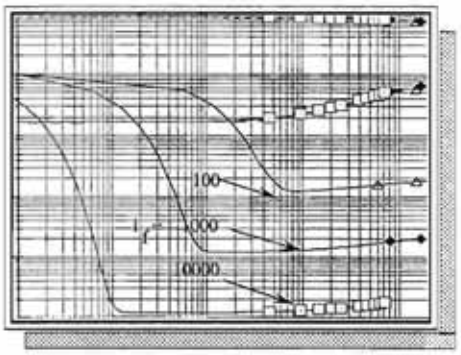
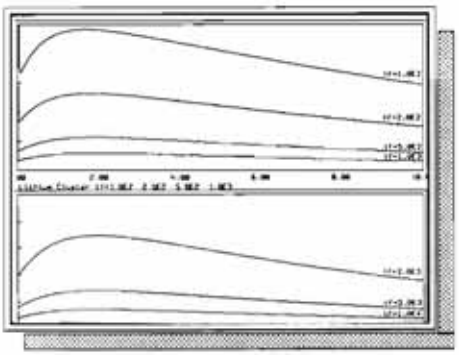
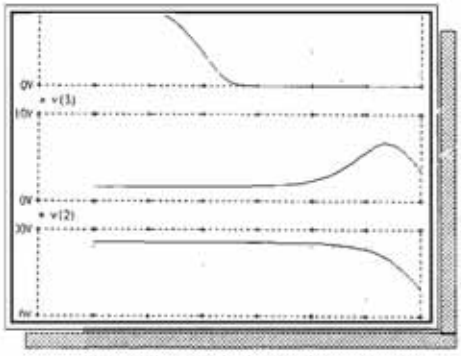
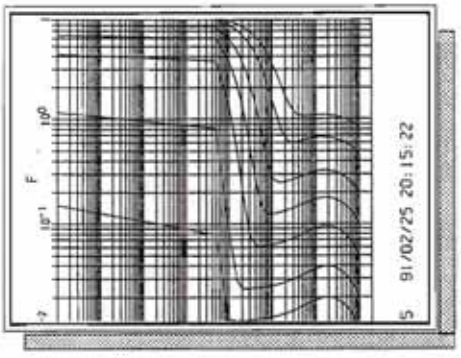
EUROSIM
Simulation News Europe

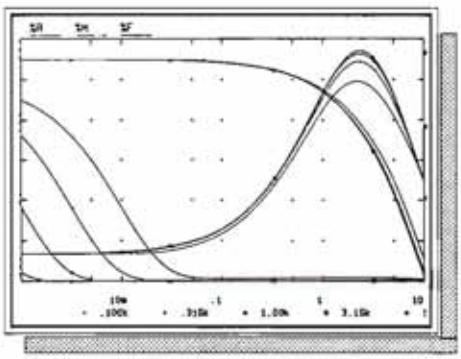
Number 1 A European Forum on Simulation Activities March 1991

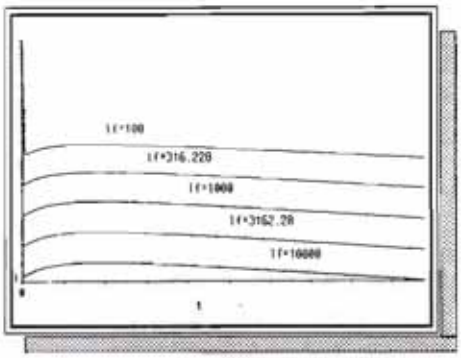












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Editor-in-Chief: Prof. Dr. Felix Breitenecker

Managing Editor & Layout: Mrs. Irmgard Husinsky

Addresses: Scientific Academy of Lower Austria, Project Center Wiener Neustadt, Adlergasse 3, A - 2700 Wiener Neustadt. Tel: +43-(0)2622 27367 11. Fax: +43-(0)2622 27367 22.
or: Computer Center, Technical University of Vienna, Wiedner Hauptstraße 8-10, A - 1040 Wien. Tel: +43-(0)222 58801 5484. Fax: +43-(0)222 587 42 11.

Editorial Board of the European Simulation Societies:

ASIM: Dr. Ingrid Bausch-Gall, Wohlfartstraße 21b, D - 8000 München 45. Tel: +49-(0)89 3232625, Fax: +49-(0)89 3231063.

DBSS: Dr. E.J.H. Kerckhoffs, Fac. of Technical Mathematics and Informatics, Delft University of Technology, Julianalaan 132, 2628 BL Delft, The Netherlands, Tel: +31-(0)15 789111, Fax: +31-(0)15 787141.

FRANCOSIM: Prof. Alain Pavé, Laboratoire de Biométrie, Université Claude Bernard, Lyon 1, F - 69622 Villeurbanne, France, Tel: +33 78 892719, Fax: +33 78 943901.

ISCS: Dr. Michele Colajanni, Dip.to Ing. Elettronica, Universita di Roma II, Via O. Raimondo 8, I - 00173 - Roma, Tel: +39-(0)6 79794484, Fax: +39-(0)6 2020519.

SIMS: Kaj Juslin, VTT/Säh, Otakaari 7 B, SF - 02150 Espoo, Finland. Tel: +358-0 456 6422, Fax: +358-0 455 0115.

UKSC: Prof. D.J. Murray-Smith, Department of Electronics and Electrical Engineering, University of Glasgow, Glasgow G12 8QQ, Scotland, U.K., Tel: +44-(0)41 339 8855 5222, Fax: +44-(0)41 330 4907.

Editorial

In November 1990 **EUROSIM - Simulation News Europe** started with the first issue, which was number 0. Response from readers from institutions and companies showed a great acceptance and the need for this information newsletter. It disseminates information to all EUROSIM member societies and to all members of these societies. Furthermore it introduces the importance of simulation to industry, government, and education.

This issue, number 1, is the first within the regular publishing period. **EUROSIM - Simulation News Europe** will be published three times a year: March, July, November.

As the structure of the first issue was successful this and the following issues will also observe this structure.

This issue starts with a report on EUROSIM activities, followed by an essay by Mr. Kotva on the role of simulation in health care. For the next issues essays on qualitative simulation and simulation and AI are planned.

A 'classical' section are the societies' reports dealing with activities within European simulation societies and activities of international societies. With great pleasure we notice the activities in the Eastern countries and especially the foundation of the Latvian Simulation Society, which will be contacted.

The series on simulation centers is continued by presentations of three institutions dealing with simulation.

A great success was the idea of the software comparison. In the last issue a model of a continuous process was published to be tested with different simulation languages. Quite a few simulationists took the challenge and sent in their simulation results. Part of these reports are published in this issue, further reports will follow. This time a model of a discrete process is presented to be tested with different simulation languages. We hope to receive again a lot of contributions.

A calendar of events completes **EUROSIM - Simulation News Europe.** For the next issue the editors plan a further section on 'industry news'.

The editors would like to thank all who contributed for this issue, the advertising companies, and the Scientific Academy of Lower Austria for the financial support.

Readers are kindly invited to send letters, comments, suggestions or contributions to one of the editors.

F. Breitenecker, I. Husinsky

EUROSIM News

In 1989 EUROSIM was founded, the Federation of European Simulation Societies. EUROSIM as "European Umbrella" was first announced at the 3rd European Simulation Conference in Edinburgh (September 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. Activities of EUROSIM will concern:

- information distribution to member societies about activities, advancements and the state-of-the-art in system simulation
- co-ordination of meetings of member simulation societies
- co-operation in joint research projects, in standardization committees and with international societies in the field of simulation

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)
- UKSC - United Kingdom Simulation Council (UK)

EUROSIM intensified contacts with people in Czechoslovakia, Greece, Hungary, Portugal, Spain and Yugoslavia for new member societies. Among these countries the following societies and informal groups, resp., contacted EUROSIM for co-operation:

- CSSC - Czechoslovak Systems Simulation Club (Czechoslovakia)
- YUSIM - Yugoslav Simulation Society (Yugoslavia)
- Hungarian Simulation Group - IMACS/Hungary

The agenda of EUROSIM are decided by a board consisting of one representative of each member simulation society. Only the society preparing and hosting the next European Simulation Conference nominates two representatives, one being the EUROSIM president for a three year period. The decisions of the board are based on preliminary bylaws.

Since the foundation of EUROSIM three board meetings discussed the agenda of EUROSIM: Liège - April 1990, Capri - July 1990, Delft - October 1990.

Board of Directors Meeting, Delft, Oct. 26 - 27,1990

Participants were Mr. Halin (ASIM), Mr. Dekker (DBSS), Mr. Maceri (ISCS), Mr. Savastano (ISCS), Mr. Zobel (UKSC) and Mr. Juslin (SIMS).

Mr. Maceri, the EUROSIM president, chaired the meeting. First a written report from Mr. Lorenz (FRANCOSIM representative, not present) was discussed. Concerning the EUROSIM bylaws Mr. Lorenz and Mr. Zobel are asked to prepare "minimum bylaws" and to contact FAIB (The Federation of International Associations, etsablished in Belgium).

The board agreed on the following: EUROSIM can morally sponsor congresses, but not financially. In case of sponsoring EUROSIM must be mentioned (and not the name of the individual society), one to three persons nominated by the EUROSIM board should become members of the scientific committee of the conference.

The next sponsored conferences are: 2nd International Conference on System Simulation and Scientific Computing - Sept. 1992, Beijing; 4th International Symposium on Systems Analysis and Simulation, August 1992, Berlin; 4th North-Moravian International Symposium on Modelling and Simulation of Systems, May 1991.

Contacts to CEC should be intensified. In this respect each society should check their contacts to industrial members busy with simulation activities within the framework of ESPRIT.

In the following the eventual new journal "Journal of Simulation - Practice and Theory" and the EUROSIM newsletter were discussed. There exist offers from Elsevier to publish the Journal, the Newsletter and both. The EUROSIM newsletter (EUROSIM - Simulation News Europe) at the moment is edited in Vienna, Mr. Maceri will contact Mr. Breitenecker concerning details (logo, etc.).

Within the discussion also Mr. Sydows journal "System Analysis, Modelling and Simulation" is mentioned as possible part of the new EUROSIM journal (there exists an offer from Mr. Sydow).

Main part of the meeting was the discussion and preparation of the European Simulation Conference 1992 in Capri. Affairs like proceedings, topics and themes, first call for papers, scientific committee and finances are discussed. Each society should send proposals for sessions and exhibitors to Mr. Maceri.

Concerning the co-operation with other societies an affiliation agreement with IMACS and SCSI, the status of a Spanish Simulation Society, and the foundation of CESC (Continental European Simulation Council - European chapter of SCS) were discussed. At the end it was decided to have not more than one to two board meetings a year, in principle before or after a regional conference.

The Potential Role of Systems Simulation in the Management of Health Care

Current changes in Czechoslovakia should mean a definitive departure from former health care policy directed towards the normative planning of health services development and the transition to a complex health planning as required by the programme of the World Health Organization "Health for All by the Year 2000". It is essentially the question of the use of ever scarcer resources in such a way that a "maximum of health" of the population will be achieved.

This change in the direction of health policy means that

a. health policy will be in the future characterized by the optimization of available resources allocation

b. it will be necessary to define the criterion of health policy effectiveness by its resultant effect on the population health, i.e. no longer in terms of the performance of health care services, of their equipment etc. as before.

From these facts it follows that for the health care decision-making

1. there will be needed entirely different types of information than those which have been up to now provided by the health care information system and which this system in its present-day conception is capable to provide;

2. it will be necessary to work out methodologies for estimating the results of prevention and the needs of curative care for evaluating the effectiveness of health policy and for optimizing the allocation of resources.

These requirements cannot, of course, be understood separately because they condition each other. According to our and foreign experience mathematical and simulation models can and must be applied during implementation of such goals.

Complex health planning must above all balance the allocation of available resources between curative care and primary prevention. In the preceding period epidemiological studies helped to identify the risk factors which should become the focus of interventions within the framework of primary prevention. The application of this epidemiological knowlegde in the health care decision-making is, however, on a very primitive level in the whole world. On the other hand the epidemiology of non-infectious diseases is for the time being still in the stage of a descriptive rather than analytical science, and therefore it is not surprising that also the use of systems simulation is more an exception than a rule. It seems that a qualitative jump could be made above all in connection with the new generation of health care information systems using fully the possibilities of modern computer technology and extending to the medical workers of the first contact line.

Traditional epidemiology usually concentrates on the study of population health status trends under the conditions of the growing risk factor prevalence and consequently also of the growing incidence of relevant diseases. It is usually concerned with a certain nosological unit or group and it takes into consideration either only one risk factor or a whole complex of these factors. For the health care decision-making it is, however, at the present time equally important to estimate the development of the population health status if there is a decline in the prevalence of risk factors as an effect of primary prevention. For these purposes it is also necessary to know how a certain risk factor influences the incidence of the whole complex of relevant diseases so that the total effect of intervention on this risk factor can be estimated. It is not possible to neglect the fact that some diseases constitute a risk factor of other diseases. These reflections suggest the character of epidemiological simulation models which will be necessary for the needs of the health care decision-making under the present circumstances.

For the time being, simulation and other epidemiological models are usually created and understood as a mere interpretation of epidemiological data. For the further development of our knowledge and for the above mentioned practical tasks it is, however, absolutely necessary to create and understand these models as a representation of our knowledge and our hypotheses about the laws of epidemiological processes. The use of these models for the prognostication represents for the time being the only possibility of gradual verification of the used hypotheses and consequently of raising the level of knowledge in this field. Another apparently even more significant possibility will be represented by the above-mentioned new generation of health care information systems.

The simulation epidemiological models will, of course, constitute the main part of models which should serve to the decision-making sphere of the health care as a tool for quantified estimates of the effects of preventive measures. For this purpose it is, however, necessary to complement them with a programme for the evaluation of preventive measures effect in generally usable quantities (e.g. change in life expectancy, years of the life gained, years of the life without a disease). These models can be, however, used for a quantified estimate of the desirable development of the curative care which, of course, cannot be made according to the present-day population health status but only according to the prognoses of its future trends.

The design of the above-mentioned simulation models and consequently also their use in the decision-making sphere of health care will in no case be a simple and straightforward process - if only because of the fact that especially at the beginning it will meet not only with the lack of reliable data and relevant hypotheses but also with a psychological barrier in the minds of the decision-makers, epidemiologists, clinical workers and probably also of the modellers themselves.

Ing. Milan Kotva, CSc., Institute of Social Medicine and Health Services Organization, Sokolska 54, CS - 128 00 Praha 2

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.

In the last issue of this journal we reported on the election of the board at the conference in Vienna. The newly elected board met on December 3rd, 1990 in Frankfurt to elect speaker and vice speaker, to decide on the tasks of the other board members and to discuss further subjects.

Elected speaker is now Dr. Ingrid Bausch-Gall, vice-speaker Prof. Dr. Felix Breitenecker. Dr. Ingrid Bausch-Gall thanked in the name of the past board Prof. Ameling for all the work he has done during his time as speaker to make ASIM a society with now more than 600 members and with an active participation at the ASIM meetings. Prof. Ameling was speaker of ASIM from 1985 to December 1990.

During the meeting it has been decided to ask Mrs. Husinsky and Prof. Peter Lorenz to join the board and help with tasks that are currently not represented in a satisfactory way. Mrs. Husinsky of TU Wien was asked to join the board due to her important task as editor of EUROSIM-Simulation News Europe, Prof. Peter Lorenz should help to set up ASIM in East Germany. Both Prof. Lorenz and Mrs. Husinsky accepted the invitation in the meantime.

Further discussion points of the board meeting were the organization of the next conference, financial issues, the co-operation with the other European societies and our publication series and other daily affair. Please contact Dr. Ingrid Bausch-Gall if you are interested in further decisions of the board.

Complete list of addresses of the board members and their tasks

If you are interested in ASIM, in a working group of ASIM or in an ASIM-meeting, please contact directly the responsible person. Here you find a complete list of addresses with the tasks of the persons within the ASIM board. Please keep this list, as it will be published only about once per year.

Prof. Dr.-Ing. W. Ameling
RWTH Aachen
Rogowski-Institut für Elektrotechnik
Schinkelstraße 1
D - 5100 Aachen
Tel: +49-(0)241/80-7600
Fax: +49-(0)241/80-7605
Book series, publications, past president, contact person for IMACS

Dr. Ingrid Bausch-Gall
BAUSCH-GALL GmbH
Wohlfartstraße 21b
D - 8000 München 45
Tel: +49-(0)89 3232625
Fax: +49-(0)89 3231063
Speaker, presentation of ASIM, contact person for members in Germany, contact person for GI

Prof. Dr. Felix Breitenecker
Technische Universität Wien
Institut für Technische Mathematik
Wiedner Hauptstraße 8-10
A-1040 Wien
Tel: +43-(0)222 58801 5374 or 5387
Fax: +43-(0)222 587 42 11
Vice speaker, contact person for EUROSIM, editor-in-chief of EUROSIM Simulation News Europe, finances, membership (please contact him on changes of your address and fields of interest), contact person for members in Austria

Dr. Hans Fuss
GMD-F1, Postfach 1240
D - 5205 St. Augustin 1
Tel: +49-(0)2241 14 2778
Fax: +49-(0)2241 14 2889
Speaker of the working group "Simulationsmethoden und -sprachen für verteilte Systeme und Prozesse", second contact person for GI, editor of "ASIM-Vorstellungsheft", mailing of EUROSIM Simulation News Europe to ASIM-members

Prof. Dr. B. Gottwald
Universität Freiburg, Fakultät für Biologie
Schänzlestraße 1
D - 7800 Freiburg
Tel: +49-(0)761 2032747
Secretary, vice speaker of the working group "Simulation in Biologie, Medizin und Ökologie"

PD Dr. J. Halin
Institut für Energietechnik
ETH Zürich
Clausiusstraße 33
CH-8092 Zürich
Tel: +41-(0)1 256 4608
Fax: +41-(0)1 2520192
Speaker of the working group "Simulationssoftware und -hardware", contact person for SCS and EUROSIM and for members in Switzerland

Mrs. Irmgard Husinsky
Technische Universität Wien
EDV-Zentrum
Wiedner Hauptstraße 8-10
A-1040 Wien
Tel: +43-(0)222 58801 5484
Fax: +43-(0)222 587 42 11
Managing editor EUROSIM-Simulation News Europe

Prof. Dr.-Ing. G. Kampe
FHT Esslingen
Flandernstraße 101
D - 7300 Esslingen
Tel: +49-(0)711 394 258 or 266
Speaker of the working group "Simulation technischer Systeme"

Dr. J. Krauth
BIBA
Bremer Institut für Betriebstechnik und angewandte Arbeitswissenschaft
Postfach 330 440
D - 2800 Bremen 33
Tel: +49-(0)421 22009 43
Fax: +49-(0)421 22009 79
Speaker of the working group "Simulation und künstliche Intelligenz"

Prof. Dr.-Ing. A. Kuhn
Fraunhofer-Institut für Transporttechnik und Warendistribution
Emil-Figge-Straße 75
D - 4600 Dortmund 50
Tel: +49-(0)231 7549 130
Fax: +49-(0)231 7549 211
Speaker of the working group "Simulation in der Fertigungstechnik"

Prof. Dr. Peter Lorenz
Technische Universität "Otto von Guericke"
Fakultät für Informatik
Postschließfach 4120
O-3010 Magdeburg
Tel: Magdeburg 5920
Contact person for members in East Germany, set up ASIM in East Germany

Dr. D. Möller
Drägerwerk AG
GB Medizintechnik
Moislinger Allee 53-55
D - 2400 Lübeck
Tel: +49-(0)451 8822940
Fax: +49-(0)451 8823779
Speaker of the working group "Simulation in Biologie, Medizin und Ökologie"

Prof. Dr. A. Sydow
Zentralinstitut für Kybernetik und Informationsprozesse
Kurstraße 33
O-1086 Berlin
Contact person for members in East Germany, set up ASIM in East Germany

Prof. Dr.-Ing. D. Tavangarian
Fernuniversität Hagen
FB Technische Informatik
Elberfelder Str. 95
D - 5800 Hagen
Tel. +49-(0)2331 804 8372 or 8371
ASIM conference 1991, contact person for journals

ASIM-Meetings in 1991

March 4-5, 1991: Meeting of the working group "Simulation technischer Systeme" at DLR in Oberpfaffenhofen.

March 7-8, 1991: Conference on "Simulation und Verstehen" in Hannover organized by the working group "Simulation in der Fertigungstechnik".

April 22-23, 1991: 7th Workshop "Simulationsmethoden und Sprachen für parallele Prozesse" in Berlin. For more information see report of the working group.

April 25-26, 1991: Workshop "Simulation und künstliche Intelligenz" in Berlin. For more information see report of the working group.

September 24-26, 1991: 7. Symposium Simulationstechnik in Hagen. This is ASIMs 1991 annual German speaking conference. Announcement see next page.

Reports from the Working Groups

Report from the Working Group "Simulationsmethoden und Sprachen für parallele Prozesse"

The 7th workshop of this working group will be held on April 22-23 in Berlin at CIT GmbH (Communication and Information Technology). Dr. Scheschonk will host the meeting. Applications of participation will be accepted already now. The facilites in Berlin do not allow more than 50 participants. As usual, there is no conference fee for members of ASIM.

Speaker of the working group: Dr. Hans Fuss

Report from the Working Group "Simulationssoftware und -hardware"

no report received

Speaker of the working group: Doz. Dr. J. Halin

Report from the Working Group "Simulation und künstliche Intelligenz"

This working group examines approaches to combine techniques developed in the fields of Simulation and Artificial Intelligence. The underlying question is: "How can the progress made by AI researchers be used to improve conventional simulation tools or to develop new tools?" We believe that AI too can benefit using simulation techniques, but the focus of this working group is on improved simulation tools.

The group helds an annual workshop, normally in April, at varying places in the German speaking countries. The next workshop will take place in Berlin at the Zentralinstitut für Kybernetik und Informationsprozesse of the former GDR, at April 25th and 26th. The discussions will concentrate on problems of object-oriented modelling, but other contributions are also welcome. Applications and abstracts of intended contributions should be sent until March 15th to the

Speaker of the working group: Dr. Johannes Krauth

Report from the Working Group "Simulation in Medizin, Biologie und Ökologie"

no report received

Speaker of the working group: Dr. D. Möller

Report from the Working Group "Simulation technischer Systeme"

The 1991 spring workshop (March 4-5) is hosted by the German Aerospace Research Establishment (DLR) at Oberpfaffenhofen near Munich, Germany. A report on the workshop will appear in the next issue.

Speaker of the working group: Prof. Dr.-Ing. Gerald Kampe

Report from the Working Group "Simulation in der Fertigungstechnik"

The working group organizes a conference in Hannover on March 7-8 on the subject "*Simulation und Verstehen*". A report on the conference will appear in the next issue.

Speaker of the working group: Prof. Dr.-Ing. A. Kuhn

ASIM 91

7. Symposium Simulationstechnik

The next annual ASIM conference, the "7. Symposium Simulationstechnik" will take place from September 24 to 26, 1991 at the University of Hagen in co-operation with the local Chamber of Commerce.

Contact person is:

Dj. Tavangarian
FernUniversität Hagen
Fachbereich Informatik
LG Technische Informatik II
Postfach 940
D - 5800 Hagen 1, Germany
Tel: +49-(0)2331 804 8372
Fax: +49-(0)2331 804 313

User Groups and Tutorials on Simulation Software and Hardware will be held on September 23. People interested in organizing a User Group meeting or a tutorial should contact the organizer before April 30.

It is the aim of the symposium to promote the exchange of ideas and experiences of experts and people interested in modelling and simulation in theory and practice. Topics will be modelling and methodology, simulation tools (hardware and software) and applications.

Firms interested in the presentation of their products are requested to contact the address mentioned above.

The city of Hagen is situated on the northern rim of the beautiful Sauerland. A social programme for participants and people in their company will be provided.

Deadlines:

April 1, 1991	Abstracts and proposals
May 1, 1991	Notification of acceptance
June 30, 1991	Camera-ready papers due

DBSS

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 1991:

- 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 SCSi.

Notice to DBSS members:

Unfortunately, there are still members who did not pay their membership fee for 1990 up to now.

We kindly but urgently request you to pay the due fee as soon as possible on the giro account of the treasurer (see below).

Contact addresses

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

Dr. E.J.H. Kerckhoffs
Fac. of Technical Mathematics and Informatics
Delft University of Technology
Julianalaan 132
2628 BL 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 1991.

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

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

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

Report on meeting

COMPUTER ALGEBRA in ENGINEERING and RESEARCH

This successful scientific symposium has been held at Delft University of Technology (Delft, the Netherlands), December 17th, 1990. The event was jointly organized by the Dutch Benelux Simulation Society (DBSS), the Foundation Computer Algebra Netherlands (CAN) and the Working Group for Industrial and Applied Mathematics (WITW). The Dutch Mathematical Society (WG) has sponsored the meeting. There were some 120 attendants from the Netherlands, Belgium, UK, Germany and Austria.

Four sessions of lectures have been presented: one plenary session "General" in the morning, and three parallel afternoon sessions: "Computer Algebra in Education", "Applications in Engineering" and "Computer Algebra, Parallelism, and Code Generation".

The lectures presented in the session "General" were:

A. Kerber: Chemical isomerism, the basic problem of graph theory and combinatorial theory of enumeration, and a program system for its solution;

F. Winkler: Applications of computer algebra to problems in Engineering;

E. Kreuzer: Computer algebra in applied dynamics

Some presentations in other sessions that might be interesting for simulationists were:

G. Hellings: Calculation of potential distributions for energy analysers;

P.G. Bakker: Applications of computer algebra in aerodynamics;

V.V. Goldman: Using computer algebra systems to generate efficient numerical code;

E.J.H. Kerckhoffs: Formula manipulation in the simulation of fermentation.

Just as an illustration in the following a short abstract is presented of the last-mentioned lecture by Kerckhoffs, which most typically reflected the use of computer algebra in (methodology-oriented) simulation:

In simulation of continuous systems characterized by ordinary and partial differential equations often insight about analytical features, such as for example stability and sensitivity, is needed or at least helpful. For this purpose computer algebra can offer attractive possibilities; among others, the output of computer algebra can be Fortran code, which is then used for further numerical solution.

An example arises in parameter sensitivity studies, where one is supposed to perturb certain parameters in a system of differential equations and wants to determine the resulting effect on the solution. Computer algebra is used to obtain the differential equations for the partial derivatives of the solution with respect to these parameters (the so-called parameter sensitivity equations). Presenting the output in Fortran form is then the first step for a numerical solution of the sensitivity equations. In the current lecture this is illustrated by a sensitivity study of equations describing biomass growth in a fermentation process.

Due to the lack of sufficient a priori knowledge the modelling of such a fermentation system has to be done in a more inductive rather than deductive way, which always leads to nonunique mathematical structures. This means that in fact a modelbase consisting of a more or less extensive set of different (candidate) models can be constructed, and their various aspects such as time-behaviour, parameter sensitivities, etc. are to be studied and compared. Consequently, appropriate software tools to experiment in a highly interactive way on such a set of models is of importance. Computer algebra systems can be a substantial part of such interactive software.

The symposium was closed with a reception. During the reception demonstrations of several computer algebra systems have been given.

A small booklet containing the abstracts of all the lectures is available. Copies can be ordered from the secretary of DBSS.

Meetings 1991 (repeated preliminary announcement)

I.

A meeting will be organized about the following topic in the domain of systems simulation: Structural analysis through parallel finite element simulation with the software package DIANA.

DIANA is a finite element analysis software package developed by TNO Institute of Building Materials and Structures (Delft, The Netherlands). DIANA can be used to model and simulate the mechanical and physical behavior of a large variety of structures. The finite element analysis of many engineering problems is very computation intensive, the use of vector/parallel computers is therefore inevitable. First DIANA and its application fields will be discussed. A methodology for parallel direct solution of large sparse matrix systems and its implementation onto DIANA will then be presented.

More details will appear in the next issue of this Journal.

II.

A meeting will be organized about 3-D graphical display for two application areas: "flight simulation" and "fluid flow simulation" (3-D scientific data visualization).

More details will appear in the next issue of this Journal.

FRANCOSIM

History

The idea of a French speaking simulation society has been first discussed in Lyon in March 1989 during the workshop "A.I. in Numerical and Symbolic Simulation". However, it took one full year to mature the idea and the society has finally been informally founded in Liège (Belgium) on the 3rd of April 1990. It has the same day been accepted as sixth full member of EUROSIM. Another meeting in Paris in June 1990 definitely fixed the most important points of the bylaws i.e. the name, seat, legal form und objectives.

Description

The societys official name is "Société Francophone de Simulation", abbreviated to FRANCOSIM. The English translation "French Speaking Simulation Society" is also official and explicitly mentioned in the bylaws.

It will have its legal seat in Roanne (France) and will take the form of an "association loi de 1901" (French form of non-profit making society).

Its objectives are defined as follow:

"The 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.

It may furthermore undertake, encourage or favour all activities that can contribute to reaching its objectives, like among others:

- *organize congresses, conferences, symposia, workshops or seminars or participate to their organization,*
- *realize or edit totally or partially periodicals, journals, newsletters or any other communication work, printed or using any media technique,*
- *cooperate with other societies dealing mainly or secondarily with simulation."*

(translated from the bylaws.)

Information

Any information about the society may be obtained from:

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

ISCS

General Information

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

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

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

Membership

At present the membership situation is as follows: 108 members, 7 of which are institutional and 4 are honorary, 95 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 addresses

For further information of application for membership, please contact:

ISCS
c/o Dip.to Ing. Elettronica
Università di Roma II
Via O. Raimondo, 8
I - 00173, Roma, Italy
Tel: +39-(0)6-79794.473/.477/.486
Fax: +39-(0)6-2020519
E-mail: IAZEOLLA@IRMIAS.BITNET

Activities

The ISCS activities in the period September through January can be synthesized as follows:

1. Promotional action for the prosecution of research on the multiprocessor INTEL iPSC/2 Hypercube, and on the 16 nodes Transputer based Computer Surface by Meiko, financed by the EEC under the *Parallel Computing Action* project.

2. The organization and sponsoring of the "Seminario di Informatica", a periodic scientific seminar held at the University of Roma II. Some of the themes of the lectures were: *Automatic development of logic language programs* (Prof. A. Pettorossi, University of Rome II, Italy), *Some aspects of implementation of parallel algorithms*

(Prof. M. Vajtersic, Slovak Academy of Sciences, Czechoslovakia). In addition an interesting co-operation has been promoted between the University of Rome II from one side and Intel Scientific Computers, and the scientific center IBM ECSEC of Roma to hold a cycle of seminars on the topic *Parallel and vector processing for linear algebra problems.*

3. Most of efforts of the ISCS are now devoted to the organization of the *4th European Simulation Congress*, that will take place in Capri, in September 1992.

Annual Meeting of ISCS Members

1990 ISCS Workshop on Computer Simulation

On the occasion of the annual meeting of ISCS members (December 14, 1990) a workshop on computer simulation was held at the University of Rome "Tor Vergata". A lot of interesting papers, coming not only from ISCS members, have testified the great attention that is given to simulation in Italy today. The Program Committee under the chairmanship of Prof. Salvatore Tucci arranged the program to stimulate discussions after individual presentations. There were about 60 participants that contributed with 21 presentations covering different fields of simulation:

- Simulation Methodologies
- Parallel and Distributed Simulation
- Hybrid Simulation
- Simulation in Biochemistry
- Simulation in Biology
- Simulation in Civil Engineering
- Simulation in Control Engineering
- Simulation in Economic Modelling
- Simulation of Electrical Fields
- Simulation in Manufacturing

Members interested to receive a copy of the proceedings of the workshop (containing 21 papers, 8 in italian and 13 in english) can contact the ISCS secretariat at the following address:

Dr. Michele Colajanni
Dip. Ingegneria Elettronica
Università di Roma "Tor Vergata"
Via O. Raimondo, 8
I - 00173, Roma, Italy
Tel.: +39-(0)6-79794473
Fax: +39-(0)6-2020519

Institution of Simulation Working Groups

The proposal of the ISCS chairman of instituting Simulation Working Groups received positive assent from the Assembly. First goal of these groups is to organize regular meetings between ISCS members interested in the same simulation field, in order to provide a forum for presentation of results, exchange of ideas and scientific discussions. Furthermore the Working Groups should be able to establish contacts with other yet existing regional Groups having analogous interests. After an interesting debate, the following Working Groups were proposed by the Assembly:

- Simulation in Industry
- Simulation in Agriculture and Environmental Sciences
- Simulation in Training and in Education
- Simulation of Biological and Medical Systems
- Simulation of Stochastic and Fluctuation Systems
- Simulation Methodologies
- Parallel and Distributed Simulation
- Software and Hardware for Simulation
- Graphical Simulation
- Expert Systems and Simulation

Other initiatives are welcome.

Elections of the new ISCS Steering Committee

During the meeting, elections of the Steering Committee of ISCS for the triennium 1991-93 were held: Prof. Guiseppe Iazeolla, University of Roma II, was confirmed in the position of ISCS chairman; as vice-Chairman Prof. Felice Cennamo, University of Napoli, was elected; whereas Dr. Vincenzo Grassi and Dr. Michele Colajanni, University of Roma II, were nominated ISCS treasurer and secretary, respectively. The Steering Committee of ISCS includes also Prof. Franco Maceri and Prof. Salvatore Tucci.

SIMS

Scandinavian Simulation Society

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, and co-operation at European and international level in the field of simulation.

To join SIMS

As a member of SIMS, you will get SIMS Information Letters, EUROSIM-Simulation News Europe, and additional information on courses, projects and meetings in the field of simulation. SIMS members have reduced participation fees on many simulation congresses.

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:

c/o M. Hänninen,
VTT /Sah, Otsvängen 7 B,
SF-02150 ESBO, Finland,
Tel: +358-0-4566564,
Fax: +358-0-4550115,
Telex: 123 704 vttte sf.

SIMS annual meetings

The 33rd annual meeting of SIMS will be held in close connection to the European Simulation Multiconference ESM 91 in Copenhagen, June 1991, which is organized by SCS in co-operation with SIMS (see calendar of events). SIMS members are encouraged to attend the ESM 91 conference. The SIMS business meeting with the elections on board members will be included in the congress time schedule. Presently Erik Mosekilde is chairman of SIMS, Markku Hänninen is secretary, Lars Lidner is treasurer, Sakari Kaijaluoto, Mats Johansson, Torleif Iversen, Odd Falmyr and Poul Rathje are board members, and Kaj Juslin is acting as international liaison.

The 34th annual SIMS meeting is preliminary planned to take place in May/June 1992 at the Technical University of Lappeenranta in Finland. The special theme for this meeting seems to be simulation in power generation.

UKSC

The UKSC (United Kingdom Simulation Council) has approximately 150 members and holds regular meetings in various parts of the United Kingdom. The Steering Committee, elected at the 1990 Annual General Meeting, is as follows:-

Chairman:	Richard Zobel
Vice-Chairman:	Mohammed Rahbar
Honorary Secretary:	David Vint
Honorary Treasurer:	Keith Nock
Committee Members:	Elizabeth Rimmington *(Membership Secretary)*
	David Murray-Smith *(Past Chairman)*
	Sally Brailsford
	Russell Cheng
	David Maclay
	Adrian McGill

Further details about UKSC membership and events may be obtained from:-

Mrs. Elizabeth Rimmington
Computing Centre
Watts Building
Brighton Polytechnic
Moulsecomb
Brighton BN2 4GJ
United Kingdom
Tel: +44-(0)273 600 900

or from:

Dr. R.N. Zobel
Department of Computer Science
University of Manchester
Oxford Road
Manchester M13 9PL
United Kingdom
Tel: +44-(0)61 275 6210
Fax: +44-(0)61 275 6280

UKSC Meetings for 1991

The following two meetings have been arranged:

Thursday, March 27th 1991. "Simulation in the Automotive Industry", at Lucas Advanced Engineering Centre, Solihull.

Wednesday, April 17th 1991. "Simulation in Robotics", at School of Mechanical and Manufacturing Engineering, Middlesex Polytechnic.

Additional Meetings are being planned on "Aerospace Simulation", "Military Training Simulation" and "VLSI System Simulation". These will take place later in 1991 and full details will be available within a few weeks.

UKSC Conference 1990: Conference Proceedings

The Proceedings of the UKSC 90 Conference which was held at the University of Sussex in September 1990 are still available at a cost of 30 pounds each plus postage.

The Proceedings, which is a hardbound volume, includes papers on the following topics:

- techniques for continuous system simulation
- techniques for discrete event simulation
- a.i. techniques in simulation
- real time simulation
- simulation in control
- simulation of networks
- object-oriented simulation
- biological and medical applications
- general engineering applications
- simulation in training and education

Orders should be sent to:

Mr. K.G. Nock
c/o Scientific Computers Ltd.,
Victoria Road,
Burgess Hill,
East Sussex, England.

Please make cheques payable to UKSC.

CSSC

Czechoslovak Systems Simulation Club (CSSC)

Contact addresses

If you are interested in the membership, information or collaboration with CSSC, please write

in the Czech Republic to

Ing. Milan Kotva, CSc.
Zeleny pruh 32
CS - 147 00 Praha 4, Czechoslovakia
Tel: +42 2 202 448 9

in the Slovak Republic to

Doc. Ing. Ruzena Apalovicova, CSc.
EF SVST, Katedra pocitacov
Mlynska dolina
CS - 812 19 Bratislava, Czechoslovakia

We can distribute business and conference information to our members.

4th North-Moravian International Symposium on Modelling and Simulation of Systems

The Symposium will be held in Vsetin from May 14 to 16, 1991. As most foreign participants will arrive via Prague (whether by plane, train or car), the CSSC intends to organize a workshop on the theory and methodology of simulation in Prague on May 13, 1991. A social programme - sightseeing tour of Prague, cultural programme and beer party - is planned. Workshop participants can then use a special bus for the transfer to Vsetin. The Second Announcement will be distributed soon to those who have already shown interest in participating. Others wishing to participate are invited to write to any CSSC contact address.

CHANGE OF ADDRESS of the organization Committee Chairman:

Ing. Jan Stefan
VS Banska
tr. 17. listopadu
CS - 708 33 Ostrava Poruba
Tel.: +42.69.4243132

Hungarian Simulation Group - IMACS/Hungary

The events in the Eastern part of Europe are promising for a unification of the continent that has been torn apart for decades. One of the most important and pioneering fields in establishing contacts is culture and science.

In the field of simulation IMACS/Hungary as base of a Hungarian Simulation Group endeavoured to establish contacts with the European simulation community and also with scientists beyond Europe. In the last decade three IMACS European Simulation Meetings have been organized. In 1980 the first one took place in Keszthely on Discrete Simulation and Related Fields, the second conference was held in Eger in 1984 on Simulation in Research and Development, the third one took place in Esztergom in 1990 on Problem Solving by Simulation.

In the 90's the contacts to the European simulation community will be intensified, based on personal contacts and on research projects. In the end of 1990 such a research project on "Intelligent Discrete Simulators" between the Central Research Institute for Physics of the Hungarian Academy of Sciences and the Technical University of Vienna and the Scientific Academy of Lower Austria was started.

A.Javor
Central Research Institute for Physics
Hungarian Academy of Sciences
P.O.Box 49
H-1525 Budapest
Tel: +36 1 1699499
Fax: +36 1 1553894

The Latvian Simulation Society

SCS is glad to inform the international simulation community of the fact that since the 15th of November 1990, there is now a Latvian Simulation Society. It is headed by Professor Leonard A. Rastrigin and Dr. Yury A. Merkuryev and numbers 25 people.

The aim of the Latvian Society is to affiliate with SCS, and other simulation societies, and to help set up within the USSR a number of Simulation Societies which will cover the whole country.

At present Dr. Merkuryev is spending some time at the European Office in order to get acquainted with the workings of a society's office and to get himself immersed in the latest news on SCS, the different simulation societies and EUROSIM.

For further information please contact:

Dr. Yury A. Merkuryev
Dept. of Automatic Control Systems
Riga Technical University
I, Kalku Street
226355 Riga, Latvia, USSR.

YUSIM

General Information

The Yugoslav Simulation Society (YUSIM) is an informal association formed in the autumn of 1990, with the idea to reach the formal status in about one year. YUSIM recently has about 40 members. Co-ordinator of the society is Professor Vlatko Ceric (see address below).

YUSIM is proposed to be a member society of EUROSIM.

Key YUSIM goals will be to promote the following:

- research in simulation modelling and analysis;
- teaching simulation methodology on the University level;
- development of simulation studies of real systems;
- development of simulation software;
- teaching simulation methodology and practice for users in industry and federal organizations;
- co-operation with international experts in the field;
- dissemination of information for members of YUSIM about the simulation activities on the international scene.

Activities in 1990

In the beginning of October 1990 the idea about a foundation of the informal Yugoslav simulation society YUSIM was discussed both on a special panel session of a 17th Yugoslav Operations Research symposium held in Kupari, and on a "Simulation Modelling seminar" held on the Faculty of Economics in Zagreb. On both places the initiative was accepted with enthusiasm, and it was decided to found the informal Yugoslav simulation society YUSIM, with the prospective to formalize it during the next year. It was decided that till founding of the formal YUSIM society exchange of information and contact with the EUROSIM federation will be mediated by Professor Vlatko Ceric, Faculty of Economics in Zagreb.

A regular monthly seminar on "Simulation Modelling" was founded and organized by Prof. Vlatko Ceric on the Faculty of Economy, University of Zagreb. The following lectures were given on the seminar:

1. Dr. Vlatko Ceric, "Conceptual Modelling in Discrete Event Simulation";
2. Dr. Mladen Mauher, "Simulation of Economic-Aspects of Complex Systems"
3. Jadranka Bozikov,M.Sc., "Simulation Models of Population Dynamics: Methods and Applications";
4. Dr. Ray Paul (London School of Economics), "Simulation Research: Research is Always Incomplete";
5. Vlatka Hlupic, M.Sc., "Simulation Study of a Disposal Processing System";
6. Mr. John Crookes (University of Lancaster), "Model Building for All";
7. Ante Mandic,M.Sc., "Modelling and Simulation of Battles".

Activities in 1991

The following activities are proposed.

Information about the activities of YUSIM members will be collected for the aim of obtaining the more precise picture about the interests and achievements of the members, and possible co-ordination of future activities. Information will include: address, type of activity (applications, research, teaching), type of simulation (discrete, system dynamics, continuous, mixed), type of systems modelled, number of published papers (journals, meetings), available software.

YUSIM members will have society meetings (besides professional lectures and contacts) on two conferences to be held in Yugoslavia in 1991.

The 13th International conference "Information Technology Interfaces ITI-1991" (formerly "Computer at the University" symposium) will be held in Cavtat near Dubrovnik, from 10-14 June 1991. The conference is organized by University Computing Centre in Zagreb, and co-organized by the London School of Economy. International Program Committee Chairman is Dr. Ray Paul (London School of Economy) and Vice-chairman is Dr. Vlatko Ceric, Faculty of Economics, Zagreb. The conference will have the simulation section, and two invited lecturers in the field of simulation: Mike Pidd from University of Lancaster, and David Murray-Smith from University of Glasgow.

All interested international simulation researchers are invited to actively join the conference (see Calendar of Events). It is not yet too late (deadline for 1-page abstracts is 1 April 1991), and Cavtat (near Dubrovnik) is one of the most beautiful small towns in the Mediterranean area indeed!

The 18th Yugoslav operational researchers symposium SYM-OP-IS'91 will be held in Herceg Novi, from 8-11 October 1991. It will have a simulation section, and one of the international invited lecturers will be from the simulation modelling area.

Information

Any information about the society may be obtained from:

Professor Vlatko Ceric
Faculty of Economics
University of Zagreb
Trg J. F. Kennedy 6
YU - 41000 Zagreb, Yugoslavia
Tel: +38 41 231 111
Fax: +38 41 235 633

SimuSolv*

MODELING AND SIMULATION SOFTWARE

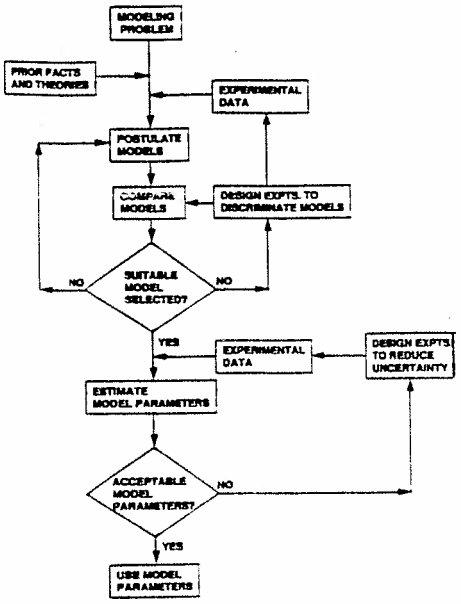
The SimuSolv* computer program supports and facilitates model-generation, simulation, parameter-estimation and optimization. The ACSL* programming language makes SimuSolv easy and intuitive to use.

Areas of application include chemical, pharmaceutical and environmental protection. For VAX, IBM, and SUN, this software will soon be available on IBM RS 6000 computers.

For detailed information on SimuSolv, ACSL and related systems, contact:

Rapid Data Limited
Crescent House
Crescent Road
Worthing
West Sussex, BN11 5RW

Tel: 44 903 202819
Fax: 44 903 820762
Tlx: 87651 RADATA G



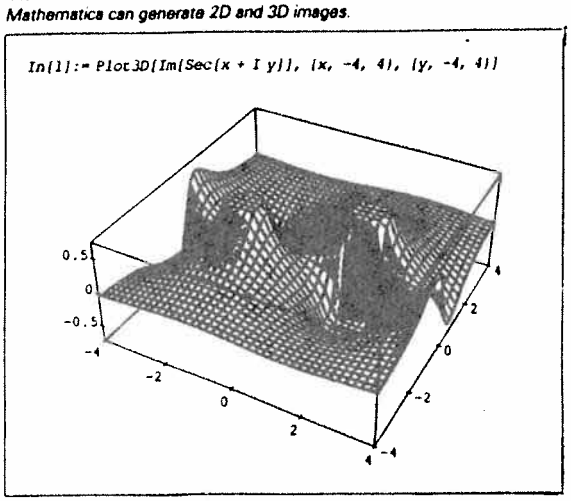
* SimuSolv is a trademark of The Dow Chemical Company. ACSL is a product of Mitchell & Gauthier Ass. Inc.

MATHEMATICA

Mathematica is a general system for numeric, symbolic and graphical computation. It is used by researchers, students, engineers, analysts and others, both as an interactive calculation tool and as a programming language. Numeric capabilities include arbitary-precision arithmetic, and matrix manipulation.

Mathematica manipulates formulas directly in algebraic form, performing such operations as symbolic equation solving, integration, differentiation, and power series expansion. Extensive graphics capabilities allow Mathematica to generate two-dimensional plots, contour plots and shaded colour three-dimensional pictures.

Visualization
Mathematica can generate 2D and 3D images.



For further details, please contact:

Rapid Data Limited
Crescent House
Crescent Road
Worthing
West Sussex
BN11 5RW

Tel: 44 903 202819
Fax: 44 903 820762

RAPID DATA

IMACS - The Association for Mathematics and Computers in Simulation

Due to recent events and at the demand of a great number of participants, the location of the

IMACS-IFAC MCTS'91
Symposium on Modelling and Control of Technological Systems, May 7-10, 1991

has been changed from Casablanca to Lille (France). The address of the symposium secretariat is as follows:

IDN Cite Scientifique - BP 48
F - 59651 Villeneuve d'Ascq Cedex, France

For all inquiries please contact the secretariat or directly Prof. P. Borne at IDN (address as above).

Please find in the following some details on the

IMACS World Congress 1991
Dublin, July 22-26, 1991

For this Congress special sessions were arranged by experts from all over the world on the following topics (in alphabetical order with the session organizers appearing in parentheses):

- Advances in parallel processing (Hiromoto)
- Approximation theory (Brezinski, Nashed, Heinig)
- Approximation theory and its applications (Kansa)
- Artificial Intelligence (Cappellini)
- Biological systems (Rossi)
- Biomedical modelling (Eisenfeld)
- Bond graph modelling (Breedveld)
- Boundary integral methods (Pröβdorf)
- Chaotic behaviour (McComb, Kapitaniak, Newell, Awrejcewicz)
- Combustion (Chung)
- Computer in medicine (Polak)
- Computational acoustics (Ding Lee, Papadakis)
- Computational chemistry (Babary, Defanceshi, Lan-Zhen)
- Computational complexity (O Dunlaing)
- Computational elasticity (Kawai, Duvaut, Ivanov, Stenberg, Crane)
- Computational electromagnetics (Nakata, Miya, Razek, Krajewski, Munro, Trowbridge, Lee)
- Computational fluid dynamics (Zhuang, Tcheremissine, Arboqst, Bates, Dey, Lundquist, Markatos, Piva, Povinelli, Znaty, Laurien, Sod)
- Computational medicine (Witten)
- Computational methods (Taha, El-Gendi, O'Callaghan, Ortiz, Parter, Stephan, Tasheva)
- Computational methods in economic decision making (Rustem)
- Computational plasma physics (Blum)
- Computer arithmetics (Moore, Vignes, Kulisch, Markov, Ullrich)
- Computer assisted teaching (Makinson)
- Control (Gorez, Troch, Hanus, Neittaanmäki, Nashed)
- Control theory (Grujic)
- Crystals (Schneider)
- Decision support systems and qualitative reasoning (Jakeman, Singh, Zimmer)
- Dynamic modelling and control of national economies (Okuguchi)
- Dynamic modelling and control of economic systems (Erol)
- Economics (Collani, Matrosov)
- Environment (Patterson, Sydow)
- Expert systems in computation (Rice)
- Graphics (Slater)
- Grids (Dervieux, McCartin, Steinberg, Mullen)
- Image processing/vision (Hirsch)
- Industrial applications (Clark)
- Inverse problems (Chavent, Chen)
- Kinematic equations in physics (Raviart)
- Manufacturing (Tzafestas, Jugel, Hoffmann, Mamalis, Slahor, Levner)
- Mathematical methods (Oustaloup, Kaczorek, Schnack, Avula, Bjorner, Gatteschi, Rodin, Stephan)
- Mathematical modelling (Riganti)
- Mathematical programming (Gondzio)
- Modelling and computation in electronics (Elschner)
- Modelling of electrical machines and converters (Robert)
- Neural computing (Choukri, Herault)
- Neuro computing (Lee)
- Nonlinear systems (Kluwick)
- Neural networks (Grujic)
- Numerical analysis of heat and mass transfer (Sarma)
- Numerical analysis of semiconductor devices (Holden, Gadiyak, Neittaanmäki, Polsky, Reklaitis)
- Numerical analysis of semiconductor devices (Polsky)
- Numerical methods (Goerisch)
- Optimization (McKeown, Zilinskas, Lüder, Marti)
- Optimization, theory and applications (Dunwoody)
- Ordinary differential equations (Butcher, Cash)
- Parallel algorithms (Kincaid, Farrell, Peskin, Greening, Mikolajczak, Nicol, Petiton, Saltz)
- Parallel computers (Leca, Schönauer)
- Partial differential equations (Voyevodin, Ames, Langer, Schmidt, Vichniac)
- Robotics (Troch, Tzafestas, Lewis)
- Scientific computation (Van de Houwen)
- Signal processing (Härle, Mehrmann, Aristov, Bendig, Kerdiles, Nashed)
- Simulation (Tzafestas, Bennett, Huber, Javor, Ma Jihu, Midvidy, Wood, Ratto, Zimmer, Guasch)

- Singular perturbation problems (Farrell, Boglaev, Cash, Tobiska)
- Software Forum (Crans)
- Stability (Akhmerov, Cahlon)
- Stability theory (Grujic)
- Symbolic computation (Harper, Wood)
- Symbolic coupling (Steinberg)
- Thermal systems (Burger, Michalski)
- Transport processes (Cushman)

In addition 302 papers have been accepted for presentation. All details concerning fees, accommodation etc. may be recieved from

IMACS'91 Congress Secretariat
26, Temple Lane
Dublin 2 Ireland

SCS - The Society for Computer Simulation

Standards Group Met

The Real-Time Computer System Simulation Standards Committee of the Society for Computer Simulation has held its second meeting in Anaheim, January 24, 1991. SCS Members and non-members from government, industry, or academies who are interested in real-time computer simulation were invited.

According to the Chairman of the RTCSSSC, Lance A. Kilar (Energy Director, Encore Computer Corporation, Ft. Lauderdale, FL, USA), this meeting focussed on technical areas where standards do not exist but where they seem to be needed. The results of two industry surveys undertaken, in the six months prior to the meeting, by committee members, was used as a basis for the committee to determine the direction, scope, and form of standard making activity to be undertaken.

The RTCSSSC is one of the four standards formulation committees organized under the Vice President for Industry of the Society for Computer Simulation (SCS).

European SCS Conferences' Update

June 17-19, 1991, The Panum Institute Copenhagen, Denmark: **ESM 91, 1991 EUROPEAN SIMULATION MULTICONFERENCE**:

At present more than 210 abstracts have been received for this year's Multiconference, which signifies that this year's edition will probably equal the one from last year in Nuremburg. The hottest topics this year are methodology, distributed and parallel simulation and simulation in industry and commerce.

August 20-22, 1991 Nice, France: **IBPSA BS'91 BUILDING SIMULATION**:

This conference solely devoted to Building Energy Simulation, has reveived 156 abstracts, of which 104 have been accepted for presentation. Subjects cover the whole spectrum of the appliance of computer simulation in the field of Building Research coupled to intelligent buildings.

September, 1991 Vienna, Austria: **SIP 1, SIMULATION IN PRACTICE**:

Nine speakers have declared their willingness to give a three day tutorial for people from industry and six companies are going to provide in depth hands on training.

November 6-8, 1991 Ghent, Belgium: **ESS 91, 1991 EUROPEAN SIMULATION SYMPOSIUM**:

This year's European Simulation Symposium will again focus on Intelligent Process Control Simulation. The other subject is still in debate, but should be decided by the end of this month.

June 1-4, 1992 York, United Kingdom: **ESM 92, 1992 EUROPEAN SIMULATION MULTICONFERENCE**:

As you can see from the heading, the dates for the 1992 European Simulation Multiconference, have more or less been finalised, and so has the venue. Formal finalisation of the venue will take place in March. Topics that are going to be presented so far are: Simulation of Computer Systems, Simulation in Energy and Japanese Simulation Research. If you have any ideas for further topics you would like to see presented, feel free to contact us at the address below.

Conference Report ESS90

The autumn sun was streaming low through the paned gothic windows when the first participants registered for the 1990 European Simulation Symposium. As it was fairly nippy outside, we pointed them in the direction of the coffee pots to warm up. Meanwhile, back in the registration area, the exhibitors arrived. Following PSI (from the US), Meiko (from the Netherlands) and the Cimulation Centre (from the UK), a bookbinding firm from Belgium showed up, which wanted to acquaint the participants with the possibilities of its facilities.

We started the proceedings at 10.30 a.m. with a presentation by Ramana Reddy, from West Virginia University, who talked till 12.30. You could hear a pin drop. In the afternoon, we were then treated to a truly excellent talk by Professor Stephanopoulos, from MIT. He really had his audience spell-bound. So much so that his interlocuters had to be shepherded down into the magnificient Medieval Hall for cocktails.

Day two, and a creeping element entered the conference: The wooden floor. As we split into two groups. Group two moved upstairs and thus provided an element of creaking floorboards into the general make of things. Guess who covered the distance to his chair this time, seemed to be the favourite guessing game.

Late afternoon, and the bus was ready to take the participants on to the university of Ghent, where they were to be subjected to several elaborate demonstrations given by Hans Vangheluwe, Lode Vermeersch, Danny van Welden and Derek Verwey at the Department of Applied Mathematics on the DESIRE project and by Mr. Montazeri at the Department of Management on their routing software.

When evening came, we went on foot through the picturesque streets of Ghent in search of food. We reached the "Vier Tafelen" (Four Tables) restaurant, (they do have more than four tables, you know), where we spent the rest of the night enjoying a splendid meal consisting of various international dishes.

On Saturday, things came to a close at midday. Still during the afternoon, for the stout at heart there still was the Phd Student Symposium where young researchers in the field of simulation met and exchanged ideas on their current research. Afterwards, we found out that this initiative was very much appreciated and we therefore will continue what we have started (thanks here again to Hans Vangheluwe).

During the conference, a meeting was also held of the Continental European Simulation Council. The bylaws were discussed as were the practicalities of a European SCS members' council.

(Philippe Geril)

Two New Publications from SCS

MODELLING AND SIMULATION 1990

This year's softbound companion to the annual Simulation Multiconference contains 135 papers and covers subjects like Simulation Methodology, Languages and Architectures, Distributed Simulation Tools, Applications, Computer Integrated Manufacturing, Simulation in Energy Systems, Simulation in Biology and Medicine, and Simulation of Computer Systems. Edited by Bernd Schmidt, this book numbers 789 pages and contains 135 papers. Price: $75.

INTELLIGENT PROCESS CONTROL AND DISCRETE EVENT SIMULATION

This softbound introduces a new set of conferences specially dedicated to fully-integrated intelligent process control simulation. The published softbound contains 42 papers and counts 249 pages. In the group Intelligent Process Control it covers subjects like Methodology, Fuzzy Simulation and Control, Intelligent Control Environments, Knowledge-Based Simulation and Control and Knowledge-Based Scheduling. Discrete Event Simulation covers areas like: Methodology, Applications, Modelling Techniques for Manufacturing Systems and Case Studies. Edited by Ghislain C. Vansteenkiste, Eugen J. Kerckhoffs, Henri Muller (-Malek) and Fernand Broeckx. This softbound numbers 249 pages and contains 42 papers. Price: $55.

Both books are available from SCS.

For further information contact:

SCS, c/o Philippe Geril,
University of Ghent,
Coupure Links 653,
B-9000 Ghent, Belgium.
Tel/Fax: +32.91.23.49.41

Simulation Activities at the Institute of Circuit Theory and Telecommunication, Technical University of Denmark

The Institute of Circuit Theory and Telecommunication has been involved in the development of computer software for electrical circuits and system analysis and synthesis since 1963.

The first program released for use outside the institute was the linear semi-symbolic network analysis program ANP1 (1967) for the determination of transfer- and driving-point network functions as rational functions of the complex frequency s. Based on the numerator and denominator polynomials the zeros and poles and the frequency characteristics were given as output. ANP1 was based on the topological tree expansion method by Mason. Later the concept was changed from a topological approach to a matrix and eigenvalue approach based on the extended node equation formulation and the QR algorithm by Francis. From the poles and zeros the numerator and denominator polynomials of the network functions are found together with the systems in the frequeny and/or time domain for arbitrary excitations. The ideal operational amplifier is available as a built-in model together with all four kinds of controlled sources and passive elements as resistors, conductors, inductors and capacitors. The latest version of this program is named ANP3. It is available in a version for IBM compatible PCs (size of EXE-file approx. 180 kbytes).

For general circuits and systems the nonlinear analysis program NAP2 has been developed. It is a numerical program which calculates any user specified relation between system variables in the time and frequency domains. The program is based on the extended node equation formulation with node potentials and impendance branch currents as primary variables. It is able to handle all kinds of controlled sources including the ideal operational amplifier and control with the time-derivative of a signal. The system parameters (elements, controlled sources etc.) may be specified as arbitrary functions of e.g. other parameters, signals, time and frequency. Sparse matrix techniques and a variable order variable step implicit integration method makes the program well suited for simulation of large stiff systems. Among the program features the optimization of the DC-bias point for transistor circuits may be mentioned. NAP2 is available in a version for IBM compatible PCs (size of the EXE-file approx. 260 kbytes).

For the design of analog and digital linear electrical filters and circuits the LCP2 program has been developed. By means of an optimization loop the program can either compensate for the application of non-ideal circuits components or make the circuit responses approximate some ideal measured specifications. The input data for the program is a specification of the target responses together with the structure and component values of an initially designed circuit. The output consists of a set of corrected component values according to a minimum of some error function which may be chosen to be of the least square, the least "p" or the mini-max type. Tables and plots of the resulting functions are optional. LCP2 is available in a version for IBM compatible PCs (size of EXE-file approx. 220 kbytes)

Erik Lindberg
Institute of Circuit Theory and
Telecommunication
343 Technical University of Denmark
DK - 2800 Lyngby
Tel: +45 45 93 12 22 3650
Fax: +45 45 93 03 55

Simulation Activities at ElektronikCentralen; Horsholm; Denmark

ElektronikCentralen (EC) is an independent, non-profit organization under the auspices of the Danish Academy of Sciences. Its main objectives are to contribute to innovation in electronics, and to provide the application of electronics in industry and society in general.

Since its start in 1967, EC has been active in research within the field of electronics for Danish as well as international companies and organizations. EC's activities span a broad range of disciplines from material and component technology through design of electronics to equipment testing.

Numerical analysis has always been an important activity at EC. Modelling, simulation, optimization and parameter extraction are parts of all its activities. Because of the multi-disciplinary character of the projects, it soon became evident that commercially available simulation software was not general enough to describe and analyse the great variety of problems. This was the reason for initiating the development of simulation software at EC.

Early experiences in software development and numerical analysis resulted in an ESA-project in 1979, where EC was requested to develop a simulator for the analysis of combined electrical and thermal problems which are typical in compact light-weight space electronics. The result of this project was the ESACAP simulation program (European Space Agency Circuit Analysis Program). The Program at that time implemented on a VAX system was characterized by a flexible description language combining structural description (node/branch) with functional and behavioural description facilities. The idea was to allow all branch values to be arbitrary functions of all system variables and their time derivatives, thereby establishing any nonlinear relationship between the variables.

The ESACAP program was a success and soon became an important tool at EC. Since then, a significant number of new description facilities and numerical algorithms have been added and ESACAP is now implemented on PCs under DOS in a 200-variable version. The hierarchical language is a combination of a net-list description and a high-level computer language including "if-then-else" structures and do-loops. In addition to the PC-version, ESACAP is available on HP9000 and APOLLO workstations in a size capable of simulating large systems.

Beside the use of ESACAP as an important in-house facility, EC now markets and sells the program. EC also organizes seminars on modelling and simulation techniques with ESACAP. EC offers on contract, guidance and assistance in connection with simulation of all types of inter-disciplinary systems. Especially in connection with ESACAP, this activity has been very successful. The domain-specific skills of the customer combine very efficiently with the simulation program designers' intimate knowledge of the software capabilities and limitations.

The modelling and simulation activities with ESACAP have included electro-optical devices, electrical/mechanical problems in connection with electrical machines, non-linear components with ferro-magnetic hysteresis, stability analysis of actively controlled fluid loops for heating and cooling systems, chaotic systems, just to mention a few.

In addition to the ESACAP inter-disciplinary simulation activities, EC is one of the leading centers for the design of custom specific micro-electronics in Denmark. Software includes the Daisy simulation system. Sun Sparc 1 and 2 stations are available.

For more information on the EC simulation activities, please contact:

Paul Stangerup
ElektronikCentralen
Venlighedsvej 4
DK - 2970 Horsholm, Denmark
Tel: +45 42 86 77 22
Fax: +45 42 86 58 98

Simulation Activities within the Department of Electronics and Electrical Engineering University of Glasgow - A Footnote

The November 1990 issue of EUROSIM Simulation News Europe included a brief presentation of activities in Glasgow. Those who saw that item may be interested to know that on 23rd January 1991 a new centre was opened in the Department involving a link-up with a German manufacturer. The Parsytec Parallel Processing Centre is a joint venture between the Department of Electronics and Electrical Engineering and Parsytec and is based upon a 400,000 pounds Parsytec Supercluster which the company has installed.

The department has plans to use the system for a variety of projects including simulation of nano-electronics and opto-electronic devices, computational fluid dynamics simulation and the modelling of biological neural networks.

Further details may be obtained from:

Miss A.I. MacKinnon
Computer Manager
Department of Electronics and Electrical Engineering
University of Glasgow
Glasgow G12 8QQ
Scotland U.K.
Tel: +44(0)41 339 8855 Extn. 5232
Fax: +44(0)41 330 4907

Simulation Work at CIMRU, U.C.G.

Research in CIM (Computer Integrated Manufacture) has been ongoing at University College Galway for over ten years now. In 1987, this research activity was formally organized into the CIM Research Unit. The CIM Research Unit is now heavily engaged in industrially based research and development funded by private companies, European Economic Community managed programmes such as ESPRIT (European Strategic Programme for Research and Development in Information Technology) and BRITE (Basic Research in Industrial Technology for Europe) and Irish government funded R&D programmes. CIMRU is heavily involved in the Irish government funded AMT (Advanced Manufacturing Technology) programme. In this regard CIMRU is changed with the responsibility of making CIM technology available to Irish industry.

CIM is a diverse area. CIMRU is particularly concerned with Production Management Systems (including Buisness Planning, Master Scheduling, Factory Co-ordination FC), Production Activity Control (PAC), Computer Aided Process Planning for assembly operations, FMS and FAS design and CIM architectures. CIMRU uses simulation, meaning digital computer simulation, for two purposes:

1. To support the design of FMS and FAS
2. To provide "real time" decision support tools at the master scheduling and FC/PAC levels.

In recent years we have extended our involvement in decision support tools to develop qualitative simulators using AI tools (in particular frame based systems) to support business planning and the development of manufacturing strategies. All of our work on simulation is oriented towards the solution of actual industrial problems. We tend to use commercially available tools such as SIMAN/CINEMA, SLAM, SIMFACTORY, PC MODEL, WITNESS, in order to train students in the simulation methodology. In terms of research we have been involved in the development of goal directed data driven simulators for manufacturing applications. We developed a tool known as FASDT (Flexible Assembly System Design Tool) which allows a user to define a Flexible Assembly System (FAS) in terms of operationally significant data and to then define the "goal" of the FAS in terms of, for example, throughput rates. The system looks at the output of a particular FAS design, as revealed by the simulator and suggests to the user some changes to the FAS configuration in order to meet the defined goal. In effect an expert system, developed using a production rule language (namely OPS5), sits at the back end of the simulator, generates suggestions based on the results of a "run" on the model and those suggestions, if accepted by the user, are automatically delivered to the model prior to the next simulation run. FASDT exists in prototype form on a VAX/VMS machine and has been partially tested with industrial data.

CIMRU has had a particular interest in Petri Net based simulators. Our interest stems from our need to create shop floor level simulators which facilitate the testing of various PAC solutions. Using software building blocks based on Petri Net models of generic shop floor modules, we developed a simulation generator to allow us to test particular PAC systems. The simulation generator creates a simulation model of the execution layer of a PAC system and allows the PAC control layer to be tested. This tool has been used to develop PAC systems for an electronics assembly cell and a six machine FMS. CIMRU has also been involved in the extention of Petri Net concepts into so called Decision Point Petri Nets, which in turn can be used to create simulators to support the design of FMS and FAS.

In summary then the work of CIMRU is concentrated on manufacturing systems analysis and design. A relatively new activity, but one which we think will be important for us in the future is that of qualitative simulation to support high level manufacturing strategy analysis using AI tools such as Knowledge Craft.

Contact:

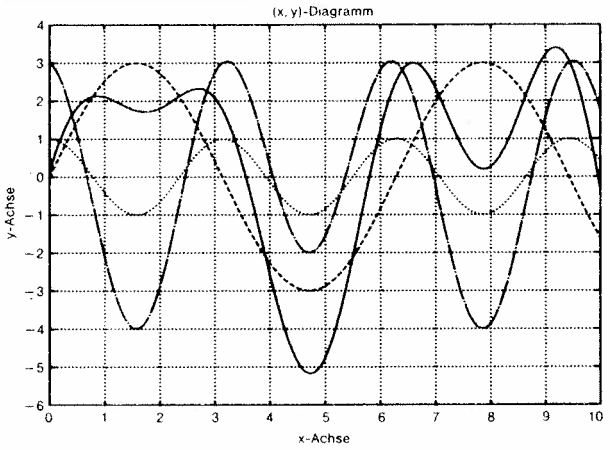
Prof. J. Browne,
CIM Research Unit,
University College Galway,
Ireland
Tel: +353 91 24411
Fax: +353 91 25700
E-Mail: ESPBROWNE@ESPRIT.UCG.IE

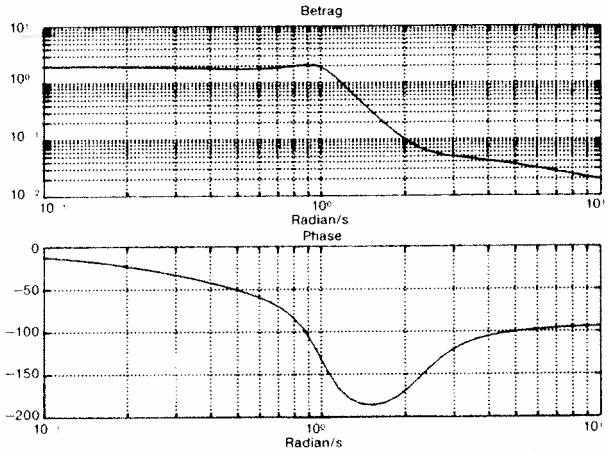
MATLAB Mathematiksoftware für den Ingenieur

Anwendungsgebiete:

- Gleichungsdefinition
- Formelauswertung
- graphische Darstellung
- Auswertung von Versuchsdaten
- Entwicklung von Algorithmen
- Eigenwertrechnung
- Matrizenarithmetik
- Polynomarithmetik
- elementare Statistik

MATLAB (MATrix LABoratory) unterstützt Ingenieure und Naturwissenschaftler bei mathematischen Berechnungen. Es ist einfach anzuwenden und ersetzt in vielen Fällen die zeitaufwendige Eigenprogrammierung. MATLAB-Toolboxen sind leistungsfähige Zusatzwerkzeuge für Spezialanwendungen. Durch die Entwicklung eigener Funktionen in MATLAB-Sprache läßt sich MATLAB an das Aufgabengebiet des Anwenders anpassen.





Eigenschaften:

- Interaktive Anwendung mit einfacher Syntax
- Speichern und wiederverwenden benutzereigener Funktionen
- Lesen und Schreiben von ASCII-Dateien
- Anbinden von FORTRAN- und C-Programmen
- Versionen für XT-, AT- und 386-PCs
- Ausgabemöglichkeit auf vielen graphischen Geräten

Toolboxen:

SIGNAL PROCESSING TOOLBOX, Funktionen für die Signalverarbeitung
CONTROL SYSTEM TOOLBOX, klassische und moderne Regelungstechnik
SYSTEM IDENTIFICATION TOOLBOX, parametrisch und nichtparametrisch
ROBUST CONTROL TOOLBOX, Analyse und Entwurf robuster Regler

Preise ohne MwSt.:

PC-MATLAB DM 1.250,–; 386-MATLAB DM 2.650,–; Toolboxen DM 490,– bis 1.190,–
Preise für Universitäten auf Anfrage.
MATLAB and PC-MATLAB are trademarks of The MathWorks, Inc.

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Comparison of Simulation Software

In the last issue (November 1990) EUROSIM-Simulation News Europe started a series on comparisons of simulation software.

This idea has become a great success: Based on simple, easily comprehensible models special features of modelling and experimentation within simulation languages, also with respect to an application area, are being compared.

In this issue the first results for "**Comparison 1: Lithium-Cluster Dynamics under Electron Bombardment**" are published. Here we would like to thank all the authors who solved the problem and sent in their contributions. Some of the reports contained complete descriptions of various experiments and different modelling approaches. Therefore we have excerpted abstracts from the reports received. Those who are interested in the full descriptions of the comparisons may write to the editors. If many people are interested we will consider to edit a special issue containing the full contributions. Reports on Comparison 1 will be continued to be published in the next issue, so please send in your contribution for simulation languages that have not yet been introduced.

Comparison 1 - Physical background

The "Lithium-Cluster Dynamics Model" describes the behaviour of defects under electron (and photon) bombardment of alkali halides. Among many others, one of the important consequences of these electronic defects is the desorption of surface atoms. The understanding and the control of such electronic desorption processes is essential for these materials when used in an environment of intensive radiation such as lasers.

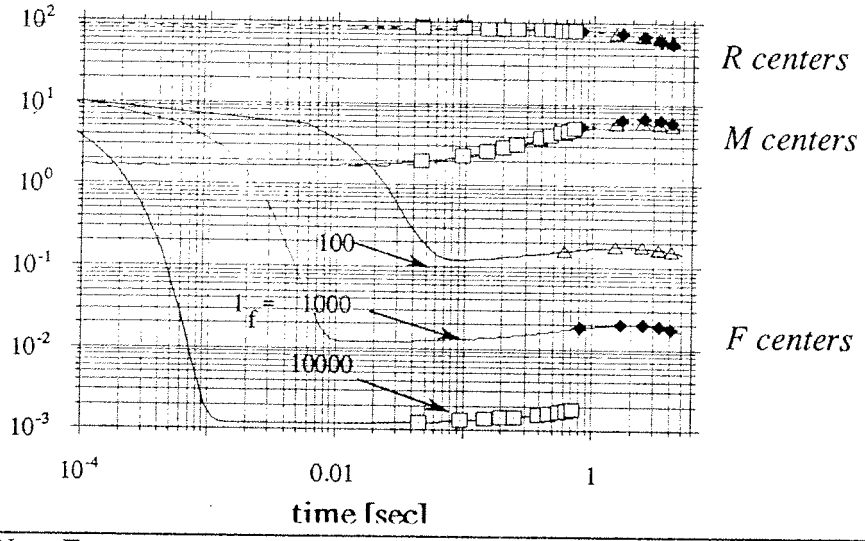
During exposure to radiation F centers are created in the surface and near surface bulk region of the crystal. The diffusion time of these F centers to the surface at elevated temperatures is very fast (msec timescale). It is a good assumption that every F center reaching the surface creates an neutral alkali atom which can desorb if the temperature is sufficiently high. In the experiments which are simulated by the model system discussed here the desorbing alkali atoms (Li) have been monitored with a quadrupol mass analyzer or via Laser Induced Fluorescence. (The temperature of the LiF crystal was 400°C to assure fast F center diffusion and evaporation of every Li atom created at the surface by a F center). Hence the amount of detected desorbed Li atoms is identical with number of F centers.

The essential experimental observation is that after irradiation (production term set to 0 in the equations) the amount of desorbed Li drops by one to two orders of magnitude but lasts for several tens of seconds beyond irradiation. Furthermore, provided the experimental para- meters are set accordingly, a maximum in the desorption yield has been observed several seconds after beam turn off. This result must be imaged by the F center behaviour. Because the F center diffusion is so fast, the experimental data imply that F centers must be "stored" in so called agglomerates which are formed from - and can then disintegrate into - F centers. In reality agglomerates with many constituents can form. For simplicity only those with two and three atoms (M and R centers) are included here (We have shown that a good quantitative description can be obtained considering at least F_9 centers, the qualitative behaviour can be already seen with R centers).

The experimental parameters in the present simulation represented by the k_r, l_f..... values and initial conditions have been chosen in such a way that the characteristic (experimentally observed) maximum in F center concentration is qualitatively simulated. In order to "see" the maximum, however, a logarithmic plot of the concentration axis is needed, because otherwise the prompt decay by more than one order of magnitude would mask the maximum.

The model has been simulated with Mathematica using the standard Runge-Kutta package on a Macintosh II Si with floating point accelerator.

Wolfgang Husinsky, Institut für Allgemeine Physik, Technische Universität Wien, Wiedner Hauptstraße 8-10, A - 1040 Wien, Austria



Comparison 1 - ESACAP

Simulation carried out by means of the simulation program ESACAP at ElektronikCentralen, Denmark:

ESACAP is a general purpose program for simulation of non-linear dynamic systems. The first version of ESACAP (ESA Circuit Analysis Program) was developed in 1979-80 for the European Space Agency (ESA) by ElektronikCentralen, Denmark.

Problems are formulated in terms of a structure (nodes/branches) and/or arbitrary expressions. Besides node potentials and branch-flow, a so-called auxiliary variable can be specified.

Differential equations may be introduced by means of the auxiliary variable. If one of the variables can be isolated on one side, the procedure is straightforward. Otherwise, a pseudo-explicit expression is formed.

For example:

$F(x, y, dx/dt, dy/dt) = 0, G(x, y, dx/dt, dy/dt) = 0$

becomes:

$x = x + F(x, y, dx/dt, dy/dt), y = y + G(x, y, dx/dt, dy/dt)$

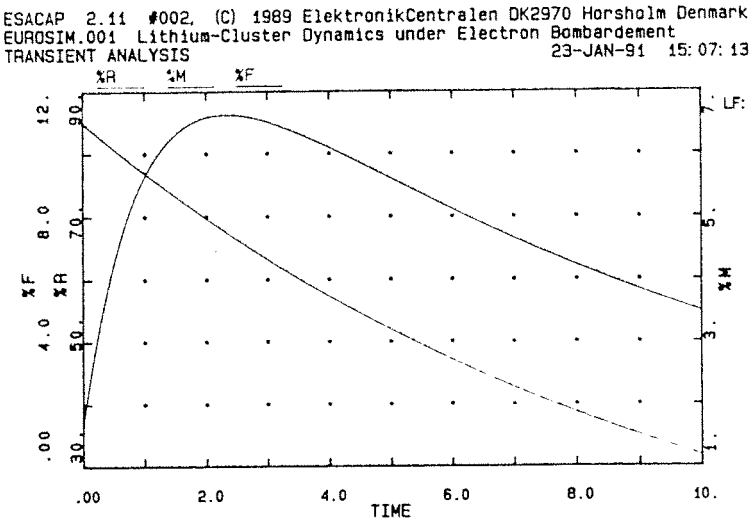
ESACAP employs numerical integration implemented as backward differential formulas of max order 6. Order and steplength are controlled by the relative truncation error. Non-linear systems are solved by a combined gradient/Newton method.

The ESACAP formulation of the actual problem is as follows:

```
KR = 1; KF = .1; LF = 1000; DR = .1; DM = 1; P = 1E4;
%R = %R-%R'-DR*%R + KR*%M*%F;
%M = %M-%M' + DR*%R-DM*%M + KF*%F*%F-
     KR*%M*%F;
%F = %F-%F' + DR*%R + 2*DM*%M-KR*%M*%F-
     2*KF*%F*%F-LF*%F + P;
```

The prefix % indicates a system variable and '(apostrophe) stands for time-derivative.

The graphics presentation of the results from task a) is shown in the figure.



The task has been run on a PC under DOS with a 80387 math. co-processor. CPU time for the numerical calculations is masked by the time needed for I/O operations. An impression of the numerical effort may be gained from the following table in which the four numbers in each entry indicate: entry 1: number of integration steps, entry 2: number of equation factorizations, entry 3: number of substitutions (new right hand sides), entry 4: total operation count (number of double precision multiplications)

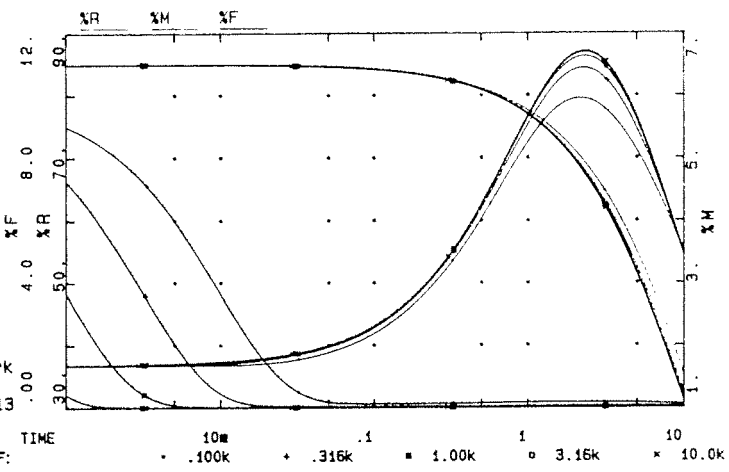
Order / Error	1	2	3	4	5	6
1e-3	118	59	53	51	51	51
	122	63	57	55	55	55
	237	118	105	102	102	102
	1321	669	600	581	581	581
1e-5	1043	204	124	105	106	106
	1051	212	132	113	114	114
	2091	410	250	214	216	216
	11528	2290	1410	1207	1218	1218
1e-7	10271	843	316	208	185	185
	10279	851	324	216	193	193
	20547	1689	632	416	370	370
	113036	9322	3516	2328	2075	2075

The next figure shows the results from task b). The graphic shows logarithmic time and parameter steps. The experimentation commands for the parameter sweep are:

```
$INIT: %F=9.975; %M=1.674; %R=84.99; END;

$PARAMETERS:
TIME=0,10; HFIRST=5E-5; ERROR=1E-7; MAXORD=6;
SWEEP(LF=1E2,1E4,LOG:2); END

$PLOT:
X(.001,10,LOG:50)=TIME;
Y(AUT)=%R!;  Y(AUT)=%M!;  Y(AUT)=%F!;  END;
```



The steady state solution during constant bombardment for different values of p is computed by the following experimentation commands (in the time domain):

```
$PARAMETERS: ERROR=1E-7; SWEEP(P=0,1E4,1E2); END;

$PLOT:
X=P;     Y(AUT)=%R!;  Y(AUT)=%M!;  Y(AUT)=%F!;  END;
```

Paul Stangerup, ElektronikCentralen, Venlighedsvej 4, DK-2970 Horsholm, Denmark. Tel: +45 42 86 77 22. Fax: +45 42 86 58 98

Comparison 1 - NAP2

Simulation Language

ANP3 & NAP2 - A package for circuits and system simulation.

An old idea: If you set up your differential equations and algebraic equations on an ideal analog computer then you may use an electronic circuit analysis program for the simulation.

The ideal integrator is modelled as a capacitor loaded current source. The voltage of the capacitor is the time integral of the current.

For "Comparison 1: Lithium-Cluster Dynamics under Electron Bombardment" the following input file for a general purpose electrical and electronic circuit analysis program is produced (model and experiment description):

```
*circuit; *list 2, 9;                    : file EUROSIM1.NAP;
:
*: Comparison 1: Lithium-Cluster Dynamics under Electron Bombardement >
: ref. EUROSIM - Simulation News Europe, pg.25, Number 0, November 1990
:
:integrating capacitors;
:
          cr 1 0 1 : vcr = v1 = r(t), R-center conc.;
          cm 2 0 1 : vcm = v2 = m(t), M-center conc.;
          cf 3 0 1 : vcf = v3 = f(t), F-center conc.;
:
: dr/dt = -dr*r + kr*m*f;
:
          irr  0 1 -0.1      vcr : dr = +0.1;
          irmf 0 1 +1.0*vcm vcf : kr = +1.0;
:
: dm/dt = +dr*r - dm*m + kf*(f**2) - kr*m*f;
:
          imr  0 2 +0.1      vcr : dr = +0.1;
          imm  0 2 -1.0      vcm : dm = +1.0;
          imf  0 2 +0.1*vcf vcf : kf = +0.1;
          immf 0 2 -1.0*vcm vcf : kr = +1.0;
:
: df/dt = dr*r + 2*dm*m - kr*m*f - 2*kf*(f**2) - lf*f + p
:
          ifr  0 3 +0.1      vcr : dr = +0.1;
          ifm  0 3 +2.0      vcm : dm = +1.0;
          ifmf 0 3 -1.0*vcm vcf : kr = +1.0;
          ifff 0 3 -0.2*vcf vcf : kf = +0.1;
lf=1.0e3;
.lf=1.0e2 : redefine lf;
          iff  0 3 -1.0*lf   vcf : lf = 1000;
:
: ebomb /tab2/ 0 1,  10  1,   10  0,   20  0;
:
:           gp   0 3  0    )=1e+4*ebomb(time);
:
  *modify  v1=84.99,   v2=1.674,  v3=9.975  : initial condition;
:            r(0)        m(0)       f(0)
  *time  0  10                 : variable order variable step integration;
  *tr vnall *plot(+50) v1 v2 v3  >     : linear time scale
            *plot(-50) v1 v2 v3  >     : logarithmic time scale
            *plot(+50) control.st        control.or 0 10  >
            *plot(-50) control.st        control.or 0 10     *probe ;
                     integration step   intgr. method order
:
  *run  hold cycle=500  minstep=1e-20  step=1n
: *end
:
: variation of parameter lf
: ------------------------
  *modify vnall=0, iall=0                  : reset solution   ;
  *modify  v1=84.99,   v2=1.674,  v3=9.975  : initial condition;
  .lf=2.0e2
  *run  hold cycle=500  minstep=1e-20  step=1n
: ------------------------
```

Please observe that it is not necessary to draw the equivalent circuit scheme. The integrating capacitors are given values 1 and placed between the reference node 0 and the nodes 1, 2 and 3. The coefficients of the differential equations are modelled as controlled current sources: ix <from-node> <to-node> <value> <control>.

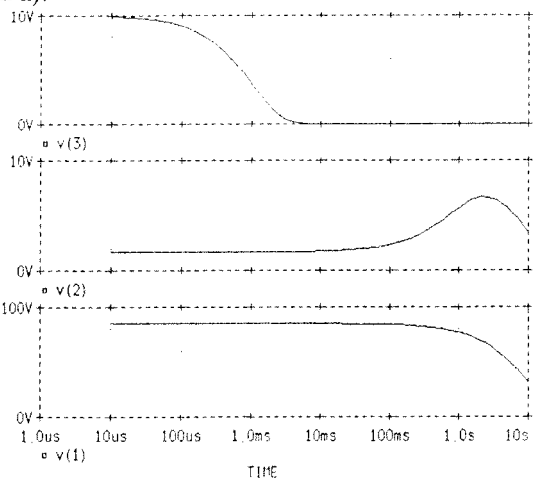
The actual electronic circuit analysis program used (NAP2) is based on the extended node equations formulation. The integration method used is a modified Gear method with variable order variable step integration. The size of the program is: 256.143 kbytes. The computer used is IBM AT compatible. Operating system: DOS 3.30. Main processor: Intel 80386, Co-processor: Intel 80287. Norton computing index relative to IBM/XT: 25.6. Disk index: 3.4.

The following table summarizes the integration effort of the stiff system over [0,10].

```
initial integration-step = minstep = 10*1e-6 = 10usec
-----------------------------------------------------

final time ..................................   10.00 sec
nr. of integrationsteps .....................   54
nr. of iterations ...........................  125
nr. of rejected steps .......................    1
max. nr. of iterations pr. integration step ..   25
nr. of NO CONVERGENCE .......................    0
total cpu-time consumption ..................    4.56 sec
```

The figure shows a simple simulation of the system in the interval [0, 10] sec with the given initial conditions (task a).



The parameter sweep (task b) is formulated within the model description, the Gear integration method works with sufficient accuracy for all values of l_f.

Steady state calculation is performed by time domain computation over [0,1000] with following experimentation description and results (l_f = 1000, p = 10000:)

```
*MODIFY  V1=0,    V2=0,    V3=0 : INITIAL CONDITION;
         r(0)     m(0)     f(0)

initial integration-step = 1nsec
minimum integration-step = 1e-20
--------------------------------

final time ..................................  1000.00 sec
max. nr. of iterations pr. integration step ..   25
total cpu-time consumption ..................    88.10 sec

nr. of integrationsteps ..................... 2896
nr. of iterations ........................... 1.83e+4
nr. of rejected steps .......................  985
nr. of NO CONVERGENCE .......................    3
solution at final time
                        1    9.998667D+02  r(1000)
                        2    9.998793D+00  m(1000)
                        3    9.999996D+00  f(1000)
```

Erik Lindberg, Institute of Circuit Theory and Telecommunication, 343 Technical University of Denmark, DK - 2800 Lyngby. Tel: + 45 45 93 12 22 3650. Fax: + 45 45 93 03 55

Comparison 1 - ACSL

ACSL (Advanced Continuous Simulation Language) is a widely used language obeying the CSSL-68 standard for simulation languages. ACSL consists of an ACSL precompiler translating ACSL syntax into FORTRAN and a runtime interpreter handling the generated simulation object program.

Model Description:

```
PROGRAM EUROSIM EXAMPLE No. 1
' Language ACSL Level 9, Mitchell & Gauthier Ass., U.S.A.'
' prepared by Dr. Ingrid Bausch-Gall, January 2nd, 1991 '
CONSTANT kr = 1., kf = 0.1, lf = 1000., dr = 0.1, dm = 1., p = 0.
CONSTANT fnull = 9.975, mnull = 1.674, rnull = 84.99 $ 'init. cond.'
ALGORITHM IALG = 2        $ 'take Gears stiff for integration '
CINTERVAL CINT = 0.05     $ 'store results at multiples of CINT'
CONSTANT TEND = 10.       $ 'simulation time'
' -------- model equations -------- '
    r = integ(-dr*r + kr*m*f,rnull)
    m = integ(dr*r - dm*m + kf*f*f -kr*m*f,mnull)
    f = integ(dr*r + 2.*dm*m-kr*m*f-2.*kf*f*f-lf*f+p,fnull)
TERMT(T.gt.TEND)          $ 'stop at simulation time'
END
```

ACSL-Runtime-Commands:

```
' a) Comparison of computer time '
prepar t,r,m,f                $ 'store results of these variables'
s ialg = 1                    $ 'calc. with ADAMS-Moulton method'
spare $ start $ spare         $ 'give computer time'
s ialg = 2                    $ 'choose now Gear's stiff'
spare $ start $ spare
s ialg = 9                    $ 'one step Runge-Kutta order 4/5'
spare $ start $ spare
' b) Parameterstudies '
s ialg = 2                    $ 'choose Gears Stiff for parameterstudies'
s lf = 1.e2
start
s nrwitg = .t.                $ 'write all results on one file'
s lf = 1.e3
start
s lf = 1.e4
start
s title = 'Example EUROSIM 1, Parameterstudies '
s title(11) = 'lf = 1.e2 (1), 1.e3 (2), 1.e4 (3)'
s ftsplt = .t.,symcpl = .t.,npccpl = 40
plot f,'xhi' = 10.,'char' = '1'    $ plot results
' c) Calculate steady state result '
s p = 1.e4
analyz 'list' = .t.,'trim'
s p = 0.
analyz 'trim'
stop
```

Results:

All calculations have been done on a Commodore PC-40(AT) with 12 MHz and a 80287 numeric co-processor.

Comparison of computer time (task a):

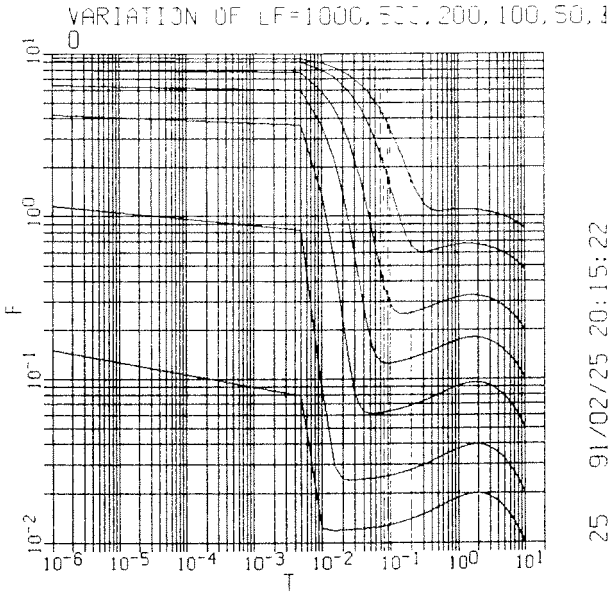
Adams-Moulton-Predictor-Corrector Method, IALG = 1 — 155.055 sec.

Gear's Stiff, IALG = 2 — 3.460 sec.

Runge-Kutta order 4/5 with stepsize control, IALG = 9 — 55.035 sec.

Parameterstudies:

The parameter sweep may be fromulated either "manually" at runtime level (see runtime commands) or automatically by programming a loop in the model description. The following figure shows the results of the parameter sweep with seven different values.



Calculate steady state result for $l_f = 1000$:

ACSL offers within the frequency domain analysis the TRIM command for the calculation of steady states (by means of iterative solution of $0 = \dot{x} = f(x)$). The results in this iteration (see also runtime commands) are:

p = 1.E4 gives as last iteration:

```
Newton step 0.24366500 Steep desc step 0.11443300 mu 0
State vector - iteration number 11
    F 10.0000000      M 10.0000000      R 1000.00000
Derivative vector - residual is 5.3226E-05 previous 0.02483470
    Scaled residual is 9.9485E-05 previous 0.04599450
    Z09996 5.1546E-05   Z09997 5.4854E-05   Z09998-5.3751E-05
```

p = 0. gives as last iteration:

```
Newton step 0.12913000 Steep desc step 0.06764160 mu 0
State vector - iteration number 8
    F-1.5045E-12      M-1.5373E-09      R 1.3290E-07
Derivative vector - residual is 1.3339E-08 previous 0.01348860
Scaled residual is 2.5906E-08 previous 0.02502220
    Z09996 1.1720E-08   Z09997 1.4827E-08   Z09998-1.3290E-08
```

Ingrid Bausch-Gall, BAUSCH-GALL GmbH, Wohlfartstraße 21b, D - 8000 München. Tel: +49-(0)89 3232625. Fax: +49-(0)89 3231063

Comparison 1 - FSIMUL

Description of FSIMUL

The blockoriented simulation package FSIMUL was developed at the Lehrstuhl für Regelungssysteme und Steuerungstechnik, Universität Bochum, FRG. The first usable version ran on a PDP 11 around 1975, the first effective PC version 1986 the actual version 1990 with windows, pulldown-menus, and comfortable editor functions. (Reference: K.H. Fasol, K. Diekmann (ed.): Simulation in der Regelungstechnik, Springer Verlag 1990.)

The numerical integration algorithms used are:

- Adams-Bashfort (2nd order) - AB
- predictor-corrector method (Adams-Bashfort Moulton) - PECE
- implicit method of Heun
- explicit method, Runge-Kutta (4th order) - RK4

Model description

The model (EUROSIM no. 0, November 1990, p. 25) was programmed on a 80386DX-25 w/ 80387 AT-type system, memory size 640 kB, VGA graphics board.

Model description (listing and graphical representation):

```
FSIMUL   IBM   5.0
-------------------------------------------------------------
file: d:\fsimul\sim\lithium.sim
model: Lithium-Cluster Dynamics under Electron Bombardement
-------------------------------------------------------------
parameters     no.   ,typ,inputs                  ;commentary

K   :1000.0    1     ,CON,                        ;lf=1000.0
K   :1.0000    2     ,CON,                        ;kr=1.0
K   :0.1000    3     ,CON,                        ;kf=0.1
K   :0.1000    4     ,CON,                        ;dr=0.1
K   :1.0000    5     ,CON,                        ;dm=1.0
K   :10000.    6     ,CON,                        ;p=1.0E4

IC  :84.990    10    ,INT,-40 60                  ;r(t)
IC  :1.6740    20    ,INT,40 -50 70 -60           ;m(t)
IC  : 9.975    30    ,INT,40 100 -60 -90 -80      ;f(t)

               40    ,MUL,4 10                    ;dr*r
               50    ,MUL,5 20                    ;dm*m
               60    ,MUL,2 20 30                 ;kr*m*f
               70    ,MUL,3 30 30                 ;kf*f^2
               80    ,MUL,1 30                    ;lf*f

K   :2.0000    90    ,GAI,70                      ;2*kf*f^2
K   :2.0000    100   ,GAI,50                      ;2*dm*m

output: block no. 30

time parameters:  endtime:  10.0 sec.
                  stepsize: h=5.0E-4
```

Lithium-Cluster under Electron Bombardment

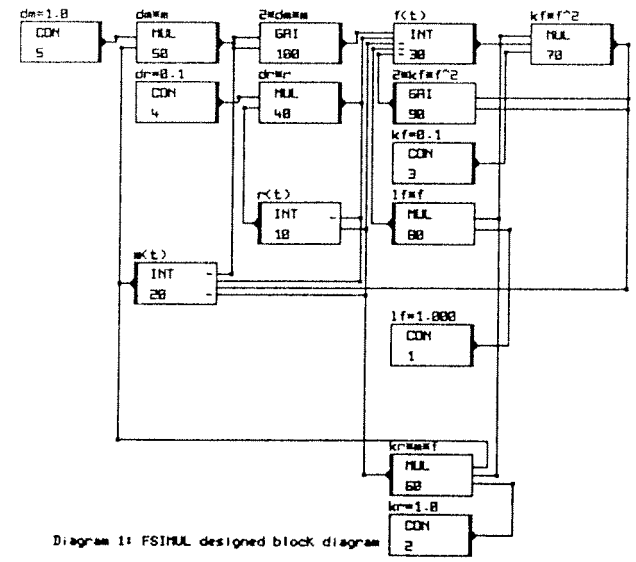


Diagram 1: FSIMUL designed block diagram

Results of the tasks

a) table of computing time (in sec.) depending on the integration algorithms with different stepsize

method	h=5.0E-4	h=1.0E-3	h=2.0E-3	h=3.5E-3
AB	104	-	-	-
PECE	163	-	-	-
Heun	182	90	-	-
RK4	187	93	48	39

(-) :numerically instable

b) parameter variation of l_f, the terminal values are:

l_f	f(t = 10 sec.)
1.0E2	0.1015
2.0E2	0.05076
5.0E2	0.02025
1.0E3	0.0101
2.0E3	0.005044
5.0E3	0.002016
1.0E4	0.001008

c) calculation of steady states (l_f = 1000), calculations in the time domain result in:

- during constant bombardment (p(t) = 1.0E4)
  f(t = 95 sec.) = 9.99
  f(t = 313 sec.) = 9.999
  f(t = 435 sec.) = 10.0
- without bombardment (p(t) = 0.0)
  f(t = 0.0023 sec.) = 1.005
  f(t = 0.0046 sec.) = 0.111
  f(t = 33.25 sec.) = 0.00101
  f(t = 79 sec.) = 1.0E-5

The figure shows the results of the parameter sweep:

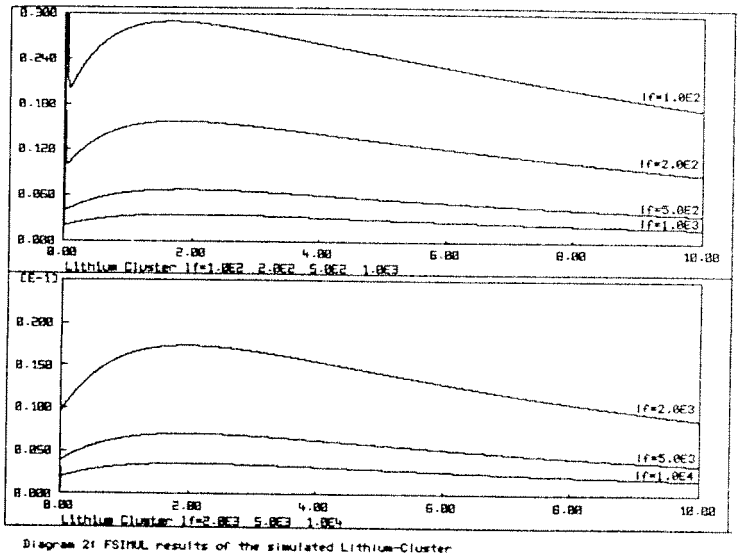


Diagram 2: FSIMUL results of the simulated Lithium-Cluster

K.H. Fasol, Lehstuhl für Regelungssysteme und Steuerungstechnik, Ruhr-Universität Bochum, Universitätsstraße 150, Geb. IB 3/152. Postfach 10 21 48. D - 4630 Bochum

Comparison 1 - SIMUL_R

SIMUL_R is a compiling simulation language for continuous and discrete systems. The system offers grafical and textual modelling, using one or more models in one simulation program. Examinations are done by using menus and/or a strong runtime interpreter.

The interpreter allows the usage of loops, command files (recursive, too) and arbitrary expressions with assignments and displaying. A special feature are user defined functions, which enable the user to add new commands to the system (commands for steady state, zero search, continuous and discrete optimization, statistical evaluations are available as well).

A huge grafical library supports among others moving plots, 3D-plots, niveau lines, cross plots (for displaying solutions of PDEs), animation for both, continuous and discrete systems.

SIMUL_R is an open system as it allows data input and output from and to other systems, including user input during simulation (by keys or grafical) as well as hardware in the loop.

Model description:

```
Lithium_Cluster {
 CONSTANT kr = 1, kf = 0.1, lf = 1000, dr = 0.1, dm = 1, p = 0;
 CONSTANT r0 = 84.99, m0 = 1.674, f0 = 9.975;
 CONSTANT tend = 10;

 DYNAMIC {
  DERIVATIVE {
    dr_r  = dr * r;
    kr_m_f = kr * m * f;
    dm_m  = dm * m;
    kf_f2  = kf * f * f;

    r = INTEG (- dr_r + kr_m_f, r0);
    m = INTEG (dr_r - dm_m + kf_f2 - kr_m_f, m0);
    f = INTEG (dr_r + 2*dm_m - kr_m_f - 2*kf_f2 - lf*f + p, f0);
  }
  TERMINATE t >= tend;          " termination condition "
 }
}
```

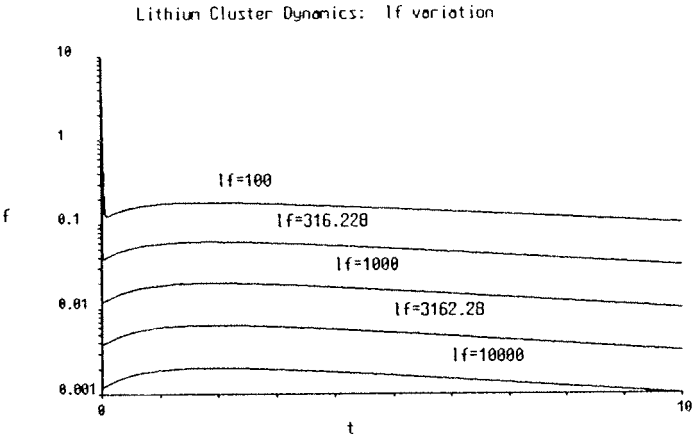
a) A relative comparison of some of SIMUL_R's integration algorithms (examinations are performed with SIMUL_R 1.13) results in:

Integration alg.	step width	time (rel to Euler)	rel. ac
Euler	0.001	1	$< 10^{-4}$
Euler (improved)	0.001	0.74	$< 10^{-4}$
Runge Kutta 4th	0.002	1.90	$< 10^{-4}$
implicit Euler	0.003	5.00	$< 10^{-4}$
implicit Euler	0.1	0.22 (!)	$< 10^{-2}$
Adams-Bashforth-Moulton (initial step width)	0.01	2.5	$< 10^{-4}$

b) The commands for the desired parameter sweep are:

```
prepare t,f,lf;                    " specify values to be prepared "
xline = 9; ynum = 3; yline = 3;    " plot legends "
number_text = true;
plot_text = 'Lithium Cluster Dynamics:  lf variation';
#horiz_screen                      " use horizontal plot legends "
#for lf_log = 2,4,.5#              " for loop: with exponents "
 lf = exp(lf_log*log(10));         " compute value 10lf_log for lf "
 cint = 1/lf;                      " set accurate step width "
 cstep = (int)lf/10;               " each cstepth point is recorded "
 start;                            " start simulation run "
  " plot f logarithmic over (0.001,10),  using t over  (0,tend)
    as x-axis, writing lf = ... to special positions of the curve "
 plot! (t(0,tend)) *f(0.001,10) = lf_log*2-2 : 'lf = '(lf);
 plot_del = false;                 " prevent deletion of last plot "
 axes_new = false;                 " avoid drawing new axes twice "
#end
plot;                              " recall the last plot "
```

The figure contains the corresponding plot.



SIMUL_R's TSCHEDULE command could have been used to set the step width to a higher value after the first computation steps (for integration algorithms with constant step width).

c) The commands for the steady state analysis and the results printed are:

```
lf = 1000;
p = 10000;
STEADY_STATE;
disp 'steady state for p = ',p,':',r, m, f;
```

steady state for p = 10000 : 1000 10 10

```
p = 0;
STEADY_STATE;
disp 'steady state for p = ',p,':',r, m, f;
```

steady state for p = 0 : 0 6.75016e-014 -1.38778e-017

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

R. Ruzicka, SIMUTECH, Hadikgasse 150, A-1140 Vienna, Austria. Tel: +43-(0)222-82 03 87; Fax: +43-(0)222-82 93 91.

Comparison 2: Flexible Assembly System

A new comparison in this issue deals with discrete simulation, a flexible assembly system. We invite all institutes and companies developing or distributing simulation software to participate in this comparison:

Please, simulate the model described and send a report to the editors in the following form:

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

Reports will be published in the next issues of EUROSIM - Simulation News Europe.

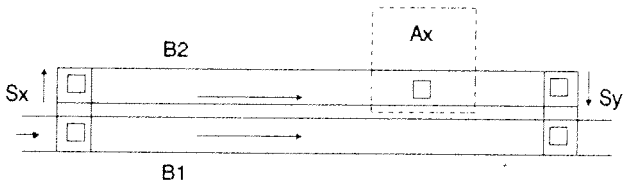
New comparisons will be prepared for the next issues, too. As it is difficult to find suitable "simple" models and relevant tasks we would like to ask you to contact the editors if you have an idea for a model to be compared in different simulation languages.

The following example of a flexible assembly system has been chosen because it checks two important features of discrete event simulation tools:

- the possibility to define and combine submodels,
- the method to describe complex control strategies.

The model consists of a number of almost identical submodels of the following structure (figure 1):

Figure 1



Two parallel conveyor belts, B1 and B2, are linked together at both ends. An assembly station Ax is placed at B2. Pallets are coming in on belt B1. If they are to be processed in Ax they are shifted in Sx to B2 and possibly enter a queue in front of Ax. If there is no more empty buffer space on B2 or the pallet is not to be processed in Ax it continues its way along B1. Parts that have been processed in Ax are shifted back to B1 in Sy, having priority over those coming from the left on B1.

The total system now consists of 8 of these subsystems, varying in length, operation and operation time (see figure 2). Between two subsequent subsystems there is a space of 0.4 m, whereas pallets from the third subsystem A2 can be shifted directly to A3, and from A6 directly to A1. The shifting parts, however, cannot function as buffers, i.e. a pallet can only enter an Sx if it can leave it immediately.

Figure 2

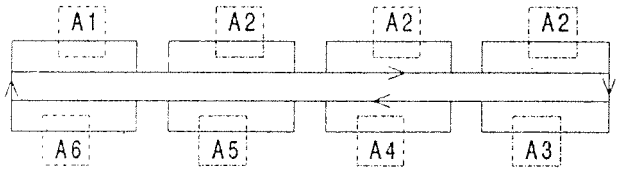


Table 1 shows the operation time of each station, the total length of B1 and the length of the buffer in front of the station.

Table 1

Station	Operation time (sec.)	Length of B 1 (m)	Length of buffer in front station (m)
A 1	15	2.0	1.2
A 2	60	1.6	0.8
A 3	20	1.6	0.8
A 4	20	1.6	0.8
A 5	20	1.6	0.8
A 6	30	2.0	1.2

There are three identical stations A2 in the system, because the operation in A2 takes much longer than the other operations.

Unprocessed parts are put on pallets in A1. They can either be processed in A2 first, and then in A3, A4, A5, or in A3, A4, A5 first, and then in A2. The sequence of operations among A3, A4, and A5 is arbitrary. Station A6 is a substitute for any of the stations A3, A4, A5, i.e. whenever one of these stations is down, or the buffer in front of it is free, the corresponding operation can be executed in A6. Finished parts are unloaded in A1, unfinished parts enter another circle.

All conveyors are running with a speed of 18 m/min., any shifting takes 2 sec., and pallet length is 0.36 m. Assuming that no station ever has a breakdown, the optimum number of pallets in the system is to be found. Therefore the total throughput and the average throughput time of the parts have to be evaluated, when 20, 40, and 60 pallets are circulating in the system.

To simplify comparison of results we suggest starting simulation experiments with empty pallets and collecting data from the 120th to the 600th minute (8 hours).

Calendar of Events

March 1991

26-28 **CEEDA '91 International Conference on Concurrent Engineering and Electronic Design Automation.** Bournemouth, U.K.
Contact: Michelle Bell, Department of Electronic Engineering, Dorset Institute, Wallisdown, Poole, BH125BB, U.K.

27 **UKSC meeting "Simulation in the Automotive Industry".** Solihull, U.K.
Contact: Elizabeth Rimmington, Computing Centre, Watts Building, Brighton Polytechnic, Moulsecomb, Brighton BN2 4GJ, U.K., Tel: +44-(0)273 600 900

April 1991

1-4 **8th International Conference on Mathematical and Computer Modelling.** University of Maryland, USA.
Contact: X.J.R. Avula, President IAMCM, University of Missouri, Rolla, Dept. of Engineering Mechanics, P.O. Bax 1488, Rolla MO 65401-0249

2-4 **IFAC Workshop on Modelling and Experimental Verification of Dynamics and Control of Flexible Aerospace Structures.** Huntsville, Alabama, USA.
Contact: Dr.S.M. Seitzer; Control Dynam. Company, Office Park South Suite 304, 600 Blvd South, Huntsville, AL 35802, USA

2-4 **IMACS International Symposium on Iterative Methods in Linear Algebra.** Brussels, Belgium.
Contact: R. Beauwens, Fac.des Sc.Appl., C.P. 165, Universite Libre de Bruxelles, Ave F.D. Roosevelt 50, B - 1050 Brussels, Belgium

1-5 **1991 Eastern Simulation Multiconference.** New Orleans, Louisiana.
Contact: Brian O'Neill, P.O. Box 17900, San Diego CA 92111. Phone: +1-619 277-3888

15-19 **EUROCAST '91. Second International Workshop on Computer Aided Systems Theory.** Krems, Austria.
Contact: Prof. F. Pichler, Institute for Systems Science, Johannes Kepler University, A - 4040 Linz, Austria. Tel: +43-(0)732 2468 896. Fax: +43-(0)732 2468 10

17 **UKSC meeting "Simulation in Robotics".** Middlesex Polytechnik, U.K.
Contact: Elizabeth Rimmington, Computing Centre, Watts Building, Brighton Polytechnic, Moulsecomb, Brighton BN2 4GJ, U.K., Tel: +44-(0)273 600 900

17-19 **International Training Equipment Conference.** Wiesbaden, Germany.
Contact: Richard Curtis, International Training Equipment Conference Limited, 10 Sambourne Road, Warminster, Wiltshire BA12 8LJ, U.K.

22-23 **ASIM Workshop. Group "Simulationsmethoden und Sprachen für parallele Prozesse".** Berlin.
Contact: Dr. H. Fuss, GMD, Postfach 1240, D - 5205 St. Augustin 1.

25-26 **ASIM Workshop. Group "Simulation und künstliche Intelligenz".** Berlin
Contact: Dr. J. Krauth, BIBA, Postfach 330560, D - 2800 Bremen 33

May 1991

2-3 **22nd Annual Pittsburgh Conference on Modeling and Engineering.** Pittsburgh, Pennsylvania
Contact: William G. Vogt, Modeling and Simulation Conference, 348 Benedum Engineering Hall, University of Pittsburgh, Pittsburgh PA 15261, USA

6-8 **3rd European Cars/Trucks Simulation Symposium.** Schliersee, Germany.
Contact: Moshe R. Heller, ASIMUTH GmbH, Planegger Strasse 26, Postfach 600438, D - 8000 Munich 60, Germany

7-10 **IMACS Symposium on Modelling and Control of Technological Systems.** Lille, France.
Contact: IMACS - MCTS Symposium, I.D.N., B.P. 48, F - 59651 Villeneuve d'Ascq Cedex, France

14-16 **4th North-Moravian International Symposium on Modelling and Simulation of Systems.** Vsetin, Czechoslovakia.
Contact: Jan Stefan, VS Banska, tr. 17. listopadu, CS - 708 33 Ostrava Poruba, Tel.: +42.69.4243132

21-24 **1991 ACM SIGMETRICS Conference on Measurement and Modelling of Computer Systems.** San Diego, California.
Contact: Prof. John Zahorjan, Dept. of Computer Science and Engineering, University of Washington, Seattle WA 98195

22-24 **5th Mediterranean Electrotechnical Conference melecon 91.** Ljubljana, Yugoslavia.
Contact: melecon 91 Secretariat, Fakulteta za Electrotehniko, Trzaska 25, YU - 61001 Ljubljana, Yugoslavia

29-31 **IFAC/(IFIP) Workshop on Computer Software Structures Integrating AI/KBS Systems in Process Control.** Bergen, Norway.
Contact: N.P. Sundby, Norwegian Soc. of Automatic Control, Kronprinsensgate 17, N - 0251 Oslo, Norway

June 1991

10-14 13th International Conference: **Information Technology Interfaces ITI-1991.** Dubrovnik, Cavtat, Yugoslavia.
Contact: Branko Radic, University Computing Centre, Conference Secretariat ITI 1991, Engelsova bb., YU - 41000 Zagreb, Yugoslavia. Tel: +38 41 510 09, Fax: +38 41 518 203

17-19 **European Simulation Multiconference ESM 91.** Copenhagen, Denmark.
Contact: Philippe Geril, European Simulation Office, University of Ghent, Coupure Links 653, B - 9000 Ghent, Belgium. Tel/Fax: +32-91 23 49 41

17-21 **28th Design Automation Conference.** San Francisco, California.
Contact: Alfred Dunlop, Program Chair, 28th DAC, MP Associates Inc., 7490 Clubhouse Road, Suite 102, Boulder, Colorado 80301. Tel: +1-303 530-4333

19-21 **IFAC Workshop on Electric Power Systems Control Centers.** Semmering, Austria.
Contact: K. Schenk, Senior Director, Siemens Österreich AG, Gudrunstr. 11, A - 1101 Vienna, Austria

24-25 **IFAC Conference. Advances in Control Education.** Boston, Massachusetts, USA.
Contact: Mike Rabins, Mech. Eng. Dept., Texas A&M University, College Station TX 77843-3123, USA. Tel: +1-409 845-1251

26-28 **3rd IMACS International Symposium on Computational Acoustics.** Cambridge, Mass. USA.
Contact: Ding Lee, Code 3122, Naval Underwater Systems Center, New London CT 06320, USA

26-28 **1991 American Control Conference.** Boston, Massachusetts.
Contact: Timothy L. Johnson, GE Corporatio, R&D, KW-D217, P.O.Box 8, Schenectady NY 12301. Tel: +1-518 387-5096. Fax: +1-518 387-5164

26-29 **12th International Conference on Application and Theory of Petri Nets.** Aarhus, Denmark.
Contact: Kurt Jensen, Computer Science Department, Aarhus University, Ny Munkegade, Bldg. 540, DK - 8000 Aarhus C, Denmark

July 1991

8-12 **IFAC/IFORS Symposium on Identification & System Parameter Estimation.** Budapest, Hungary.
Contact: Eva Soos, Computer & Autom. Inst., HAS, Kende u. 13-17, H - 1111 Budapest

8-12 **ICIAM 91, 2nd International Conference on Industrial and Applied Mathematics.** Washington, D.C., USA
Contact: ICIAM 91 Conference Manager, c/o SIAM, 3600 University City Science Center, Philadelphia PA 19104-2688, USA. Tel: +1-215 3829800, Fax: +1-215 3867999, E-mail: iciam@wharton.upenn.edu

15-17 **5th IFAC/IMACS Symposium on Computer Aided Design in Control & Engineering Systems.** Swansea, U.K.
Contact: H.A. Barker, Dept. of Elect. and Electronic Engg, Univ. College of Swansea, Singleton Park, Swansea SA2 8PP U.K.

22-24 **1991 Summer Computer Simulation Conference.** Baltimore, Maryland.
Contact: Brian O'Neill, P.O. Box 17900, San Diego CA 92111. Tel: +1-619 277-3888

22-26 **13th IMACS WORLD CONGRESS on Computation & Applied Mathematics.** Dublin, Ireland
Contact: IMACS '91 Secretariat, 26 Temple Lane, Dublin, Ireland. Tel: +353 1 452081, Fax: +353 1 451739

August 1991

5-9 **14th International Symposium on Mathematical Programming.** Amsterdam, The Netherlands.
Contact: 14th International Symposium on Mathematical Programming, Paulus Potterstraat 40, 1071 DB Amsterdam, The Netherlands.

13-15 **IFAC Symposium on Distributed Intelligent Systems DIS '91.** Washington DC, USA.
Contact: Prof.A.H. Lewis, LIDS 35-410, M.I.T. Cambridge, MA 02139, USA

19-22 **EFMI/IIASA/IFAC International Conference. Medical Information Systems and Expert Systems.** Vienna, Austria.
Contact: K.P. Adlassnig, MIE '91 Secr. General, c/o Inst. f. Med. Computerwissenschaften, Garnisong. 13, 8. Hof, A - 1090 Vienna, Austria

20-22 **IBPSA BS'91 Building Simulation.** Nice, France.
Contact: Philippe Geril, European Simulation Office, University of Ghent, Coupure Links 653, B - 9000 Ghent, Belgium. Tel/Fax: +32-91 23 49 41

September 1991

2-6 **15th IFIP Conference on System Modelling and Optimization.** Zurich, Switzerland.
Contact: Karl Frauendorfer, Institut für Operations Research, Universität Zürich, Moussonstr. 15, CH - 8044 Zurich, Switzerland

2-6 **ECCTD-91. European Conference on Circuit Theory and Design.** Copenhagen, Denmark.
Contact: ECCTD-91, Institute for Circuit Theory and Telecommunication, 343 Technical University of Denmark, DK - 2800 Lyngby. Tel: +45 42 88 15 66, Fax: +45 45 93 03 55

4-6 **IFAC Symposium on Design Methods of Control Systems.** Zurich, Switzerland.
Contact: Prof.F. Kraus, ETH Zentrum ETL, CH - 8092 Zurich, Switzerland

7-9 **International Workshop on Software for Automatic Control Systems.** Irkutsk, USSR.
Contact: V.M. Matrosov, Director of the Irkutsk Computing Center, Siberian Branch, USSER Academy of Science, Lermotov Str. 134, SU - 664033 Irkutsk, USSR

10-13 **IFAC Symposium on Fault Detection, Supervision and Safety for Technical Processes SAFEPROCESS '91.** Baden-Baden, Germany.
Contact: Herbert Wiefels, VDI/VDE - GMA, Postfach 1139, D - 4000 Dusseldorf 1, Germany

16-18 **IFAC/IFIP/IMACS Symposium on Robot Control - SYROCO '91.** Vienna, Austria.
Contact: J. Hähnel, OEPWZ, Rockhgasse 6, A - 1014 Vienna, Austria. Tel: +43-(0)222 533 8636/0

18-20 **MMB'91: 6th Conference on Measurement, Modelling and Evaluation of Computer Systems.** Munich, Germany.
Contact: Axel Lehmann, Fritz Lehmann, Fakultät für Informatik, Universität der Bundeswehr München, Werner-Heisenberg-Weg 39, D - 8014 Neubiberg, Germany. Tel: +49-(0)89 6004 2648, +49-(0)89 6004 2280, Fax: +49-(0) 6004 3560.

23-25 **3rd IFAC Workshop on Artificial Intelligence in Real Time Control.** Napa, California, USA.
Contact: Prof. G.J. Suski, Lawrence Livermore Nat. Lab., 7000 East Ave, Livermore, CA 94550, USA

24-26 **7. Symposium Simulationstechnik, ASIM 91.** Hagen, Germany.
Contact: Dj. Tavangarian, FernUniversität Hagen, Fachbereich Informatik, LG Technische Informatik II, Postfach 940, D - 5800 Hagen 1, Germany. Tel: +49-(0)2331 804 8372, Fax: +49-(0)2331 804 313

25-27 **5th International Conference on Fault-Tolerant Computing Systems.** Nürnberg, Germany.
Contact: W. Hohl, IMMD III, Universität Erlangen-Nürnberg, Martensstr. 3, D - 8520 Erlangen, Germany. Tel: +49-(0)9131 857003. Fax: +49-(0)9131 39388

SIP1. Simulation in Practice. Vienna, Austria
Contact: Philippe Geril, European Simulation Office, University of Ghent, Coupure Links 653, B - 9000 Ghent, Belgium. Tel/Fax: +32-91 23 49 41

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2-4 **IFAC Workshop on Cultural Aspects of Automation.** Krems, Austria.
Contact: P. Kopacek, Inst. f. Handhabungsgeräte und Robotertechnik, Techn. Universität Wien, Karlsplatz 13, A - 1040 Wien, Austria.

8-11 **SYM-OP-IS'91.** Herceg Novi, Yugoslavia.
Contact: Vlatko Ceric, Faculty of Economics, University of Zagreb, Trg J. F. Kennedy 6, YU - 41000 Zagreb, Yugoslavia. Tel: +38 41 231 111, Fax: +38 41 235 633

13-16 **7th International Conference on Mechanics in Medicine and Biology ICMMB'91.** Ljubljana, Yugoslavia.
Contact: Cankarjev dom, Cultural and Congress Centre, Mrs. Maja Stojkovic, Kidricev park 1, YU - 61000 Ljubljana, Yogoslavia. Tel: +38 61 210 956, Fax: +38 61 217 431

17-18 Conference Seminar on **Functional Electrical Stimulation.** Ljubljana, Yugoslavia.
Contact: see ICMMB'91

16-19 **Workshop on Cardiovascular Dynamics** (Satellite Symposium of the 7th ICMMB'91). Tinje, Austria.
Contact: Prof. G. Juznic, Institute of Physiology, Faculty of Medicine, Zaloska 4, YU - 61105 Ljubljana, Yugoslavia

November

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

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June

1-4 **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

August

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

week from 28th to October 3
ESC '92, 4th European Simulation Congress. Capri, Italy.
Contact: Dr. Vincenzo Grassi, Dip. Ingegneria Elettronica, Università di Roma II, Via O. Raimondo, 8, I - 00173, Roma, Italy, Tel: +39-(0)6-79794477, Fax: +39-(0)6-2020519 .