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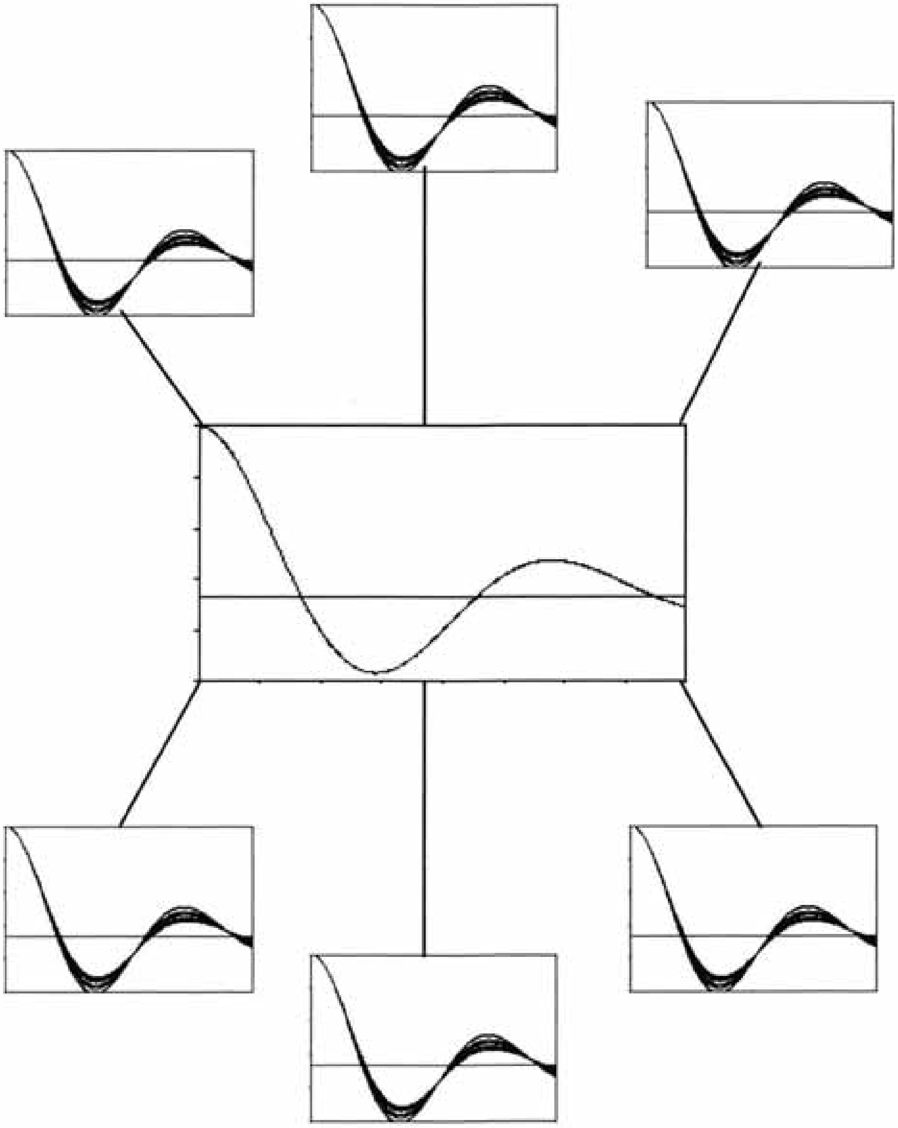

Number 10
March 1994

A EUROPEAN FORUM ON SIMULATION ACTIVITIES

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Readership Information

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If you have any contributions, remarks, suggestions, etc. please contact the editors. Deadline for the next issue will be May 31, 1994.

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EUROSIM - Simulation News Europe

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

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ARGE Simulation News

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Editorial

We are happy that the 1994 issues of the newsletter **EUROSIM - Simulation News Europe** will all have 44 pages. Due to the numerous contributions from the simulation societies and the solutions sent in for the software comparisons we were still not able to publish all material we received. We would like to thank all those who have contributed to this issue. Our special thanks go to F. Cellier for his interesting essay.

A new type of comparison is initiated on page 21, with particular emphasis on testing distributed and parallel simulation tasks. All readers are invited to take part in this comparison and send in their solutions. The software comparisons will be continued.

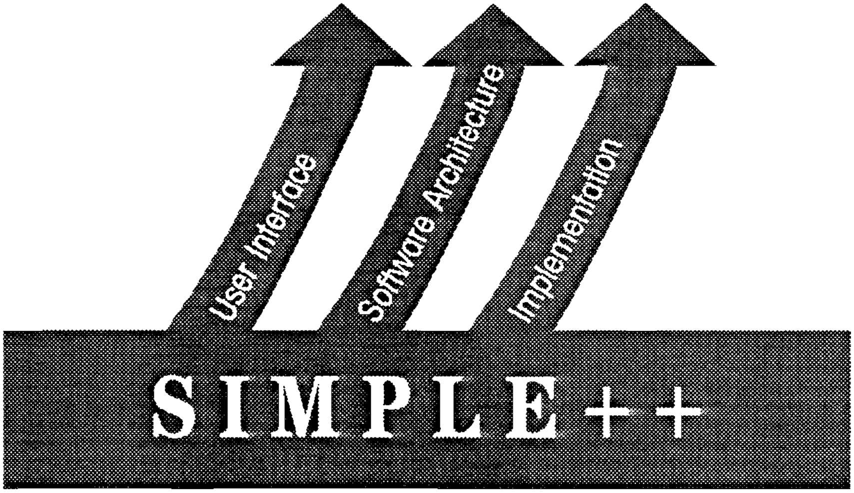
F. Breitenecker, I. Husinsky

Aims and Scope

The newsletter EUROSIM - Simulation News Europe publishes information related to simulation. It is distributed to all members of all European member societies. It contains essays on simulation, reports from EUROSIM and from the European simulation societies, reports from international societies, presentations of simulation centres, industry news, book reviews, a calendar of events. A special series on simulation comparisons gives an overview on features of simulation software and hardware. All contributions are selected and may be edited by the editors of the newsletter.

The new Class of Simulation Software

»Full Object Orientation«



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SIMPLE++ was developed by AESOP together with the Fraunhofer Institute for Production and Automation (IPA) and is based on over 10 years of experience in applying and developing simulation software.

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Fax (+49-711) 1 63 59 99
AESOP GmbH, Königstraße 82
D-70173 Stuttgart
Germany

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EUROSIM News

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

The following national and regional simulation societies form EUROSIM: ASIM - Arbeitsgemeinschaft Simulation (Austria, Germany, Switzerland), CSSS - the Czech and Slovak Simulation Society (Czech Republic, Slovak Republic), DBSS - Dutch Benelux Simulation Society (Belgium, The Netherlands), FRANCOSIM - Société Francophone de Simulation (Belgium, France), ISCS - Italian Society for Computer Simulation (Italy), SIMS - Simulation Society of Scandinavia (Denmark, Finland, Norway, Sweden), UKSS - United Kingdom Simulation Society (UK), and, as a new member, HSTAG, the Hungarian Simulation Tools and Application Group (Hungary).

EUROSIM is governed by a **Board** consisting of one representative of each member society. The Board elects officers, who are at present:

F. Breitenecker (ASIM)	president,
F. Maceri (ISCS)	past president,
R. Zobel (UKSS)	secretary,
L. Dekker (DBSS)	treasurer.

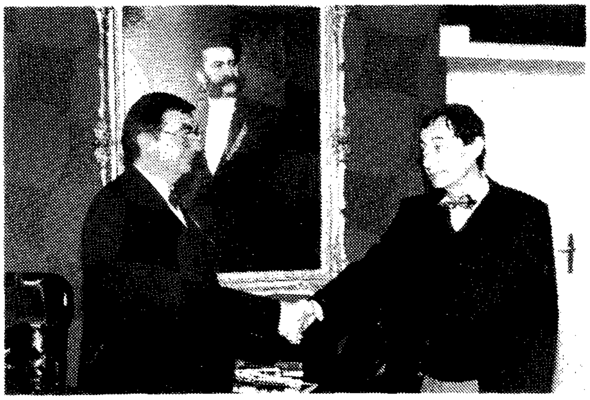
At the last Board meeting in Vienna on February 4 and 5, 1994, the following topics were discussed and decided: First of all, the application for membership from HSTAG, the Hungarian Simulation Tools and Application Group, was accepted unanimously. EUROSIM therefore has now eight members and has indicated its willingness to warmly welcome any new member that fulfills the conditions of admission. Decisions on other applications for membership and for the observer status were postponed.

The Board furthermore decided to try to stimulate simulation activities in Spain and Portugal and to intensify contacts to simulation groups in the reform countries, e.g. Latvia, Ukraine, Russia, Poland, etc.

Details of the forthcoming EUROSIM Congress were discussed. A preliminary announcement is available, a first call for papers will be printed soon.

In the following meeting of the Editorial Board of EUROSIM's scientific journal "**Simulation Practice and Theory**", Prof. L. Dekker, the Editor in Chief, reported on the success of the first three issues and gave an overview of forthcoming issues. Two associate editors were nominated: Prof. Dr. D. J. Murray-Smith (Glasgow University) and Dr. K. Juslin (VTT Finland). Authors interested in publishing in this journal are requested to contact the editor (Prof. L. Dekker, Noordeinseweg 61, 2651 LE Berkel en Rodenrijs, The Netherlands, Tel: +31-1891 12714, Fax: +31-1891 13883).

The **Proceedings** of the **EUROSIM '92** Simulation Congress (Editors: F. Maceri, G. Iazeolla), Capri, Italy, 28 September - 4 October 1992, appeared at Elsevier Science B.V., ISBN 0-444-89331-8.



Mr. Breitenecker, EUROSIM President (left), shakes hands with Prof. Jávor, head of HSTAG

Letter from the President

Dear Simulationists,

This is the third new-style **EUROSIM - Simulation News Europe** (SNE), the newsletter of the European simulation societies, which will have 44 pages from now on. This newsletter is also incorporated into the scientific journal "Simulation Practice and Theory", both being official publications of EUROSIM.

As a major point I would like to welcome HSTAG, the Hungarian Simulation Tools and Application Group, as a new member of EUROSIM. HSTAG, under the leadership of Prof. András Jávor, was unanimously accepted as a new member at the last Board meeting. I offer my personal congratulations to HSTAG and Prof. Jávor and am sure that the new member will enrich the work of EUROSIM substantially.

The next EUROSIM Congress, the "family meeting" of the European simulation societies, will be held in Vienna in September 1995. Please find a preliminary announcement on page 23 in this issue.

F. Breitenecker, EUROSIM President

Teaching Physical System Modeling at the University of Arizona

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Abstract

This paper deals with the subject of teaching university students the art of physical system modeling, a topic notoriously downplayed in the education of our future scientists and engineers. It is shown that, although modeling is truly an "art" and not a "science", it is not a "black art", i.e., it is a subject that can indeed be taught successfully, since it observes a set of general rules and practices - almost like a science. Moreover, computer programs can be provided that gently push the user towards following recommended procedures in the making of physically sound models, that help him or her in verifying the consistency and completeness of these models, and support him or her in detecting errors and unraveling shortcomings in them.

Introduction

Students are trained to accept the fact that a program is "incorrect" as long as it produces error messages during compilation or at run time, but they assume it to be "correct", as soon as these error messages have disappeared. I have rarely seen students in my career as a university teacher who would turn around once they received beautifully looking multi-colored graphs from their simulation program to check whether their model carries any physical meaning or not.

Simulation languages have traditionally been optimized for short user programs, thereby sacrificing all redundancy - and most possibilities to discover errors in the code. For example, few of today's simulation languages require variables to be declared. Thus, mistyping of variable names will often go unnoticed. You write:

$variable1 = par1 * cons2$
$variable2 = variable3 + par2 * varaible1$
plot $variable2$

... but don't despair! You'll still get nice multi-colored graphs. *Variable1* is now a variable that is defined but never used (well, why not!), and *varaible1* is another variable that is used but never defined ... but the simulation compiler is "helpful" - it simply defaults *varaible1* to 0.0, making *variable2* equal to *variable3*, which can be plotted beautifully and elegantly. Thus, the program "runs," and our student can turn to the next homework problem - after all, time is money, right?

Traditionally, most classes on continuous-system simulation offered at our universities have focused on the process of translating models into the format required by the simulation language in use. This trend was encouraged by simulation language manuals that do exactly the same. Simulation languages *are* very useful. They support the user in encoding his or her model, and offer nice interfaces to the numerical software (the integration algorithms) and to the graphing software. However, simulation languages offer no support at all for helping the user in getting his or her equations right - zero, nil, zip! Yet, this is the most difficult part of the overall system analysis cycle.

For these reasons, we, at the University of Arizona, have split the task of teaching modeling and simulation into two. In a first semester, the student is taught how to model physical systems, i.e., how to get the equations of his or her model right, and in the subsequent semester, the student is then taught the trade of simulating these previously obtained equations. Thus, the first semester [2] has a flavor of *theoretical physics*, instructing the student what to watch out for when applying his or her meta-knowledge to a particular situation or when turning experimental observations into mathematical equations, whereas the second semester [6] has a flavor of *applied mathematics*, training the student in techniques of numerical integration of ordinary differential equation (ODE) systems and differential algebraic equations (DAE) systems, the conversion of partial differential equations (PDEs) into sets of ODEs by the method-of-lines, simulation with noise, and problems in numerical and semi-analytical parameter estimation and state identification.

Modeling Software

While the process of *modeling*, i.e., the codification of knowledge about physical systems into mathematical equations, cannot usually be fully automated, this does not say that computers and computer programs have no part in that process. Modeling programs can:

- support the user in organizing partial knowledge about the physical system under study,
- help the user with identifying missing equations, i.e., pointing out to him or her which phenomena have not yet been modeled,
- aid the process of verifying internal consistency within equations, and cross-consistency between equations, and finally
- preprocess the model through symbolic formula manipulation to generate a syntactically correct and semantically sound simulation program.

Dymola

The most advanced of the currently available modeling tools is Dymola [2, 5, 7, 8]. We found that Dymola is a big help in teaching modeling to students.

Dymola supports the user in several different ways:

- Dymola forces the user to declare all variables (helas!), and provides valuable diagnostic aids during the model translation process.
- Dymola is object-oriented and thereby truly modular. It enables the user to encapsulate descriptions of physical phenomena in hierarchically structured model classes. True, most simulation languages offer a macro capability, but macros are a much less powerful concept. Dymola supports the construction of truly modular domain libraries of properly debugged component models representing task-relevant aspects of physical objects.
- Dymola supports the topological connection of subsystems. Topology is a powerful concept in ensuring model correctness. If the component submodels are correct, the topologically connected higher-level model is most likely correct as well. Humans are quite good at discovering wiring errors in topological descriptions, and Dymola again introduces helpful redundancy to ensure the discovery of wiring errors - as it is on purpose made rather difficult to squeeze a European 220 Volt plug into a U.S. 110 Volt socket, and vice-versa, Dymola provides mechanisms to ensure the compatibility between software "plugs" and software "sockets."
- Maybe most importantly of all: Dymola supports the use of *bond graphs* [1, 2, 3, 4, 10]. Bond graphs are a very powerful object-oriented tool for ensuring correctness of models of physical systems. Bond graphs model the flow of power through a physical system. Thereby, strict observation of the energy conservation law is automatically enforced, an important concept in model validation.

This last item gives rise to an interesting comment. When Hilding Elmqvist designed Dymola in 1978 [7], he did not think about bond graphs at all. Yet, the model definition and connection capabilities designed into Dymola turned out to be powerful enough to support bond graph modeling *without necessity to change a single line of code in the Dymola translator*. This fact alone is a strong argument in favor of object-oriented modeling. However, it is by no means the only one that can be made. The object-oriented approach to modeling allows complete encapsulation of all relevant properties of a physical object in a software module called a *model class*. Many domain-specific model classes can be stored together in a *domain library*. In this way, mathematical descriptions (models) of physical objects can be encoded and carefully debugged once and for all for the benefit of later users of these models. Very elaborate domain libraries have already been made available, e.g. one for modeling all kinds of tree-structured multi-body systems, such as robots [9].

For all these reasons, Dymola has become a major backbone in supporting my modeling class at the University of Arizona [2]. Since Dymola has been introduced into the class, the quality of student simulation programs as well as the student understanding of the mechanisms of modeling have been drastically improved. Also, the students love it! They are *highly motivated* in the class because they understand that their learning focuses around fundamental properties of physical systems rather than the nitty-gritty details of the - necessarily contemporary - syntax of a programming language.

Teaching bond graphs, a modeling technique that many engineers and scientists out in the field still shun away from because the graphical representation looks unfamiliar and non-intuitive to them, turned out to be easily accepted by students. Contrary to accomplished engineers and scientists who already know (or at least believe to know) how physical systems are to be modeled and who don't have either the time or the inclination to learn something drastically different unless they are forced to do so, students are open-minded. It is their *raison d'être* to digest new ideas and master new concepts, and they have plenty of time set aside for this task. They find bond graphs neither obscene nor otherwise repulsive, and once they got the hang of it, they turn quickly into experienced physical system modelers. The problem is *not* jotting down some equations and getting them to compile without producing error messages ... that is the easy part. The problem is what to do if these equations turn out to poorly reflect reality. How do you go about determining which part of the model is inappropriate and needs to be modified? Bond graph modelers have a much better chance of getting the model right the first time around, and they find it much easier to enhance/modify a given model in order to incorporate additional facets of reality into it.

It is the same as with programming in general. It is very hard to convince a programmer "of the old school", i.e., someone who grew up on Fortran and has years of experience in Fortran programming to try something new. The fact is that he or she indeed *can* program anything and everything in Fortran. However, it is easy to teach students structured programming, and they will undoubtedly and quickly become more reliable and efficient programmers in comparison with the old-timers.

Justification

Why is it important to train our students in the "art" of physical system modeling? Is it not true that a detailed and very specific domain knowledge is necessary for coming up with useful mathematical models in *any* domain? Do I truly and earnestly believe that I can turn my students into "renaissance men and women", into "scientists" who are at the same time mathematicians, physicists, engineers, and philosophers, i.e., into generalists that can compete with the domain specialists in solving the relevant problems of this world?

I believe strongly that there is still need for both the specialist and the generalist. It is true that in the past, at the time of an Isaak Newton maybe, it was possible for a physicist to know everything about all aspects of physics. At that time, there was no need for specialization. This is no longer true. Without the specialists who know everything there is to be known about a very small and specialized subset of physics, no true progress can be achieved any longer. Thus, the domain specialists have become an essential and valuable part of our scientific community, and indeed, there are many more specialists needed than generalists.

However, this does not mean that there is no longer any need for generalists at all. Many problems in science and engineering are interdisciplinary in nature. Our domain specialists usually suffer from a syndrome that the French call *déformation professionelle*. They feel so cozy and comfortable in their small niches of science that they have no inclination what-so-ever to look outside their realms and consider the interactions of their tiny empires with the larger world. This is where the generalists are still needed. Generalists are the mediators between domain specialists of different domains. They translate the language of one domain specialist to another. They look at the larger picture. It is also true that, even in this century, the most important new discoveries in physics were made by generalists rather than by specialists, and I predict that this will remain so.

A tree has many small branches and only one stem. The small branches are responsible for carrying the leaves and for keeping the tree alive. Small branches can eventually grow thicker and branch into new sub-branches. Yet, the overall shape of the tree can't be fundamentally changed by activities of the many small branches alone. Sometimes, an entirely new branch has to grow out of the stem directly, a branch that will then grow much more rapidly than the small branches and quickly develop an entire new subsystem of branches and sub-branches and leaves.

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EUROSIM Societies

ASIM

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

Reports from ASIM

The ASIM board met on December 3, 1993 in Kassel. Main topic was the election of speaker and vice-speaker. As already announced Ingrid Bausch-Gall and Felix Breitenecker were no candidates any more. New speaker of ASIM is Prof. D. Möller of TU Clausthal, vice-speaker Dr. Peter Schäfer of DAIMLER-BENZ in Berlin. Both persons are well known in their field and support ASIM actively since a long time.

Prof. Ameling, one of the founders of ASIM in 1981 and speaker from 1985 to 1991 was elected as honorary member. Herewith ASIM wants to thank Prof. Ameling for all his activities and his work during the founding and growing phase of ASIM. Without his work ASIM would not be what it is today.

Further points of discussion were finances, the organization of ASIM conferences, working group meetings and the structure of working groups. The ASIM board will meet again on April 11th, 1994 in Frankfurt.

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ASIM Meetings to come

March 24-25, 1994: Workshop of the ASIM working group "*Simulationssoftware und Simulationshardware*".

April 13-15, 1994: 7th Workshop of the working group "*Simulation und künstliche Intelligenz*" at DLR in Braunschweig.

April 28-30, 1994: 6. Ebernburger Gespräche of the ASIM working group "*Simulation in Biologie, Medizin und Ökologie*".

October 11-13, 1994: *9. Symposium Simulationstechnik* in Stuttgart. This is ASIMs 1993 German speaking conference. More information and contact address see below.

September 11-15, 1995: EUROSIM Congress at TU in Vienna.

Meetings with ASIM Participation to come

August 22-25, 1994: CISS - First Joint Conference of International Simulation Societies, ETH Zürich. Contact PD Dr. Jürgen Halin (address see above).

August 28 - September 2, 1994: *IFIP-GI-Jahrestagung 1994. Fachgespräch Simulationstechnik.* Contact Dr. Ingrid Bausch-Gall, Wohlfartstraße 21b, D-80939 München, Fax: +49-(0)89/3231063.

September 18-23, 1994: 18th Artificial Intelligence Conference KI 94 in Saarbrücken. For more information see report of the working group "*Simulation und Künstliche Intelligenz*".

9th Symposium on Simulation (ASIM 94)

This symposium will be organized in October 10-13, 1994, in Stuttgart, Southern Germany. It covers all aspects of modelling and simulation methods and tools, as well as the application of simulation in various technical and scientific areas. During the symposium an exhibition will show the state of the art in simulation hardware and software.

On the first day user groups will meet (ACSL, ADAMS, GPSS, MATLAB, MATRIXx, SIMAN, SPICE). Three tutorials will give an insight into Hardware-in-the-Loop-Simulation, Animation, Mechatronics.

Invited papers will be presented on simulation program interfacing, automotive simulators, simulation in chemical industry, modelling and simulation in molecular genetics, simulation in the GUS.

Participants will visit the Stuttgart Planetary Simulator and a traditional wine cave in the nearby Rems Valley (for animation and real taste).

Abstracts (1 to 2 pages, 3 copies) should arrive until March 1st, 1994. The conference language is German. The deadline for full papers (camera ready) is July 1st, 1994.

Further information can be obtained from:
Dipl.-Ing. (FH) Martin Kraus, Fachhochschule für Technik Esslingen, Flandernstr. 101, D-73732 Esslingen. Tel: +49-(0)711/397-3755, Fax: +49-(0)711/397-3763, E-mail: kraus@ti.fht-esslingen.de

Working Groups

"Simulationsmethoden und Sprachen für parallele Prozesse"

See also working group "*Simulation technischer Systeme*" for a joint report. The next workshop will be held later in the year 1995.

Speaker: Dr. Hans Fuss, GMD, D-53731 St. Augustin. Tel: +49-(0)2241/ 14-3125, Fax: +49-(0)2241/14-3006, E-mail: fuss@gmd.de

"Simulationssoftware und -hardware"

The next meeting of the working group will be held from March 24th to 25th 1994 at the University of Clausthal with the topic "The importance of simulation software and hardware in solving engineering tasks". Actual research results are presented by the invited speakers Prof. Dr. Ch. Zenger (Univ. of München), Prof. Dr. F. Durst (Univ. of Erlangen-Nürnberg), Prof. Dr. H. Burckhard (Technical Univ. of Hamburg-Harburg) and invited speakers from IBM, DEC, SGI, HP. Moreover soft- and hardware will be presented by different companies. An ACSL User Group Meeting will be held on March 23.

Speaker: Prof. Dr. Dietmar P.F. Möller, TU Clausthal, Institut für Informatik, Erzstraße 1, D-38678 Clausthal-Zellerfeld, Tel: +49-(0)5323/722402 or 722504, Fax: +49-(0)5323/723572

"Simulation und künstliche Intelligenz"

Advances in computers, software engineering, artificial intelligence, modelling and simulation have produced useful synergies to realize advanced modelling and simulation systems. The term "Simulation and AI" in ASIM in 1988 was a step in building a bridge between these two domains. During the last five years, we have held six workshops where we discussed two aspects: (1) The use of simulation in artificial intelligence studies i.e. simulation of cognitive processes, (2) The application of artificial intelligence in modelling and simulation.

However mainly the second aspect constitutes the subject of interest of our group. The state of the art in this subject is developing with an increasing acceleration. Some directions of research are the following:

- AI in modelling and simulation tools and environments, e.g. intelligent front-ends, use of object oriented paradigm
- providing advanced systematic concepts to build models
- qualitative modelling
- AI in modelling problems where it is difficult to invent a straightforward algorithmic approach
- modelling with incomplete and uncertain knowledge
- simulation with objects having perception abilities
- machine learning in interpreting simulation results, simulation of objects with learning abilities, simulated scenarios, etc.
- AI in analysis and validation of simulation models, e.g. application of genetic algorithms.

The working group does not use the term AI restrictively. With the emphasis put on simulation we are open for any new ideas and concepts, which may help to improve existing modelling methods and tools or to develop new ones. In our further activities we intend to establish more relations to industrial users of modelling and simulation methods and co-operate with other societies active in the domain of AI and simulation. We thank Dr. J. Krauth for being the speaker of the working group and initiating its activities for many years. The working group will come together to its yearly meeting on April 13 - 15 during the 7th workshop in Braunschweig.

We inted as well to intensify our co-operation with the AI community and organize a workshop within the 18th Artificial Intelligence Conference KI'94 Saarbrücken, September 18-23, 1994 : Methods and Concepts of AI in Simulation. I hope to see you at one of these two events.

Speaker: Dr.-Ing. Helena Szczerbicka, Universität Karlsruhe, Inst. für Rechnerentwurf und Fehlertoleranz, Postfach 6980, D-76128 Karlsruhe, Tel: +49-(0)721/608-4216, Fax +49-(0)721/370455, E-mail: helena@ira.uka.de.

"Simulation in Medizin, Biologie und Ökologie"

The 6th Ebernburg conference of the working group will be held from April 24th to 30th 1994 at the castle of Ebernburg, Bad Münster am Stein-Ebernburg, as a conference on environmental analysis and environmental informatics.

Actual research in modelling, simulation and identification of environmental systems, including modern methods like knowledge based technologies, genetic algorithms, neural nets, fuzzy logic etc. will be presented by invited speakers and selected papers. For participation or/and presentation please contact one of the organizers: Prof. Dr. D.P.F. Möller (address see above), Prof. Dr. O. Richter, Institute of Geoecology, Technical University of Braunschweig, Langer Kamp 19c, D-38106 Braunschweig, Tel: +49-(0)531/3915627, Fax: +49-(0)531/3918170.

Speaker: Prof. Dr. Björn Gottwald, Universität Freiburg, Fakultät für Biologie, Schänzlestraße 1, D-79104 Freiburg, Tel: +49-(0)761/203-289,1 Fax: +49-(0)761/203-2894

"Simulation technischer Systeme"

The working groups "*Simulationsmethoden und Sprachen für parallele Prozesse*" and "*Simulation technischer Systeme*" had their annual Spring Workshop at Vienna Technical University on January 31 and February 1, 1994. The meeting was hosted by Prof. Dr. Troch and Prof. Dr. Springer and the organization was in the hands of Prof. Dr. Breitenecker and Dr. H. Ecker.

This was the first time that both working groups met in a joint workshop to bring together specialists on both fields. The discussions showed that simulation methodologists and simulation applicants can very well learn from each other. The positive result of this experiment should encourage other working groups to organize joint meetings for theory as well as application oriented participants. The international presentations covered a broad variety of subjects, e.g. automotive fluids, control system applications, circuit simulation, comparison of parallel simulation, Petri nets, genetic algorithms.

In the evening of the first day a dinner brought together the 50 industrial and academic participants for personal and scientific discussions and for the exchange of simulation know-how. The papers of this workshop will be published as "*ASIM-Mitteilung No. 40*".

The 1995 workshop will be held at *Deutsche Aerospace Airbus GmbH* in Hamburg on Feb. 20 and 21, 1995.

Speaker: Prof. Dr.-Ing. Gerald Kampe, FHT Esslingen, Flandernstraße 101, D-73732 Esslingen, Tel: +49-(0)711/3511-3740 or -3741, Fax: +49-(0)711/397-3763, E-mail: kampe@fhti1.ti.fht-esslingen.de

"Simulation in der Fertigungstechnik"

The Working Group "*Simulation in der Fertigungstechnik*" produced a guideline for simulation technology with the title "*Handbuch Simulationsanwendungen in Produktion und Logistik*", published in December 1993 as volume 7 in "*Fortschritte der Simulationstechnik*", Vieweg Verlag, Wiesbaden, Germany (ISBN 3-528-06581-8). The book contains several contributions covering simulation applications and projects, gives a survey of present simulation instruments and discusses adjacent aspects such as data management and methods for result interpretation. Finally, the guideline offers an outlook of the future of simulation technology. The guideline specifically addresses potential users of simulation. Detailed information about the ASIM working group conference "*Simulation und Fabrikbetrieb*" held on 10th and 11th of February, 1993, in Aachen, Germany, is published as *ASIM-Mitteilungen, Heft-Nr. 37*. The next event organized by the ASIM Working Group will take place at the University of Nürnberg/Erlangen, Germany, in February 1995.

Speaker: Prof. Dr.-Ing. A. Kuhn, Fraunhofer-Institut, IML, Joseph-von-Fraunhofer-Straße 2-4, D-44227 Dortmund. Tel: +49-(0)231/9743-132, Fax: +49-(0)231/9743-23431

"Simulation in der Betriebswirtschaft"

Speaker: Prof. Dr.-Ing. W. Hummeltenberg, Universität Hamburg, FB Wirtschaftswissenschaften, Bundesstraße 55, D-20146 Hamburg. Tel: +49-(0)4123-4023, Fax: +49-(0)4123-6435

"Simulation von Verkehrssystemen"

Speaker : Mr. Karl-Heinz Münch, SIEMENS AG, Bereich VT2 CIR, Ackerstraße 22, D-38126 Braunschweig, Tel: +49-(0)531-226-2225, Fax: +49-(0)531-226-4305

Ingrid Bausch-Gall

CSSS

General Information

CSSS (Czech&Slovak Simulation Society) is a scientific non-profit association of Czech/Slovak speaking individuals professionally involved in simulation. CSSS has now about 70 individual members of Czech, Slovak and Hungarian nationality. At the end of 1993, the new Committee of CSSS was elected. Milan Kotva continues as Chairman, Mikolas Alexik as Vice-Chairman and Marcela Dedouchová as Treasurer of the Committee. Jan Stefan takes over as Scientific Secretary. Other Committee members are Pavel Cerny, Frantisek Hauser, Evzen Kindler, Zdena Rabova, Veronika Stoffova, Milan Straskraba and Milan Sujansky.

Activities

The Slovak Group of CSSS organized in 1993 a seminar on **Control, Modelling and Simulation of Systems** which was held on October 12-14 in Sulov. Altogether 33 papers were presented by domestic authors in six sessions. On the occasion of this seminar, a lot of new Slovak members entered CSSS. In 1994, a similar seminar will be held in Kosice (Slovakia).

From May 31 to June 2, 1994, the traditional (28th in the row!) Moravian-Silesian Conference on **Modelling and Simulation of Systems MOSIS'94** will be held in Zabreh in Moravia. More than fourty contributions in seven sessions are expected by the organizers. For further information contact the E-mail address **jan.stefan @ vsb.cz**.

The **9th Prague Symposium** on **Computer Simulation in Biology, Ecology and Medicine** will take place in Zurich (Switzerland) as a session of CISS - First Joint Conference of International Simulation Societies (August 22-25, 1994). Milan Kotva remains as Conference-Chair, Edward Dowd (World Health Organisation, Geneva) takes over as Program-Chair. Additional information can be requested via E-mail **dowd @ unicc.bitnet,** or **simul @ utia.cas.cz.**

The Local Steering Committee of the **European Simulation Multiconference ESM'95** continues its work. This meeting will be held on June 5-7, 1995 in Prague. Until now, Eugen J.H. Kerckhoffs (The Netherlands), Richard Zobel (United Kingdom), George J. Klir (U.S.A.), Ole-Johan Dahl (Norway), Sven E. Jørgensen (Denmark), K. Heinz Weigl (Austria) and Wolfgang Borutzky (Germany) promised to take over as Conference Chairmen. Further information can be obtained on the E-mail address **simul @ utia.cas.cz.** Call for Papers will be sent around in March-April 1994.

Contact Addresses

Milan Kotva (Chairman of CSSS)
Zeleny pruh 32, 147 00 Praha 4 - Branik
Czech Republic
Tel: +42-2 7992145 (office), +42-2 464179 (at home)
Fax: +42-2 7992318 or 763211 or 7934594
E-mail: simul @ utia.cas.cz

Mikolas Alexik (Vice-Chairman of CSSS)
VSDS-KTK, Velky diel, 010 26 Zilina
Slovak Republic
Tel: +42-89 54042, Fax: +42-89 54806
E-mail: alexik @ uvt.utc.sk

M. Kotva

DBSS

General Information

In Europe there are several examples of regional simulation societies, covering a geographical area of a common language. One of those, DBSS, is grouping the Dutch speaking simulation people from the Benelux countries.

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

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

To accomplish the above goals DBSS shall:

- stimulate the organization of meetings in the domain of systems simulation; in these local meetings the emphasis will be in informality exchange;

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

DBSS is closely co-operating with the other member societies of EUROSIM. Moreover, for already many years, DBSS has affiliation agreements with IMACS (International Association for Mathematics and Computers in Simulation) and SCSi (Society for Computer Simulation International).

DBSS-Membership

Individuals (in particular Dutch speaking ones) and institutes etc. from the Benelux countries, active in the field of simulation, can become DBSS-member. Membership fee (per annum) is in 1994:

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

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

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

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

The membership fee should be paid to:

Giro account 3582241
J.C. Zuidervaart,
Leeuwerikplantsoen 27
2636 ET Schipluiden, The Netherlands

with the mention: DBSS membership 1994.

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. DBSS-members can benefit also from a reduced subscription rate on the EUROSIM journal Simulation Practice and Theory.

The steering committee of DBSS consists of

L. Dekker	Chairman
J.C. Zuidervaart	Secretary, Treasurer.

Meeting Reports

October 15th, 1993, Prof. Ralph C. Huntsinger, professor of Computer Science and Engineering/Mechanical Engineering and Manufacturing, California State University, Chico, U.S.A., gave a lecture entitled "A compare and contrast of three popular simulation languages".

Abstract
This lecture will give the strenghts and weaknesses of the following continuous system simulation languages:
1. ESL and ESL-IMP The European space agency Simulation Language
2. CSSL-IV Continuous Systems Simulation Language version Four
3. TUTSIM/TUTCAD from Tutsim Products.

These languages are representative of the popular continuous system simulation languages in use at the present time. They have both the differential equation and block diagram modes of use and handle discontinuities and stiff sets of equations with different levels of ease. Other differences will be discussed as time permits. The use of these high level languages to organize and represent real world systems will be discussed.

Coming Events

In 1995 the second EUROSIM congress will take place in Vienna, Austria. DBSS nominated in the scientific committee of this conference: L. Dekker, Delft University of Technology and F.J. Pasveer, Polytechnic Rotterdam and Environments.

June 21-23, 1994 the international EUROSIM conference "**Massively Parallel Processing Applications and Development**", organized by DBSS, will take place.

Invited/keynote speakers:

Farhat, Ch.; University of Colorado, USA: Current reflections on massively parallel processing in computational mechanics

Giloi, W.K.; GMD Inst. for Computer Architecture and Software Technology, Germany: Programming models and supporting architecture for massively parallel computers

Hey, A.J.G.; University of Southampton, England, Subject: modelling MPP applications

Katgerman, L.; Delft University of Technology/Alcan International, The Netherlands: Computer simulation of coagulation processes

Shapiro, E.: Stanford, USA: MPP systems, opportunities, visions, reality

Smit, W.,; AKZO Electronic Products b.v., The Netherlands: A rationale for photonic computer systems

Provisional programme:

Apart from the keynote speakers, approximately 100 papers will be presented in four parallel sessions with the following topics.

* programming tools
* architecture/data base processing
* load balancing

- * programming models
- * performance evaluation
- * parallelization programs/algorithms
- * modelling/simulation MPP applications
- * semiconductor device simulation
- * fluid dynamics
- * image processing/rendering

HPCN programme:

Several papers will be presented forming part of the HPCN programme of the European Community, among others: HAMLET; PPPE; CAMAS; GP-MIMD; PALACE; EUROPORT 1; EUROPORT 2; DESIRE, PATRANS, PEPS; PASHA; PACC; PAPAGENA.

NOWESP session: MAST II programme, Commission of the European Communities. This special session (Modelling, Measuring and Simulation of Water Flow/Pollutant Transport in the Northern West Continental Shelf) will take place on Tuesday, June 21, 1994. During the MPP conference six papers will be presented by people involved in this project. Those who wish to attend exclusively this special NOWESP session pay a special fee of dfl 250.- (including coffee, tea, lunch), dfl 350.- (including conference proceedings, coffee, tea, lunch).

Scientific Committee:

The Scientific Committee has been extended with: Ir. S.W. Brok, Delft University of Technology, The Netherlands, Prof. Dr. I. Sofronov, All-Russia Scientific Research Institute of Experimental Physics, Russia.

Elsevier/EUROSIM Award:

Elsevier Science B.V. and EUROSIM will award the best paper, submitted by one author, in the category Young Scientists. The age of the author must be not more than 30 (thirty) years.

Exhibition:

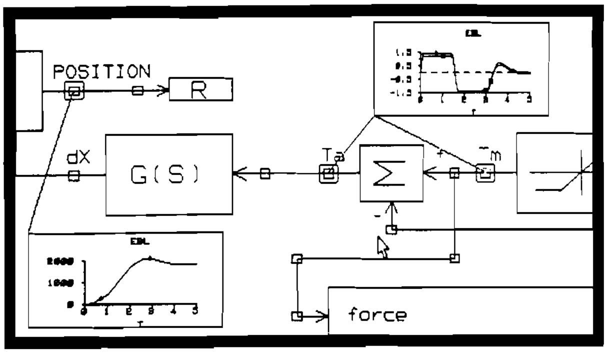
During the conference in the Aula Conference Centre an exhibition will be organized, partly for commercial use, partly for scientific use. Uptil now CONVEX, IBM and some institutes of the Delft University have confirmed their participation in the exhibition.

2nd/final announcement:

The 2nd/final announcement has been mailed in January in this year, including a.o. the provisional programme and a registration form. If you did not receive this brochure, please do not hesitate to contact the

Aula Conference Centre
P.O. Box 5020, 2600 GA Delft, The Netherlands
Tel: +31 15 788022/781340
Fax: +31 15 786755
E-mail: secretariaat@rc.tudelft.nl

J.C. Zuidervaart



FRANCOSIM

FRANCOSIM was founded in 1991 and its legal seat is in Roanne, France. It aims to the promotion and development of simulation technique and its related tools in the French speaking community. Its activity is mainly concentrated in the fields of Industry, Education, and Research.

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

Correspondent in Belgium is:
Fr. Lorenz
Centre socran, Parc scientifique
Avenue Pré-Aily, B - 4031 Angleur

Contributions per annum are FF 275. Please do not forget to renew your contribution for 1994. From this year on, contributions will be taken into account for a civil year, that is from January until December, since this seems to correspond better to the accounting systems of private companies and universities as well. We used to consider the subscriptions starting in September but this will be changed now.

Next events to come

A bond graph school is planned from 12th to 16th September 1994. It will be organized as such: 7 two-hour lectures, 5 tutorials of two hours, 4 computing practicals of two hours.

The bond graph preprocessor CAMP will be used: it translates the bond graph displayed on the screen into equations compatible with solvers of the CSSL norm. The solver used will be ACSL. For further information please contact N. Sarles or Prof. Lebrun, Tel: +33-77 70 80 80.

Simulation of Continuous Systems

This working group regularly meets in Noisy le Grand under the direction of E.S.I.E.E. school. The local contact is:

M. Hamam, Group ESIEE
2, boulevard B. Pascal, F - 93160 Noisy le Grand,
Tel: +33-1 45 92 66 11

The schedule for the coming month is:
Thursday, March 31st 1994
Wednesday, May 11th 1994
Thursday, June 9th 1994

The meetings take place at ESIEE in Noisy le Grand.

User Groups

Two meetings have taken place in the last months. In October an "**ACSL User Group**" met for the first time in la SNECMA, Moissy Cramayel, and the next meeting will be on June 21st, 1994. The place of the meeting has not been decided yet. It will be organized on the basis of examples presented by various users, any suggestions are welcome and will be helpful to make the program. In January a "**MATRIXx User Group**" met at Thomson-TRT in Guyancout for the first time. The next meeting is on June 15th, 1994. Here again suggestions to establish the program are welcome. In both cases university and industry were represented and found common interest in exchanging their viewpoints about the simulation tools in question.

N. Sarles

HSTAG

General Information

HSTAG (Hungarian Simulation Tools and Application Group), established in 1981, is an association promoting the exchange of information within the community of people involved in research, development, application and education of simulation in Hungary and also contribute to the enhancement of exchanging information between the Hungarian simulation community and the simulation communities abroad. HSTAG deals with the organization of lectures, exhibitions, demonstrations, round table discussions and conferences.

Activities

We are pleased that upon our application on the meeting of the EUROSIM Board on the 4th of February 1994 in Vienna HSTAG was accepted as a new member of EUROSIM. HSTAG together with IMACS/Hungary participates in the organization of the IMACS European Simulation Meeting on Simulation Tools and Applications to be held in Györ, Hungary (half way between Budapest and Vienna) in August 28-30, 1995. Further details will be published in the next issue of the journal.

Contact Address

Prof. Dr. András Jávor (Chairman)
KFKI Research Institute
for Measurement and Computing Techniques
H-1525 Budapest, P.O.Box 49, Hungary
Tel: +36 1 1699499, Fax: +36 1 1695532
E-mail: h7023jav@ella.hu

A. Jávor

ISCS

General Information

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

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

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

Membership

At present ISCS counts 132 members: 6 institutional, 4 honorary, 120 regular and 2 affiliate.

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

Contact Address

For further information or application for membership, please contact:

ISCS
c/o Dipartimento di Ingegneria Elettronica
Università di Roma "Tor Vergata"
Via della Ricerca Scientifica, I-00133, Roma, Italy
Phone: +39 6 72594.477 (.478/.486)
Fax: +39 6 2020519
E-mail: iazeolla@irmias.bitnet

Activities

The ISCS is taking part in the project among several research centers and universities in USA, Europe and Asia to create a global knowledge network aiming to facilitate world-wide sharing of information needed for developing environmentally sound products.

The project, named CERES (for the Roman goddess who was believed to protect the fruits of the Earth), has been launched by The Concurrent Engineering Research Center (CERC) at West Virginia University in co-operation with a number of universities in Europe and Asia.

From the educational point of view, ISCS is continuing to organize and sponsor the "Seminario di Informatica", a periodic scientific seminar held at the University of Roma "Tor Vergata", whose main topics are simulation, performance evaluation and parallel and distributed computing.

Moreover, ISCS promotes Summer Simulation Schools with the aim of extending the knowledge about simulation and its applications to graduate and PhD students, and young researchers working in industry or academia.

The next annual meeting of ISCS members is scheduled to be held on March 4th 1994 in Rome, at the Dipartimento di Ingegneria Elettronica, Università di Roma "Tor Vergata". ISCS members are warmly invited to participate because on that occasion the new Steering Committee for the period 1994-1997 will be elected. In addition, new ISCS strategies for the future will be determined. Among them three important points will be discussed:

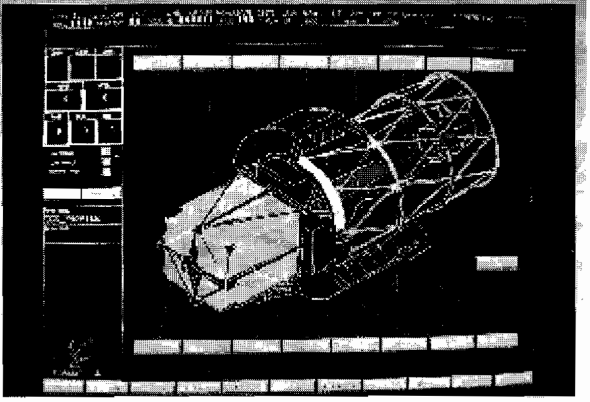
1) How to give new stimuli to the ISCS Working Groups. These groups were created in 1991 with the goal of organizing regular meetings between ISCS members interested in the same simulation field, and providing a forum for presentation of results, exchange of ideas and scientific discussions. At present, the following Working Groups have been established: Simulation in Industry and Management, Simulation in Agriculture and Environmental Sciences, Simulation in Training and in Education, Simulation in Biology and Medicine, Simulation in Electrical Engineering, Concurrent and Distributed Simulation, Software and Hardware for Simulation, Expert Systems and Simulation.

Is it possible to set up links with other yet existing Working Groups of European countries?

2) Organization of The 3rd Workshop on Computer Simulation. This meeting has become a traditional appointment of Italian scientists involved in simulation. The successful events of the 1990 workshop held in Rome (there were about 60 participants that contributed with 21 presentations covering different fields of simulation) and the 1992 workshop held in conjunction with EUROSIM 92 in Capri, testified the great attention given to simulation in Italy.

3) Contribution of ISCS members and Working Groups to the CERES project (for more details see the ISCS corner of this bulletin, November 1993).

M. Colajanni



RTworks used in the Hubble Space Project

SIMS

The Scandinavian Simulation Society, SIMS, has about 250 members from Denmark, Finland, Norway and Sweden. For 35 years SIMS has served as the regional simulation society in Scandinavia, gathering individuals and organisations involved in simulation. The activities have been concentrated on arranging annual meetings and courses, delivery of information letters, and co-operation at European and international level in the field of simulation.

How to join SIMS ?

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

Eija Karita Puska
VTT Energy, Nuclear Energy
P.O.Box 1604, FIN-02044 VTT, Finland
Tel: +358-0-4565036, Fax: +358-0-4565000
E-mail:eija-karita.puska@vtt.fi

SIMS'94 Simulation Conference

Programme:

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

Conference Themes include, but are not limited to:

* Applied Simulation Technology
* Modelling Tools and Techniques
* User Interface and Visualisation
* Engineering and Training Simulators
* Finite Element Simulation Techniques
* Flow Simulations
* Modelling and Simulation of Industrial Processes
* Simulation in Factory Planning
* Simulation in Chemical Engineering
* Simulation in Control Engineering
* Simulation of Mechanical Systems
* Simulation of Electronic Systems
* Simulation of Marine Systems

This year's conference will also include simulation techniques based on solving systems of partial differential equations.

Demonstrations and Exhibitions:

There will be an area available for poster sessions, demonstrations and exhibitions during the conference. If you want to participate in these activities - please contact Lars Langemyr.

Programme Committee:

Prof. Sören Andersson, KTH
Prof. em. Germund Dahlquist, KTH
Tekn. lic. Henry Islo, KTH
Tekn. dr Inger Klein, LiTH
Tekn. dr Lars Langemyr, COMSOL
Tekn. lic. Johan Lennblad, Volvo
Prof. Martin Lesser, KTH
Tekn. lic. Sven-Olof Lundqvist, STFI
Tekn. dr Per Lötstedt, Saab Military Aircraft
Tekn. dr Sven Erik Mattsson, LTH
Docent Luis Moreno, KTH
Tekn. dr Tommy Svensson, Bofors Underwater Systems
Prof. Gustaf Söderlind, LTH

Organising Committee:

Lars Langemyr, COMSOL
Maria Johansson, COMSOL
Agneta Sjögren, Volvo

Timetable for Authors:

Authors should submit an extended abstract of approximately 500 words to the address below by February 15th, 1994. Abstracts will be reviewed by members of the program committee, and notification of acceptance or rejection will be sent by March 15th, 1994. The final program and registration form will be published by March 31st, 1994. Final versions of the accepted papers are due by June 15th, 1994.

Language:

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

Conference Venue:

The conference will be held in Stockholm, Sweden on August 17-19, 1994. The conference will take place in Stockholm at the Royal Institute of Technology - a world class teaching and research institute with long tradition of simulation in a large number of disciplines. The conference will take place just after the famous Stockholm Water Festival. During the conference we will visit the Stockholm archipelago with boat and taste a Swedish smörgasbord.

Correspondence Address:

SIMS, c/o Lars Langemyr
Computer Solutions Europe AB
Björnnäsvägen 21
S-113 47 Stockholm, Sweden
Tel: +46-(0)8-153022
Fax: +46-(0)8-157635
E-mail: sims@comsol.se

E. K. Puska

UKSS

General Information

The United Kingdom Simulation Society was founded in 1991 as a successor to the United Kingdom Simulation Council which was originally founded in 1970. Its aim is to promote the advancement of simulation in the UK and to provide a forum for discussion and dissemination of information connected with simulation. At present it has about 70-80 members.

Membership

The Individual Membership subscription fee is stlg 20 (20 GB pounds) per year, and includes receiving copies of this excellent Newsletter. There is a corporate membership costing stlg100 for five transferable memberships. For further information on membership please contact the Membership secretary:

Mrs Elizabeth Rimmington
Computer Centre, University of Brighton
Moulescomb, BRIGHTON BN2 4GJ, UK

Activities

This has been a quiet 'winter hibernation' period for the Society following its very successful national conference held in September last year. Copies of the Proceedings, including nearly fifty papers on all aspects of simulation, are still available and can be obtained from the Society, price stlg 20 (20 GB pounds).

However the new committee of the UKSS (reported last issue) is planning a programme of events leading towards its next biennial conference, which will be held in Scotland in September 1995.

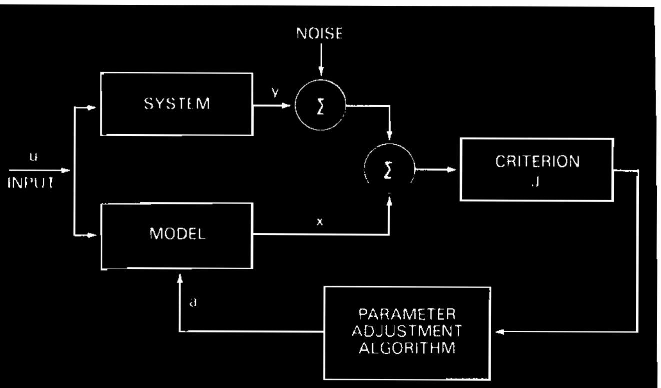
The first event will be a one day workshop on distributed and interactive simulation to be held in Edinburgh on Friday April 8th. Any proposals for contributions to the workshop would be welcome. This will be followed by a meeting on circuit simulation later in the year.

Other proposed meeting topics are: Real-time Simulation and Control; Graphical Applications and Analysis; Object Oriented Programming in Simulation.

Further details on any of the above can be obtained from the Society's Chairman: Rob Pooley, Department of Computer Science, University of Edinburgh, Scotland, EH39 4PP, Tel: +44 31 650 5123, FAX: +44 31 667 7209, E-mail: rjp@uk.ac.edinburgh.dcs

Members who wish to report simulation activities of interest to other members are welcome to send in details to the Society's General Secretary: Russell Cheng, School of Mathematics, University of Wales, College of Cardiff, 23 Senghennydd Road, Cardiff, CF2 4YH, UK, Tel +44 222 874827, FAX +44 222 874199, email cheng@uk.ac.cardiff

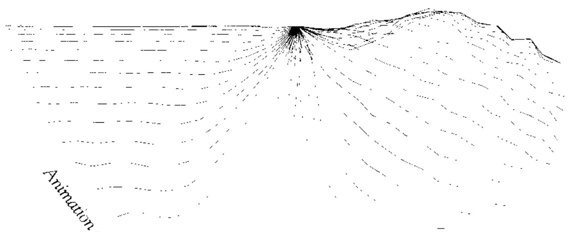
Russell Cheng



Dymola

Dynamic Modeling Language

Dymola – for combined continuous/discrete modeling



Animation of a chain with fifteen links modeled in Dymola™ from Dynasim.

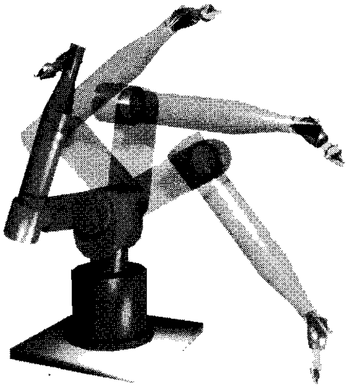
Scalable modeling methodology

- Organizes modeling knowledge – object-oriented
- Reuse of models – model libraries available
- High-level language for model composition – physically oriented connections
- Allows input of general equations
- Produces efficient simulation code
- Treats combined continuous/discrete models properly
- Unified language constructs – multi-disciplinary models

```
model robot {Model of 6 degree-of-freedom robot.}
  submodel (Inertial)  i(g=9.81, ng3=-1)
  submodel (Revolute3) r1(n3=1), r2(n1=1), r3(n1=1)
  submodel (Revolute3) r4(n3=1), r5(n1=1), r6(n3=1)
  submodel (Bar)       p3(r3=0.5), p5(r3=0.73)
  submodel (Body) m1(I33 = 1.16)
  submodel (Body) m2(m=56.5, r1=0.172, r3=0.205,
                  I11=2.58, I22=2.73, I33=0.64, I31=-0.46)
  submodel (Body) m3(...), m4(...), m5(...), load(m=10, r1=0.1)

  connect
    i to r1 to r2 to p3 to r3 to r4 to p5 to r5 to r6 to load,
    m1 at r1:b, m2 at r2:b, m3 at r3:b, m4 at r4:b, m5 at r5:b
end
```

Example of how models are described in Dymola – industrial robot.



Typical use of Dymola, modeling of industrial robot.

Capabilities

- Causality analysis – graph theoretical algorithms
- Symbolic solution of equations
- Finds minimal systems of simultaneous equations (algebraic loops)
- Code to solve systems of linear equations either symbolically or numerically
- Code to solve systems of nonlinear equations – including symbolic Jacobian
- Automatic index reduction of DAE – symbolic differentiation
- Simplification of expressions (partial evaluation)
- Automatic generation of code for handling of time- and state-events
- Output of models for the simulation programs ACSL, Desire, Simnon and SIMULINK
- Generation of FORTRAN subroutines according to the DSblock format designed at DLR (German Aerospace Research Establishment)

Applicable

- Mechatronic systems
- Robot simulations – trajectory optimization
- Power electronics simulation
- Chemical systems
- Education – unified modeling methodology

Available

- On PC/Windows, Macintosh, UNIX (SparcStation, HP 9000, IBM RS/6000), VAX/VMS
- Library for tree strucrured multi-body systems from DLR (German Aerospace Research Establishment)
- Library of electrical components
- Control block library
- Bond graph library

Additional information

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European and International Societies

CROSSIM

CROSSIM (The Croatian Society for Simulation Modelling) was founded in March 1992 in Zagreb. CROSSIM is a non-profit society with the following main goals: promotion of knowledge, methods and techniques of simulation; establishment of professional standards in simulation; development of education and training in simulation; organization of professional meetings and publishing in the field; co-operation with similar domestic and international institutions. In June 1992 CROSSIM sent a letter of intention to EUROSIM with a request to become a full member of the EUROSIM federation, and in November 1993 another letter of intention to get the "Observer status" in the EUROSIM federation. The Society is also in the process to become an affiliation institution with The Society for Computer Simulation, USA.

Membership

The annual membership fee is equivalent to 8 German marks for regular members, and 2 German marks for students. CROSSIM currently has 49 individual members (including one member from each of the following countries: USA, United Kingdom and Hungary).

Contact Address

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Activities

- Organizing a simulation seminar which is regularly held at the Faculty of Economics, University of Zagreb.
- Co-operation in founding of the new international journal Computing and Information Technology, launched in 1993 (including computer modelling and simulation topics). Information about the journal is available from the CROSSIM Chairman.
- Work on several scientific projects in discrete and continuous simulation, and applications of simulation in such diverse fields as engineering, economy, medicine, ecology, etc.
- Publication of papers in international and domestic journals and conference proceedings.
- Co-organizing the 16h International Conference "Information Technology Interfaces" ITI '94, to be held in Pula, Croatia, from 14-17 June 1994. The conference traditionally has a strong simulation session. Please contact the CROSSIM Chairman.
- Co-organizing the 4th Operations Research Conference in Croatia, to be held in the beginning of October 1994 in Rab, Croatia. The conference has a simulation session. Papers are in Croatian and English.

V. Ceric

PSCS

The Polish Society for Computer Simulation was officially established on September 15, 1993 and has presently 80 members.

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SLOSIM

Simulation has a very long tradition in Slovenia. The kernel was founded by prof. Bremsak more than thirty years ago. He built his own analog computer, which was one of the first in Europe. Later the activities in this field were focussed on the use of two EAI analog-hybrid systems and on the digital simulation as well. Here also our own digital simulation language SIMCOS was developed. The simulation tools mentioned were mainly used in the field of control systems and in the fields of biomedicine and pharmacokinetics.

Currently the simulation activities are concentrated on the Faculty of Electrical and Computer Engineering in Ljubljana in close co-operation with a group on Jozef Stefan Institute and enterprise INEA. Simulation groups are also on Technical University in Maribor and on the Faculty of Natural Sciences and Technology in Ljubljana. Our estimate is that in the groups mentioned at least fifty researchers work in the area of simulation.

The idea of establishing our own simulation society originates from the first days of our independence. Momentarily we are in the constitution procedure. The kernel of the Slovene Simulation Society (SLOSIM) consists of the above mentioned groups. However, in the future an effort to extend the membership also to other technical and nontechnical areas will be made. Of course, our great wish is that SLOSIM becomes a member of EUROSIM.

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R. Karba

Comparison of Parallel Simulation Techniques

EUROSIM - Simulation News Europe features a series on comparisons of simulation software. Simulation languages are compared in terms of their features for modelling and experimentation using simple and easily comprehensible models drawn from a number of different application areas. This series on simulation software comparisons will be continued.

This issue introduces a new type of comparison dealing with the benefits of distributed and parallel computation for simulation tasks.

Three test examples have been chosen to investigate the types of parallelisation techniques best suited to particular types of simulation tasks.

Each test example should be first solved in a serial fashion to provide a reference for the investigation of speed-up factors. The examples should then be tested using the parallel facilities (software and hardware) available. Performance should be assessed in terms of a numerical value found by dividing the time for serial solution by the time for the parallel solution (speed-up factor *f*). Wherever appropriate, serial solutions should be based on the same environment. Measurements of time should be in terms of the total elapsed time for running the task. Information must be provided about the method of parallelisation or distribution of subtasks. If of interest, more than one solution for a particular test example may be offered. Furthermore, a rough indication should be provided for the program preparation time, especially for the parallel solution.

This new type of comparison addresses users of all types of parallel and distributed facilities. The spectrum may range from simulation languages, via general purpose programming languages, to special parallel languages and from networks of workstations, via special parallel computers, to very high performance computers.

The objective is to make comparisons of different types of problems and of methods for the parallelisation of simulation tasks. It is not intended that this should involve direct comparisons of the (hardware) performance of parallel facilities.

Solutions for publication in EUROSIM- Simulation News Europe should not be more than one and a half page in length (see sample solution on page 24). Opportunities for the publication of more extended discussions will be provided at the forthcoming EUROSIM Congress in Vienna where it is expected that there will be a special session on these comparisons of parallel techniques. Further details on the EUROSIM Congress may be found on page 23.

The first test example is a **Monte Carlo study**. A damped second order mass-spring system is described by the equation

$$m\ddot{x}(t) + kx(t) + d\dot{x}(t) = 0$$

$$\dot{x}(0) = 0\ ,\ x(0) = 0.1\ ,\ k = 9000\ ,\ m = 450$$

where the damping factor d should be chosen as a random quantity uniformly distributed in the interval [800, 1200].

The task is to perform 1000 simulation runs and to calculate and store the average responses over the time interval [0,2.] for the motion *x(t)* for subsequent plotting.

Figure 1 shows some simulation runs (using ACSL with RK4-algorithm with stepsize 0.001), figure 2 gives an example of the average response (calculated under PVM in the sample solution).

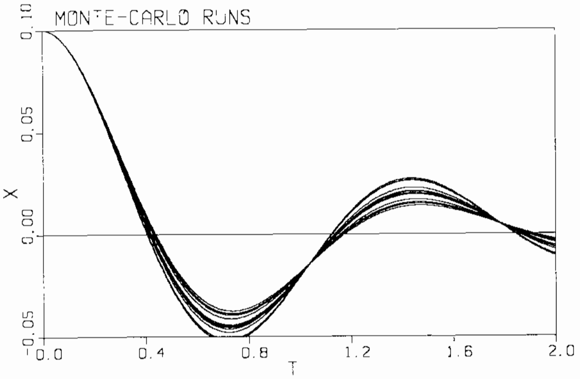

Figure 1

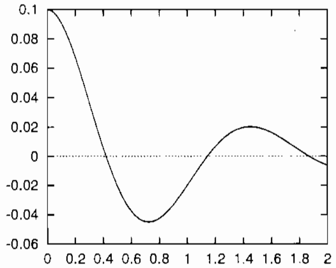

Figure 2

The second example is concerned with **coupled predator-prey population** models. Five predator-prey populations (v_1, v_2), (w_1, w_2), (x_1, x_2), (y_1, y_2) and (z_1, z_2) are interacting. The model equations are:

$$\dot{v}_1 = a_v v_1 - b_v v_1 v_2 - c_v v_1^2$$
$$\dot{v}_2 = -d_v v_2 + e_v v_1 v_2 - f_v v_2^2 + r_v$$
$$r_v = v_2\,(g_v w_1 + h_v x_1 + j_v y_1 + k_v z_1)$$

$a_v = 2,\ b_v = 0.5,\ c_v = 0.01,\ d_v = 0.2,\ e_v = 0.4,$
$f_v = 0.02,\ g_v = 0.01,\ h_v = 0.02,\ j_v = 0.01,\ k_v = 0.03$

$$\dot{w}_1 = a_w w_1 - b_w w_1 w_2 - c_w w_1^2 + r_w$$
$$r_w = w_1 (-g_w v_2 + h_w x_2)$$
$$\dot{w}_2 = - d_w w_2 + e_w w_1 w_2 - f_w w_2^2$$

$a_w = 1$, $b_w = 0.5$, $c_w = 0.02$, $d_w = 0.1$, $e_w = 0.4$, $f_w = 0.04$, $g_w = 0.02$, $h_w = 0.04$

$$\dot{x}_1 = a_x x_1 - b_x x_1 x_2 - c_x x_1^2 + r_x$$
$$r_x = -g_x x_1 v_2$$
$$\dot{x}_2 = - d_x x_2 + e_x x_1 x_2 - f_x x_2^2 + s_x$$
$$s_x = -h_x x_2 w_1$$

$a_x = 3$, $b_x = 0.9$, $c_x = 0.02$, $d_x = 0.2$, $e_x = 0.2$, $f_x = 0.04$, $g_x = 0.025$, $h_x = 0.1$

$$\dot{y}_1 = a_y y_1 - b_y y_1 y_2 - c_y y_1^2 + r_y$$
$$r_y = y_1 (-g_y v_2 + h_y z_2)$$
$$\dot{y}_2 = - d_y y_2 + e_y y_1 y_2 - f_y y_2^2$$

$a_y = 1$, $b_y = 0.8$, $c_y = 0.04$, $d_y = 0.2$, $e_y = 0.6$, $f_y = 0.07$, $g_y = 0.03$, $h_y = 0.025$

$$\dot{z}_1 = a_z z_1 - b_z z_1 z_2 - c_z z_1^2 + r_z$$
$$r_z = -g_z z_1 v_2$$
$$\dot{z}_2 = - d_z z_2 + e_z z_1 z_2 - f_z z_2^2 + s_z$$
$$s_z = -h_z z_2 y_1$$

$a_z = 3$, $b_z = 0.7$, $c_z = 0.02$, $d_z = 0.5$, $e_z = 0.3$, $f_z = 0.04$, $g_z = 0.02$, $h_z = 0.04$

All initial populations are normalized to 1.

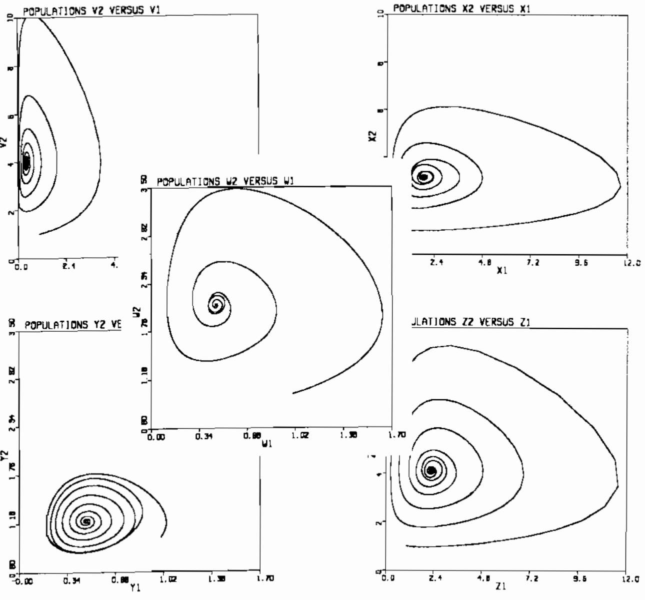

Figure 3

The task is to solve the system within the time interval [0, 100] in a serial fashion and in an appropriate parallel fashion and to provide the terminal values of each population. Solutions obtained using ACSL in double precison are shown in fig. 3, the terminal values at t=100 (stepsize 0.01, RK4-algorithm) and the equilibrium solutions are shown in the following table.

Population	t=100	Equilibrium	Difference
v_1	0.40494874	0.41235712	0.007408
v_2	3.9389271	3.992722	0.053795
w_1	0.45572852	0.45765668	0.001928
w_2	2.06389283	2.07652643	0.012634
x_1	1.86489724	1.86502448	0.000127
x_2	3.18278282	3.18097946	0.001803
y_1	0.4677289	0.47392759	0.006199
y_2	1.20213106	1.20497504	0.002844
z_1	2.27700122	2.2773994	0.000398
z_2	4.10808012	4.10656804	0.001512

It is expected that with this example little or no improvement may be found through parallelisation. Negative results are of considerable interest and should not be discarded.

The third example is based on a second order **partial differential equation** describing a swinging rope with length L fixed at one end and forced at the other.

$$u_{xx}(t,x) = a\, u_{tt}(x,t)$$

$$u(0,t) = 0,\ u(l,t) = b\, e^{-dt} \sin\omega t,\ u(x,0) = u_x(x,0) = 0$$

Discretisation by the method of lines by dividing the length into N equidistant intervals and replacing the differential quotient $u_{xx}(t,x)$ by a central difference quotient results in a set of weakly coupled equations:

$$k^2 a\, \ddot{u}_i(t) = u_{i-1}(t) - 2u_i(t) + u_{i+1}(t)\ ,\ i = 1, \ldots, N-1;$$

$$u_i(0) = u_i(0) = 0,\ u_0(t) = u(0,t) = 0,$$

$$u_N(t) = u(L,t) = b\, e^{-dt} \sin\omega t$$

$$L = 10,\ a = 2,\ b = 1,\ d = 0.2,\ \omega = 1,\ k = L/N$$

The task is to solve the system of equations with a discretisation $N = 800$ or more lines within the time horizon [0, 30] in a serial and in an appropriate parallel fashion. As result the lines at $x=9L/10$, $x=3L/4$, $x=L/2$, $x=L/4$ and $x=L/10$ should be stored for subsequent plotting. Figure 4 shows results for these lines calculated with ACSL with double accuracy (integration stepsize 0.005, RK4-algorithm).

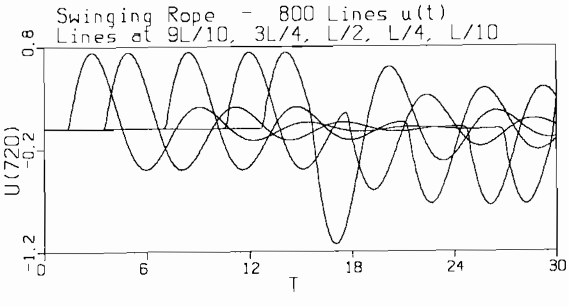

Figure 4

EUROSIM
FEDERATION OF EUROPEAN
SIMULATION SOCIETIES

EUROSIM CONGRESS '95
TU VIENNA · September 11-15

Preliminary
Announcement

EUROSIM Simulation Congress

September 11 - 15, 1995

Technical University
of Vienna
Vienna, Austria

The **EUROSIM Simulation Congress '95** is organized on behalf of EUROSIM by **ASIM** (*Arbeitsgemeinschaft Simulation*), the German speaking Simulation Society, in co-operation with CSSS, DBSS, FRANCOSIM, HSTAG, ISCS, SIMS, UKSS.

Local Organizers are the Computer Centre and the Dept. Simulation Techniques of the Technical University of Vienna.

Organization Committee: Mrs. Irmgard Husinsky (Computer Centre), Prof. Dr. Felix Breitenecker (Dept. Simulation Techniques).

Scientific Programme: The EUROSIM Simulation Congress is concerned with all aspects of computer simulation methodology and application. Topics of particular interest include, but are not limited to:

- Simulation Languages and Tools
- Simulation Methodologies
- Parallel Simulation
- Distributed Interactive Simulation
- High Performance Simulation
- Massively Parallel Applications, Modelling and Simulation
- Industrial Simulation
- Simulation in Manufacturing
- Applications in Various Areas
  (e.g. Knowledge-based Simulation, Telecommunication, Use of Training Simulators, etc.)
- Development of Simulators
- Real-time Simulation
- Virtual Reality, Multimedia Applications
- Synthetic Environments
- Modelling and Simulation in Education

Invited Speakers will give special in-depth presentations. There will be an **Exhibition** of hardware and software related to simulation. **Poster Sessions** and **Workshops** will be organized.

Preliminary Schedule: September 11: User Group Meetings for simulation languages and tools. September 12 - 15: Scientific Programme, Social Programme: Welcome Party, Reception, Dinner

Preliminary Scientific Committee:

F. Breitenecker (Austria), Chairman; M. Alexik (Slovak Republic), W. Ameling (Germany), S. Balsamo (Italy), I. Bausch-Gall (Germany), L. Dekker (The Netherlands), V. De Nitto (Italy), H.J. Halin (Switzerland), I. Husinsky (Austria), T. Iversen (Norway), A. Jávor (Hungary), K. Juslin (Finland), W. Kleinert (Austria), M. Kotva (Czech Republic), M. Lebrun (France), F. Lorenz (Belgium), D.P.F. Möller (Germany), D. Murray-Smith (Great Britain), F.J. Pasveer (The Netherlands), R. Pooley (Great Britain), T. Schriber (USA), F. Stanciulescu (Romania), I. Troch (Austria), W. Weisz (Austria), R. Zobel (Great Britain)

The official language will be English.

The congress will take place at the Technical University of Vienna, located in the centre of Vienna.

More details (deadlines, registration fee, proceedings) will be published in spring.

Contact Address:

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Sample Solution: Workstation Cluster under PVM

All test examples of the comparison have been run on a cluster of nine IBM RS/6000-320H workstations (at the Computer Centre of the Technical University of Vienna), connected via Token Ring (16 MBit/s), using PVM version 3.1. PVM (Parallel Virtual Machine) is a software package that allows a heterogeneous network of parallel, serial, or vector computers to appear as a single distributed memory computer (virtual parallel computer). PVM consists of daemon processes and a user library. Applications (written in FORTRAN or C) can be parallelized by using message passing constructs. PVM has been developed at Oak Ridge National Laboratory and other US research labs, is distributed freely in the interest of advancement of science, and is being used in computational applications around the world.

The structure of the **Monte-Carlo study**, the first test example, permits a coarse grain parallelization in the sense of data partitioning. The basic idea is to distribute the simulation runs to the available processors. Each simulation run is independent of all others. The master processor partitions the problem, sends the initial data to and receives the results from the worker processors doing the simulation runs (fig.1). The example has been programmed in FORTRAN, single precision, using the RK4-algorithm with stepsize h=0.001.

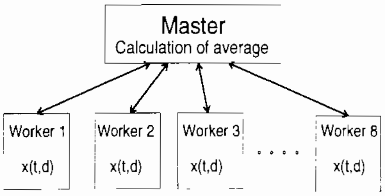


Figure 1

In order to keep communication times low as a first attempt a parallelization with static load balancing is done. Each of the eight workers in the cluster gets 125 random numbers (parameter d), performs 125 simulation runs, and returns the average response of $x(t,d)$. The master does the final computations and writes the results to a file. Postprocessing (graphical output) of the result is done using Gnuplot (see fig.2, page 21). The resulting speed-up factor with eight workers is f=5,53.

In order to gain advantages of possible free resources as a second attempt dynamic load balancing of the workers is done. As soon as one of the workers has finished one simulation run and has sent back the response $x(t,d)$ the master sends a new random number to this worker and starts the simulation again. The master calculates the average response "dynamically" while waiting for the next free worker. This procedure did not succeed. Because all 1000 responses (2000 real numbers each) are sent to the master, the overhead for communication becomes very large and the speed-up factor is significantly less than 1 (f=0.25). If the master provides for the worker more than one parameter d in advance in order to continue the simulation without waiting, the factor "improves" to f=0.95. In a second try the master controls only the dynamic load of the workers, but each worker calculates the average himself and sends it at the end to the master, which then calculates the final average response. This procedure results in a speed-up factor of f=4.9, even worse than the solution with static balancing. The worker load using dynamic balancing differs only slightly from static balancing: the workers perform 125±3 simulation runs.

Because of the homogeneous structure of the cluster and of the structure of this test example static load balancing is to prefer. Further investigations, e.g. non-homogeneous clusters with PVM or dependence of the the speed-up factor on the number of workers, will be investigated.

Parallelization of the **coupled predator-prey population** model, the second test example, was not successful, mainly because of the slow communication. As a first attempt the example is distributed in a generic way: each submodel for two populations is implemented on one worker, while the master controls only initialization of the simulation runs at the workers and has to wait for the terminal values. The workers have to exchange data corresponding to the coupling terms at communication intervals (fig.2). The example has been programmed in FORTRAN, single precision.

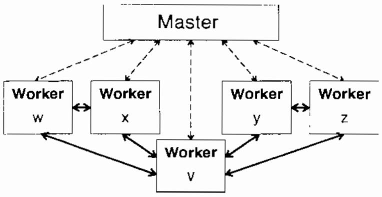


Figure 2

First, communication is performed before each integration step with steplength h=0.01 (communication interval $c_{int}=h$). The integration at the workers with the RK4-algorithm calculates in this case only the intermediate evaluations of the model equations with "old" values from the other workers. This parallel solution takes 20 times longer than the serial one (f=0.05). Consequently it is tried to enlarge the communication interval c_{int}, so that the integration algorithm uses "old" values for more than one step. The following table summarizes the results with communication intervals up to $c_{int}=20h$ with sufficiently exact terminal values (deviation from solution less than 10E-4, in case of $c_{int}=20h$ 10E-3).

c_{int}	h	$2h$	$5h$	$10h$	$20h$
f	0.05	0.10	0.21	0.39	0.77

Improvements can be made by a) interpolating the data within the communication interval, b) making the communication depending on the change of the states (while some populations are still oscillating, some are almost in the equilibrium), and c) distributing the submodels to only three processors. In the last case the first worker calculates the populations v, the second w and x, and the third y and z - reducing the communication to a third (results will be published later).

The third test example, the **partial differential equation**, consists in case of a discretisation with N=800 lines $u_i(t)$ of 1600 state variables. A generic way to distribute this problem is to divide the system governing differential equations into M (number of processors) equally sized (N/M lines $u_i(t)$) subsystems implemented at one worker (fig.3). Only the boundary values (boundary lines) of each subset (worker) have to be exchanged with the neighbouring subset (worker), while the master controls only initialization and waits for the results of five lines. The problem was programmed in C, double precision, using the RK4-algorithm with fixed stepsize h=0.005.

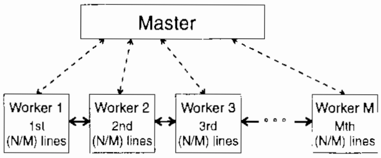


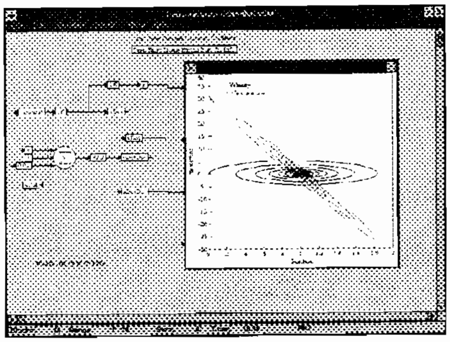
Figure 3

As in the second test example, experiments with different communication intervals c_{int} from $c_{int}=h$ up to $c_{int}=10h$ were done. Furthermore the number of lines was varied (N=600, N=800, N=1000). Using eight workers, an average speed-up factor of f=3.4 can be reached. The results for the speed-up factors are given in the following table, "*" indicates solutions with deviations greater than 10E-3, "+" instability (wrong results) because of a too long communication interval.

f	h	$2h$	$4h$	$6h$	$8h$	$10h$
N=600	0.59	1.1	1.9	2.6	3.10	3.5*
N=800	0.72	1.37	2.05	3.20	3.82*	
N=1000	0.93	2.05	3.10	3.80	4.30*	

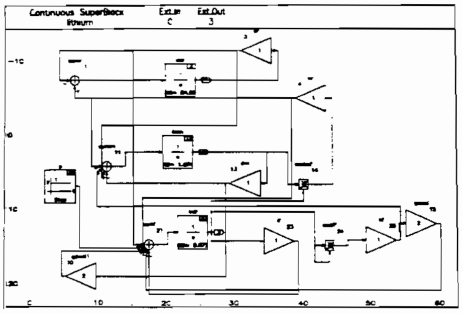
All serial solutions were performed at the same environment with the same compilers using only one processor of the cluster. Being familiar with the PVM system, programming and testing the parallel solutions took about four times longer than programming and testing the serial solutions.

F. Breitenecker, I. Husinsky, G. Schuster



Comparison 1 - MATRIXx

MATRIXx is a comprehensive linear system analysis tool. It is an interactive matrix manipulation environment which combines powerful numerical tools of LINPACK and EISPACK with an easy to use interface, comprehensive graphics facility and an expandable function library. In MATRIXx nonlinear sytems have to be described by block diagrams, Fig. 1. Leaving the graphical model editor (System Build) by the command analyze, the simulation is carried out in the MATRIXx core. To compare the complete capabilities of the different integration algorithms, the simulations have been carried out for two time 'vectors': with 77 non equidistant points and with 10 000 equidistantly spaced points of 1 msec.



For the non equidistant time vector the command sequence is

```
sim('ialg'); 6
v = [1.2,1.5,2,3,4,5,6,7,8,9,10];
t = [1e-6 1e-5 1e-4 1e-3 1e-2 0.1 1];
t = t*v
clock('cpu'); yss=sim(t); time =clock('cpu');
```

For equidistantly spaced points row number 3,4 and 5 are replaced by `t = [0.001:0.001:10]';`

Results: PC 486, 33 Mz

Integration algorithm	10 000 equidistant time points	77 not equidistant time points
Implicit Stiff System Solver	117.0 sec	3.02 sec
Variable Kutta-Merson	261.0 sec	71.0 sec
Fixed Kutta-Merson	255.7 sec	
4th order Runge Kutta	217.7 sec	
RK2 (Modified Euler)	132.6 sec	
Euler	90.3 sec	

Results: Workstation Sun 4, 40 MHz

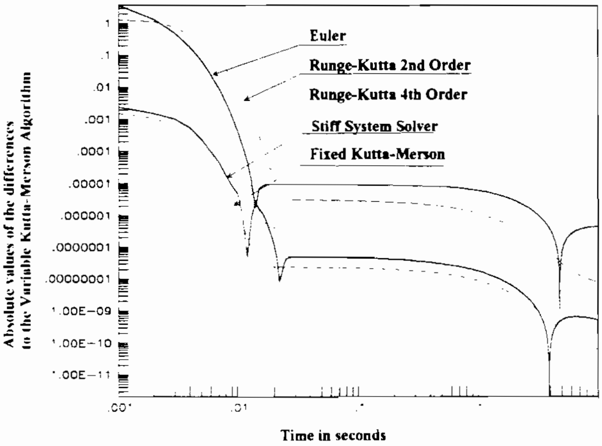
Quicksim Solver	8.2 sec	failed
Variable Adams-Moulton	11.62 sec	1.78 sec
Stiff System Solver	15.21 sec	0.43 sec
Variable Kutta-Merson	24.83 sec	6.65 sec
Fixed Kutta-Merson	23.31 sec	
4th order Runge Kutta	19.02 sec	
RK2 (Modified Euler)	11.81 sec	
Euler	8.19 sec	

For the Parameter simulation the 'Stiff System Solver' was used and the command sequence is: (compiled in a so called Execute File):

```
kr = 1; kf=0.1;lf = 1000; dr = 0.1; dem = 1; p = 0;
v = [1.2,1.5,2,3,4,5,6,7,8,9,10];
t1 = [1e-6,1e-5,1e-4,1e-3,1e-2,0.1,1];
t = (t1.*.v)';
lfp = [100,200,500,800,1000,2000,5000,8000,1e4];
y3 = 0*t;
clock('cpu');
for i=1:9;...
lf = lfp(i);...
y = sim(t);...
y3=[y3,y(:,3)];...
end;
plot(t,y3(:,2:20),'logx,logy');...
time=clock('cpu')
```

PC-Simulation: 29.0 sec Workstation Simulation: 3.56 sec

To compare the results of the different integration algorithms the Variable Kutta-Merson algorithm is considered as a reference (deviations see figure).



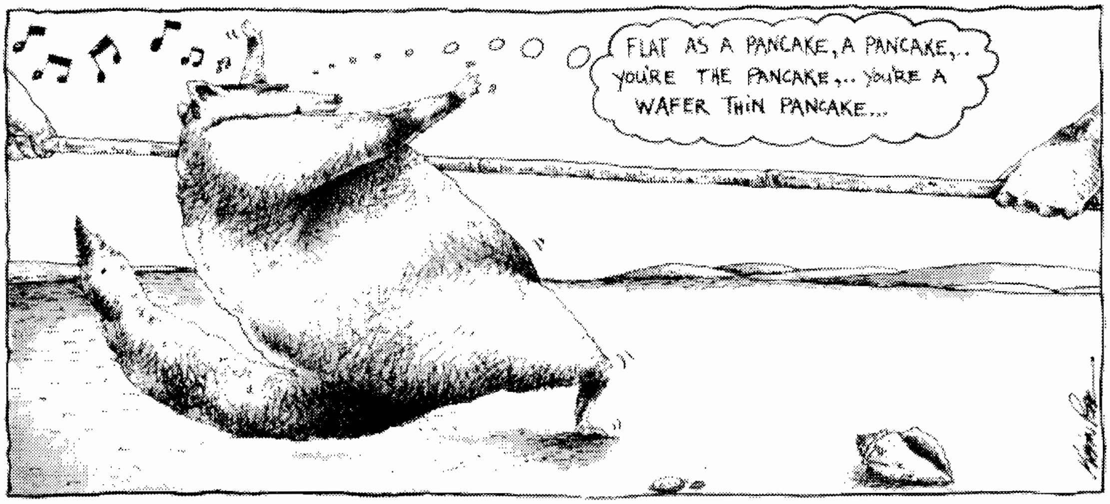
For the calculation of the steady state the trim command causes a linearization of the system under consideration with all the known problems. An iteration of the procedure can improve the result. Two iteration steps have been carried out. The command for the calculation of the steady state is

```
[xt,ut,yt] = trim(0,1,[0,0,0],[0,0,0],x0)
```

The trimmed variables are: state vector xt, the input ut, and the output yt. The first parameter of the trim command is the input value u and the second indicates that this value should be frozen. The next two vectors concern the nominal output vector where the second means that the output is not frozen. x0 indicates the initial condition. In the second iteration step x0 is replaced by xt from the foregoing step. The result is shown in the following table:

p	r	m	f
0	-3.4e-7	-1.1e-9	-3.0e-11
10 000	1002.6	10	10

Rudolf H. Kern, Fachbereich Feinwerktechnik Fachhochschule Heilbronn, Max-Planck-Str. 39, D-74081 Heilbronn



FLAT AS A PANCAKE, A PANCAKE,.. YOU'RE THE PANCAKE,.. YOU'RE A WAFER THIN PANCAKE...

Comparison 2 - PCModel

PCModel is a full-function simulation language and graphic animation system with an interactive session control facility providing extremly responsive interaction with the simulation as it executes.

The object-based language allows to define 6 integer and 2 time variables for each object, in the simulation equal to a pallet. While the location dimensions of all A2 and the A3, A4, A5 stations are the same, it is easy to create submodels for each of the four subsystem types with relative locations. The conveyor B1 represents the main-path in the model. At each Sx-location in front of a submodel, the pallet is asked if the process of the station ahead is done or not, and if not, if the buffer in front of the operation location is able to absorb the pallet. After being processed in the subsystem, the appropriate object variable is decremented. If a desired location is blocked the pallet waits at place until the location is free again. With this PCModel- feature it is not necessary to create a FIFO-buffer in front of the process locations.

Results of running the model with 20, 40 and 60 pallets: The number of throughputs stayed nearly the same with 20, 40 or 60 pallets in the system. During the animation the system seemed to be well balanced with 20 parts. Every station was well occupied, even A6 sometimes (1.7 hours of 8), this shows the result of processed pallets in A6. More parts in the system seem to make the subsystem A2 to a bottleneck. A change of logical control of A6 to a fourth station A2 shows that the throughput did not rise up, because of the new bottleneck stations A3, A4 and A5, but A6 was as well frequent with a full buffer in front of it, as the 'original' stations A2. This is a sign that the processing times of the system are not optimally synchronised. A partition of the processes shows that A6 substituted to 56% station A3, to 30% A4 and only to 14% A5 with 20 parts in system. The other runs show an equal substitution of A3, A4 and A5, (figure 1).

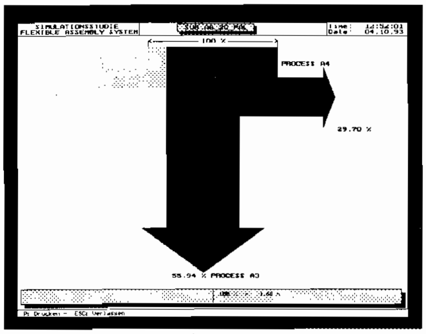


Figure 1

The more pallets are in the system the higher the average and maximum throughput time rises up. The longest throughput time of a pallet with 20 parts in the system was 21 minutes, with 60 pallets instead nearly 2 hours. The average throughput time stayed, except at the beginning, constant and variation was only little but on different levels: 6.6 minutes for 20 pallets, 13.3 minutes for 40 pallets and 20 minutes for 60 pallets in the system, (figure 2 and 3).

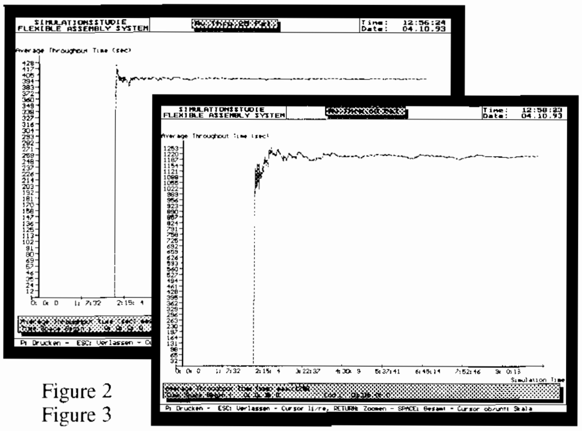


Figure 2
Figure 3

Development and execution times: The model required 8 hours to design and debug the logic and 3 hours for the overlay (figure 4). The DIPLAN Corp. developed analyzing software tools for PCModel report files for different needs. For this simulation the tools needed just a configuration file. This took about half an hour.

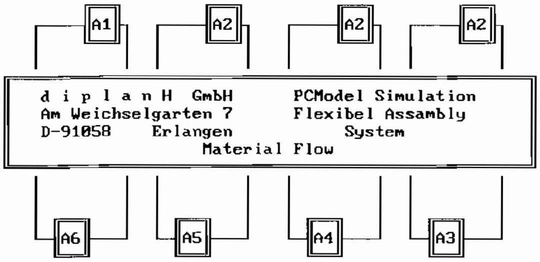
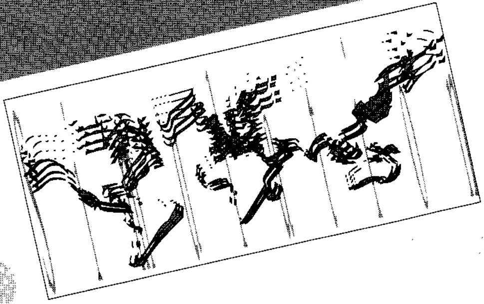


Figure 4

The model execution time varied depending upon the number of parts in the system. With 20 parts in the system, the model executed in 5 minutes on an i386 IBM PC compatible operating at 40 MHz. With 60 parts in the system the model executed in less than 15 minutes on the same computer.

For more information and comments please contact: *Dr. K. Schlüter, M. Stichert, DIPLAN GmbH, Am Weichselgarten 7, D-91058 Erlangen, Germany, Tel: +49-9131-691-235, FAX: +49-9131-691-111.*



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  ISS Italian Simulation Society
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  UKSS United Kingdom Simulation Soc.
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- **JSST** Japanese Society for Simulation Technology
- **KSS** Korean Simulation Society
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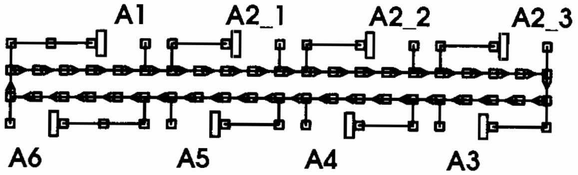
Comparison 2 - MOSYS

Description of MOSYS

MOSYS is a complex modularly structured simulation tool developed by the Fraunhofer Institute for Production Systems and Design Technology (IPK) Berlin. The tool enables the user to create and evaluate models of any discrete system with the desired degree of detail. The basic philosophy of the simulation tool is that any system can be generated by using five different types of elementary building blocks which can be composed in subsystems of the considered model on an arbitrary number of hierarchical levels. Thus the user is enabled to create models following either a top down or a bottom up strategy what makes the work essentially easier. The software runs on different platforms as IBM/370, VAX-stations and Unix-PCs.

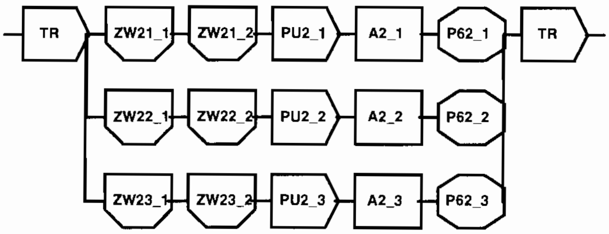
Model Description

The system's model was generated in a quite detailed way. The topological model shown below reflects the real distances and speeds of the transportation facilities of the system.



Topological layout of the system

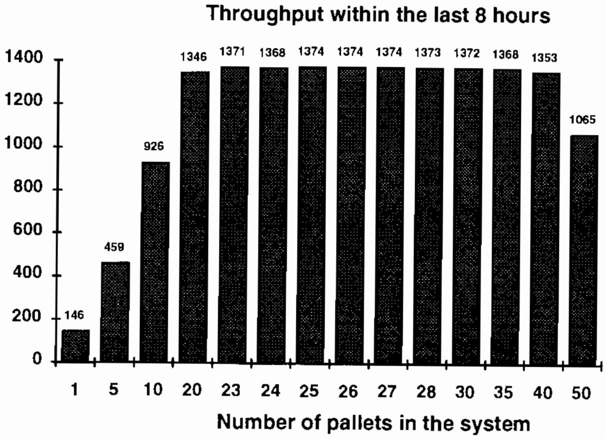
Behind each assembly station Ax in the functional model there is a number of test elements determining the further route of parts through the system depending on their status (for instance in the picture below the three stations A2 are shown with the logical flow for a part which has already passed station A6 before it was processed on A2_x (x=1,2,3).



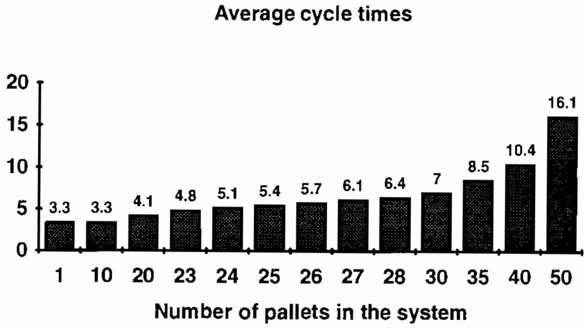
Section of the functional operation plan

Simulation Results

The main goal of the simulation was to find out the optimal number of pallets in the system and to determine the cycle time of the pallets (i.e. the time passing between fixing a part on a pallet and taking it apart). The results are given in the following diagram.



The system has its maximum throughput for 25 - 27 pallets. The respective cycle times are given in the following diagram:



Comparing the simulation runs and taking into account the pallet cycle times, too, it turns out that the optimum number of pallets in the system is about 25-26. Here the throughput is at the maximum and the pallet cycle times are not essentially larger than the overall processing time, i.e. waiting times in front of the stations and the time for additional turns around on the belt are very small. For a higher number of pallets in the system the throughput remains relatively stable up to 40, while the cycle time increases. For more than 40 pallets the throughput strongly declines due to blocking effects and, finally for 60 pallets in the system deadlocks occur.

For further information please contact: *Markus Rabe or Norbert Deul: IPK Berlin, Pascalstraße 8-9, D-10587 Berlin, Tel: +49-(0)30 39006248, Fax: +49-(0)30 3911037.*

Comparison 6 - Discussion of Results obtained with Micro Saint

The approach that we followed in solving this problem was to build the model, identify the system's weak points and develop hypothetical solutions and study how these solutions will improve performance of the health care system. The model development process is discussed in SNE 9, this article will focus on a discussion of the findings using Micro Saint.

Assumptions - The only assumption that we made was that for patients requiring multiple visits to a casualty ward (CW) (Patient types 1 and 3), they were always sent to the same CW the second time as they went to the first time.

Defining the System Weak Points - Using the patient inter-arrival times presented, the queues began to grow quickly at registration and the casualty wards and, essentially, they continued to grow throughout the day until no further patients were admitted to the facility.

Additionally, because of the patient allocation scheme, doctors finished serving their assigned quota of patients at CW1 significantly before the less experienced doctors at CW2. Finally, because of the extensive queues built in front of the CWs, patients of types 1 and 3 were taking substantially longer to be served than patients of types two and four.

The queues at the plaster and x-rays did appear to be quite reasonable, often with no one in the queue for plaster and the queue for x-ray growing slowly throughout the day, but still quite small in comparison to the queues for the CWs.

Develop Hypothetical Solutions - Based on the information gained from our model, we determined that patients on the baseline condition were all spending in excess of 92% of their time in the system in queues. Patients arriving later in the day would spend significantly more than that.

We ran the option of moving an experienced doctor from CW 1 to CW 2 and an inexperienced doctor from CW 2 to CW 1 when the queue length at CW 2 exceeded 20. However, since the queue lengths were almost always over 20, this had little effect except to move the doctor permanently. The 60/40 patient allocation scheme and the need for patients to revisit the CW they went to first also had a negative effect on performance. In effect, all that occurred was that the doctors were allocated evenly among the CWs and the patients were allocated unevenly.These data are presented in the original report (task b).

It seemed obvious from the imbalance of the queues between the units that this was a balancing problem. In effect, what we were trying to do was level the two CWs. We tried the option of giving each CW one experienced and one inexperienced doctor and then allocating patients based on the ward with the minimum queue length. This results in the improvements indicated in Table 1 (task b).

Table 1 Service Times (mins)

	task a	task b	task c	task d
close (hr)	13.50	13.41	13.53	12.52
type 1	236.9	234.5	163.0	128.9
type 2	136.1	142.8	160.8	135.0
type 3	263.2	256.9	180.5	142.2
type 4	130.7	128.4	156.3	119.5
overall	176.9	173.1	160.9	127.1
std dev	82.7	80.0	74.9	56.8

task a: baseline model
task b: equally allocated doctors
task c: sorted queues
task d: equally allocated doctors and sorted queues

Finally, we considered the problem of patients types 1 and 3 that had to be served twice by the CWs. The need to wait in two queues at CWs resulted in total "in system" time being unfairly long relative to the time required to receive actual service. To reduce their service time, we instituted a system simulating each patient being given a number when they arrived at the clinic and then, when entering a queue, patients were served based on that time (first in the system first served as opposed to first in the queue). This resulted in the time presented in Table 1, (task c) dramatically leveling the service time between the different patient groups.

With this, it was clear that the equal allocation of doctors and patient assignments and the queue assignment schemes were both good and could be implemented together, thereby reducing mean patient service time and reducing the between patient variability. These results were simulated and are presented as task d in Table 1. This also resulted in a synergistic improvement in overall clinic performance.

Results - The simple result is that this clinic was understaffed with doctors for the proposed demand. No amount of refinement in strategies would affect this basic problem. However, the queuing system we proposed coupled with a more reasonable allocation of experienced doctors led to a more efficient utilization of those limited resources as well as a more equitable distribution of service times.

For information contact Andrew Rayner, RAPID DATA LTD, Crescent House,Crescent Rd,Worthing W Sussex, BN11 5RW UK. Tel: +44.903.821266; Fax: +44.903.820762.

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Comparison 6 - EXAM

Description of EXAM: EXAM is a general purpose simulation system for discrete models. It is implemented on IBM AT under MS-Windows. A brief description of EXAM has been given in SNE 7.

Model Description: The figure shows the model of the Emergency Department constructed with the help of EXAM's model editor. The model was assembled from blocksof one of the standard libraries (the library for queueing systems). By this way casualty wards, X-raying, registration and plaster room were represented by a single block (module "Multi-server"). The instances of the module have different values of parameters. The first parameter is the number of servers (two for CW1, CW2, X-raying and one for registration and plaster room). The second is the service time. The waiting area is represented by the module "Distributor" that determines the next operation for patients. The module "Generator" forms the input stream.

Results:

a) In order to estimate the average overall treatment time 50 simulation runs were made. The results are summarized in Table 1.

	Average overall treatment time (min)
All patients	171.4
Patients of type 1	193.3
Patients of type 2	168.3
Patients of type 3	199.3
Patients of type 4	161.6

Table 1

b) Changing of parameters of service under particular conditions (i.e. exchanging two doctors) were added to the above experiment. Because of overload of the system, the results depend only slightly on these changes (Table 2).

	Average overall treatment time (min)
All patients	173.6
Patients of type 1	190.3
Patients of type 2	172.0
Patients of type 3	209.5
Patients of type 4	164.6

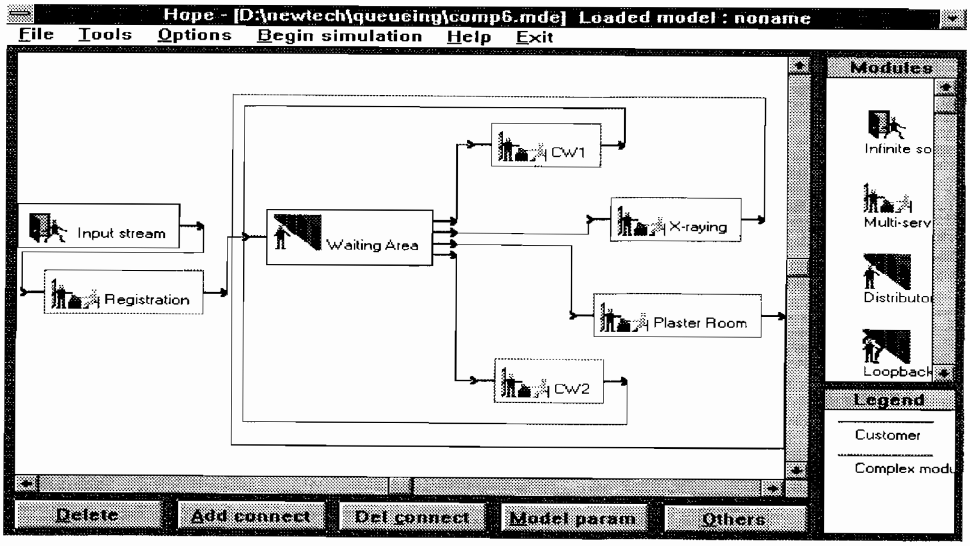
Table 2

c) For minimizing the standard deviation we used the suggested method (Table 3). Due to overloading, the queue length at each treatment point is very large. For this reason the main contribution to the average times is connected with waiting in the queues. The replica of service (for 1 and 3 types) is dramatically less than the waiting time.

	Average overall treatment time (min)
All patients	163.5
Patients of type 1	165.7
Patients of type 2	164.2
Patients of type 3	170.9
Patients of type 4	160.2

Table 3

For more information and comments please contact: *Dr. Prof. V. Kalashnikov, Institute of System Analysis, 9, Prospect 60 let Oktyabrya, 117312 Moscow, Russia; Tel: +7-095-1355444; Fax: +7-095-9382209; E-mail: mconeau@glas.apc.org*



Comparison 7 - PSIMOS

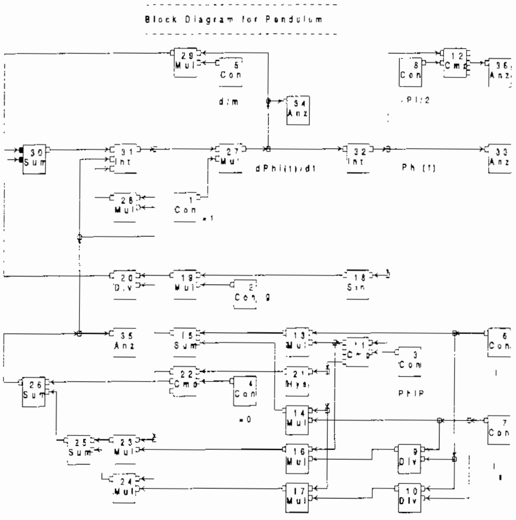
Short description

PSIMOS is a PC software package for system analysis, simulation of linear and nonlinear systems, system identification, controller design and direct realtime applications based on standard boards (e.g. DAS 1600).

Based on a block-oriented modeling procedure nonlinear systems may be modeled in two ways depending on the user's preferences. Models are entered as a connection table using a standard ASCII editor or they are created graphically as a block diagram with the PSIMOS block diagram editor. These two procedures may also be applied alternatively for realtime models.

Model description

Applying the PSIMOS block diagram editor the following structure can be created.



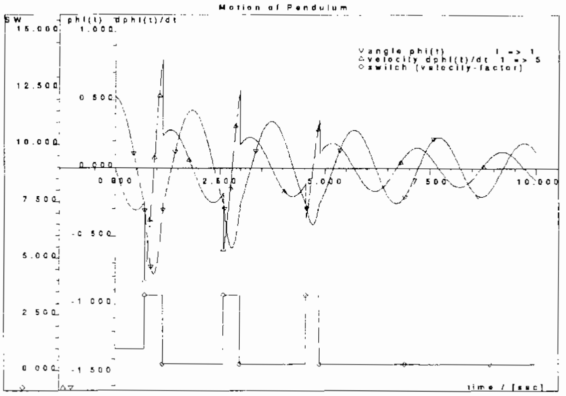
All blocks are directly taken from the PSIMOS block library. Two blocks are explained explicitely here: the integration block (No. 31) and the comparator (No. 11,12, 22). The first one provides a control input for taking new state values each time the control input changes. A comparator may be parametrized for static or dynamic work. If switched to dynamic, the block ensures that events are simulated with user-definable accuracy.

Results

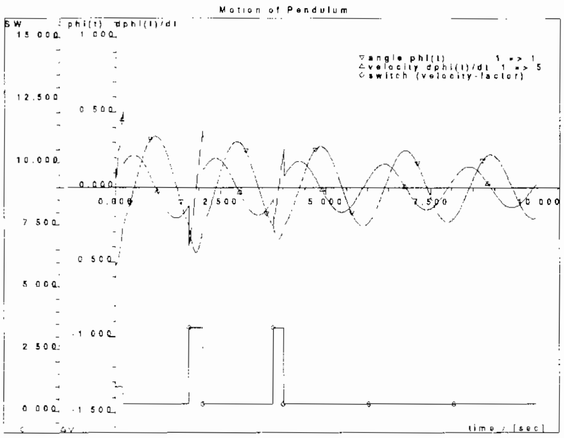
a) The following plots show the results for

i) d=0.2, $\varphi_o = +\pi/6$ and ii) d=0.1, $\varphi_o = -\pi/6$

i)



ii)



b) There are two ways for comparing the results. The first is by carrying out simulation runs with both the nonlinear and the linear model included and plotting the curves. The second method is to perform sequential simulation runs while storing simulated data to a file. A small model with file-read-blocks available in the PSIMOS block library reads both files and shows the different curves for comparison.

c) Using the above simulation model especially with the blocks 8, 12 and 36, the comparator (12) informs about the event '***-π/2 is reached***'.

The desired angular initial velocity can be found with PSIMOS since the program allows to define parameters to be varied easily from a menu. Inserting the initial velocity in this menu for fast access, few trials yield two results:

$(d\varphi/dt)_{01} = -2.186$, $(d\varphi/dt)_{02} = +2.304$.

Siegfried Delzer, ITK Ingenieurbüro für Technische Kybernetik, Ritterstraße 51, D-79541 Lörrach, Tel: +49-(0)7621-5045, Fax: +49-(0)7621-56605

Comparison 7 - ACSL

In "EUROSIM - Simulation News Europe" issue Number 8 of July 1993, F. Breitenecker has already given a solution for comparison 7 with ACSL. Therefore I will only describe an alternative method for task c). This method permits calculation of the unknown angle velocities without an iteration program by using ACSL's own iteration routine dealing with condition dependent DISCRETE sections.

Task c): For the pendulum equation

$$ml\ddot{\varphi} + dl\dot{\varphi} + mg\sin\varphi = 0 \qquad \varphi(0) = \frac{\pi}{6} \tag{1}$$

the angle velocities $\dot{\varphi}_a(0) < 0$ and $\dot{\varphi}_b(0) > 0$ are to be determined so that at the returning point $\dot{\varphi}(t_1) = 0$ the angle $\varphi(t_1) = -\pi/2$ is valid. The pendulum length l changes over a period of time between full length l_f and short length l_s. Because at $t = t_1$ both φ and $\dot{\varphi}$ are known and t does not appear explicitly in the differential equation, the unknowns $\dot{\varphi}_a(0)$, $\dot{\varphi}_b(0)$ are calculable by means of an initial value problem (IVP). Equation (1) is solved backward from the returning point by using the new variables:

$$t' = t_1 - t\,, \qquad \alpha(t') = \varphi(t)\,. \tag{2}$$

Because of

$$\frac{d\alpha}{dt'} = -\frac{d\varphi}{dt}\,, \quad \frac{d^2\alpha}{dt'^2} = \frac{d^2\varphi}{dt^2}\,, \tag{3}$$

we get a new differential equation

$$ml\ddot{\alpha} - dl\dot{\alpha} + mg\sin\alpha = 0 \quad \alpha(0) = -\frac{\pi}{2}\,, \quad \dot{\alpha}(0) = 0\,, \tag{4}$$

whose solution is increasing and terminates when $\alpha(t')$ at $t' = t_1$ reaches the starting point $\alpha_1 = \varphi(0)$.

A DISCRETE section POINT is called either with

a) `SCHEDULE POINT .XP. (alpha - alpha1)` or
b) `SCHEDULE POINT .XN. (alpha - alpha1)`

and by the system's own iteration method gives the values at t' = t_1 or t = 0.

The DISCRETE section POINT contains as a terminal condition
a) `TERMT (alpha .GE. alpha1)` or
b) `TERMT (alpha .LE. alpha1)`.

The desired initial values of the angle velocities are

$$\dot{\varphi}_a(0) = -\dot{\alpha}_a(t_1)\,, \qquad \dot{\varphi}_b(0) = -\dot{\alpha}_b(t_1)\,. \tag{5}$$

```
PROGRAM Constrained Pendulum Backward - Case a
! ----- Model Parameters (Units kg-m-sec)
       CONSTANT m = 1.02, g = 9.81, d = 0.2
       CONSTANT lf = 1, lp = 0.7, alphad0 = 0
       Pi = 4*ATAN(1.0); alpha0 = -Pi/2
       alphap = -Pi/12; alpha1 = Pi/6; ls = lf-lp
INITIAL
! ----- Determine Initial Length of Pendulum
       l = lf
       IF (alpha0 .LT. alphap) l = ls
END ! of INITIAL
DYNAMIC
DERIVATIVE
! ----- Differential Equation
       alphadd = -(-d*l*alphad+m*g*sin(alpha))/(m*l)
       alphad  = INTEG(alphadd, alphad0)
       alpha   = INTEG(alphad, alpha0)
! ----- Events
       SCHEDULE SHORT .XN. (alpha-alphap)
       SCHEDULE LONG .XP. (alpha-alphap)
       SCHEDULE POINT .XP. (alpha-alpha1)
END ! of DERIVATIVE
! ----- Communication Interval
       CINTERVAL CINT = 0.005
! ----- Discrete Sections
       DISCRETE SHORT ! Hit on Pin
       CALL LOGD(.TRUE.)
       l = ls
       alphad = alphad*lf/ls
       CALL LOGD(.TRUE.)
       END ! of SHORT
       DISCRETE LONG ! Separate from Pin
       CALL LOGD(.TRUE.)
       l = lf
       alphad = alphad*ls/lf
       CALL LOGD(.TRUE.)
       END ! of LONG
       DISCRETE POINT ! Starting Point
! ----- Termination Condition
       TERMT(alpha .GE. alpha1)
       END ! of POINT
END ! of DYNAMIC
END ! of PROGRAM
```

The numerical results are the following:

a) $\dot{\varphi}_a(0) = -2.1847$ at $\varphi(0) = 0.523599$,

b) $\dot{\varphi}_b(0) = 2.29107$ at $\varphi(0) = 0.523599$.

For validation the pendulum is solved forward with these values. The run terminates a) at $t_1 = 0.601251$ with $\varphi = -1.5708$ and $\dot{\varphi} = 6.1933E{-}07$ as well as b) at $t_1 = 1.254100$ with $\varphi = -1.5708$ and $\dot{\varphi} = 2.1884E{-}06$. These are within the accuracy of acceptable results.

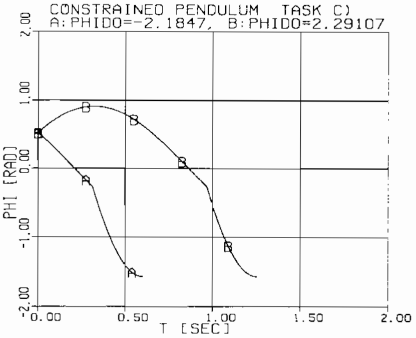


Figure 1. Angle-Time-Functions up to the returning point $\varphi = -\pi/2$

R. Hohmann, Department of Simulation and Graphics, Otto-von-Guericke-University Magdeburg, Universitätsplatz 2, D - 39106 Magdeburg, Germany.

Book Review

F. Breitenecker, H. Ecker, I. Bausch-Gall:
"Simulation mit ACSL"
Published by Friedr. Vieweg & Sohn Verlagsgesellschaft mbH, Braunschweig/Wiesbaden, 1993 (in German language), ISBN 3-528-06381-5

This volume forms one of the ASIM book series on simulation topics. Written by three experienced users of ACSL continuous system simulation language it provides a comprehensive introduction to continuous system simulation methods in the context of facilities provided within ACSL. A large number of very useful illustrative examples are included, drawn from several different disciplines.

The book is of potential value both to those who are experienced ACSL users who should find much to interest them in the examples and in some of chapters on more advanced features of the language, and to those who are less familiar with ACSL but who wish to become more experts in its use. The authors should be congratulated in including material which links features of ACSL to more general and fundamental issues of continuous system simulation. Examples of this are to be found in sections of the book which deal with numerical integration methods and linearisation.

The first few chapters are used to introduce the ACSL language through a range of example problems, to discuss the structure of ACSL simulation models, to describe the use of specific features such as function tables and to review the procedures for run-time control and experimentation with ACSL models. Later chapters cover the use of DISCRETE sections, MACROS and frequency response tools in ACSL.

Practical questions concerned with the interpretation of errors arising in ACSL programs at translation stage, in compilation and at run-time are discussed in detail in Chapter 8. This is a particulary useful section of the book, especially for the less-experienced ACSL user.

The final two chapters address applications which involve simulation experiments of a more complex kind, involving multiple runs with different parameter sets, distributed parameter models, Monte Carlo problems and optimisation.

This book is to be recommended for all interested in continuous system simulation. One criticism is the lack of an index but this is of minor importance in a book such as this which has a highly logical structure. The contents list is a detail one and shows very clearly the division of material into chapters, sections and sub-sections.

D. J. Murray-Smith, Glasgow

Call for Papers!

The 1994 Winter Simulation Conference will be held December 11-14, 1994, in Orlando, Florida, USA. Highlights of the conference include:

- **Introductory and advanced tutorials on system simulation**
- **State-of-the-art reviews of current research and practice**
- **Invited and contributed papers on simulation applications and methodology**
- **Panel discussions on current issues**
- **Exhibits by software and hardware vendors**

Papers are currently being solicited for presentation at the conference and publication in the conference proceedings. To submit a paper that was not previously published or presented elsewhere, please request a complete Call for Papers from WSC Program Chair Andrew F. Seila, Terry College of Business, 201 Brooks Hall, University of Georgia, Athens, GA 30602-6255, USA, Phone: (706) 542-3586, Fax: (706) 542-4295, E-Mail: aseila@cbacc.cba.uga.edu. Papers are due by April 15.

WSC '94

1994 Winter Simulation Conference

An Overview of Simulation Activities in the former Soviet Union

Computer simulation is of common use in the former Soviet Union. Simulation activities are located mainly at Universities and Research Institutes of the State Academies of Science. Simulation applications are also done at Applied Research Institutes. There are a lot of simulation centres and groups. It is quite impossible to mention all of them. We shall reflect the main simulation activities and the main simulation centres operating in this part of the world.

Simulation research in the former Soviet Union is mostly concentrated in Russia (Moscow, St. Petersburg, Novosibirsk, Krasnoyarsk), Ukraina (Kiev), Belorussia (Minsk, Gomel), Latvia (Riga), and Lithuania (Kaunas). There are four main aspects in development: theoretical, applied, programming, and educational. In the following the numbers in parentheses indicate the simulation groups mentioned later, where the corresponding activities take place.

Theoretical investigations in computer modelling and simulation (mainly in Moscow, St. Petersburg, and Riga) are connected with general methodological concepts. Their main directions are: statistical aspects, correlated experiments, ties between preciseness and complexity of models: the late Prof. Dr. Yu. Polljak. {11}, {25}, {29}, {35}; structural methods, generalized Petri-nets, a concept of simulation centres (especially for manufacturing systems): the late Prof. Dr. A. Vavilov {9}; a qualitative analysis of simulation models (with regard to the stability and stationarity of simulation processes): {4}; an aggregative approach to formalisation of complex systems: the late Prof. Dr. N. Buslenko; {4}; optimization of simulation systems. {11}, {19}, {28}, {29}.

Applied simulation and modelling activities take place in the following main directions: computer systems (Kaunas, Novosibirsk, Moscow, Kiev, Gomel): {13}, {27}, {36}; manufacturing systems (Moscow, St. Petersburg, Minsk, Kiev, Riga): {8}, {9}, {10}, {19}, {22}, {28}; ecology and environment (Moscow, Krasnoyarsk, Kiev, Minsk) {5}, {15}, {18}, {21}, {23}; control systems (Moscow, St. Petersburg, Krasnoyarsk): {3}, {7}, {14}; energetics (Kiev): {20}; economics (Kiev, Riga): {18}, {28}, {31}.

Programming aspects are developed along the following lines: various versions of aggregative simulation models (Prof. Dr. V. Kalashnikov, Moscow): {4}; general simulation tools (for instance, the simulation language NEDIS for combined systems has been developed in Kiev under guidance of Dr. V. Gusev and Dr. T. Marianovich): {16},{18}, {30}, {33}; simulation tools for computer systems (Prof. Dr. I. Maksimej in Gomel, Dr. M. Nechipurenko in Novosibirsk): {13}, {27}; simulation centres (Prof. Dr. B. Fomin in St. Petersburg): {9}.

Educational activities in simulation and modelling are concentrated mainly at universities. We shall mention three of them:

{1}. Scientific Research Institute for Modelling and Intellectualization of Complex Systems (IMICS) at the St. Petersburg State Electro-Technical University (Prof. Dr. B. Sovetov) has issued a well-known (in the former Soviet Union) textbook on modelling and simulation [1], has been supplied also with laboratory and practical work. Currently its computer-aided version is under development.

{2}. Department of Modelling and Simulation at the Riga Technical University (Associate Prof. Dr. Yu. Merkuryev, Associate Prof. Dr. Ju. Tolujev, and Prof. Dr. L. Novitsky) is preparing (together with a joint venture "LMS") a computer-aided instruction course in discrete-event simulation. Currently its first three lessons for IBM PC are available.

{3}. Control Department of the St. Petersburg State Electro-Technical University (Prof. Dr. V. Sovetov, Prof. Dr. D. Imajev, Dr. L. Poshehonov) has developed (together with the Technical University of Gdansk, Poland) a PC-based simulation tool CLASSIC for continuous systems. It may be used for both simulation of control systems and education in the field of Automatic Control.

In 1986 a group of simulationists from Moscow, Novosibirsk and Kiev (in Ukraina) was rewarded with the highest award that had been established in the Soviet Union for scientific and practical work: with The USSR State Award. Their work was based on the concept of aggregative simulation systems. The aggregative approach to simulation was developed in the 60's under the guidance of the late Prof. Dr. Nicolaj Buslenko. Nowadays this direction is headed by Prof. Dr. Vladimir Kalashnikov ({4}. Institute for Systems Analysis/Russian Academy of Sciences, Moscow). It incorporates the following lines: formalisation of complex systems into so-called "aggregative models"; computer realisation of this formalism in order to get simulation models; working out mathematical support for aggregative models; increasing reliability of simulation results. This approach is close to the general scheme of "discrete models" by Prof. B. Zeigler, but mathematical description in aggregative models plays a more important role. It may be studied in detail from [2]. Several versions of simulation systems have been elaborated. The last one, named EXAM [3], is based on an object-oriented language and includes both model description and experiment description tools.

Other simulation centres in **Moscow** are: {5}. Computer Centre of Russian Academy of Sciences (Prof. Dr. N. Moiseev): Simulation in Ecology and Environment.

{6}. InterEVM (Prof. Dr. V. Baraniuk): Simulation of complex systems in order to evaluate their reliability.

{7}. Flight Research Institute (Dr. L. Berestov, V. Rogozin): Simulation for flight research.

{8}. Centrprogrammsystem (Dr. L. Massarsky, Tver): Simulation of discrete manufacturing processes. A special simulation tool SIMPROGRAP has been developed. It may be used for design aims.

St. Petersburg: {9}. St. Petersburg State Electro-Technical University (Prof. Dr. B. Fomin): Simulation of manufacturing systems.

{10}. St. Petersburg Technical University (Prof. Dr. V. Katkovnik, Dr. N. Ganin): Simulation of manufacturing systems.

{11}. St. Petersburg University (Prof. Dr. S. Ermakov, Dr. V. Mels, Dr. N. Krivulin): Mathematical theory of simulation processes: solution of differential, partial differential, and integration equations of mathematical physics by means of simulation; mathematical methods of variance reduction techniques, data aggregation, and experimental design; special methods for optimization of systems described by simulation models.

{12}. St. Petersburg Institute for Informatics and Automatics/Russian Academy of Sciences (Prof. Dr. R. Yusupov): Validation and visualization of simulation models; Distributed object-oriented simulation environment; Neural networks.

Syberia: {13}. Computer Centre/ Russian Academy of Sciences, Syberian Branch, Novosibirsk (Dr. M. Nechipurenko): Simulation of computer systems.

{14}. Space Technology University/Krasnoyarsk (Prof. Dr. A. Antomoshkin): Modelling for spacecraft systems.

{15}. Computer Centre/Russian Academy of Sciences, Syberian Branch, Krasnoyarsk (Prof. Dr. Yu. Shokin, Prof. Dr. V. Shaidurov, Dr. S. Sharyi): Interval simulation of continuous systems; Simulation of Environment and Ecology.

Ukraina: {16}. Institute for Cybernetics/Ukrainan Academy of Sciences (Dr. V. Gusev): Simulation tools for discrete/continuous systems NEDIS. Now its object-oriented version NEDIS-90 is under development.

{17}. Institute for Cybernetics/Ukrainan Academy of Sciences (Prof. Dr. A. Ivahnenko): GMDH (Group Method of Data Handling) modelling algorithms.

{18}. Institute for Cybernetics/Ukrainan Academy of Sciences (Various groups): Simulation is used in Economics, Ecology, Computer-Aided Design, Transport, System Analysis, Decision Making. Several simulation tools have been prepared: for inventory systems, maritime systems, etc.

{19}. Kiev Technical University (Prof. Dr. L. Yampolskij): Simulation of manufacturing systems; Intelligent planning of simulation experiments.

{20}. Institute for Modelling in Energetics/Ukrainan Academy of Sciences (Prof. Dr. A. Verlan): Simulation and modelling in Energetics.

Belorussia: {21}. Computer Centre/Belorussian Academy of Sciences (Prof. Dr. V. Katkov): Simulation in Ecology.

{22}. Institute for Technical Cybernetics/Belorussian Academy of Sciences (Prof. Dr. V. Tanajev): Simulation of manufacturing systems.

{23}. Central Botanical Garden/ Belorussian Academy of Sciences (Dr. A. Fradkin): Simulation of forests.

{24}. Belorussian State University (Prof. Dr. G. Medvedev): Analytical modelling and simulation of communication networks.

{25}. Belorussian State University (Prof. Dr. Yu. Harin): Statistical aspects of simulation.

{26}. Computer Centre/ Belorussian Academy of Sciences, Gomel Branch (Dr. Yu. Kuzminskij): Real-time simulation of gas pipelines.

{27}. Gomel University (Prof. Dr. I. Maksimej): Simulation of computer systems.

Latvia: {28}. Riga Technical University (Associate Prof. Dr. Yu. Merkuryev, Associate Prof. Dr. Ju. Tolujev, Associate Prof. Dr. G. Merkuryeva): Simulation of manufacturing systems; Simulation in Economics; Simulation in Logistics; Optimization of simulation models; Knowledge-based user-friendly simulation; Simulation of continuous systems in the frequency domain (together with Dr. V. Bardachenko).

{29}. Riga Technical University (Prof. Dr. L. Rastrigin): Optimization of simulation models, using correlated runs; Modelling of educational processes. Models being developed are used in the educational system ASOLIA. It assists in studying foreign languages on the personal computer. Various versions are available (for instance, for English or German speaking students studying Russian). Audio support is also provided.

{30}. Latvian University (Dr. G. Ionin and Dr. V. Supe): Simulation tools for discrete-event systems.

{31}. Latvian University (Associate Prof. Dr. M. Purgailis): Simulation in Economics.

{32}. Latvian Academy of Medicine (Dr. S. Gandz): Simulation for the disaster medicine.

{33}. Information Engineering Centre/Latvian Academy of Sciences (Dr. A. Strekalev): Simulation tools for Petri-net based models.

{34}. Software House Riga AG (Dr. J. Tenteris, Dr. V. Zulis, and A. Teilans): Data modelling; Modelling of information systems.

Simulation activities are quite intensive in Latvia. In 1990 the Latvian Simulation Society has been founded. It was the first (and still remains unique) professional simulation society in the former Soviet Union (with Associate Prof. Dr. Yu. Merkuryev as Chairman). In 1993 the Department of Modelling and Simulation ws established at the Riga Technical University (with Associate Prof. Dr. Yu. Merkuryev as Head). It concentrates educational activities in the simulation area in Latvia and also is involved in corresponding research ({2}, {28}, {29}) [4]. For instance, a user-friendly intelligent discrete-event object-oriented simulation system is currently under development at the department together with the Department of Applied Mathematics, Biometrics and Process Control (Prof. Dr. Gh. Vansteekiste and ir. H. Vangheluwe) of the University of Ghent, Belgium.

Lithuania: {35}. Kaunas Technical University (Prof. Dr. H. Pranevitchius): Simulation of computer networks by means of aggregative models.

When contacting simulationists from the former Soviet Union it is important to take into account also organizational aspects. Let us consider some features which are typical for this part of the world.

a). Many scientists from the former Soviet Union don't have any experience in contacts with their foreign colleagues. Often they are passive in these contacts, passive in travelling abroad, in attending international events, even if their visits are financially supported.

b). Another problem is the language. Unfortunately, many scientists here have communication difficulties because of language problems. At the same time, as such contacts take place, people get more practical experience, and this problem decreases.

c). We continue with the visa problem. When planning visits from the former Soviet Union it is necessary to take special arrangements for visa support: to ensure personal invitations, to contact embassies, etc.

d). There is also an information problem. Generally scientists in the former Soviet Union don't have permanent access to information about international events. Sometimes they receive this information, but too late, thus not having enough time to prepare abstracts and other necessary information in time. Therefore it is desirable that the information (Call for Papers, etc.) is sent directly to the corresponding simulation centres. Another possibility is to put this information into well-circulated scientific magazines (for instance those being issued in Russia). It is possible also to contact the authors of this paper: Dr. Yuri Merkuryev represents the Society for Computer Simulation International in the former Soviet Union, and Dr. Vladimir Kalashnikov co-ordinates organizational activities of the professional simulation society in Russia.

This paper is based on the invited talk that has been presented at the 1992 European Simulation Symposium in Dresden, Germany (November 5-8, 1992) and takes into account also recent developments. Simulation activities are quite wide and well developed in the former Soviet Union. Actually, ESS92 was the first event where these activities have been well represented. We are extremely sure that close contacts between the international simulation community and simulationists from that part of the world will bring benefits for both parties.

Acknowledgements: It is our pleasure to thank Philippe Geril, Prof. Dr. Axel Lehmann, Prof. Dr. Eugene Kerckhoffs, Prof. Dr. Wilfried Krug, Rainer Rimane, and Prof. Dr. Ghislain Vansteenkiste for their initiatives and their support, which resulted in the organization of the special session on simulation activities in the former Soviet Union at ESS92. Prof. Dr. Boris Fomin from the St. Petersburg State Electro-Technical University and Prof. Dr. Leonard Rastrigin from the Riga Technical University gave us additional information concerning some simulation centres in Russia. We are greatful also to Dr. Vladimir Gusev from the Institute for Cybernetics of the Ukrainan Academy of Sciences and Dr. Gennady Kuznecov from the Computer Centre of the Belorussian Academy of Sciences for information on simulation activities in Ukraina and Belorussia.

References

[1] Sovetov B. Ja., Jakoviev S.A. (1985). Systems Modelling. Moscow, Higher School Publishing House. (in Russian)

[2] Kalashnikov V.V. (1991). Aggregative Systems: Modelling, Mathematical Analysis, Simulation. Syst. Anal., Model. Simul. Vol. 8, No. 7. pp 507-514.

[3] Kalashnikov V.V., Morozov A.I., Sedunov V.M., Shashkov L.E. (1992). EXAM: An Object-Oriented Environment for Simulation Experimental Pattern Recognition and Image Analysis. Vol. 2, No. 1. pp 66-76.

[4] Merkuryev, Yury .A. (1993). Simulation Activities at the Riga Technical University. EUROSIM - Simulation News Europe, No. 7, p 26.

Yury A. Merkuryev, Riga Technical University, Kalku Street No. 1, LV-1658 Riga, Latvia, E-mail: merkur@itl.rtu.lv.
Vladimir V. Kalashnikov, Institute of System Analysis, Prospect 60 Let Oktjabrja, 9, 117312 Moscow, Russia, E-mail: mconeau@glas.apc.org

Calendar of Events

March 1994

23-25 **Workshop of the ASIM Working Group "*Simulationsssoftware und -hardware*",** plus German Speaking ACSL User Group Meeting. Clausthal, Germany
Contact: Prof. D. Möller, TU Clausthal, Institut für Informatik, Erzstr. 1, D-38678 Clausthal-Zellerfeld, Tel. +49-(0)5323 722402 or 722504, Fax +49-(0)5323 723572

April 1994

7-8 **CEEDA '94**. International Conference on Concurrent Engineering and Electronic Design Automation. Bournemouth, U.K.
Contact: Philippe Geril. The Society for Computer Simulation, European Simulation Office, University of Ghent, Coupure Links 653, B-9000 Ghent, Belgium. Tel/Fax: +32-92 234941, E-Mail: scsi@fland.rug.ac.be

28-30 **"*Ebernburger Gespräche*" of the ASIM Working Group "*Simulation in Biologie, Medizin und Ökologie*"**. Ebernburg, Germany
Contact: Prof. D. Möller, TU Clausthal, Institut für Informatik, Erzstr. 1, D-38678 Clausthal-Zellerfeld, Tel. +49-(0)5323 722402 or 722504, Fax +49-(0)5323 723572

May 1994

10-13 **CIM 94**, International Conference on Computer Integrated Manufacturing. Zakopane, Poland
Contact: Prof. Dr. R. Knosala, The Institute of Machine Technology, Silesian Technical University, Konarskiego 18a, PL-44-100 Gliwice. Tel: +48-32 371657, Fax: +48-32 315857

24-28 International Workshop on **Mathematical Methods and Tools in Computer Simulation**. St. Petersburg, Russia
Contact: Prof. S. Ermakov, Faculty of Mathemtics and Mechanics, St. Petersburg State University, Bibliotechnaya sq. 2, Petrodvorets, St. Petersburg, 198904 Russia. Fax: +7 812 428 6649, E-mail: statmod@hq.math.lgu.spb.su

31-June, 2
MOSIS '94. 28th Spring International Moravo-Silesian Conference **Modelling and Simulation of System**. Zabreh na Morave. Czech Republic
Contact: Jan Stefan, Technical University Ostrava, Dept. of Computer Science, tr. 17. listopadu, CZ-70833 Ostrava, Czech Republic. Fax: +42 (0)69 6919597, E-mail: Jan.Stefan@vsb.cz

June 1994

1-3 **ESM'94, 1994 SCS European Simulation Multiconference.** Barcelona, Spain
Contact: Philippe Geril. The Society for Computer Simulation, European Simulation Office, University of Ghent, Coupure Links 653, B-9000 Ghent, Belgium. Tel/Fax: +32-92 234941, E-Mail: scsi@fland.rug.ac.be

14-17 16th International Conference "**Information Technology Interfaces**" **ITI '94**. Pula, Croatia
Contact: Branka Radic, University Computing Centre, J. Marohnica bb, 41000 Zagreb, Croatia, Tel. +385 41 518 656, Fax: +385 41 518 451, E-mail: iti@srce.hr

21-23 **Massively Parallel Processing, Applications and Development**. EUROSIM Conference, Delft, The Netherlands.
Contact: Aula Conference Centre, P.O. Box 5020, 2600 GA Delft, The Netherlands, Tel: +31-15 788022/781340
Fax: +31-15 786755, E-mail: Secretariaat@rc.tudelft.nl

24-25 PSCS Workshop "**Simulation in Research and Development**"
Contact: A. Jaskiewicz, c/o IPPT/PAN, 00-049 Warsaw, Poland, Swietokrzyska 21, Tel: +48-22 261281 263, Fax: +48-22 269815

July 1994

18-21 **Summer Computer Simulation Conference** SCSC '94. La Jolla, CA, USA
Contact: SCS, P.O.Box 17900, San Diego, CA 92177, Tel: +1 619 277 3888, Fax: +1 619 277 3930, E-mail: scs@sdsc.bitnet

August 1994

17-19 **SIMS '94 Simulation Conference**. Stockholm, Sweden
Contact: SIMS, c/o Lars Langemyr, Computer Solutions Europe AB, Björnnävägen 21, S-113 47 Stockholm, Sweden, Tel: +46-(0)8-153022, Fax: +46-(0)8-157635
E-mail: sims@comsol.se

22-25 **1st Joint Conference of International Simulation Societies**. Zurich, Switzerland
Contact: Dr. J. Halin, ETH Zurich, Institute for Energy Technology, Clausiusstrasse 33, CH-8092 Zürich, Tel: +41-(0)1 632-4608, Fax: +41-(0)1 262-2158

September 1994

6-8 16th Workshop-Colloquium **Special Problems of Simulation Models** (in Czech or Slovak). Brno, Czech Republik
Contact: Jan Stefan, Technical University Ostrava, Dept. of Computer Science, tr. 17. listopadu, CZ-70833 Ostrava, Czech Republic. Fax: +42 (0)69 6919597,
E-mail: Jan.Stefan@vsb.cz

October 1994

3-7 2nd International Workshop on **Massive Parallelism: Hardware, Software and Applications**. Capri, Italy
Contact: A. Mazzarella, Instituto di Cibernetica, Via Toiano 6, I - 80072 Arco Felice, Tel: +39 81 853 4123, Fax: +39 81 526 7654, E-mail: secyann@cib.n.cnr.it

9-12 **European Simulation Symposium ESS 94**. Istanbul, Turkey
Contact: Philippe Geril. The Society for Computer Simulation, European Simulation Office, University of Ghent, Coupure Links 653, B-9000 Ghent, Belgium. Tel/Fax: +32-92 234941, E-Mail: scsi@fland.rug.ac.be

10-13 **ASIM 94. 9. Symposium Simulationstechnik**. Stuttgart, Germany.
Contact: M. Kraus, Fachhochschule für Technik Esslingen, Flandernstr. 101, D-73732 Esslingen. Tel: +49-(0)711/397-3755, Fax: +49-(0)711/397-3763,
E-mail: kraus@ti.fht-esslingen.de

December 1994

11-14 **1994 Winter Simulation Conference**. Orlando, Florida
Contact: D. A. Sadowski, Systems Modeling Corp., 504 Beaver Street, Sewickley, PA 15143, USA, Tel: +1-412 741 3727, Fax: +1-412 741 5635, E-mail: 516-3072@mcimail.com

June 1995

5-7 **European Simulation Multiconference ESM '95**. Prague, Czech Republic
Contact: E-mail: simul@utia.cas.cz

September 1995

11-15 **EUROSIM '95 European Simulation Congress**. Vienna, Austria
Contact: Computer Centre, Technical University of Vienna, Wiedner Hauptstr. 8-10, A-1040 Vienna, Austria.
Tel: +43-1 58801 5484, Fax: +43-1 5874211,
E-mail: eurosim95@email.tuwien.ac.at

April 1989

EUROSIM '98 European Simulation Congress. Finland

Classes on Simulation

March 1994

15-16 ***Kurs zur Modellierung mit SIMULINK***, München, Germany.
Contact: BAUSCH-GALL GmbH, Wohlfartstr. 21 b, D - 80939 München, Fax: +49-(0)89 3231063

21-25 **Computer Modelling of Aerospace Vehicle Dynamics**. Cranfield, UK.
Contact: P.G. Thomasson, College of Aeronautics, Cranfield University, Cranfield, Bedford, MK43 0AL, UK. Tel: +44-234 750111 5186, Fax: +44-234 750083.

April 1994

11-13 **Comnet III**, CACI Training Course, Camberley, U.K.
Contact: CACI Products Division, Coliseum Business Centre, Watchmoor Park, Riverside Way, Camberley, Surrey GU15 3YL, U.K. Tel: +44 276 671671, Fax: +44 276 670677

11-13 **Simfactory II.5**, CACI Training Course.Maastricht, NL
Contact: CACI Products Division, G. Martinolaan 85, 6229 GS Maastricht, The Netherlands, Tel: +31 43 670780, Fax: +31 43 670 200

6-8 **ACSL Class**, Eastbourne, U.K.
Contact: Rapid Data Ltd., Crescent Road, Worthing, West Sussex BN11 5RW, England, Tel: +44-903 202819, Fax: +44-903 820762, E-Mail: radata@ibmpcug.co.uk

13 **Seminar on ACSL**, Vienna, Austria.
Contact: I. Husinsky, Computer Center, TU Vienna, Wiedner Hauptstr. 8-10, A-1040 Wien, Tel: +43-1 58801 5484.

19-21 ***Simulation Kontinuierlicher Systeme***. Oberfaffenhofen
Contact: Carl-Cranz-Gesellschaft e.V., Postfach 11 12, D - 82234 Oberpfaffenhofen, Tel: +49-(0)8153 28-2413, Fax: +49-(0)8153 28-1345.

26-27 ***Kurs zur Modellierung und Simulation mit ACSL***, München, Germany.
Contact: BAUSCH-GALL GmbH, Wohlfartstr. 21 b, D - 80939 München, Fax: +49-(0)89 3231063

May 1994

2-6 ***Flug- und Systemsmulation***. Braunschweig,
Contact: Carl-Cranz-Gesellschaft e.V., Postfach 11 12, D - 82234 Oberpfaffenhofen, Tel: +49-(0)8153 28-2413, Fax: +49-(0)8153 28-1345.

9-11 **Simscript II.5**, CACI Training Course, Camberley, U.K.
Contact: CACI Products Division, Coliseum Business Centre, Watchmoor Park, Riverside Way, Camberley, Surrey GU15 3YL, U.K. Tel: +44 276 671671, Fax: +44 276 670677

10 **Seminar on SIMUL_R**, Vienna, Austria.
Contact: I. Husinsky, Computer Center, TU Vienna, Wiedner Hauptstr. 8-10, A-1040 Wien, Tel: +43-1 58801 5484.

16-18 **Modsim II**, CACI Training Course,Maastricht, Netherlands
Contact: CACI Products Division, G. Martinolaan 85, 6229 GS Maastricht, The Netherlands, Tel: +31 43 670780, Fax: +31 43 670 200

30-June 3
Mathematical Modelling and Digital Computer Simulation of Engineering and Scientific Systems. Zurich, Switzerland
Contact: Dr. Halin, ETH Zurich, Clausiusstr. 33, CH-8092 Zurich, Tel: +41-1 632 46 08, Fax: +41-1 262 21 58

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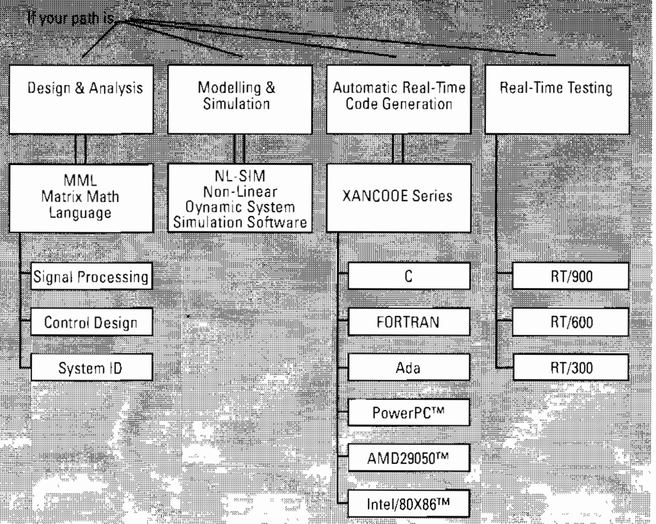

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