (2/50 and 2/80 with 80287 coprocessor). 25 modules with 19000 lines of source code (430 kB) / 380 kB object code.

2. Model Implementation

The sample model is implemented in the process interaction style using also higher modelling constructs of DESMO. The model consists of three components: the subsystems, the conveyors linking these subsystems and the pallets as dynamic elements. The pallets are defined as processes. Each subsystem and each conveyor is realized as a Modula-2 record with the related elements as record components. If feasible the elements are represented by higher modelling constructs; i.e. the station, one buffer behind the station and the conveyors between the systems are *resources*. The conveyors B1 and B2 are simply implemented as (free capacity) counter variables. To enter a system a pallet has to go through a *conditional waiting* object. There it is checked if the pallet can enter and on which way it will pass through the system. The pallet operation sequence is realized as a Modula set with station numbers as elements. The set contents and a limiting condition (A2 being the first or last station) determine the station selection of a pallet. System control follows the pallet process description and the automatical synchronization mechanisms.

The simulation program has 400 lines of code (14 kB) and the run time on the PS 2/80 is 80 sec for the sample system (15 pallets).

3. Simulation Results

As starting condition pallets are not permitted on conveyor B2. Therefore the maximum number of pallets in the system is 40 (capacities of all B1 and the conveyors between the systems). The simulation experiments were executed with 10 pallets in the system up to 40 by steps of 5. The results show that 20 is a favourable number of pallets (see Tab.1). The throughput is too small if there are less pallets in the system. On the other hand more pallets are not increasing the throughput of the system because of congestion effects whereas the average throughput time of one pallet increases significantly.

Nr. of pallets	througput (pallets)	avg.through-put-time (min)
10	939	5.1
15	1351	5.3
20	1408	6.8
25	1407	8.5
30	1409	10.2
35	1408	12.0
40	1409	13.7

Tab. 1: Results
(data collection from 120th to 600th minute)

Documentation:

B. Page: Discrete Event Simulation and Modula-2. Syst. Anal. Model. Simul. 7 (1990) 5, 339-358

B. Page et. al.: Diskrete Simulation. Eine Einführung mit Modula-2. Springer 1991 (see also review, page 25)

Contact:

Prof. Dr.-Ing. Bernd Page, Dipl.-Inform. Andreas Häuslein, cand.inform. Dirk Martinssen, FB Informatik, Universität Hamburg, Vogt-Kölln-Str.30, W-2000 Hamburg 54, Germany

Comparison 2 - TOMAS

Simulation System TOMAS/16

1. Description of the Language

The simulation system TOMAS (Technology Oriented Modelling And Simulation) supports simulation in the field of discrete technological processes. At the end of the 70ies it was designed by the Faculty of Informatics of the Technical University Dresden and realised for the first time in the beginning of the 80ies. In 1990 TOMAS/16 was implemented by DVZ Neubrandenburg GmbH for MS-DOS PCs. Since then it has been offered on the software market.

TOMAS is mainly used in two areas:

- during designing of manufacturing processes
- during planning and controlling of manufacturings

TOMAS - being a building element system - consists of 12 modules, by means of which the user - supported by the computer - can build models. As TOMAS is a simulation system oriented at special fields, the modules present universal manufacturing subprocesses, that means, they imitate typical processes of manufacturing.

These modules - operators and generators - will be passed by operands during simulation. Operands may be for example manufacturing jobs, lots, vehicles, parts.

Behaviour of the single operators and generators is specified by parametrization of the elements. Then the model is able to be processed.

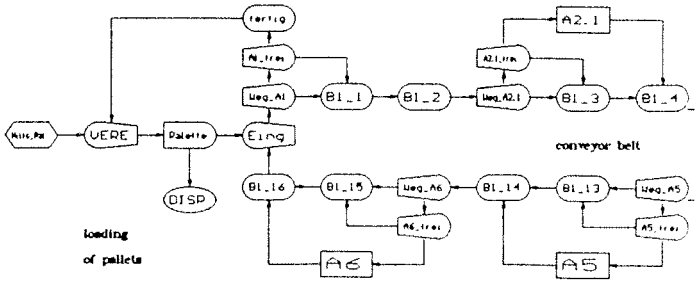
The management of the simulation system TOMAS/16 is easy for the user, because it is menu-driven and many helps will be available in on-line status.

2. Model Description

To solve the problem 7 of the 12 modules were used, realising the following functions:

Num.	Module	Function
1	GENO generator of operand	creates first pallets
1	GENA passive generator	terminates completely processed parts, put unprocessed parts on pallets (A1)
2	VERE joining operator	subelement to connect pallets
1	DISP disposition operator	sink of model, statistics of pallets
7	BEMM processing operator	manipulate parts of pallets (A2-A6)
16	VERZ branching operator	branching of pallets
17	SPEI storing operator	sections of conveyor belts B1 and B2

The following picture shows how pallets will be controlled in the model and a part of the conveyor belt.



3. Experimentation Results

In contrast to other solutions published in "Eurosim" in our model the pallets are created step by step. They are put on the conveyor belts if there is a place available (see model picture above). So we can show that never more than 40 pallets are on the belt. If more than 40 are created then a part of the pallets is waiting in front of the belt. If there were more pallets on the belt a deadlock would be determinated.

The optimum number of pallets may be seen in the following table:

Number of Pallets	Total Throughput	Average Throughput Time 120th to 600th minute
10	848	5.655
13	964	6.461
14	1018	6.590
15	1014	7.091
16	**1031**	**7.431**
17	857	9.290
18	867	9.679
20	884	10.394
30	951	14.754
40	1005	18.832

The biggest throughput will be reached by a number of 16 pallets. If there are more pallets on the belt the average throughput time will be greater, that means some pallets must circulate over and over, before being processed.

Further increasing the number of pallets doesn't yield the same numbers as with 16 pallets, because the third A2-station's and the A6-station's capacity aren't fully used if 16 pallets are in the system.

For information and comments, please phone, fax or write to:

Beate Steinke, DVZ Neubrandenburg GmbH, Bereich Softwareentwicklung und Systemberatung, Woldegker Straße 12, 0-2000 Neubrandenburg, Germany, Tel: +37-90-587 443 Fax: +37-90-587 302

Comparison 2 - SIMPLE-mac

1. A description of SIMPLE-mac

The starting point for this object oriented simulator is a limited supply of parameterizable elements (modules) which allow a complete representation of any discrete system. Controller modules provide a flexible representation (in the form of decision tables) of the complete data flow. The individual modules can be grouped together to form macros, which can in turn serve as modules for the model development process. The creation of an animation layout results from the model development process and therefore requires no additional effort.

Because of SIMPLE's modular concept it is not necessary to create the simulation model via a programming language. Instead, the individual modules are arranged on the screen and connected to one another through material and data flow. In the event the fundamental attributes of a given element are insufficient, its attributes can be extended through the addition of local and/or global controllers.

An additional advantage of SIMPLE-mac is the possibility to view and modify all model parameters without having to leave the simulator.

SIMPLE-mac is operated via a menu driven, window oriented graphic interface. It also provides its own editor for the arrangement of modules and the creation of decision tables. The graphic interface was designed in the MAC-OS style.

2. Model description

The time elapsed for positioning a pallet in the work station Ax (moving from the end of the buffer zone to the work station - 1.33 seconds) is included as a part of the operation time. This method results in an optimal value for the total throughput of 1440 parts (see EUROSIM-91/2, page 28).

The basic submodule consists of seven "RUTSCHE" (Chute) elements and a local controller. This module was used to represent the work stations A2, A3, A4, A5 and A6. To model the first work station (A1) the basic submodule was extended with a controller for the creation and destruction of entities. Further, it was attempted to improve the throughput and throughput time by using a smaller number of pallets with the help of a supervisory controller.

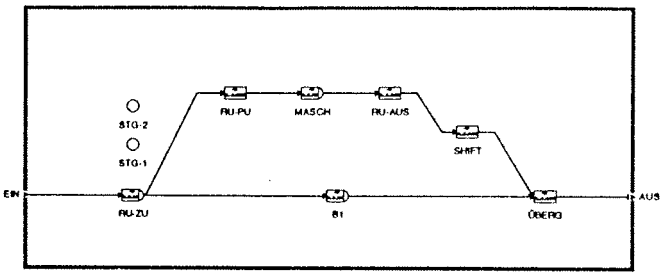
3. Results of the simulation

The diagram shows the results of the individual simulation runs. By using the SIMPLE-mac features to create superimposed, complex controllers an improved strategy for small numbers of pallets could be found.

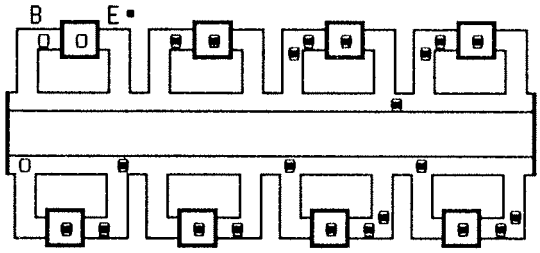
With the use of 50 pallets and more the system blocked due to the exhaustion of the capacity of the conveyor belt.

For information or comments, please phone, fax or write to :

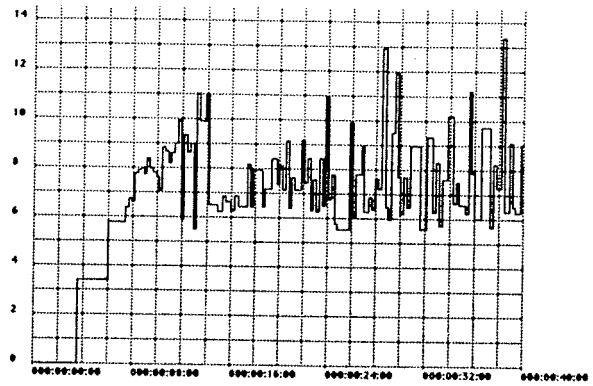
Gernot Kronreif, Fa. UNSELD & PARTNER, Lerchenfelderstraße 44/V, A-1080 Vienna, Austria. Tel: +43-(0)222-4030371; Fax: +43-(0)3332-65149.



basic sub-module



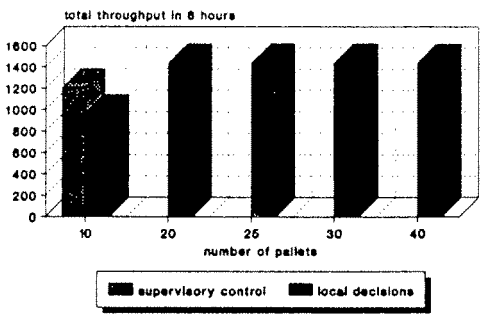
animation layout



throughput time (20 pallets)

no. of pallets in system	total troughput	avg. trough-put time [s]	min. trough-put time [s]	max. trough-put time [s]
10	960	300,0	254,6	318,3
10 (with super-visory control)	1200	240,2	220,1	260,9
20	1439	400,2	270,3	748,0
25	1440	500,4	311,4	1839,5
30	1440	580,7	389,2	2339,0
40	1438	803,7	320,7	3525,1

Flexible Assembly System
Total Throughput



Comparison 2 - WITNESS

1. Description of WITNESS

The simulating system WITNESS used to simulate the given problem offers global elements to build the model. Elements can describe discrete and continuous events. In this case only the discrete elements were needed. The elements are defined by name and displayed on the screen. Any display can be used by creating icons with an editor. The third step of describing the model is detailing the elements. Every element has got a parameter mask which has to be filled by the user. Parameters are cycle-time, capacity or breakdown details as well as material flow or information flow links between the elements and control strategies to run the model. Simulating the model produces an online animation. Results can be given by standard statistics or self-made functions and values.

The used WITNESS version runs on PC 386 with OS/2.

2. Building the model

To build a model that simulates the given problem, the following WITNESS standard elements have been used: machines for every Ax; conveyor for every Sx, Sy, B2, B3 (conveyor between Ax and Sy) and C (conveyor between the subsystems); buffer for every B1; part to define the pallet; attributes (of parts) to give every pallet its individual state of work; variables to define dynamic cycle-times.

Two assumptions were made to complete the model:

- empty pallets (and pallets with completely processed parts) that cannot get to station A1 because the buffer in front of A1 is full move on through the system

- the operation time in A6 is 30 sec for every execution of the work that should be done in A3, A4 or A5. A6 does all the remaining work of A3, A4, A5 as one complete operation.

Using WITNESS, it is at last impossible to build the model out of submodels. The given problem consists of eight slightly different areas but WITNESS does only give the opportunity to define slightly different elements. There is, as well, the possibility to build a system out of subsystems by creating a subsystem as an individual model and integrating these models into a new system. For this it is necessary for the user to make use of a text editor and to rename and control the identifier of all elements.

3. Results

To find the optimal number of pallets to run the system, various simulation runs were made. The results we are interested in were given by the standard statistic output of WITNESS by collecting data from the 120th to the 600th minute.

a.) the optimum number of pallets in the system is 17. By looking at the results it is interesting to see that it is possible to get an output of 1441 parts although there should be a maximum value of 1440 parts, given by the simulated time (8 hours) divided by the longest operation time (20 sec).

b.) the average throughput time by using 17 pallets is 350.6 sec.

c.) the system will get a deadlock situation by using 62 pallets.

d.) the optimum efficiencies of stations in the system will be given by using 17 pallets. In this case, station A6 won't be used at all (only perhaps at the reason of randomly chosen start positions of empty parts). The efficiencies of all other 'normal' stations is 100 %.

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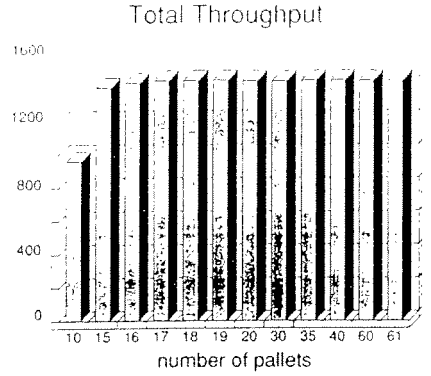
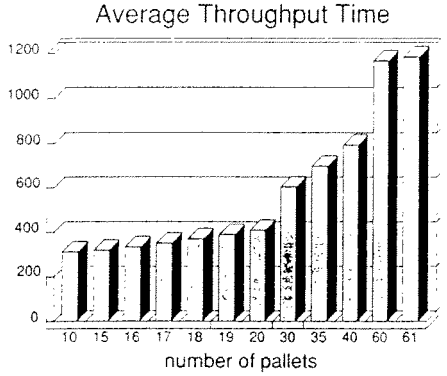
number of pallets	total throughput	average throughput time	efficiencies (%)							
			A1	A2 (1)	A2 (2)	A2 (3)	A3	A4	A5	A6
10	959	311,75	49,99	100,00	99,97	0,00	66,66	66,65	66,67	0,00
15	1398	320,35	72,81	100,00	100,00	91,26	97,08	97,08	97,09	0,00
16	1426	334,38	74,25	100,00	100,00	97,00	98,01	99,00	99,00	1,46
17	1440	350,62	75,00	100,00	100,00	100,00	100,00	100,00	100,00	0,00
18	1440	370,11	47,98	100,00	100,00	99,76	84,58	99,10	99,76	24,20
19	1441	389,33	75,04	100,00	100,00	99,84	94,58	98,27	99,23	11,25
20	1439	409,30	74,94	100,00	99,99	99,67	89,94	94,91	97,64	25,73
30	1438	602,85	74,93	100,00	100,00	100,00	87,76	92,20	95,34	37,38
35	1441	697,10	75,05	100,00	100,00	100,00	89,02	93,84	96,18	31,98
40	1441	791,92	75,06	100,00	100,00	100,00	91,57	95,36	96,69	24,76
60	1439	1166,40	74,94	100,00	100,00	100,00	90,84	94,80	96,52	26,15
61	1440	1183,70	75,02	100,00	100,00	100,00	93,55	96,30	97,27	18,62





Comparison 3 - 386-MATLAB

Introduction: MATLAB is a C-based general tool for mathematical and engineering calculations with limited capabilities for simulation of non-linear equation systems. Versions are available for many personal computers and workstations and for the Cray super computer.

Model Description: The model may be transformed to a vector equation $\dot{x}=Ax+Bu$, $u=VDC$, resulting in the following m-file

```
function xs = cepa(t,x)
R1 = 0.05; R2 = 5.0e6; C2 = 17.9e-9; TRF = 1e-9;
if t < TRF, R = R1 + (R2-R1)*(t/TRF); end
if t > TRF, R = R2; end
if t > 5, R = R 2 - (R2-R1)*(t-5e-6)/TRF; end
if t > 5+TRF, R = R1; end
u = njpar(1,6); A = njpar(1:4,1:4);
A(2,2) = -1/(C2*R); B = njpar(1:4,5);
xs = A*x + B*u;
```

Results: All calculations were done on an IBM PS/2 Model 80 (80386 processor with an 80387 numeric coprocessor) using 386-MATLAB version 3.5j, for comparison also on an 8086-PC with PC-MATLAB 3.5g.

Calculation of System Eigenvalues: The eigenvalues calculated using the MATLAB built-in function EIG are shown in the table:

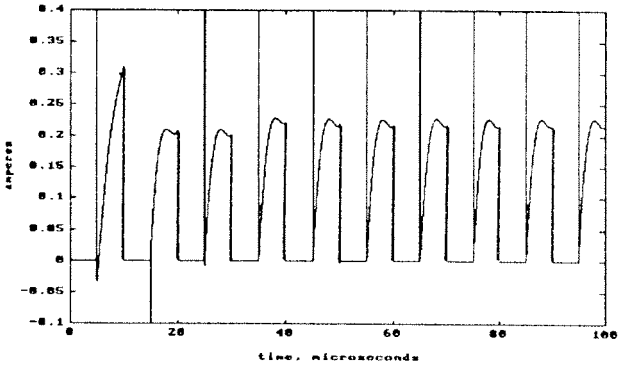
Eigenvalue	ON-Period
λ_1	$-1.11731759 * 10^{+3}$
λ_2	$-6.25782767 * 10^{-4}$
λ_3	$-1.13038814 * 10^{-1} + 6.58352220 * 10^{-1}i$
λ_4	$-1.13038814 * 10^{-1} - 6.58352220 * 10^{-1}i$
Eigenvalue	OFF-Period
λ_1	$-5.47082024 * 10^{-2} + 1.04079719 * 10^{+0}i$
λ_2	$-5.47082024 * 10^{-2} - 1.04079719 * 10^{+0}i$
λ_3	$-5.82284186 * 10^{-2} + 5.32750192 * 10^{-1}i$
λ_4	$-5.82284186 * 10^{-2} - 5.32750192 * 10^{-1}i$

The condition numbers in the two cases are respectively around $1.79*10^{+6}$ and $2.99*10^{+4}$. That is extremely high, indicating the result may be unreliable. Checking the accuracy (via singular value decomposition) gives an error matrix with largest elements of the order of 10^{-6}. Hence only the first six digits in the eigenvalue calculation should be trusted.

Simulation of 10 Oscillation Periods: Even though the problem is very ill-conditioned an attemp has been made to simulate 10 periods of the power amplifier. MATLAB contains two variable step integration routines based on the Runge-Kutta method: ODE23 and ODE45. The latter was used in this work with a relative tolerance set to $1.0*10^{-8}$. The routines as supplied result in the message 'SINGULARITY LIKELY' because of a too large initial Δt (one hundredth of t_{final} - t_{start}). This is avoided by simulating subintervals of the period of oscillation and saving the results for each subinterval on disk. The following approach was taken: change the m-file, so that it simulates one period and stores the results on disk; add a loop to simulate 10 periods to the above mentioned m-file; construct an m-file which plots the results.

One of the reasons for doing this is that PC-MATLAB can only handle vectors up to 4047 elements for storing (not 386-MATLAB).

The simulations on a 80386 was completed in a few minutes. The simulations on a 8086 were of course not as fast. Simulating ten periods took more than 4 hours. The results indicate, that the initial transient lasts for two to three periods and the transients last at least 4 periods and maybe 5 periods (figure 1).

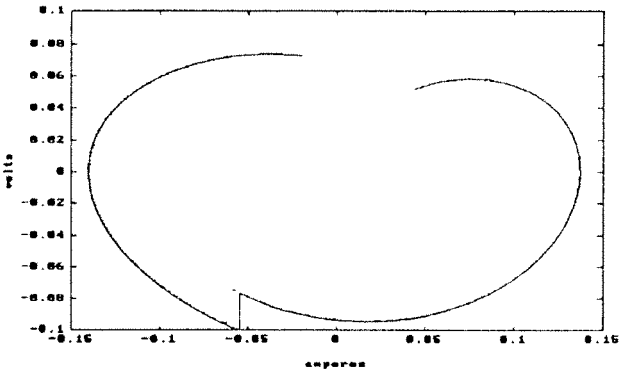


Rise/fall Time Parameter Study: An attempt at simulating the time interval $[0;9*10^{-6}]$ seconds for different values of TRF was not successful for the largest values of TRF. At about $5.001*10^{-6}$ seconds the numerically evaluated Jacobian appears to be singular. The results were obtained by "adding" a parameter loop for TRF:

```
ts=[0.0 0.5*TRF TRF 5.0 5.0+0.5*TRF 5.0+TRF 5.0+2.0*TRF 6.0 7.5];
tf=[0.5*TRF TRF 5.0 5.0+0.5*TRF 5.0+TRF 5.0+2.0*TRF 6.0 7.5 9.0];
for k=1:length(ts),
    [t,y]=ode45('cepa',ts(k),tf(k),x0,1.0e-8,1);
    eval(['save file',int2str(j),int2str(k),'t y'])
x0=y(length(t),1:4)';
    clear t y
end
```

The simulations for different rise/fall times gave identical results when plotted against a linear time axis, and showed very small deviations with a logarithmic time axis.

These results should be expected since the combined rise/fall time even for the largest TRF value is only 2% of the period of oscillation. However, for the smaller TRF values it is evident, that the tolerance used in the integration may have been too low. The phase plane curve of the voltage difference V2-V3 as a function of the current in coil L3 is shown in figure 2. The discontinuity in the curves is evident, the tolerance during the integration (dynamic simulation) was not low enough. Only the curve for the highest value of TRF shows any difference from the others. It was during the calculation of this response, that singularity was encountered around t = 5.001 microseconds.



Niels Jensen, The PDDC Group, Department of Chemical Engineering, Technical University of Denmark, Lyngby, Denmark

shortened version

Comparison 3 - SIL

This example is in many ways typical for electrical engineering problems: 1) They seem simple, 2) They require more than "just" solving a system of ODE's, and 3) they really are nasty due to stiffness and discontinuities.

It is impossible in SIL to solve question a) because SIL has no eigenvalue routine incorporated. It is though possible to store the Jacobian matrix in a file during the solution and by using for example MATLAB the eigenvalues can be computed.

The SIL model used for computing the time response is given in figure 1. The following details should be noticed.

1)A DISCRETE variable is used for implementing a 100 kHz square wave.

```
$TITLE=Comparison 3 (EUROSIM)
begin
(* Comparison 3 model. (Erik Lindberg)*)
parameter  VDC(5),
     L1(79.9E-6), C2(17.9E-9),
     L3(232.0E-6),C4(9.66E-9),
     RL(52.4),TRF(1E-15),
     Ron(5.0E-2),  Roff(5.0E6);
variable   (*  To define the R(t) ramp  *)
     R, SWITCHTIME(0), R1(),
     (*  The state variables  *)
     ax1(0), bx2(0), cx3(0), ex4(0),
     (*  Output variables  *)
     Rescur, Outvol;
derivative (* The derivatives *)
     Dx1(ax1), Dx2(bx2),
     Dx3(cx3), Dx4(ex4);
sampletime (* Also for the R(t) ramp  *)
     Tmain(5.0E-6);
discrete   RT1(Tmain)(SWITCHTIME),
     RT2(Tmain)(R1);
time T(0:100E-6);
STEPSIZE:=1.0E-12; MAXSTEPSIZE := 1.0E-5;
METHOD := 139;    (*  Stiff option  *)
RT1 := T;   (*  The following defines R(t) *)
R1  := Roff;
IF R1 < 1 THEN
 begin
 RT2 := Roff;
 IF T > SWITCHTIME + TRF THEN
   R := Ron
 ELSE
   R:=Roff+(T-SWITCHTIME)*(Ron-Roff) /TRF
 end
ELSE
 begin
 RT2 := Ron;
 IF T > SWITCHTIME + TRF THEN
   R := Roff
 ELSE
   R:=Ron+(T-SWITCHTIME)*(Roff-Ron)/TRF
 end;
     (*  The differential equations  *)
Dx1 := (-bx2 + VDC) / L1;
Dx2 := (ax1 - bx2/R - cx3) / C2;
Dx3 := (bx2 - RL*cx3 - ex4) / L3;
Dx4 := cx3 / C4;
     (*  Output statements  *)
Rescur := bx2/r; Outvol := cx3*RL;
plot(ax1, bx2, cx3, ex4);
plot(Rescur, Outvol);
end.
$GRCOM=yaxis(-50:150:-8:5);xaxis(::-5:4);sim
```

Figure 1: The SIL model

2)An IF-THEN-ELSE statement is used for modeling the initial ramp (the time delay) of the square wave; this delay is given as a parameter.

3) The equations are given in a form similar to the way the problem is stated.

4)An initial graphics command adjusts the scaling of the Y-axis.

Figure 2 is a screen dump obtained from solving question b). SIL solves the problem in 50 seconds on a 16 MHz 386/387 PC with the default 10^{-5} mixed absolute relative error tolerance. 864 steps were taken. Notice the 125 Amp spikes.

Figure 3 contains the time-curves of the 4 state variables. Due to the scaling x_1 and x_3 disappears in the zero-line. Notice the use of the DRAW command instead of making another simulation.

Part of the answers to question c) can be found in figure 4. The model is not listed since it is essentially the same as in question b). This is the phase-plan plot of VL3 vs. IL3 for TRF = 10^{-7} and TRF = 10^{-11} respectively. The solutions for the rest of the required values of TRF coincides with TRF = 10^{-11} solution. Notice on this figure how the initial values of the state variables are changed so they equal the final values from the previous run, see also figure 3.

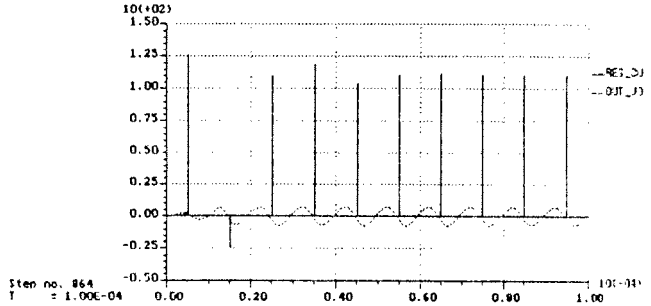


Figure 2: Time solution

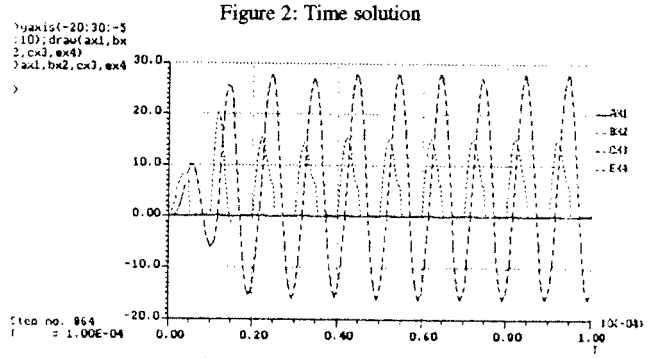


Figure 3: The 4 state variables

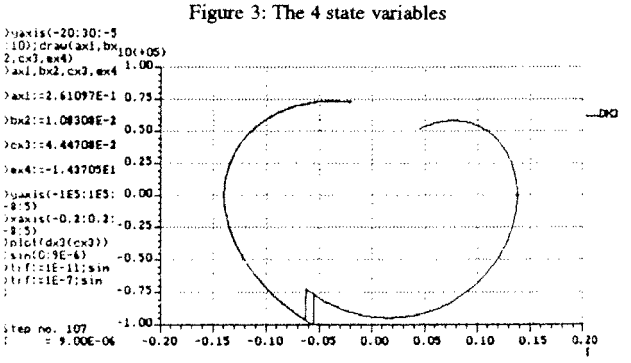


Figure 4: Phase plane plot

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shortened version

Comparison 3 - SIMUL_R, BAPS

1. The language

SIMUL_R is a compiling simulation language for continuous and discrete systems. It has been introduced in EUROSIM - Simulation News Europe, Number 1.

BAPS is a bond graph preprocessor for simulation languages (such as SIMUL_R, HYBSYS, ACSL). Bond graphs are a graphical notation for dynamic systems. They are very useful with electrical or inter-disciplinary models. Basic objects (like resistors R, inductance I, capacity C, etc.) connected by lines (so called bonds) build up a bond graph model.

A bond graph model can be built up graphically (using BAPSDRAW under MS-Windows or X-Windows) or textually (using the BAPS-language). BAPS supports linear and non-linear elements, checks the model on causality conflicts and creates input files for a simulation language.

2. The Model

Figure 1 shows the bond graph for the amplifier, without assigned element constants. The element constants may be non-linear expressions: in this case we used the table function capability of BAPS and SIMUL_R to built up the resistance R(t). As the figure shows it is not necessary to inspect the circuit for building up the differential equations. This is done automatically by BAPS!

BAPS 2.2 and SIMUL_R 2.0/double precision have been used.

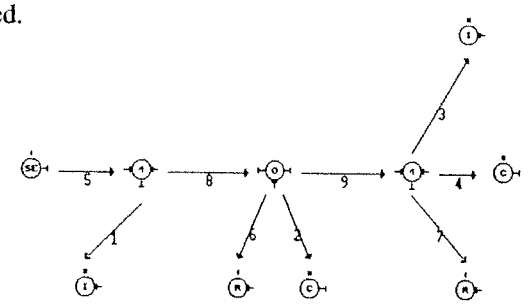


Figure 1: A bond graph model of the amplifier.

3. The Results

Task (a), calculation of the eigenvalues of the system, can be performed in SIMUL_R by the commands

```
t=0; JACOBI A; EIGENVALUE A:er,ei;
disp 'Eigenvalues for ON-state';
#for a=0,3# disp 'real =',er[a],' imaginare= ',ei[a]; #end
```

The values are:

On: -1.11732 E 9	Off: -54708.2 + i*1.0408 E 6
-625.783	-54708.2 - i*1.0408 E 6
-113039 + i*658352	-58288.4 + i*532750
-113039 - i*658352	-58288.4 - i*532750

Task (b): Figure 2 shows the simulation over [0,100E-6]. IR(t) and VL are computed automatically by BAPS.

The parameter variation for TRF, task (c) is done by using SIMUL_R's loop-command:

```
#loop TRF=1E-15,1E-11,1E-9,1E-7# ... start; #end
```

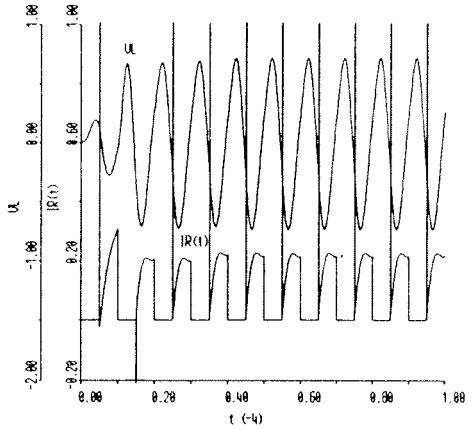


Figure 2: Simulation over [0,100E-6].

Figure 3 and 4 show the desired plots (only the curve for TRF=1E-7 differs graphically from the other ones). The voltage differences are computed automatically by BAPS. The phase plane plot shows a nice feature of SIMUL_R: curve legends at special positions of the curve and texts, depending on the data-values.

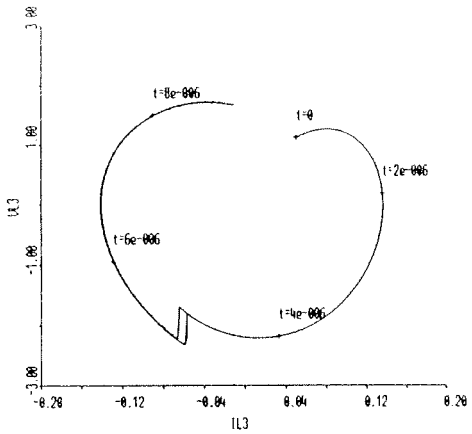


Figure 3: Phase plane curves of the parameter study.

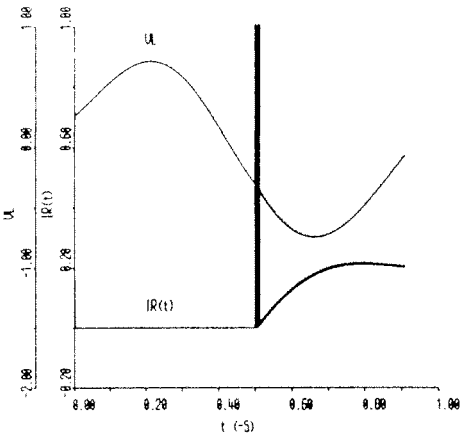


Figure 4: Time curves of the parameter study.

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

Comparison 3 - DYNAST

DYNAST was presented as a solver for stiff nonlinear algebro-differential equations in implicit form in EUROSIM Simulation News Europe, Number 3, November 1991, p. 32. The comparison 3 problem gives the chance to demonstrate some of the DYNAST capabilities to analyze dynamic systems, the structure of which is characterized by a port diagram - represented by an electrical circuit diagram in this case.

Model Description

All the tasks of the problem can be solved by submitting the following input data to DYNAST:

```
*: EUROSIM Comparison 3, task (a)
*SYSTEM;                    : system structure specification
E 1 = 5_V;                  L1 1-2 = 79.9u_H;   C2 2 = 17.9n_F;
L3 2-3 = 232u_H;            C4 3-4 = 9.66n_F;   RL 4 = 52.4_ohm;
Rt0 2 = .05_ohm;              *: R(t) is ON:
*PZ; RUN;                   : computation of system eigenvalues
MODIFY Rt0 = 5me_ohm;: parameter R(t) ON/OFF modification
RUN; MODIFY Rt0 = 1t_ohm;   *: R(t) is OFF:
*: EUROSIM Comparison 3, task (b)
*APP;                       : appending R(t) impulsewise variation
TRF = 1f_s; P = 10u_s;: impulse rise/fall time and period
R /pulse/ L1=50m, L2=5me, TR=TRF, TT=P/2-2*TRF, TF=TRF, P=P;
Rt 2 = R(time);             : time-variable resistor
IRt = V.C2/Rt;  VL = I.L3*RL;  V23 = V.2 - V.3;    : outputs
*TR; TR 0 100u;             : transient analysis for  0 < t < 100us
PRINT Rt, I.L1, V.C2, I.L3, V.C4, IRt, VL, V23;
RUN min = 1me;              : adjusting minimal step to 0.1ns
*: EUROSIM Comparison 3, task (c)
TR 0 9u; RUN;               : transient analysis for  0 < t < 9us
MODIFY TRF = 10p_s;         : parameter TRF variations
RUN; MODIFY TRF = 1n_s; RUN; MODIFY TRF = .1u_s; RUN;
*END;
```

The structure of the circuit is specified in the SYSTEM section of the input data by the incidence of individual components at the circuit nodes. For this circuit input data DYNAST formulated automatically 7 equations. Besides that, however, the DYNAST users software environment is capable of generating the input data from a port or block diagram created graphically on the computer screen using the OrCAD schematic capture editor. The comparison 3 problem was solved using an IBM/PC AT 286-287 with relative speed of 575% only with respect to the original IBM XT.

Results

Task (a): The system eigenvalues were computed as poles of system transfer functions which can be computed by DYNAST in semisymbolic form (and then used further to obtain semi-symbolic-form frequency- or time-responses):

R(T) IS ON:

POLES	REAL PART	IMAG PART
1	-6.2578276747491D+02	0.0000000000000D+00
2	-1.1173175944112D+09	0.0000000000000D+00
3	-1.1303881489929D+05	6.5835222046854D+05
4	-1.1303881489929D+05	-6.5835222046854D+05

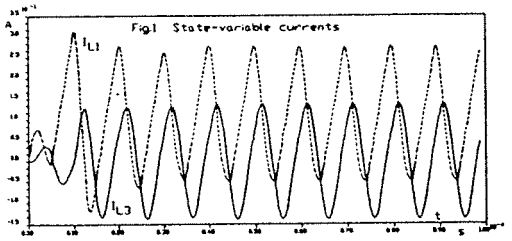
R(T) IS OFF:

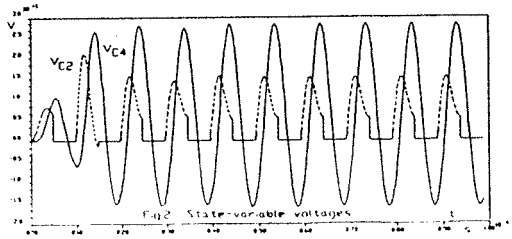
POLES	REAL PART	IMAG PART
1	-5.8228418609882D+04	5.3275019240597D+05
2	-5.8228418609882D+04	-5.3275019240597D+05
3	-5.4708202465055D+04	1.0407971978548D+06
4	-5.4708202465055D+04	-1.0407971978548D+06

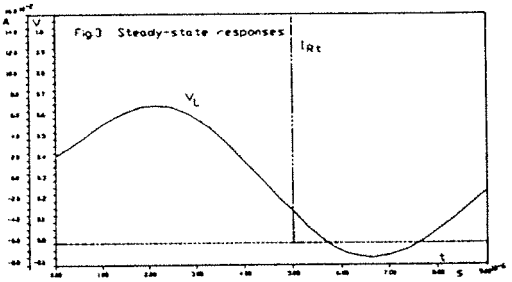
The analysis of the two circuit modifications took 0.22s and 0.17s, respectively.

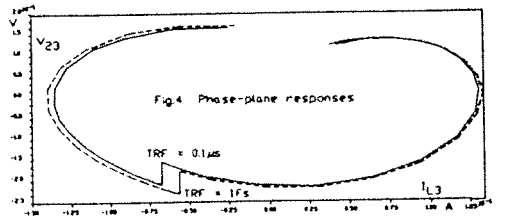
Task (b): The time-domain analysis of the circuit in the ten-period switching-impulse-train case was performed with the minimal value limit of the DYNAST integration steplengths adjusted to 0.1µs. This permits for distinguishing of the switched-resistor current sharp spikes, as the problem author suggested already. The resultant responses of state-variable inductor currents and capacitor voltages are shown in fig.1 and fig.2, respectively. The integration required 1278 iterations in 923 integration steps (323 of them were rejected). The steplength and integration method order were optimized by DYNAST during the computation in such a way, that all the six method orders were applied almost evenly. All that took 160s. More than half of this time, however, was spent on displaying the output data (which is typical for such simple problems, of course).

Task (c): Periodic steady-state responses of the spike-shaped switched-resistor current and of the circuit output voltage are shown in fig.3. Fig.4 displays phase-plane responses of the inductor L3 voltage with respect to its current for different values of the rise/fall switched-resistor variation times.









DYNAST is distributed by DYN, Nad lesikem 27, CS-160 00 Prague 6, Czechoslovakia, Tel: +42-2-311 79 04.

Herman Mann, Sc.D., Mech. Eng., division PMA, Katholieke Universiteit Leuven, Celestijnenlaan 300B, B-3001 Heverlee, Belgium, E-mail: mann@mech.kuleuven.ac.be

Comparison 3 - ACSL

ACSL is a general purpose continuous simulation language. It models systems described by time dependent, nonlinear differential equations and/or transfer functions. Linear analysis capabilities (Bode, Nichols, root locus, eigenvalues, for example) are available at runtime.

ACSL runs on personal computers, workstations, mainframe computers, and supercomputers. Programs created on one platform can be transferred to and run on any other platform.

Description of Model: First we set the data logging rate and choose the integration algorithm to be Gear's stiff. The nominal value for control of the minimum allowable integration step size is 1.0E-10, but the simulation time scale is in microseconds, so we reduce this control. The default initial condition name of the independent variable cannot be accessed. Specifying the IC name and value in the program allows us to set the value back to zero after a reinitialization.

The resistor switching sequence is defined in a table for one cycle, then modulated in the calculation of R based on time and the cycle period. Integration is defined with the INTEG operator. A run terminates when the first argument of the TERMT statement becomes true; for this program, it is a time limit.

```
program simulation comparison 3
    cinterval     cint = 1.0e-7
    algorithm     ialg = 2
    minterval     mint = 1.0e-15
    variable      t, tz = 0
    table         onoff, 1, 5 &
                  / 0.0  , 1.0e-9, 5.0e-6, 5.0e-6, 10.0e-6  &
                  , 5.0e-2, 5.0e+6, 5.0e+6, 5.0e-2, 5.0e-2 /
derivative
    constant      L1 = 79.9e-6 , C2 = 17.9e-9 , L3 = 232.0e-6, C4 = 9.66e-9
    constant      Rl = 52.4 , VDC = 5.0, period = 10.0e-6
    R = onoff(mod(t, period))
    constant      x1z = 0.0, x2z = 0.0, x3z = 0.0, x4z = 0.0
    IR = x2/R; VL = x3*RL; VL3 = x3d
    x1 = integ((-x2 + VDC)/L1, x1z)
    x2 = integ((x1 - x2/R - x3)/C2, x2z)
    x3d = (x2 - RL*x3 - x4)/L3
    x3 = integ((x2 - RL*x3 - x4)/L3, x3z)
    x4 = integ(x3/C4, x4z)
    constant      tstp = 99.99e-6
    termt(t .ge. tstp, 'Stopped on time limit')
end ! of DERIVATIVE
end ! of PROGRAM
```

Results: All calculations have been performed on a Sun 4 workstation, using ACSL Level 10x.

(a) To obtain the eigenvalues for the OFF and ON periods, we set T to a point where the resistor is off, execute the ANALYZE/EIGEN command, then repeat for ON:

```
ACSL> SET t=1.5E-6; ANALYZE/EIGEN
Complex eigenvalues in ascending order
     REAL       IMAGINARY      FREQUENCY   DAMPING
  1 -58228.4000 +/-532750.000    535923.0   0.108651
  3 -54708.2000 +/-1.0408E+06    1.04E+06   0.052491
ACSL> SET t=8E-6 ; ANALYZE/EIGEN
Complex eigenvalues in ascending order
     REAL       IMAGINARY      FREQUENCY   DAMPING
  1 -625.783000
  2 -113039.000 +/-658352.000    667986.0   0.169223
  4 -1.1173E+09
```

(b) A run is initiated with the START command. It stops on the time limit TSTP, and a summary of the Gear's stiff algorithm is produced (commands: START; PLOT x1,x2,x3,x4,ir,vl). Figure 1 shows parts of the plotted results.

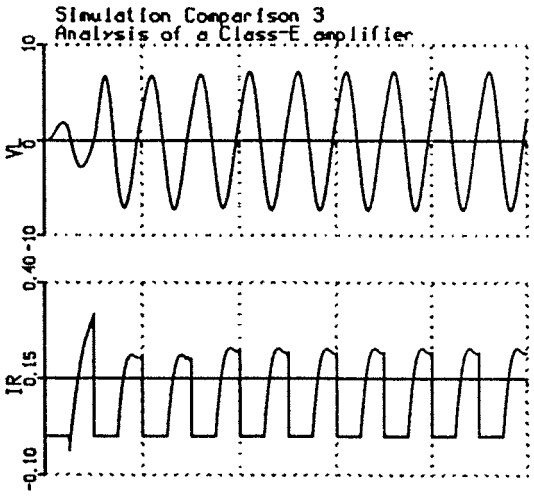


Figure 1. Time histories for task (b)

(c) The values of the states at this point are written into the initial condition vector, overwriting the original conditions. The initial condition of the independent variable is set back to zero, and the stopping time is reduced.

```
ACSL> REINIT;  SET tz=0,tstp=9.9e-6
```

Values in the table ONOFF are changed to vary the resistor cutoff slope. At runtime, the table data is first in the array and the breakpoints last. To change the second and fourth breakpoints in the five-element table, therefore, the seventh and ninth elements of the array are set.

The ON period of the resistor is shifted over the next four runs to the start time plus 1.0E-15, 1.0E-11, 1.0E-9, and 1.0E-7 successively. After the four runs have been completed, a phase-plane plot of X3D versus X3 is produced.

```
ACSL> SET onoff(7)=0.000000001d-6,onoff(9)=5.000000001d-6
ACSL> START;  SET NRWITG=.T.
ACSL> SET onoff(7)=0.00001d-6,onoff(9)=5.00001d-6
ACSL> START; SET onoff(7)=0.001d-6,onoff(9)=5.001d-6
ACSL> START; SET onoff(7)=0.1d-6,onoff(9)=5.1d-6
ACSL> START; PLOT /XAXIS=x3 x3d
```

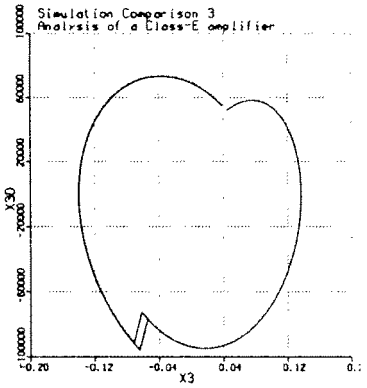


Figure 2. Phase-plane plot for task (c)

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shortened version

Comparison 4 - Remarks on deadlock

Deadlock is impossible in the Comparison 4 System

A single constraint is sufficient to guarantee that models implementing the dining philosopher problem will never deadlock:

> No two philosophers can be allowed to grab the same chopstick. This implies that examination / grabbing of any chopstick must be an indivisible operation; i.e., no other philosopher can intervene in this process for a given philosopher.

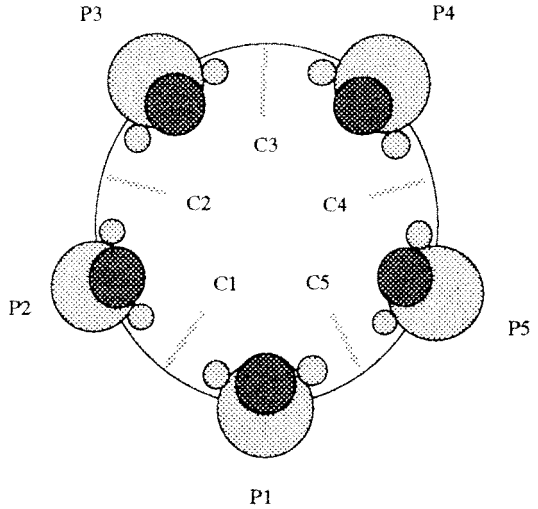
The dining philosophers problem was devised by Dijkstra to illustrate how to safely implement "critical regions" of code in an operating system. A critical section is a section of code which must be executed by a single task without interruption. The general problem included accounting for multiple processors executing in parallel with at least some shared memory.

When one SIMULATES on a single processor, using traditional simulation software, nothing really happens in parallel. Even events which occur at the same exact instant in simulated time are processed in a sequence determined by the scheduling algorithms employed in the language /simulator. Thus, the most natural way to model the examine / grab process is as a zero-time activity. If the activity takes place over time, interlocks, e.g., semaphores, must be implemented to guarantee exclusivity.

The proof of the sufficiency of the above assertion follows. The proof is for the worst-case model, in which hungry philosophers grab the first available chopstick (to their left or right, indiscriminantly). Zero-time examination / grab activities are assumed, although the proof is easily extended to cover non-zero time, semaphore-guarded decision processes.

Label the five philosophers P1 ... P5.

Label the five chopsticks C1 ... C5, where C1 is to the left of P1.



The only way we can get into a state where all five philosophers are waiting for at least one chopstick is from a state in which four philosophers are waiting. This is a consequence of the constraint: only one philosopher can grab a given chopstick at a time.

Consider the "4 waiting" state. Assume, without loss of generality, that P1 is NOT waiting and P2...P5 ARE. P1 must either be meditating or eating.

Case 1 (P1 is eating)

We know that P1 owns C1 and C5, because he is eating.

We know that C2, C3 and C4 are owned in some combination by P2...P5, since they are not in use by P1, and waiting philosophers grab chop-sticks at the earliest possible opportunity.

Therefore, at least one of P2...P5 has NO chopsticks. (Four philosophers own three chopsticks.)

Not more than one of P2...P5 can be waiting for both chopsticks, because if any two philosophers had NO chopsticks, at least one of the other two philosophers would have to have two chopsticks.

Therefore, exactly one of P2...P5 is waiting for BOTH chopsticks. Therefore, P2 and P5 cannot BOTH be waiting for both chopsticks.

Therefore, EITHER P2 or P5 is waiting ONLY for a chopstick owned by P1.

Therefore, when P1 finishes his meal, one of P2 or P5 can acquire the remaining chopstick he needs.

Therefore, deadlock is impossible in this case.

Case 2 (P1 is meditating)

Since neither C1 nor C5 are owned by P1, P2 must own C1, and P5 must own C5. (Hungry philosophers grab the first available chopstick.)

P3 must own C2; otherwise, P2 would not be waiting.

Similarly, P4 must own C3, and P5 must own C4.

This is a contradiction, since P5 cannot own both C4 AND C5 if it is waiting.

Therefore, deadlock is impossible in this case.

Q.E.D.

James O. Henriksen, President, Wolverine Software Corporation, 4115 Annandale Road, Annandale, VA 22003-2500 USA

Comparison 4 - GPSS/H

For purposes of this comparison, three different versions of the Dining Philosophers problem were implemented in GPSS/H. In the descriptions which follow, the word "hungry" describes a philosopher who has completed a period of meditation and wishes to begin eating.

The first model follows the problem statement exactly; i.e., a hungry philosopher first grabs the chopstick to his left (when it becomes available), and then he grabs the chopstick to his right (when it becomes available). In the second model, a hungry philosopher grabs the first chopstick which becomes available (to his left or right, indiscriminantly) and then the second. In both the first and second models, a small amount of time is required to grab a chopstick. In the third model, a hungry philosopher waits until both chopsticks are available and then grabs them both, instantaneously.

This problem is easily represented in the GPSS/H world view. In all three models, transactions are used to represent the five philosophers. The transactions flow through a block diagram, competing for chopsticks, which are represented as five Facilities (GPSS/H single-server entities). Model #1 is a straightforward implementation, and due to space limitations, is not shown. The chopstick contention portion of model #2 is as follows:

```
        TRANSFER    BOTH,GRABL,GRABR    GRAB FIRST AVAIL CHOPSTICK
GRABL   SEIZE       P$LEFT              GRAB LEFT
        ADVANCE     0.25                15 SECONDS
        SEIZE       P$RIGHT             GRAB RIGHT
        ADVANCE     0.25                15 SECONDS
        TRANSFER    ,EAT
GRABR   SEIZE       P$RIGHT             GRAB RIGHT
        ADVANCE     0.25                15 SECONDS
        SEIZE       P$LEFT              GRAB LEFT
        ADVANCE     0.25                15 SECONDS
```

The TRANSFER BOTH block first attempts to enter the SEIZE block labeled GRABL. If the Facility representing the philosopher's left chopstick is currently in use, the TRANSFER BOTH block attempts to enter the SEIZE block labeled GRABR. If the Facility representing the philosopher's right chopstick is currently in use, the TRANSFER block is executed repeatedly (at least once for each successive value of the simulator clock), until one of the SEIZE blocks can be entered. Upon successful entry to a SEIZE block, the "other" chopstick is competed for by means of a complementary SEIZE block. The chopstick contention portion of model #3 is as follows:

```
RETRY   GATE NU     P$LEFT              WAIT FOR LEFT NOT IN USE
        GATE NU     P$RIGHT             WAIT FOR RIGHT NOT IN USE
        TRANSFER    SIM,GRAB,RETRY      SIMULTANEOUSLY NOT IN USE
GRAB    SEIZE       P$LEFT              GRAB LEFT CHOPSTICK
        SEIZE       P$RIGHT             AND RIGHT CHOPSTICK
```

The two successive GATE NU blocks allow a philosopher transaction to proceed only when the referenced chopstick (GPSS/H facility) is not in use. If any delay is incurred at either GATE NU block, a "delayed" flags is set in the philosopher transaction. The TRANSFER SIM block tests the "delayed" flag. If the flag is on, the flag is cleared, and the transaction is routed to the block labeled RETRY. If the flag is clear, the transaction is routed to the block labeled GRAB. In this manner, a transaction gets to GRAB only when both chopsticks are SIMultaneously not in use.

All three models used the same distributions for eating times and meditating times. The relationships of these timings is extremely important. If the minimum meditating time is too long, relative to eating times, contention for chopsticks is minimized. On the other hand, if the minimum meditating time is too short, it will almost always be the case that two philosophers are eating and three are waiting for chopsticks. If the minimum meditation time is zero, a philosopher experiencing a meditation time delay of zero will simply reacquire the chopsticks he gave up at the completion of his most recent meal.

All three models were run for 100,000 meals. Results obtained on a 20Mhz 386 PC were as follows:

Model	Avg Time in Queue	Avg Meditat. Grab-Eat-Cycle Time	GPSS/H Blocks / CPU second
#1	35.391	271.26	10,666
#2	33.433	267.17	10,160
#3	21.157	242.81	12,736

As one would expect, the shortest cycle time is obtained by the "polite" approach, and the worst cycle time is obtained by always attempting to grab the left chopstick first.

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Comparison 4 - DESMO

1. The DESMO Software

The description of the DESMO software is given in Comparison 2 DESMO (Flexible Assembly System) in this Simulation Newsletter issue, page 33.

2. Model Implementation

The model is implemented in the process interaction style with a philosopher process and a cleaning process as main components. It also consists of higher modelling constructs of DESMO like *resources* for the chopsticks and a *conditional waiting* object (here: *q*) for the philosopher's status "hungry". The program structure shows the basic situation without a deadlock. At the beginning all chopsticks rest on the table. Then a deadlock can only occur if all philosophers take e.g. their left chopstick at the same time and then wait for the right one. Otherwise at least one philosopher can occupy his chopsticks and start to eat at once. In DESMO a function exists which can recognize a possible deadlock and inform the user (see example).

One way of avoiding a deadlock is to take both chopsticks at the same time. After meditating the philosopher is hungry. A procedure (here: *TwoChopsticksFree*) in combination with the object *q* is used for testing if both chopsticks are available. Only if this is true a philosopher takes the chopsticks (*Acquire*) and starts to eat. In the other case the philosopher will be inserted automatically into an internal queue of *q*. There he remains until both chopsticks are free. After eating a philosopher returns the chopsticks (*Release*) and starts his cleaning process immediately (every philosopher has a cleaning process). The philosopher's process is interrupted and the cleaning process takes over. The immediate start prevents a use of dirty chopsticks by other waiting philosopher processes because the chopsticks are held by the cleaning process now. After cleaning the cleaning process releases the chopsticks and signals this new state to the object *q* (*Signal*). All philosophers waiting in the queue of *q* are activated automatically for a new test. A philosopher with a positive result takes his chopsticks and starts eating again. The others remain in the queue until chopsticks are clean again. Simulation results confirm an equal utilization rate for all chopsticks.

For a strategy to let one philosopher starve the cleaning processes of the neighbouring philosophers have to guarantee to look that the starving philosopher can never get both chopsticks at the same time. If one of these chopsticks lay on the table the cleaning process has to hold back the other one until the first chopstick will be used. Results show a lower use rate for the chopsticks of the starving philosopher than for the other chopsticks.

DESMO Part of a deadlock warning

Warning: Cycle in resource allocation graph; deadlock(s) not impossible!

'Phil 5' holds resources of 'Chopst 5',
which are waited for by 'Phil 4'.
'Phil 4' holds resources of 'Chopst 4',
which are waited for by 'Phil 3'.
'Phil 3' holds resources of 'Chopst 3',
which are waited for by 'Phil 2'.
'Phil 2' holds resources of 'Chopst 2',
which are waited for by 'Phil 1'.
'Phil 1' holds resources of 'Chopst 1',
which are waited for by 'Phil 5'.

DESMO Program structure

```
PROCEDURE TwoChopsticksFree (p : Entity) : BOOLEAN;
VAR pAttr : PhilAttr;
BEGIN
    pAttr := Attributes (p);
    RETURN (Avail (pAttr^.l) > 0) AND (Avail (pAttr^.r) > 0)
END TwoChopsticksFree;

PROCEDURE CleaningProcess (Clean : Entity);
VAR cAttr : CleanAttr;
    l, r    : Res.Object;
BEGIN
    cAttr := Attributes (Clean);
    l := Chopstick [cAttr^.No];
    r := Chopstick [cAttr^.No MOD 5 +1];
    LOOP
            Passivate;
            Acquire (l, 1);
            Acquire (r, 1);
            Hold (CleaningTime); (* 5 min *)
            Release (l, 1);
            Release (r, 1);
            Signal (q);
    END;
END CleaningProcess;

PROCEDURE PhilosopherProcess (Phil : Entity);
VAR pAttr : PhilAttr;
BEGIN
    pAttr := Attributes (Phil);
    LOOP
            Hold (Sample (Think)); (* 20-30min *)
            WaitUntil (q, TwoChopsticksFree);
            Acquire (pAttr^.l, 1);
            Acquire (pAttr^.r, 1);
            Hold (Sample (Eat)); (* 10-20min *)
            Release (pAttr^.l, 1);
            Release (pAttr^.r, 1);
            Schedule (Cleaning [pAttr^.No], NOW ());
    END;
    END;
END PhilosopherProcess;
```

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WINTER SIMULATION CONFERENCE

WSC'92

1967 *Twenty-Fifth Anniversary* 1992

1992 Winter Simulation Conference
December 13-16, 1992
Crystal Gateway Marriott
Arlington, VA

ANNOUNCEMENT AND FINAL CALL FOR PAPERS

The 1992 Winter Simulation Conference will feature introductory tutorials on the fundamentals of system simulation, state-of-the-art reviews of current practice and research, contributed papers on applications and methodologies for simulation, panel discussions on current issues, and exhibits by software and hardware vendors. We encourage submissions in the following categories (or *tracks*):

- **Introductory Tutorials and State-of the-Art Reviews**- Expository presentations on current or emerging simulation practice. Introductory Tutorials are designed for newcomers to the field of simulation. State-of the-Art Reviews provide practitioners and researchers with an overview of recent fundamental advances in the field.
- **Software and Modelware Tutorials** - Expository presentations on simulation languages as well as software and hardware systems for specification, development, documentation, management, animation, and presentation of simulation models.
- **Modeling Methodology** - Discrete and combined discrete-continuous simulation; concepts and techniques for general systems modeling; model specification and development; support environments; animation; knowledge-based simulation; object-oriented simulation; parallel and distributed simulation; artificial intelligence; software engineering; verification, validation, and testing.
- **Analysis Methodology** - Modeling, fitting, and generating stochastic input processes; start-up techniques; experimental design; metamodels; output analysis; optimization; sensitivity analysis; ranking and selection procedures; variance reduction techniques.
- **Manufacturing Applications** - Facilities planning; flexible systems; materials handling; production and inventory control; on-line control; computer integrated manufacturing; robotics; warehousing and distribution.
- **General Applications** - Agriculture; computer and communication systems; energy systems; environment; government (e.g., policy planning and regulation); military systems; service systems (e.g., health care and financial institutions); transportation systems.

We will consider submissions in other areas. **All submissions will be reviewed**. Accepted papers will be published in the conference *Proceedings*, which will be copyrighted and widely disseminated. All talks and tutorials must be accompanied by an acceptable *Proceedings* paper. All published papers must be at least three and at most ten *Proceedings* pages. Software and modelware tutorials may not exceed five *Proceedings* pages.

DEADLINES AND REQUIREMENTS:

Send all submissions to the Program Chair (address below). Include a title and identify the corresponding author; for each coauthor or panel participant, include: full name, affiliation, complete address, telephone number, FAX number (if available), and electronic mail address (if available).

- **March 2, 1992** - Submit one- to three-page proposals to present tutorials or state-of-the-art reviews, to organize and chair regular paper sessions, or to organize and chair panel sessions.
- **April 1, 1992** - Submit four copies of contributed papers not previously published or presented. Each submission must be a full-length paper, including an abstract and a list of key words indicating one of the main categories (tracks) listed above. **Submission implies that an author will attend WSC '92 to present the paper, and all clearances required for publication of the paper will be obtained by August 1, 1992.**
- **June 1, 1992** - Contributors will receive notification of paper acceptance and an Author's Kit including Instructions for Preparing Manuscripts.
- **August 1, 1992** - Authors provide camera-ready manuscript copy (meeting the length requirements specified above) to the *Proceedings* Editor. Electronic submission of papers will be allowed for LaTeX files meeting the criteria specified in the Instructions for Preparing Manuscripts.
- **November 2, 1992** - Ph.D.-Student Colloquium Submissions. TIMS/College on Simulation invites Ph.D. students nearing completion of the dissertation to present 15-minute research summaries on Sunday night, December 6, 1992. Submit abstracts to Jorge Haddock, Department of Decision Sciences and Engineering Systems, Rensselaer Polytechnic Institute, Troy, New York 12180-3590,tel:(518)276-8099;e-mail: `ffye@rpitsmts.bitnet`.

FOR FURTHER INFORMATION CONTACT:

- **Program** - James R. Wilson, WSC '92 Program Chair, Department of Industrial Engineering, North Carolina State University, Box 7906, Raleigh, NC 27695-7906, tel: (919) 515-6415; FAX: (919) 515-5281; e-mail: `jwilson@eos.ncsu.edu`.
- **General** - Robert C. Crain, WSC '92 General Chair, Wolverine Software Corporation, 4115 Annandale Road, Suite 200, Annandale, VA 22003-2500, tel: (703) 750-3910; FAX: (703) 642-9634; e-mail: `wolverine_software@um.cc.umich.edu`.

SPONSORING SOCIETIES:

American Statistical Association (ASA), Association for Computing Machinery: Special Interest Group on Simulation (ACM/SIGSIM), Institute of Electrical and Electronics Engineers: Computer Society (IEEE/CS), Institute of Electrical and Electronics Engineers: Systems, Man, and Cybernetics Society (IEEE/SMGS), Institute of Industrial Engineers (IIE), National Institute of Standards and Technology (NIST), Operations Research Society of American (ORSA), The Institute of Management Sciences: College on Simulation (TIMS/CS), The Society for Computer Simulation (SCS)

Calendar of Events

March 1991

18-19 **"Visualisierung und Präsentation von Modellen und Resultaten der Simulation"**. Magdeburg, Germany.
Contact: Dr. V. Hinz, Technische Universität "Otto von Guericke" Magdeburg, Universitätsplatz 2, PSF 4120, O - 3010 Magdeburg, Germany, Tel.: +49-(0)91 592 766, Email: HINZ@DMDTU11.bitnet.

25-26 **Modelling for Control and Simulation** (GMA-committee 1.3) Langen/Hessen, Germany.
Contact: Prof. I. Troch, Technische Universität Wien, Wiedner Hauptstr. 8-10, A - 1040 Wien, Austria

26-28 **5th Ebernburg Working Conference**. Ebernburg, Germany
Contact: Prof.D. Möller, TU Clausthal, Institut für Informatik, Erzstr. 1, W - 3392 Clausthal-Zellerfeld, Tel: +49-(0)5323 722402.

April 1992

1-3 **5th Annual IMSL User Group Europe**. Munich, Germany.
Contact: IMSL User Group Liaison. P.O. Box 4605, Houston, Texas 77210-4605, USA

5-8 **IFAC Conference "Modelling and Control of Biotechnical Processes"**. Monterey, California.
Contact: Prof. M. Karim, Dept of Agri/Chem. Engg., Colorado State Univ., Fort Collins, CO 80523.

6-9 **1992 Simulation MultiConference**. Orlando, Florida
Contact: B. O'Neill, SCS, P.O. Box 17900, San Diego, CA 92177. Tel.: +1-619-277 3888, Fax: +1-619-277 3930.

9 FRANCOSIM Seminar **"Simulation, a helping tool for workshop piloting"**. Paris, France
Contact: I.U.T. de maintenance industrielle, Centre universitaire Mendès France, F-42300 Roanne, Tel: +33-77 44 89 28

22-24 **DIDAMATICA '92**. Campobasso, Italy
Contact: ISCS

27-28 ASIM Workshop **"Simulationsmethoden und Sprachen für parallele Prozesse"**. Dresden, Germany
Contact: Dr. H. Fuss, GMD-F1, Postfach 1240, W-5205 St. Augustin 1. Tel: +49-(0)2241/14-2778, Fax: +49-(0)2241/14-2889

30-May 1 **23rd Annual Pittsburgh Conference on Modelling and Simulation**. Pittsburgh, PA.
Contact: W.G. Vogt,348 Benedum Engineering Hall, Univ. of Pittsburgh, Pittsburgh, PA 15261.

May 1992

4-6 **ICOOMS 92, International Conference on Object-Oriented Manufacturing Systems**. Calgary, Canada.
Contact: D. Norrie, Div. of Manufacturing Engineering, Univ. of Calgary, 2500 University Drive N.W., Calgary, T2N 1N4, Alberta, Canada, Tel: 403-220 5787, Fax: 403-282 8406.

5 **UKSS meeting.** Edinburgh.
Contact: Rob Pooley, Department of Computer Science, University of Edinburgh

4-6 FRANCOSIM Seminar on **"Computational methods in multibody system dynamics"**. Roanne, France
Contact: Marc Alirand , Société IMAGINE, Maison de la productique , F-42300 Roanne , Tel: +33-77 70 80 80

7-8 **ASIM Workshop. Group "Simulation und künstliche Intelligenz"**. Dortmund, Germany.
Contact: Dr. Johannes Krauth, BIBA, Bremer Institut für Betriebstechnik und angewandte Arbeitswissenschaft, Postfach 33 04 40, W-2800 Bremen 33. Tel: +49-(0)421/22009-43, Fax: +49-(0)421/22009-79.

25-28 **IFAC Symposium "Information Control Problems in Manufacturing Technology"**. Toronto, Canada.
Contact: Dr. J. Scrimgeour, Advanced Manufacturing Technologies 6 Ind. Automation, Div. of EE National Research Council, Ottawa, Ont. K1A OR8, Canada.

June 1992

1-3 **ESM 92. European Simulation Multiconference**. York, U.K.
Contact: Philippe Geril, European Simulation Office, University of Ghent, Coupure Links 653, B - 9000 Ghent, Belgium. Tel/Fax: +32-91 23 49 41.

1-5 **1992 ACM SIGMETRICS and PERFORMANCE '92 International Conference on Measurement and Modeling of Computer Systems**. Newport, Rhode Island, USA
Contact: Linda Wright, Digital Equipment Corporation, 151 Taylor Street, Littleton, MA 01460, Tel: +1-508-952 4476.

10-12 **SIMS 92 Simulation Conference**. Lappeenranta, Finland.
Contact: M. Hänninen, Technical Research Center of Finland, P.O. Box 208 (Tekniikantie) 4), SF - 02151 Espoo, Finland. Tel:+358-0 4561, Fax:+358-0 456 5000.

16-18 1992 IFAC/IFIP/IMACS International Symposium on **Artificial Intelligence in Real-Time Control**. Delft, The Netherlands.
Contact: AIRTC 1992, Congress Office KIVI, P.O.Box 30424, 2500 GK The Hague, The Netherlands. Tel: +31 70 3919890, Fax: +31 70 3919840.

22-24 **IMACS International Conference on Computer Methods for Partial Differential Equations**. New Brunswick, NJ.
Contact: Karen Hahn, Rutgers University, Department of Computer Science, New Brunswick, NJ 08903, USA, Fax: +1-(908) 932 5530

22-26 **Multigrid Course**. Sankt Augustin near Bonn, Germany.
Contact: Barbara Steckel, Wolfgang Joppich, Institut für Methodische Grundlagen (F1/T), GMD, Postfach 1316, W-5205 Sankt Augustin 1, Germany. Tel: +49-(0)2241 14 2768 or 2748, Fax: +49-(0)2241 14 2460, email: gmap16@dbngmd21.bitnet.

23-25 18th IFAC/IFIP Workshop on **Real-Time Programming (WRTP '92)**. Bruges, Belgium
Contact: IFAC/IFIP WRTP'92, c/o BIRA, Desguinlei 214, B-2018 Antwerp, Belgium. Tel: +32 3 216 09 96, Fax: +32 3 216 06 89.

July 1992

1-3 **IFAC Symposium "Adaptive Control and Signal Processing"**. Grenoble, France.
Contact: L. Dugard, Lab dÁutomatique de Grenoble-ENSIEG, BP 46, F-38402 St. Martin d'Heres, France

8-10 **AIS'92. 3rd Annual Conference on Artificial Intelligence, Simulation & Planning in High Autonomy Systems**. Perth, Australia
Contact: Ms. Mary Simpson, School of Computing Science, Curtin University, P.O. Box U1987, Perth, WA 6001, Australia, Tel: +61-9-351 7298, Fax: +61-9-351 2819

14-17 **1992 International Systems Dynamics Conference**. Utrecht, The Netherlands.
Contact: Dr. J. Vennix, Utrecht Univ., Dept. of Social Sciences, Gamma-Informatics Unit, P.O. Box 80140, 3508 TC Utrecht, The Netherlands, Tel:+31-(0)30 534880, Fax: +31-(0)30 531619.

19-24 **10th International Conference on Multiple Criteria Decision Making**. Taipei, Taiwan.
Contact: Prof. Gwo-Hshiung Tzeng, College of Management, National Chiao Tung University 4F, 114, Sec. 1, Chung-Hsiao W. Rd., Taipei 100, Taiwan, R.O.C. Tel.: 011-886-2-3146515, Fax: 011-886-2-3120082

27-30 **1992 Summer Computer Simulation Conference**. Reno, Nevada.
Contact: B. O'Neill, SCS, P.O. Box 17900, San Diego, CA 92177. Tel.: +1-619-277 3888, Fax: +1-619-277 3930.

August 1992

18-20 **IFAC/IFORS/(IFIP)/(IIASA) Symposium "Modelling and Control of National Economies"**. Beijing, China
Contact: Prof. Jong-Ming Wu, Dept. of Computer Science and Techn., Beijing Information Technology Institute, Beijing, China

19-21 First International Conference on **Intelligent Systems Engineering**. Edinburgh, UK
Contact: ISE 92, Conference Services, The Institution of Electrical Engineers, Savoy Place, London WC2R 0BL, UK, Tel: +44 (0)71 240 1871 222, Fax +44 (0)71 497 3633.

22-26 **IFAC/IFORS Symposium "Large Scale Systems: Theory and Applications"**. Beijing, China.
Contact: Prof. Bao Liu, Inst.of Systems Engineering, College of Engg., Tianjin University, Tianjin, China

23-25 **IFAC Workshop "Distributed Computer Control Systems" (CDDS 92)**. Beijing, China.
Contact: Prof. Bing Zhong Gong, POB 927, Beijing 10080, China

25-28 **4th International Symposium on Systems Analysis and Simulation**. Berlin, Germany
Contact: Conference Secretariat SAS 92, WGMA, Chamber of Technology, Clara-Zetkin-Straße 115-117, O-1086 Berlin,Germany. Tel: +37-2 2265 218, Fax: +37-2 2265 256

26-28 **IMACS RM2S '92 Kobe**. Kobi, Japan.
Contact: Prof. S. Tsafestas, Intelligent Robotics and Control Unit, Computer Science Division, National Technical University of Athens, Zografou I5773, Athens, Greece, Fax: +30-1-7757504

27 - September 2

4th International Symposium on Systems Analysis and Simulation. Berlin, Germany.
Contact: Conference Secretariat SAS 1992, Clara-Zetkin-Str. 115-117, O - 1086 Berlin.

September 1992

2-4 9th IFAC Workshop on **Control Applications of Optimizations**. München, Germany
Contact: Dr. Dieter Kraft, Fachhochschule München, Dachauerstr. 98b, D-8000 München 2. Tel: +49-(0)89 1265 1108, Fax: +49-(0)89 1265 1392, email: kraft@maschinenbau.fh-muenchen.dbp.de

2-4 **International Conference on Control: Modelling, Computation, Information**. Manchester UK.
Contact: Dr.R.P. Jones, Department of Engineering, University of Warwick, Coventry CV4 7AL, U.K.

3-5 **IFAC Workshop "System Structure and Control"**. Prag, CSFR.
Contact: Dr.S. Kubik, Inst.of Inf. Theory and Automation, Pod vodarenskou vezi 4, CS-1182 Prague

7-10 **Aerospace Vehicle Dynamics and Control**. Cranfield Institute of Technology, UK
Contact: Miss Pamela Irving, Conference Officer, The Institute of Mathematics and its Applications, 16 Nelson Street, Essex SS1 1EF. Tel: +44-(0)702) 354020, Fax: +44-(0)702 354111.

15-18 **"Information Technology Interfaces" ITI '92**. Pula, Croatia.
Contact: Branka Radic, University Computing Centre, Engelsova bb, 41000 Zagreb, Croatia, Tel: +38-41 510 099, Fax: +38-41 518 451

IFAC Symposium "Low Cost Automation". Vienna, Austria.
Contact: Prof.W. Kopacek, c/o ÖPWZ, Rockhgasse 6, A-1014 Vienna, Austria

Conference on "Simulation and User Benefit" by ASIM working group "Simulation in der Fertigungstechnik". Aachen, Germany
Contact: Prof. A. Kuhn, Fraunhofer-Institut, IML, Emil-Figge-Straße 75, W - 4600 Dortmund 50, Tel: +49-(0)231 7549 130, Fax: +49-(0)231 7549 211.

29 - October 2

EUROSIM '92. EUROSIM Simulation Congress. Capri, Italy.
Contact: Mrs. Antonella Di Chiara, Dept. of Civil Engineering, University of Rome "Tor Vergata", Via della Ricerca Scientifica, I - 00173 Roma, Italy, Tel: +39-6-72594575, Fax: +39-6-72594586, Telex: 622302 ROMCIV I

October 1992

20-23 **2nd Beijing International Conference on System Simulation and Scientific Computing**. Beijing, China.
Contact: Prof. Chen, Zong Ji, Dept. of Control Engineering, Beijing University of Aeronautics and Astronautics, Beijing 100083, China, Fax: 86-1-2015347, Telex: 222700 BUAA CN.

29 FRANCOSIM Workshop on "**Simulation - Outils Modernes de Développement**": Liège; Belgium.
Contact: Mme Lacrosse, AIM, Rue Saint Gilles 31, B-4000 Liège, Tel: +32-41 22 29 46

November 1992

5-7 **SIMTECH 92: Simulation Technology Conference International 1992**. Houston, Texas.
Contact: Mary Lou Padgett, Auburn Univ., 1165 Owens Road, Auburn, AL 36830, Tel: +1-205-821 2472.

6-8 **ESS 92 European Simulation Symposium**. Dresden, Germany.
Contact: Philippe Geril, European Simulation Office, University of Ghent, Coupure Links 653, B - 9000 Ghent, Belgium. Tel/Fax: +32-91 23 49 41

9-11 SiSy b/e/m 92 - **8th Prague Symposium on Computer Simulation in Biology, Ecology and Medicine**. Prague, Czech and Slovak Federative Republic.
Contact: Milan Kotva, Zeleny pruh 32, CS-147 00 Praha 4, Czechoslovakia; Tel: +42.2.7992145; fax: +42.2.763211 or +42.2.7992318.

December 1992

7-11 **IMACS Symposium on Scientific Computing and Mathematical Modelling**. Bangalore, India.
Contact: Prof. S.K. Dey, Department of Mathematics, Eastern Illinois University, Charleston, IL 61920, Fax: +1-217-581 5188.

13-16 **Winter Simulation Conference WSC' 92**. Arlington, VA, USA.
Contact: Robert C. Crain, WSC '92 General Chair, Wolverine Software Corporation, 4115 Annandale Road, Suite 200, Annandale, VA 22003-2500, tel: +1-703-750-3910; FAX: +1-703-642-9634; e-mail:wolverine_software@um.cc.umich.edu.

January 1993

3-7 **International Conference on Scientific Computation and Differential Equations**. Auckland, New Zealand.
Contact: Dr. John Butcher, Dept. of Mathematics and Statistics, University of Auckland, Auckland, New Zealand.

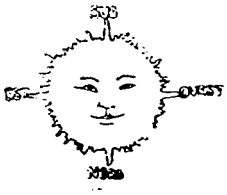
17-20 **1993 International Conference on Bond Graph Modeling and Simulation**. San Diego, CA, USA.
Contact: F.E. Cellier, Dept. of Electr. and Computer Engr., University of Arizona, Tucson, Arizona 85721. Tel: +1-602-621 6192, Fax: +1-602-621 8076, E-mail: Cellier@ECE.arizona.edu

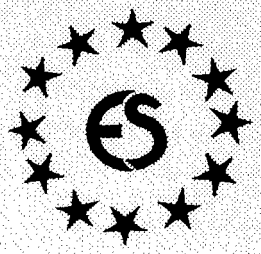
May 1993

17-20 **5th International Symposium on Modelling and Simulation of Systems**. Olomouc, CSFR
Contact: Jan Stefan, Department of Computer Science, Technical University of Ostrava, tr. 17. listopadu, CS-70833 Ostrava.

September 1993

28-30 **ASIM 93. 8th Symposium Simulationstechnik**. Berlin, Germany.
Contact: P. Schäfer, DAIMLER-BENZ AG, Forschungsinstitut, Alt Moabit 91 b , W - 1000 Berlin 21.





eurosim 92

EUROSIM SIMULATION CONGRESS

Capri, Italy, September 29 - October 2, 1992

This international congress is organized on behalf of EUROSIM by the Italian Society for Computer Simulation (ISCS) in co-operation with

ASIM Arbeitsgemeinschaft Simulation, DBSS Dutch Benelux Simulation Society, FRANCOSIM Société Francophone de Simulation, SIMS Simulation Society of Scandinavia, UKSS United Kingdom Simulation Society

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Conference Chairman: F. Maceri (Italy)

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Scientific Program: The Eurosim Simulation Congress is concerned with all aspects of computer simulation methodology and application. Papers will cover the following areas:

- Simulation languages / Simulation architectures
- Simulation methodologies
- Simulation of computer systems and networks
- Supercomputing in simulation
- Parallel and distributed simulation
- Simulation factory and automation
- Computational physics and chemistry
- Simulation in:
  - Aeronautics, Astronautics, Astrophysics
  - Automotive industry
  - Biology and medicine
  - Control Engineering
  - Earthquake engineering
  - Economy/business management
  - Education, Energy systems
  - Electrical Engineering (power plants)
  - Electronic design, Expert systems
  - Social sciences, Training
  - Transportation and traffic control

Venue: The Congress will take place on the Island of Capri, Italy. The Congress sessions will be held at the Grand Hotel Quisisana, from September 29 to October 2, 1992.

Exhibition: There will be an exhibition throughout the period of the Congress at the Conference site. Enquiries about the exhibition facilities are welcome. The exhibition will have two sections, one for the commercial demonstrations and one for posters.

Registration Fees: Conference registration includes a copy of the Conference Proceedings, coffeee breaks, and official banquet.

Early registration fee (before August 31, 1992) is **300** ECU for authors and members of ASIM, DBSS, FRANCOSIM, ISCS, SIMS, UKSS, SCSI, **350 ECU** for other participants. After August 31,1992 registration fee will be increased by 50 ECU. Payment can also be in italian lire.

The official language of the Congress will be English.

For further information please contact the Congress Secretariat:

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