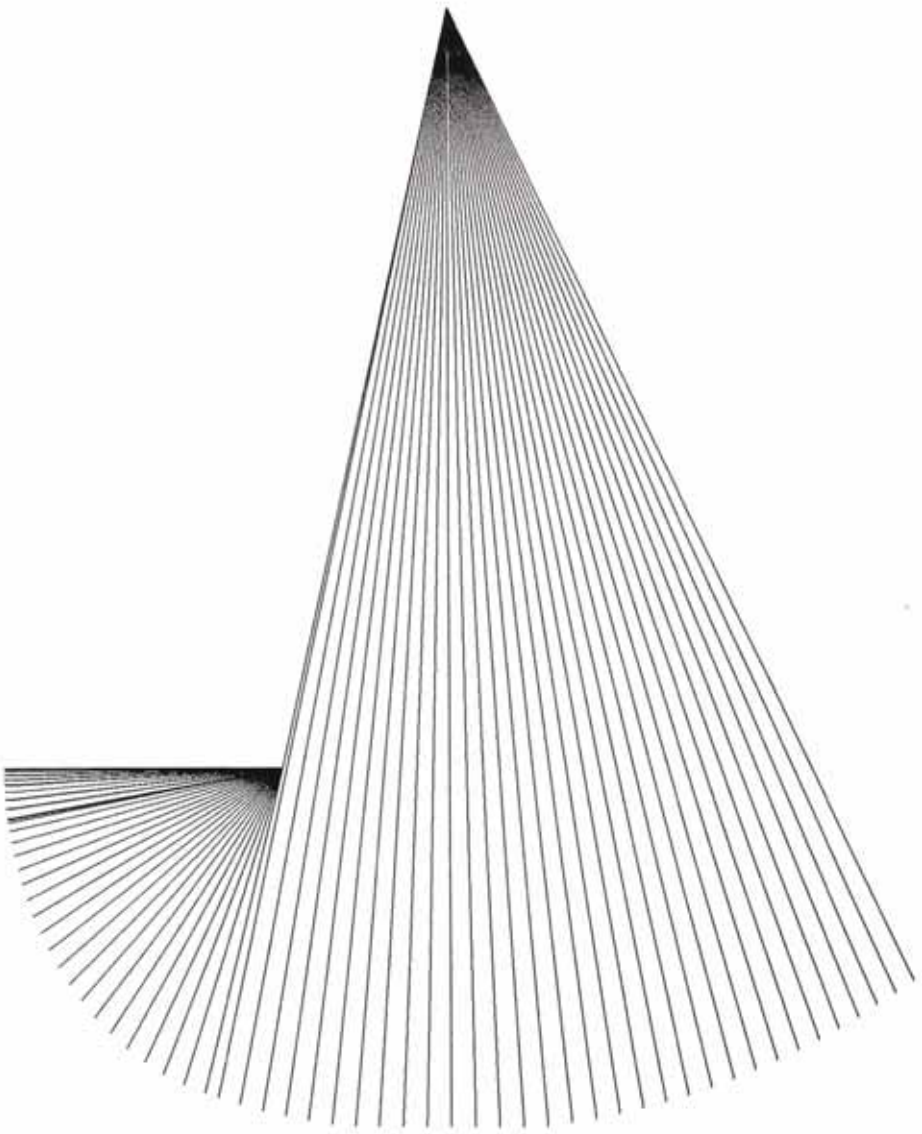
SIMULATION NEWS EUROPE

EUROSIM



Number 8 July 1993

A EUROPEAN FORUM ON SIMULATION ACTIVITIES

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Readership Information

EUROSIM - Simulation News Europe is published on behalf of EUROSIM (the Federation of European Simulation Societies) three times a year by the "ARGE Simulation News", a non-profit working group. Circulation is 2500. EUROSIM - Simulation News Europe is distributed by all member societies to their individual members (as part of the membership services). It is also included in the new scientific journal "Simulation Practice and Theory", published by Elsevier Science Publishers.

Editors: Prof. Dr. Felix Breitenecker,
Mrs. Irmgard Husinsky

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Editorial Board of the European Simulation Societies:

The title page illustration shows a Cartesian coordinate plot of a constrained pendulum (comparison 7, solution with SIMUL_R, see also page 29), where the real movement of the pendulum can be seen.

Editorial

The idea of the newsletter **EUROSIM - Simulation News Europe** is to promote simulation in Europe by publishing information related to simulation. It disseminates information to all EUROSIM member societies and to all members of these societies. Furthermore it introduces the importance of simulation to industry, government, and education.

Following this purpose we publish essays on simulation, reports from EUROSIM and the members of EUROSIM (the European simulation societies), reports from international societies, presentations of simulation centers, industry news, book reviews, calendar of events, etc. Furthermore the successful series on software comparisons gives an overview on features of simulation languages.

The newsletter is edited at TU Vienna and this is the first issue printed by Elsevier Science Publishers. We have a new title page and a new layout. According to the new publishing conditions there is a limit of 32 pages for this issue and the page size is smaller than in previous issues. We could not publish all material that we received and we had to edit most of the contributions to fit. We hope that next year we will be able to have issues with 40 pages.

The production of the newsletter is financed by advertisements and grants covering current expenses for editing, being this time especially the adaptation to the new publishing conditions (graphic artwork for new title page, promotion, etc.), and general editorial expenses.

We would like to thank all who have contributed to this issue and invite readers to send us comments and contributions.

Deadline for the next issue will be October 4, 1993.

F. Breitenecker, I. Husinsky

EUROSIM - Simulation News Europe

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

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

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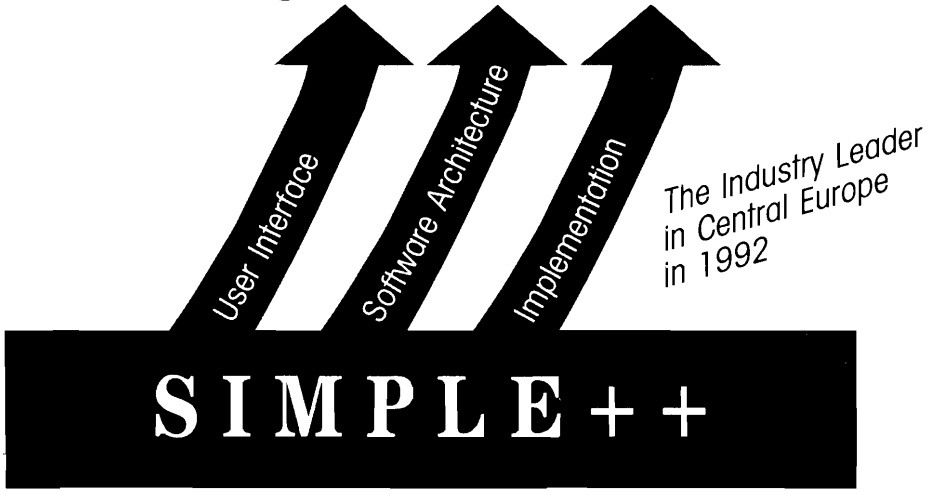
The new Class of Simulation Software

»Full Object Orientation«



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Peter Gangl
Phone (+49-711) 16 35 90
Fax (+49-711) 1 63 59 99
AESOP GmbH, Königstraße 82
D-7000 Stuttgart 1
Germany

AESOP

EUROSIM News

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

EUROSIM was formally founded as federation of simulation societies in 1992. The following national and regional simulation societies founded EUROSIM: ASIM - Arbeitsgemeinschaft Simulation (Austria, Germany, Switzerland), DBSS - Dutch Benelux Simulation Society (Belgium, The Netherlands), FRANCOSIM - Société Francophone de Simulation (Belgium, France), ISCS - Italian Society for Computer Simulation (Italy), SIMS - Simulation Society of Scandinavia (Denmark, Finland, Norway, Sweden), UKSS - United Kingdom Simulation Society (UK).

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

F. Breitenecker (ASIM)	president
R. Zobel (UKSS)	secretary
L. Dekker (DBSS)	treasurer

The next EUROSIM Board meeting will take place during the UKSS 1993 EUROSIM conference.

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

The next EUROSIM Congress will be organized by ASIM and will take place at the Technical University of Vienna, Austria, September 11 - 15, 1995, by F. Breitenecker and I. Husinsky. More detailed information will be given in the following issues of EUROSIM - Simulation News Europe.

The first issue of the EUROSIM journal "**Simulation Practice and Theory**" is now published (Editor: Prof. L. Dekker). EUROSIM member societies and individuals are encouraged to contribute to the journal. In particular, new work of significant interest for simulationists will be welcomed, but authors of recent good conference papers are also encouraged to consider enlarging such papers to a full journal contribution. Please contact Prof. Dr. L. Dekker, Noordeinseweg 61, 2651 LE Berkel en Rodenrijs, The Netherlands, Tel: +31-15 783 221.

Letter from the President

Dear simulationist,

You are reading the new-style EUROSIM - Simulation News Europe, the newsletter of the European simulation societies. This newsletter is also incorporated into the new scientific journal "Simulation Practice and Theory". Both are publications of EUROSIM, the Federation of European simulation societies. I hope you enjoy the newsletter and, where appropriate, the scientific journal.

First of all, I would like to thank Prof. L. Dekker for the hard work in setting up EUROSIM's scientific journal and Mrs. I. Husinsky for her excellent job of editing of the newsletter. Both publications try to meet the aim of EUROSIM, the promotion of modelling and simulation in industry, research, and development.

Furthermore I would like to draw your attention to the various simulation congresses, organized or cosponsored by EUROSIM, EUROSIM societies or other societies, which aim to spread the idea of modelling and simulation as problem solving tool and offer contacts for simulationists and future simulationists.

The next EUROSIM Congress, the "family meeting" of the European simulation societies, will take place in Vienna, September 1995. I am looking forward to meeting you all there.

If you have any questions, comments or suggestions on EUROSIM, on the scientific journal "Simulation Practice and Theory", on the newsletter EUROSIM - Simulation News Europe, or on any other simulation affairs, please contact the representatives of the European societies, the editors of the journal and the newsletter, or me directly.

F. Breitenecker, EUROSIM president

An Identification-Based Approach to the Validation of Complex Nonlinear Dynamic Models

D.J. Murray-Smith

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University of Glasgow, Glasgow G12 8QQ, Scotland

Abstract

Validation is a vitally important part of the process of simulation model development. The tools of system identification provide one possible method of approach to the problems of linear and nonlinear model validation. Experience gained with system identification in the context of helicopter modelling may prove helpful to many engaged in other modelling and simulation applications involving complex dynamic systems.

Introduction

The development of dynamic models of complex nonlinear systems is often attempted using a combination of theoretical modelling and empirical tuning of model parameters guided by comparisons of model responses with measured response data from the real system. However, such comparisons of system response variables with the corresponding quantities predicted by a theoretical model are not usually sufficient to provide the model developer with real insight concerning the source of any deficiency in the model. There are two fundamental ways in which a mathematical model may be deficient: it may have an inappropriate structure or it may have inappropriate parameter values. In most cases both types of deficiency are likely to be present in the initial formulation of a model. Assessment of the adequacy, or otherwise, of a mathematical model must take into account the purpose of the model and the way in which the model is to be used. For most applications empirical model adjustments can lead to unrealistic values of parameters which, although possibly providing an adequate fit between the model and the measured system responses for one particular experiment or test record, have no physical basis. The larger the number of parameters available for adjustment in this way the more likely it is that some combination can be found which provides a good match of a model response to the corresponding measured quantity. This apparent good fit for one particular case may, however, mask major deficiencies in the model structure and the model may well prove to have no general predictive value. The validation of theoretical flight mechanics models for helicopters provides a particularly challenging application which is of considerable practical importance. An integrated experimental and theoretical approach to model development, which is gaining acceptance in the aerospace field, could well provide benefits in other areas.

Helicopter Modelling and Simulation

The flight test development phase for a new design of helicopter is a time-consuming and costly process even in the case of projects which are judged to be highly successful in the long term. There are also many examples where the original design requirements have had to be reduced in some respects in order to allow the aircraft to enter service. Many of the problems encountered in the flight test phase of a design and development project can be traced back to inadequacies in mathematical models which formed the basis of design calculations. Problems of model accuracy and applicability are therefore of critical importance and it is generally recognised that simulation models currently available for helicopter handling qualities studies and for flight control system design must be used with considerable caution.

What then are the problem areas in helicopter modelling and simulation? Firstly, unlike the flight dynamics of fixed-wing aircraft, the dynamics of rotary wing aircraft involve high order differential equations. The coupled dynamics of the rotors and the body of the vehicle gives a system having a large number of degrees of freedom and involves mathematical descriptions in which there are many ill-defined parameters. The complexities of the rotor systems themselves, the associated air inflow dynamics and kinematic and aerodynamic nonlinearities add to the difficulties of modelling and of model validation.

In the case of helicopter models intended for handling qualities studies, flight control system design or the development of training simulators, the validation process is really concerned with the determination of the range and accuracy of the model for predicting the aircraft's response to external disturbances and to control inputs from the pilot. Since the system itself is inherently nonlinear both amplitude-dependent and frequency-dependent effects are of fundamental importance. In the case of models to be used in the assessment of flying qualities and overall dynamic performance

(for flight control system design, for example) the frequency range of interest extends to about 20 rad/s. The amplitude envelope of interest is also considerable and may be defined in terms of the maximum translational and rotational velocities and accelerations. The model accuracy requirements within the range of frequency and amplitude of interest are highly dependent upon the intended application of the model.

In some respects the validation process may be viewed as one of calibration and of establishing the limits of applicability for the model. However it should also be noted that the process of defining these limits usually highlights the features of the model which require further development.

The Role of System Identification

The tools of system identification provide a useful approach to the problems encountered in the validation of theoretical models and in the systematic development of such models. Identification methods are well established in the fixed-wing aircraft field [1] but are not so widely accepted in the helicopter industry where they have been regarded by many as lacking sufficient robustness and reliability for routine use. Present methods of system identification and parameter estimation are applicable mainly to linear models. Validation of a nonlinear model using identification methods therefore involves a series of tests in which linearised versions of the theoretical model, for a number of chosen operating conditions, are compared with linear models estimated from system response measurements at those operating points. Considerable insight can then be obtained by comparing trends in the theoretical and estimated parameter values as operating conditions are varied [2].

Both time-domain and frequency-domain identification methods have been applied to helicopter identification in the past with varying degrees of success. In order to provide an objective assessment of the potential of identification techniques to the modelling of helicopters and other forms of rotorcraft a Working Group was established in 1987 by the Flight Mechanics Panel of AGARD (Advisory Group for Aerospace Research and Development, an organisation funded by NATO). This Working Group reported in 1991 and the published findings are of considerable value both for helicopter specialists and for others concerned with the validation of complex dynamic models. Although some sections of the Advisory Report [3] and associated Lecture Series volume [4] address specific issues which are only of interest to aerospace specialists many issues of methodology are discussed which should be of interest to anyone involved in the modelling and simulation of continuous dynamic systems, whatever the field of application. One point emphasised in the AGARD findings is that the successful identification of a rotary wing aircraft depends critically upon four factors. These are defined as motions (manoeuvres and test input design), measurements (instrumentation and data acquisition), methods (time-domain and frequency-domain identification) and models (model structure and robustness). Such factors are quite clearly of equal importance in other fields of application.

Discussion

Experience with the helicopter application certainly re-emphasises, in a practical context, many issues which have been the subject of much previous theoretical and philosophical discussion. For example, it is clear that the form of a mathematical model is always highly dependent upon the intended use of the model and the background to its development. In many systems it is possible to maintain a close relationship between elements of a model and the corresponding components of the real system. In other cases this may prove impossible because of major areas of uncertainty within the quantitative descriptions of the system which are available a priori. In such situations, where uncertainties are dominant, system identification techniques can provide particular insight in establishing possible model structures as well as in determining estimates of relevant system parameters.

When system identification methods are used for the refinement of theoretical models clear indications must be provided concerning the accuracy of parameter estimates and the validity of the model structure. In the case of parametric models such questions of accuracy are closely linked to numerical identifiability and thus to experimental design issues. The helicopter applications which have been reviewed here, and which are described in detail in the references, provide useful illustrations of the value of an integrated experimental and theoretical approach to the practical problems of modelling a complex system. Efficient and effective interaction between the computer, the experimental data and the user is essential for this model-based type of approach. Further development of this integrated approach is dependent upon improvements in computer hardware and software to facilitate the use of complex nonlinear simulation models in conjunction with large databases involving experimental records.

References

[1] Klein, V. 'Estimation of aircraft parameters from flight data', Progress in Aerospace Sci., Vol. 26, pp. 1-77, 1989.
[2] Bradley, R., Padfield, G.D., Murray-Smith, D.J. and Thomson, D.G. 'Validation of helicopter mathematical models', Trans. Inst. of Measurement and Control, Vol. 12, pp. 186-196, 1990.
[3] AGARD Advisory Report 280, "Rotorcraft System Identification", AGARD, Neuilly sur Seine, France, 1991.
[4] AGARD Lecture Series 178 "Rotorcraft System Identification", AGARD, Neuilly sur Seine, France, 1991.

ASIM

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

Reports from ASIM

The last meeting of the ASIM board was on April 30. The board discussed several points, amongst others:

ASIM conference 1993 in Berlin: Prof. Sydow and Mr. Schäfer reported on the status of the preparation of the ASIM conference in Berlin from September 27-30. More than 180 abstracts have been submitted, about 120 papers have been accepted. During the conference the annual meeting of ASIM members will take place.

Working groups:
a) Dr. Halin resigned as speaker of the working group "*Simulationssoft- und -hardware*". The board thanked him for the work he did for this working group since 1984. Dr. Halin continues to work as contact person for our Swiss members, as ASIM's EUROSIM representative, and as contact person to SCS. There was no elected vice-speaker for the working group, so the board asked Prof. Möller to act as speaker of the working group for the next two years and to look for a vice-speaker. Elections will be in two years. A new speaker for the working group "*Simulation in Biologie, Medizin und Umweltschutz*" will be elected at the next meeting.
b) A new working group will be founded with the title "*Arbeitswissenschaft und Ergonomie*". Details will be discussed at the next board meeting.
c) The board discussed if there is an interest in a working group "*Simulation in den Naturwissenschaften*". This will also be discussed at the next meeting.

ASIM book series: Five books will be published this year in the ASIM book series at *Vieweg Verlag*. Please contact Prof. Ameling or any other member of the board if you want to publish a book on simulation in the ASIM book series.

The next meeting of the board will be on September 27th. Main points of discussion will be the preparation of the Meeting of ASIM Members and the structure of the working groups. Please contact Dr. Bausch-Gall if the board should discuss any other specific subject.

Contact Addresses

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Meeting of ASIM Members

All ASIM members are invited to come to the *ASIM Mitgliederversammlung* during the ASIM Symposium in Berlin on Tuesday, September 28 at 6 p.m. (Hörsaal 3010, TU Berlin, Straße des 17. Juni). The ASIM board will report about its activities and a **new ASIM board will be elected** for the following three years. Please contact Dr. Bausch-Gall if there are special subjects you would like to discuss at this meeting or if you are interested to work in the ASIM board. A separate invitation will be mailed at the end of July to all ASIM members..

ASIM Meetings to come

8. Symposium Simulationstechnik, ASIM 93
September 27 - 30, 1993

Technische Universität Berlin, Straße des 17. Juni
D - 10623 Berlin

This is ASIM's 1993 German speaking conference.

Invited speakers: Prof. H. Haken (Stuttgart), Prof. F. Vester (München), Prof. C. v.d. Malsburg (Dortmund), Prof. U. Trottenberg (Bonn), Prof. H.-P. Schwefel (Bochum), Prof. R. Wiedermann (Karlsruhe), Prof. D. Jackél (Berlin)

Accepted papers in 4 to 5 parallel sessions.

Exhibition (September 27 - 30).

User Groups meet on September 27: ACSL, Matlab, MATRIXx, SPICE.

Tutorials are on September 27: Parallel Computers, Bondgraphs, Fuzzy Logic.

Social program: Reception by the Senate (Monday, September 27), Conference Banquet in Brewery (Tuesday, September 28), Organ Concert (*Französischer Dom*, Wednesday, September 29).

Contact Address: R.-P. Schäfer, GMD-FIRST, Rudower Chaussee 5, Geb. 13.7, D - 12489 Berlin, Tel: +49-(0)30 6392 1814, Fax: +49-(0)30 6392 1805.

January 31 - February 1, 1994: Spring workshop of the working group "*Simulation Technischer Systeme*" in Vienna. Contact Prof. Dr. Gerald Kampe.

September 1994: *9. Symposium Simulationstechnik* in Stuttgart. Contact Prof. Dr. Gerald Kampe for more information.

September 1995: EUROSIM Congress in Vienna.

Working Groups

"Simulationsmethoden und Sprachen für parallele Prozesse"

Speaker: Dr. Hans Fuss, GMD-I1, Postfach 1240, D-53731 St. Augustin 1. Tel: +49-(0)2241/14-3125, Fax: +49-(0)2241/14-3006, E-mail: fuss@gmd.de

"Simulationssoftware und -hardware"

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"

This year's meeting took place on April 22 nd 23 in Karlsruhe. Contributions were centered on the topics optimization (first day) and artificial intelligence (second day). 33 participants and good discussions made the meeting a successful one. Next spring's meeting will be in Braunschweig.

In the elections during the meeting Dr. Helena Szczerbicka was elected as speaker of the working group, Dr. Thomas Uthmann as vice-speaker.

Speaker: Dr.-Ing. Helena Szczerbicka, Universität Karlsruhe, Institut für Rechnerentwurf und Fehlertoleranz, Zirkel 2, D-76133 Karlsruhe, Tel. +49-(0)721/608-4216, Fax +49-(0)721/370455, E-mail: helena@ira.uka.de.

"Simulation in Medizin, Biologie und Ökologie"

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

"Simulation technischer Systeme"

This working group held its annual spring workshop on March 8-9, 1993. About 50 participants from industry, universities, and research centers met at the Institute for Control Engineering at Erlangen-Nürnberg-University. The workshop was organized by Prof. Dr.-Ing. W. Bär. In the morning of the first day ACSL users came together for their users group meeting.

In the first workshop session the host institute presented research projects with emphasis on robot control. A visit to the laboratories allowed to see the robots in action. Two sessions informed about various simulators and simulation case studies. One session focussed on simulation in automotive engineering. Of special interest to the audience was the session on hardware-in-the-loop, where powerful tools were presented. It is remarkable that in this field new approaches to simulation are already available.

According to tradition the workshop was free of charge. The workshop dinner allowed fruitful discussions in the pleasant atmosphere of an Erlangen inn. The extended abstracts of this workshop will be published as *ASIM-Mitteilungen Nr. 34*.

On January 31 and February 1, 1994 the 11th spring workshop will take place at TU Vienna, Austria. This workshop will be followed by the 1st MATHMOD conference of IMACS.

Speaker: Prof. Dr.-Ing. Gerald Kampe, FHT Esslingen, Flandernstraße 101, D-73732 Esslingen. Tel: +49-(0)711/3511-3740 or 3741

"Simulation in der Fertigungstechnik"

Together with different working groups spanning several universities and companies the ASIM working group "*Simulation in der Fertigungstechnik*" produced a guideline for simulation technology, which will be published under the title "*Simulationsanwendungen in Produktion und Logistik*" this summer in the ASIM book series in *Vieweg Verlag*. 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 and will be presented to interested guests from research, industry and press during an event to be held at the Fraunhofer Institute for Material Flow and Logistics in Dortmund, Germany, on June 17, 1993. The press conference is accompanied by the presentation of selected papers from the guideline as well as presentations about activities of further ASIM working groups. (Report by Sigrid Wenzel, FhG IML Dortmund.)

Speaker: Prof. Dr.-Ing. A. Kuhn, Fraunhofer-Institut, IML, Emil-Figge-Straße 75, D-44227 Dortmund. Tel: +49-(0)231/9743-130, Fax: +49-(0)231/9743-211

"Simulation in der Betriebswirtschaft"

The working group met this spring for its biannual meeting in Braunlage. The number of participants was limited to about 80 persons. Selected papers will be published in the ASIM book series in *Vieweg Verlag* this year. The next meeting will be in 1995 and will be announced in this journal. For more information contact the speaker of the working group.

Speaker: Prof. Dr.-Ing. W. Hummeltenberg, Universität Hamburg, FB Wirtschaftswissenschaften, Bundesstraße 55, D-20146 Hamburg. Tel: +49-(0)4123-4023, Fax: -49-(0)4123-5535

"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

I. Bausch-Gall

DBSS

General Information

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

DBSS 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 Mathemathics and Computers in Simulation) and SCSi (Society for Computer Simulation International).

DBSS-Membership

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

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

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

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

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

The membership fee should be paid to:

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

with the mention: DBSS membership 1993.

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

Meeting Reports

DBSS has organized, by ir. Frank J. Pasveer (Institute of Technology, Rotterdam), a symposium about "Technical and Vocational Training and Simulation Practice in Relation with Education". This symposium took place in the Dish Hotel in Delft on April 28th,

1993. Hereafter a short overview of the lectures and demonstrations is given.

Speakers: ir. H. Mijnarends (Institute of Technology, Rotterdam). Combined generation of electricity and heath. Initially, co-generation of electricity operated inefficiently with favourable exhaust-gas-emission due to misfiring and inadequate control. With the aid of PSI, a simulation language for analog and digital systems, research was done in optimal control of a co-generation installation at the Institute of Technology (HR&O) in Dordrecht. With the aid of students the PSI-models were verified.

ing. J. van der Meulen (Institude of Technology, Gelderland). Robot-simulation with transputers attached to a PC. The parallellised equations of motion of a robot were implemented on a T800 transputer system, attached to a PC. The PC operated as a display tool and the transputer set did the calculations.

ir. W. de Valk (Institude of Technology, Eindhoven). Design and simulation of an ASIC. The use of IC design tools was introduced by means of a simple digital filter. Gate circuitry was composed of standard-data-pad-units. Logical simulation, chip layout and test vectors were demonstrated. W. de Valk wrote a book about ASIC design, published by Addison-Wesley (the book is written in Dutch).

A. Poldervaart and R. Terhoeve (Institute of Technology, Rotterdam). Neural network on a DOS computer. The simulation tools for neural networks can be divided into two groups; neural software libraries (Owl Neural Network Library) and neuro-simulators (Brainmaker, Neural Works). These tools have two major disadvantages, (1) the developed neural nets can not be easily used in an external application and (2) they are not able to simulate all types of neural nets. To compensate these disadvantages, our approach consists of a software framework built of separate parts. The framework offers a complete interactive graphical development and simulation environment. When a neural net is developed, the parts that perform the actual simulation can be disconnected from the framework and pasted into an external application, which solves the first disadvantage stated. To solve the second disadvantage, the various parts of the framework are offered in a library-like manner. To add a new type of neural net, program code can be added to the framework. The addition of program code is easy because the framework is written in the object-oriented programming language C++. The powerful C++ property of inheritance offers the possibility for a new type of network to "inherit" some basic net features from already existing network types. This approach gives a better opportunity to develop and simulate neural nets and to use them in an external application.

dr. R.B.J. Pijlgroms (Institute of Technology, Amsterdam). Computer simulation of dynamic systems. The system to be simulated is determined by its mathematical formulation. Knowledge and insight into the system is explicitly necessary for successful simulation runs. Demonstrations are presented with the model of a "chaotic system".

ir. J.W.M. Andriessen (Institute of Technology, Gelderland). Simulation of digital signal processing. Interactive design and simulation per PC of the behaviour of digital transversale and recursive filters. Spectral analysis by Fast Fourier Transform introduce frequency dependency of the systems involved.

ing. W. Prevo (Institute of Technology, Heerlen) Adaptive PID controller. The DIRAC principle is applied. DIRAC stands for direct adaptive control. The adaptive controller is based on a model reference algorithm. With this algorithm the error between a real signal value and a calculated signal value has an influence on the direct adjustment of the regulator parameters. The controller has been tested by using simulations and tests with a "real" process. Based on these tests and simulations the following conclusion has been reached: If some variables related to the parameter correction speed and the model are choosen correctly, a stable control system with good parameter convergence is obtained.

Y. Bosma and D. Heidelberg of Sattcontrol Etten-Leur, Holland. The Sattline applications are programmed in objects. In this way the software is very efficient in use and in programming. Together with the powerful simulation tools it is a cost reducing system with a lot of possibilities.

Demonstrations: CENTRIFORCE (J. Twaalfhoven) BOBCAD-CAM: DOS software for design and manufacture of tools and dies.

Milling3D, 4Ax1s wire EDM, CATHE. VECTOR windows software for professional drafting and 3D manifacturing.

FOXBORO Nederland BV (B. Overgoor). Demonstration of Intelligent Automation (I/A) open industrial systems.

SATCONTROL. Benelux BV (D. Heidelberg). Sattcontrol is a manufacturer of PLC and SCADA systems.

DCS (G. Groenendijk and R. Elderson). Flight simulation with a physical cockpit controlled by a 80486 PC.

Institute of Technology, Rotterdam (E. Doves and ir. F.J. Pasveer). Simulation of blood pressure measurement in the heart through a catheter by means of the electrical analogon, of a transmission line.

Meetings Planned

On behalf of the Federation of European Simulation Societies (EUROSIM) and in co-operation with AKZO the Dutch Benelux Simulation Society is organizing an international conference entitled: Massively Parallel Processing Applications and Development. Date: June 21-23, 1994 Location: Aula Conference Centre, Delft, The Netherlands.

Participants are requested to submit papers, related to the following topics:

Applications: industry, business, economics, ecology, energy systems, meteorology, seismics, fluid dynamics, data base processing, others

Methods and Techniques: simulation of MPP Applications, modelling of MPP Applications, programming models for MPP computers, architecture of MPP computers, parallel programming tools, parallelization of sequential programs and algorithms, others

Deadlines: Abstract (original + five copies, 2 pages of A4): September 1, 1993.
Notice of provisional acceptance: November 1, 1993.
Full manuscript: February 1, 1994.
Notice of acceptance of full manuscript: April 1, 1994.

More detailed information can be obtained from the Organization Secretariat EUROSIM 1994 International MPP Conference, Aula Conference Centre, P.O. Box 5020, 2600 GA Delft, The Netherlands, Tel: +31 (0)15-788022, Fax: +31 (0)15-786755, E-mail: secretariaat@rc.tudelft.nl

J.C. Zuidervaart

FRANCOSIM

FRANCOSIM aims to the promotion and development of simulation models, tools, and methods as well as related techniques in all human activities and notably in industry, research, and education, and this especially in the international French speaking community.

FRANCOSIM is a non-profit organisation. Charges per annum are FF 275.

Contact Address

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F - 42300 Roanne, France
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Next Meeting:
"Simulation of Continuous Systems"

This working group is now established at the ESIEE-school in Noisy le Grand. The last meeting took place on April 28 and the next date to note is June 25, 1993.

The local contact is:

M. Hamam Yskandar, Groupe ESIEE
2, Boulevard Blaise Pascal,
F - 93160 Noisy le Grand
Tel: +33-16 45 92 66 11

N. Sarles

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

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

Membership

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

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

Contact Addresses

For further information or application for membership, please contact:

ISCS c/o Dipartimento Ingegneria Elettronica
Università di Roma "Tor Vergata"
Via della Ricerca Scientifica
I-00133, Roma, Italy
Tel: +39 6 725944.77 (.78/.86)
Fax: +39 6 2020519
E-mail: iazeolla@irmias.bitnet

Activities

ISCS is devoting most of its efforts to the organization of *Performance '93* (16th IFIP W.G. 7.3 International Symposium on *Computer Performance Modelling, Measurement and Evaluation*). This international conference, one of the most important in the performance evaluation field, will take place in Roma, from September 27 through October 1, 1993.

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

The two days before the conference sessions (September 27 and 28) will be entirely devoted to the following Tutorials:

Real Time Systems (F. Panzieri, Università di Bologna, Italy), *Dependability and Performance Modeling Using Markovian Stochastic Reward Nets* (K.S. Trivedi, Duke University, USA), *Parallel Simulation* (R. Ayani, RIT, Sweden), *Properties and Analysis of Queueing Network Models with Finite Capacities* (S. Balsamo, Università di Pisa, Italy), *Providing Quality of Service Guarantees in Broadband ISDN* (Don Towsley, University of Massachusetts, USA), *Methodological Issues in Parallel Scheduling* (R. Nelson, IBM Research Division, USA), *Performance and Dependability Modeling with Deterministic and Stochastic Petri Nets* (C. Lindemann, University of Berlin, Germany), *Queueing Networks with Negative and Positive Customers, Neural Networks and Applications* (Erol Gelenbe, University of Paris - V, France), *Performance Measurement Using System Monitors - Survey over Measurement, Principles of Software-Hardware and Hybrid Monitors* (E.M. Thurner,

Siemens, Germany), *Bottleneck Identification in Multiclass Product Form Network* (P. Schweitzer, Rochester, USA; G. Serazzi, M. Broglia, Università di Milano, Italy), *Performance Engineering of Software Systems* (Connie U. Smith, L&S Computer Technology, USA), *Algorithms for the Batch Markovian Arrival Process* (D. Lucantoni, AT&T, USA), *Relaxation for Massively Parallel Discrete Event Simulation* (Boris Lubachevsky, AT&T, USA), *Metropolitan Area Networks (MANs): Protocols Modeling and Performance Evaluation* (M. Conti, E. Gregori, L. Lenzini, CNUCE-CNR, Italy), *Fast Simulation of Rare Events in Queueing and Reliability Models* (P. Heidelberger, IBM Research Division, USA), *Multiprocessor and Distributed System Design* (U. Herzog, University of Erlangen, Germany), *Queueing Networks with Finite Capacity* (R. Onvural, IBM RTP, USA), *Analysis and Control of Polling Systems* (U. Yechialy, University of Tel Aviv, Israel), *Response Time Distributions in Queueing Network Models* (P. Harrison, Imperial College, London, UK), *Maximum Entropy Analysis of Queueing Models* (D. Kouvatsos, Bradford University, UK), *Performance Analysis and Optimization with the Power-Series Algorithm* (J.P.C. Blanc, Tilburg University, The Netherlands).

The conference sessions (September 29 through October 1) will be devoted to the presentation of the 19 contributions selected, on the full paper basis, from 104 submissions. The Scientific Committee was chaired by Prof. G. Iazeolla (University of Roma "Tor Vergata") and Dr. Stephen S. Lavenberg (IBM Research Division, Yorktown Heights). The list of accepted paper follows:

Workload Analysis
The Implications of Distributed Data in a Commercial Environment on the Design of Hierarchical Storage Management
Tracy Sienknecht, Joe Martinka, Rich Friedrich, Peter Friedenbach (Hewlett-Packard, USA)
Toward a unified model of program behavior
Douglas T. Michel, William C. Hobart (Air Force Institute of Technology, USA)

Communication Systems
Effective Bandwidth and Fast Simulation of ATM Intree Networks
Cheng-Shang Chang, Philip Heidelberger (IBM Research Division, USA), Sandeep Juneja (Stanford University, USA), Perwez Shahabuddin (IBM Research Division, USA)
Fast Parallel Solution of Fixed Point Equations for the Performance Evaluation of Circuit-Switched Networks
Albert G. Greenberg, Andrew M. Odlyzko (AT&T Bell Laboratories, USA), Jennifer Rexford (University of Michigan, USA), David Espinosa (Columbia University, USA)

Processor and I/O Systems
Design and Implementation of an Instruction Cache for Reducing the Cost of Branches
Antonio M. Gonzalez (Universidad Politecnica de Cataluna, Spain)
Minimizing Mean Seek Distance in Mirrored Disk Systems by Cylinder Remapping
Robert Geist, Darrell Suggs, Robert Reynolds (Clemson University, USA)
An Analytical Model of Reconstruction Time in Mirrored Disks
Arif Merchant (NEC, USA), Philip S. Yu (IBM Research Division, USA)

Queueing and Stochastic Models
Mean Waiting Times in Nonpreemptive Priority Queues with Markovian Arrival and I.I.D. Service Processes
Tetsuya Takine, Yutaka Matsumoto (Kyoto University, Japan), Tatsuya Suda (University of California at Irvine, USA), Toshiharu Hasegawa (Kyoto University, Japan)

Routing in the Presence of Breakdowns
Isi Mitrani (University of Newcastle, UK), Paul E.EWright (AT&TBell Laboratories, USA)
Two Vacation Models for Token-Ring Networks where Service is Controlled by Timers
Kin K. Leung, David M. Lucantoni (AT&T Bell Laboratories, USA)
Bounds for Quasi-lumpable Markov Chains
Giuliana Franceschinis (Università di Torino, Italy), Richard R. Muntz (University of California at Los Angeles, USA)
Interpolation Approximations for Symmetric Fork-Join Queues
Subir Varma (IBM Corporation, USA), Armand M. Makowski (University of Maryland, USA)
Fast Transient Simulation of Markovian Models of Highly Dependable Systems
Perwez Shahabuddin (IBM Research Division, USA)

Parallel Systems
Performance Benefits and Limitations of Large NUMA Multiprocessors
Kenneth C. Sevcik, Songnian Zhon (University of Toronto, Canada)
Optimal Task Scheduling on Distributed Parallel Processors Cheng-Shang Chang, Randolph Nelson (IBM Research Division, USA), David D. Yao (Columbia University, USA)

Database Systems
Optimization of a Database Hierarchy for Mobility Tracking in a Personal Communication Network
V. Ananthram (Cornell University, USA), M.L. Honig, Upamanyu Madhow, V.K. Wei (Bellcore, USA)
Limits of Parallelism in Hash Join Algorithms
Antoine N. Mourad (University of Illinois, USA), Robert J.T. Morris, Arun Swami, Honesty C. Young (IBM Research Division, USA)

Stochastic Petri Nets
Analysis of Stochastic Petri Nets by the Method of Supplementary Variables
Reinhard German, Cristoph Lindemann (Technische Universität Berlin, Germany)
Markov Regenerative Stochastic Petri Nets
Hoon Choi (Duke University, USA), Vidyadhar G. Kulkarni (University of North Carolina, USA), Kishor S. Trivedi (Duke University, USA)

In addition to these presentations, there will be a poster session with 11 contributions, and two talks will be given by two invited speakers (Debasis Mitra from AT&T Bell Laboratories, the other to be determined).

For further information please contact:

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M. Colajanni

SIMS

The Scandinavian Simulation Society, SIMS, has about 250 members from Denmark, Finland, Norway and Sweden. For more than 30 years SIMS has served as the regional simulation society in Scandinavia, gathering individuals and organizations involved in simulation. The activities have been concentrated on arranging annual meetings and courses, delivery of information letters, and co-operation at European and international level in the field of simulation.

How to join SIMS ?

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

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

E. K. Puska

UKSS

A meeting on the theme of "Real-Time Simulation for Control" was held in Cambridge on 13th May 1993. This was organised by David Maclay of Cambridge Control Ltd. and took place at the Trinity Centre, Cambridge Science Park. The following papers were presented:

"The Use of Hardware in the Loop Simulation to Evaluate Controllers". G. Baynham, Applied Dynamics International.
"A Large Scale Transputer Network Application: The Aero-Mechanical Simulation of a Single Rotor Helicopter for Control System Design". S.T. Lawes and T. Clarke, University of York.
"An Appropriate Computer Architecture for Hardware in the Loop Simulation". V. Rich, Encore Computer.
"Hardware in the Loop Simulation Using a DSP-Based Prototyping Environment". D. Maclay, Cambridge Control Ltd.
"Assessment of Feedback and Nonlinear Compensation for a Weapon Control System". D. Purdy, Royal Military College of Science.
"A Real-Time Simulator for the Process Industries". S. Habibi, Cambridge Control Ltd.
"Dynamic Data Visualisation with DataViews". D. Stewart, V.I. Corporation.
"Hardware in the Loop Testing/Simulation for an Aerospace Application". H. Mirab, Integrated Systems Inc. Ltd.

There was also a small exhibition/demonstration involving contributions from: Applied Dynamics International, Encore Computer, V.I. Corporation, Integrated Systems Inc. Ltd., University of York.

An opportunity was also provided for those attending the meeting to visit the premises of Cambridge Control Ltd. and to see something of that company's activities. The UKSS Committee is very grateful to David Maclay and to Cambridge Control Ltd. for making this meeting possible.

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

Mrs. E. Rimmington
Computing Centre
Watts Building
University of Brighton
Moulsecomb, Brighton BN2 4GJ
Tel.: +44-(0) 273 600 900

D. Murray-Smith

United Kingdom Simulation Society Conference UKSS93

Keswick Hotel, Lake District, Cumbria, U.K.
13th-15th September 1993

Plans are now well advanced for the Conference and sixteen topics have already been identified which should provide a basis for separate sessions within the Conference. These are as follows:

Aerospace Applications * Artificial Intelligence in Simulation * Robotics Applications * Discrete Event Simulation * Education * Environmental Simulation * Applications in Manufacturing * Military Applications * Object Oriented Methods * Simulation Tools and Methodology * Transport Applications * Simulation Products * Parallel Processing in Simulation * General Applications of Simulation * Real Time Simulation * Neural Network Simulation

Although the conference is primarily a national event participants from any country are very welcome to attend. Members of the EUROSIM Societies, SCSI, JSST and CSSC will be offered a reduced registration fee of £150 which is the same as the fee for authors of papers being presented. Non-members must pay a registration fee of £170 and in all cases registration after 1st August involves an additional fee of £25. The registration fee includes a copy of the conference proceedings, teas and coffees, three-course lunches, the conference dinner and get-together.

Further details may be obtained from: Dr. R. Zobel, Department of Computer Science, University of Manchester, Oxford Road, Manchester M13 9PL. Tel. +44-(0)61 275 6189, Fax: +44-(0)61 275 6236, E-mail: rzobel@cs.man.ac.uk

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RAPID DATA

CROSSIM

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

Membership

The annual membership fee is equivalent to 8 German marks for regular members, and 2 German marks for students. CROSSIM currently has 47 individual members (including one member from USA, United Kingdom and Hungary each).

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Professor Vlatko Ceric (Chairman of CROSSIM)
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Activities

- Organizing a simulation seminar regularly held at the Faculty of Economics, University of Zagreb.
- Co-operation in founding of the new international journal *Computing and Information Technology*, to be launched from 1993 (including computer modelling topics). Anybody interested in receiving information about the journal may contact the CROSSIM chairman.
- Work on several scientific projects in discrete and continuous simulation, and applications of simulation in such diverse fields as engineering, economy, medicine, ecology etc.
- Publications (one simulation textbook in Croatian in press, papers in international and domestic journals and conference proceedings).
- Co-organizing the 15h International Conference *"Information Technology Interfaces" ITI '93*, in Pula, Croatia from 15-18 June 1993. The conference traditionally has a strong simulation session.
- Co-organizing the *3rd Operations Research Conference in Croatia*, to be held from 5-7 October 1993 in Rovinj. Papers are in Croatian and English.

V. Ceric

CSSS

General Information

CSSS (Czech&Slovak Simulation Society) is an association of Czech/Slovak speaking individuals professionally involved in simulation. CSSS was founded in 1977 as a Technical Section of both the Czech and Slovak Committee (at present: Society) for Applied Cybernetics and Informatics, the members of the Czechoslovak Scientific and Technological Society (at present: Czech Union of Scientific and Technological Societies and the Union of Slovak Scientific and Technological Societies). CSSS has now about 70 individual members both from the Czech Republic and the Slovak Republic. Due to the kind support from EUROSIM and SCS, besides other reasons, CSSS membership is increasing.

Activities

The CSSS Steering Committee met on April 7, 1993 in Prague to discuss open subjects. Main attention was focused on the proposal of SCS to organize the European Simulation Multiconference 1995 (ESM '95) in Prague. The idea was accepted and M. Kotva (Chairman of CSSS) was designated as the General Chair of ESM '95. As Program Chairman H. Weigl (Austria) was proposed by SCS.

On June 1-4 the traditional International Symposium on Modelling and Simulation MOSIS '93 was held in Olomouc. A report on the meeting will be given in the next issue.

Contact Addresses

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Mikolas Alexik (Vice-Chairman of CSSS)
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M. Kotva

Hungarian Simulation Group IMACS/Hungary

As a succession of the series of IMACS European Simulation Meetings organized in Hungary (in 1980 on Discrete Simulation and Related Fields in Keszthely, in 1984 on Simulation in Research and Development in Eger and in 1990 on Problem Solving by Simulation in Esztergom) we have started to organize the next IMACS European Simulation Meeting to be held in the last week of August 1995. The Conference is planned to be held in the town of Gyor, situated in the West of Hungary half-way between Budapest and Vienna. The idea to organize the Conference has been urged by participants of the former meetings where on the average scientists from 17 countries participated, also from overseas and the Far East. Further details about the topics and other aspects of the conference will be published in the next issues of the journal.

Prof. Dr. András Jávor (Chairman of IMACS/Hungary)
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A. Jávor

SCS

ESS93
1993 SCS European Simulation Symposium
Delft, The Netherlands, October 25-28, 1993.

ESS93 is hosted by Delft University of Technology. The university belongs to the leading technical universities of Europe.

The Scientific Program is structured around four major themes: Dynamic Modelling and Information Systems * Multimedia Systems and Virtual Reality * High-Performance Computing and Simulation * New Trends in Methods and Tools

Contact address for information and late papers: The Society for Computer Simulation International, European Office, c/o Philippe Geril, University of Ghent, Coupure Links 653, B-9000 Ghent, Belgium Tel/Fax: +32 91 234941, E-Mail: scsi@fland.rug.ac.be

IMACS

1. MATHMOD VIENNA

February 2-4, 1994
Technical University Vienna, Austria

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

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

Social program: Get-Together Party (Tuesday, February 1) * Reception by the Mayor of Vienna (Wednesday, February 2) * Viennese Heuriger (Thursday, February 3)

Deadlines: Posters and late papers: Submission: October 10, 1993, Notification of authors: November 1, 1993, Extended abstracts due: December 15, 1993.

All correspondence should be addressed to: Univ. Prof. Dr. Inge Troch, Technische Universität Wien, Wiedner Hauptstr. 8-10, A-1040 Wien, Tel: +43-(0)222 58801 5367, Fax: +43-(0)222 568093, Email: itroch@email.tuwien.ac.at

Simulation activities at the University of Latvia

Simulation activities at the University of Latvia are mainly concentrated in the Operations Research Laboratory at the Research Institute of Mathematics and Computer Science and in the Economics Department of the University of Latvia.

The Operations Research Laboratory has approximately 30 years of experience in the software development for simulation and simulation applications in the communication systems area. The work started in the begining of the 60ties with the development of simulation programs for the theoretical models of public utility systems, which led to the development of the first general purpose discrete event simulation packages, based on the original programming language for Soviet computers of BESM class. The main aim of the project was to provide the programming tools for those scientists, who are investigating teletraffic models and developing theoretical methods for their investigation. In this case, the simulation method may be used for the result verification. Later, at the end of the 70ties, the original package developed into the simulation system SPALM for IBM/360 compatible computers. This system was implemented in more than 10 scientific institutions and research organizations on the territory of the previous USSR. The system consisted of 3 main parts: graphic specification language AL, general purpose programming language PAL, and simulation language PALM (extension of PAL).

Of course, because of the lack of graphic hardware at that time, the graphic specification step was done "by hand" and then translated into the terms of linear programming language. The most remarkable features of the system at that time were the following:

- simplicity (small number of the basic elements for model description, simple syntax),
- the syntax of the language was "international" - no reserved words, close to mathematical formulas,
- the programs were considerably more efficient than those in GPSS,
- possibility to use both built-in and user-collected and processed results.

In parallel with this work, the possibility of the usage of the specification language SDL for simulation purposes was considered. This language was recommended by CCITT for the description of communication systems with stored program control. Some supplements were developed for SDL to enable the description of teletraffic models. The simulation system SDL/PL was designed on the basis of SDL and the general purpose programming language PL/1 for IBM/360 compatible computers.

When the personal computers appeared, the simulation tools continued their development, taking into account the graphic capabilities of the hardware. The next step for the SPALM system was the development of simulation tools with different application areas on the basis of the specification language SITA (the modified version of AL) :

- SITA/B - the simulation system for education purposes, which used the graphic description of the model and graphic tracing of the model run, as well as result presentation in a graphic form with the possibility to present and compare the results of different programs;
- SITA/C - the professional simulation system on the basis of the C language;
- ITA - the analytic simulation package, based on the numerical calculations of model states with the model description in a table form.

SDL-based tools for model descriptions were developed on IBM PC - the graphic editors for both structure and behaviour descriptions of models in SDL. At the same time the developed software tools were used for simulation applications: some theoretical problems of teletraffic systems (the impact of repeated calls, overload phenomenon) have been investigated using SPALM, SITA/C and ITA languages. SDL/PL was applied to developed a complex model of the environment of the telephone exchange for the purpose of debugging the stored program control algorithms with the environment simulation method. All the activities in the simulation field have been regularly reported at the user's conferences (International Teletraffic Congresses, international and local (USSR) conferences on teletraffic systems analysis, communication networks, etc.). In 1992 a survey of the development of software tools was presented at the European Simulation Symposium (ESS'92) in Dresden, Germany. The activities in the Economics Faculty of the University of Latvia are mainly concerned with the application of simulation for the analyses of economic systems and decision making games.

Gerard Jonin, Victor Supe, Research Institute of Mathematics and Computer Science, University of Latvia, Rainis boulv. 29, Riga, LV1459 Latvia, E-MAIL: jonin@mii.lu.lv

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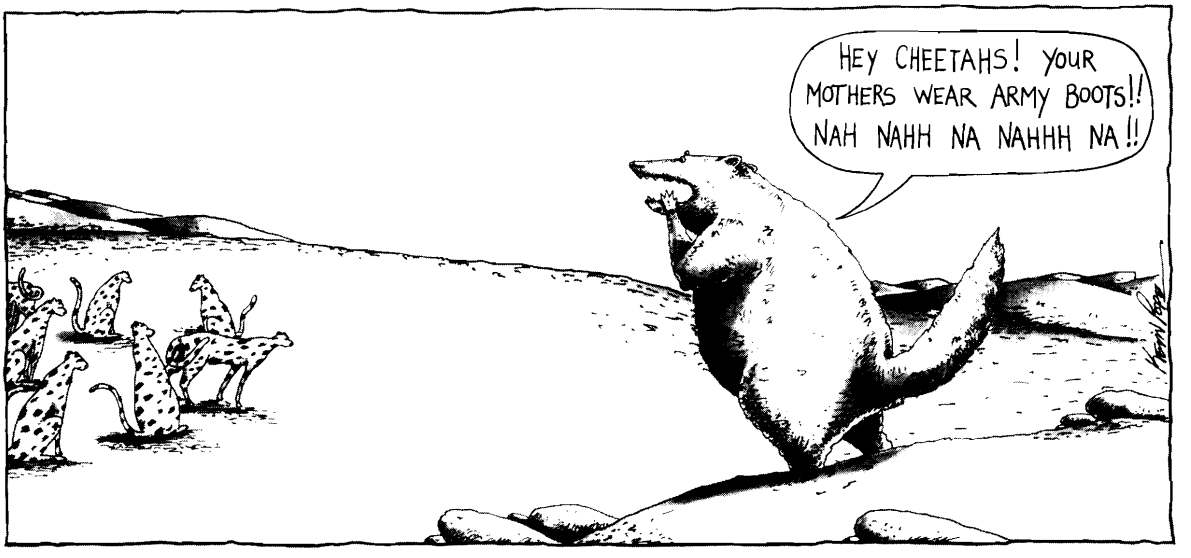

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Industry News

ProModel for Windows

The long awaited ProModel for Windows has now been released and it's launch heralds a new era for simulation technology. Specifically designed to take advantage of the Windows graphic user interface it enables an intuitive approach to model-building through the familiar Windows point and click menu environment allowing even first time users to build complete, accurate working models quickly and easily.

With an extensive library of detailed graphic icons adding realism and simple line drawing adding animation to the models, literally anyone with a desire to be involved can model quickly and correctly and achieve excellent results.

The comprehensive and detailed reports analysis means results are interpreted quickly and accurately, thus enabling the right decision to be made rapidly. ProModel for Windows will banish any pre-conceived ideas about simulation needing dedicated staff, the use of complex programming languages, and special equipment as it is so simple to use and will run on a standard PC.

Information: Production Modeling Corporation of Europe, Barclays Venture Centre, University of Warwick Science Park, Coventry CV4 7EZ, England. Tei:+44 (0)203 693485, Fax:+44 (0)203 690185.

ESL

ESL, the simulation language developed by Prof. John Hay et al. of Salford University for dynamic continuous systems modelling within the European Space Agency (ESA), is now being marketed in the UK and Europe by the Solutions Foundry Ltd. of Kettering, England.

ESL has been carefully developed over twenty years to meet ESA's changing needs and requirements, and continues to be improved and expanded for use on different platforms including Sun, Vax and PC.

Further information is available from The Solutions Foundry Ltd., 3 Chase Farra, Geddington, Kettering, Northants NN14 1RA, United Kingdom or by telephoning (44/0)-536-742549.

Systems Modeling Corporation Releases Arena

Sewickley, Pennsylvania (May 12, 1993) .... Systems Modeling Corporation, a leading simulation software developer, today announced the release of ARENA, the newest innovation in computer software for the simulation industry. Arena is an easy-to-use, extensible package which creates a model of a real or proposed system or process.

The key to Arena's ease-of-use is the concept of "application solution templates (AST)," a collection of specific modules which tailor the product to a user's particular needs. Unlike other simulation tools in which the modeling constructs are hard-coded (or permanently fixed) into the software, Arena modeling constructs are soft-specified in a separate data file, the template. This approach allows the software to be focused on many different application areas without the need to change any of Arena's underlying code.

Systems Modeling has developed four templates for use with Arena. These are the Arena AST, an AST for manufacturing industries, an IDEF AST, and an AST designed in conjunction with SEMATECH for developing wafer-fabrication operations in the semiconductor industry.

Arena is a portable system that can run on many different platforms: PCs (running on either MS-DOS or OS/2) and Sun Sparc, HP/9000, DECStation, and IBM RS/6000 workstations.

Contact: Caroline Collins Zenkevich, Systems Modeling Corp., The Park Building, 504 Beaver Street, Sewickley, PA 15143, Tel: +1-412 741 3727, Fax: +1-412 741 5635.

Object-Oriented Network Modelling with COMNET III

Simulate your LAN/MAN and WAN performance in a single environment using COMNET III. The object-oriented design of COMNET III lends itself to the study of networks ranging from high-performance LANs to complex enterprise-wide systems. Predict the performance of these networks, do "what if" trade-off studies and evaluate different signs. Build your COMNET III models by graphically selecting palette icons representing nodes, links, protocols and traffic, and positioning them on the screen with a mouse. You can alter node, link or traffic parameters or change the network topology on the fly and immediately see the effect of your change.

COMNET III is portable and will run on PCs under WINDOWS or OS/2 and also on workstations such as HP and SUN.

For more information please contact: Peter Holt, CACI Products Division, MECC Business Center, g. Martinolaan 85, 6229 GS Maastricht, The Netherlands, Tel: +31 43 670780, Fax: +31 43 670 200

GPSS/H Professional Release 2.01 now shipping

Wolverine Software Corporation announces GPSS/H Professional Release 2.01 the newest update of its popular PC-based simulation software. GPSS/H Professional Release 2.01 runs as a 32-bit application under DOS, Windows, and OS/2 2.x to provide unlimited model size and blazingly fast execution. For most real-world models, GPSS/H Professional is four or more times faster than competitor's 16-bit software.

GPSS/H Professional Release 2.01 has several other new features. A new option allows GPSS/H to write a fully compiled model out to disk, which then can be run repeatedly without re-compilation, or used in conjuction with Wolverine's new Run-time GPSS/H. Another new option, "Quiet Mode" causes GPSS/H Professional to run a model without writing any output to the screen. There are also several enhancements to memory utilization, in addition to improved error messages.

Contact: Joan Lopacki, Wolverine Software Corporation, 4115 Annandale Road, Suite 200, Annandale VA 2203-2500, Tel: +1-703 750 3910, Fax: +1-703 642 9634.

TRACE - Real-time analysis for closed-loop control

dSPACE extends its product line of software tools for controller implementation and real-time simulation with the real-time analysis tool TRACE for MS-Windows. TRACE is used for data acquisition and graphical display during a control or hardware-in-the-loop simulation experiment with dSPACE DSP and I/O boards. TRACE records complete time histories of any variables in the DSP program, without interrupting the closed-loop operation. The TRACE code on the DSP is generated and automatically modified corresponding to the TRACE parameters currently selected, yielding highly-efficient DSP code with minimum execution time. An important feature is that TRACE works automatically without additional programming by the user.

Complex functions like trigger, downsampling and automatic TRACE allow flexible data acquisition. The versatile properties of the plot facility include zoom, cursor readout and user-defined plot frame layout. All data can be stored and loaded to control design and analysis tools such as MATLAB and MATRIXx for detailed analysis and controller or simulation model improvement.

TRACE for MS-Windows is available for all DSPACE floating-point processor and controller boards, based on TMS320C30, TMS320C31 and TMS320C40.

DSP system for high-speed control connected to Sun SPARC workstation

A complete DSP-based hardware system for high-speed control, hardware-in-the-loop simulation and signal processing tasks is included in the new MiniBox and can be connected to a Sun SPARC workstation directly. The workstation is used as a platform for controller design, off-line simulation, code generation and analysis. Available software tools include a C compiler, C code generator from block diagrams (SIMULINK), MATLAB and MATRIXx interfaces and TRACE for non-intrusive closed-loop data recording and display.

The MiniBox with a high-speed DSP controller board inside performs all real-time computation and I/O tasks. On-board there are implemented a floating-point TMS320C31 DSP (33 MFLOPS) and a unique set of I/O channels including four A/D, four D/A, digital I/O, PWM and two incremental encoder interfaces.

dSPACE GmbH - An der Schönen Aussicht 2 - D - 33098 Paderborn, Germany

MATLAB Version 4.0 auf PCs verfügbar

Unterföhring. Das Programmpaket MATLAB Version 4.0 ist ab sofort auch für PCs (mindestens 386er mit Coprozessor) unter MS-Windows lieferbar. Die neue Version 4.0 stellt leistungsfähige 3D-Graphiken zur Visualisierung und Animation bereit. Erweiterte Möglichkeiten beim Debugging sowie bei der Ausführung von I/O-Operationen vereinfachen die Erstellung selbst kompliziertester Abhängigkeiten. Spezielle Operatoren stehen zur einfachen Durchführung von Berechnungen mit spärlich besetzten Matrizen zur Verfügung.

BAUSCH-GALL GmbH, Firkenweg 7, D - 85774 Unterföhring

Classes on Simulation

September 1993

7-9 **CACI Comnet III**, Camberley, U.K.
Contact: Stamatia Mukherjee, CACI Products Division, Coliseum Business Centre, Watchmoor Park, Riverside Way, Camberley, Surrey GU15 3YL, U.K. Tel: +44 276 671671, Fax: +44 276 670677

14-16 **CACI Simfactory II.5**, Maastricht, Netherlands
Contact: Janine Muijlkens, CACI Products Division, MECC Business Center, g. Martinolaan 85, 6229 GS Maastricht, The Netherlands, Tel: +31 43 670780, Fax: +31 43 670 200

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

21-22 **CACI L-NET II.5** , Maastricht, Netherlands
Contact: Janine Muijlkens, CACI Products Division, MECC Business Center, g. Martinolaan 85, 6229 GS Maastricht, The Netherlands, Tel: +31 43 670780, Fax: +31 43 670 200

October 1993

6-8 **CACI SIMSCRIPT II.5**, Camberley, U.K.
Contact: Stamatia Mukherjee, CACI Products Division, Coliseum Business Centre, Watchmoor Park, Riverside Way, Camberley, Surrey GU15 3YL, U.K. Tel: +44 276 671671, Fax: +44 276 670677

18-22 **CACI MODSIM/SIMOBJECT** , Maastricht, Netherlands
Contact: Janine Muijlkens, CACI Products Division, MECC Business Center, g. Martinolaan 85, 6229 GS Maastricht, The Netherlands, Tel: +31 43 670780, Fax: +31 43 670 200

Book Review

System Improvement Using Simulation
Ch.R.Harrel, R.E.Bateman, Th.J.Gogg, J.R.A.Mott

JMI Consulting Group and PROMODEL Corporation
Pubblished by PROMODEL Corporation, 1875 South State Street, Orem, Utah 84058, 148 pages

This textbook is designed to give the reader a quick overview on the fundamental principles, procedures and benefits associated with simulation. It uses the simulation language ProModel as basis for describing simulation models. Although the book is published by PROMODEL Corporation who developed the ProModel language it is much more than a User Guide for ProModel - it is a good introduction to modeling and simulation of discrete and stochastic processes in general.

The first three chapters introduce to simulation in general, trying to answer the questions "What is simulation", "Why simulate" and "How does simulation work". The fourth chapter deals with the terminology of simulation, defining the most important terms like state, event, random numbers, terminating, and steady state simulations, etc. In the following ProModel as simulation tool is introduced. The next chapter discusses all steps of a simulation project: problem definition and statement of objectives, model formulation, data collection, model development, verification, validation, experimentation, analysis of results, implementation.

Four chapters deal with statistics. A very good overview introduces into understanding of probability distributions, another chapter deals with the question how to find the right distribution (including goodness-of-fit tests). Of high practical use is a guideline how to extract values from probability distributions and an introduction to output analysis.

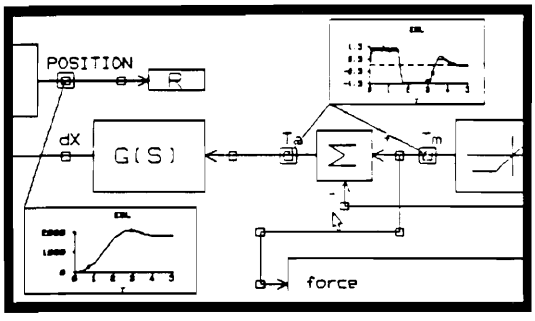
The closing chapters give a financial perspective on the benefits of simulation (discussing in detail different costs of a simulation) and sketch applications of simulation (manufacturing, service, health care, logistics).

Appendices offer charts for slides or handouts on general topics, probability distributions, confidence interval, output report, ProModel structures, and notations, etc. Furthermore twelve exercises show how to simulate models with ProModel.

The textbook has to be recommended as low-level introduction to discrete simulation and may help in preparing courses in simulation.

F. Breitenecker

ESL: THE LANGUAGE OF SIMULATION



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

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

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

* Advanced language features for handling continuous mathematical models with discontinuities.
* Advanced graphical interface for generating simulation models and displaying results.
* Interpretive running for checking, or compiled Fortran 77 code for optimum performance.
* Hardware support includes PC-AT, SUN and DEC workstations, IBM RS6000, VAX, Prime and Gould Minicomputers.
* Low cost evaluation copies available.
* Regular seminar and training course programme.
* Alternative textual or pictorial block model definition.

For more information contact:-

Dr J L Hay

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M6 6AP
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Comparison of Simulation Software

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

Features are, for instance:

- modelling technique,
- event handling,
- numerical interation,
- steady-state calculation,
- parameter sweep,
- output analysis,
- animation.

Seven comparisons have been defined in previous issues of EUROSIM - Simulation News Europe. Definitions of the comparisons are available from the editors.

Comparison 1 (Lithium-Cluster Dynamics under Electron Bombardment, November 1990) addressed all kinds of simulation software. 19 solutions have been sent in, a summary can be found in Number 6, November 1992.

Comparison 2 (Flexible Assembly System, March 1991, comments July 1991) resulted in 17 solutions. This comparison will expire by the end of 1993. A preliminary evaluation can be found in Number 4, an updated version will be prepared.

Comparison 3 (Analysis of a Generalized Class-E Amplifier, July 1991) focussed on simulation of electronic circuits resulting in up to now 10 solutions. A preliminary evaluation is being prepared, the comparison will end in July 1994.

Comparison 4 (Dining Philosophers, November 1991) is a more general task involving not only simulation but also different modelling techniques like Petri nets. Up to now 8 solutions have been sent in, the comparison will continue to run.

Comparison 5 (Two State Model, March 1992, revised July 1992) takes more into account a very high accuracy computation than state events. The comparison will continue to run.

Comparison 6 (Emergency Department - Follow-up Treatment, November 1992). 2 Solutions have been presented up to now.

Comparison 7 (Constrained Pendulum, March 1993) is a continuous comparison which addresses all kinds of simulation software.

Comparisons that have been existing for quite some time will be terminated. We will continue to define new comparisons.

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

SNE No.	Comparison						
	C1	C2	C3	C4	C5	C6	C7
0	Def						
1	5	Def					
2	4	4	Def				
3	4	3	3	Def			
4	1	5	5	3	Def		
5	4	-	1	1	2		
6	-	2	-	2	1	Def	
7	1	2	1	2	-	1	Def
8	-	1				1	3
Total	19	17	10	8	3	2	3

We invite all institutes and companies developing or distributing simulation software to participate in this comparison.

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

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

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

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

EUROSIM - Simulation News Europe Editors

Comparison 2 - Taylor II

1. Description of Taylor II

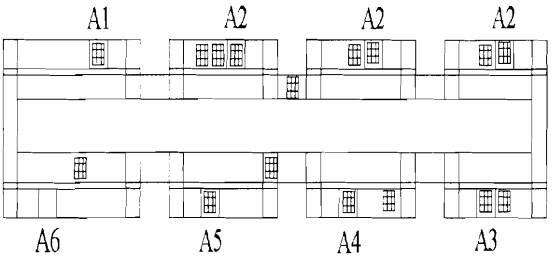
Taylor is a Dutch product developed by F&H Logistics and Automation B.V. in Tilburg, the Netherlands, since 1986. In mid 1992 the package, now called Taylor II, received a complete new structure. Taylor II is developed for all kinds of discrete event simulation and offers a wide range of special functions for processes in production and logistics.

Modeling in Taylor II starts with building a layout of different element types like machine, buffer, conveyor, etc. The second step is to create one or more routings. Now the model runs immediately with the standard 2d-animation. This offers the possibility of a visual debug. The third step, detailing the model, is done by filling out parameter masks. Typical parameters are capacities, breakdown behaviour, cycletimes, etc. At strategic points you often have to make complex decisions regarding where products are sent to. For this purpose the fixed addresses in the routings can be replaced by TLI-statements. TLI (Taylor Language Interface) is an easy to use macro language that enables you to define rules for order picking, assembly, complex guiding and receiving strategies. Furthermore, the package includes many features for pre- and user-defined analysis, animation and presentation. Taylor II runs on PC with MS-DOS or compatible. An MS-Windows version will appear in 1993.

2. Model Description

For the given problem only two types of elements were necessary: machines for every Sx, Sy and Ax; conveyors for every (part of) Bx and the connection of the subsystems. The pallets (products in Taylor) were given attributes for individual information and user-defined variables for calculating the processing time at A6 and measuring the throughput time. The attribute values of the pallets were stored in a matrix which has been used as a decision table. At every Sx there is a query in the routing and depending on the table values (0 or 1) the pallet is sent to B2 or B1. B1 is always possible just in case that there is not enough empty space on a B2.

Taylor II does not offer the possibility to build a model out of submodels. But, you only have to specify the parameters you need. This in combination with the easy creation of layout and routings, accounts for very fast modeling. The following figure shows the model in standard 2d-representation with an additional background drawing.

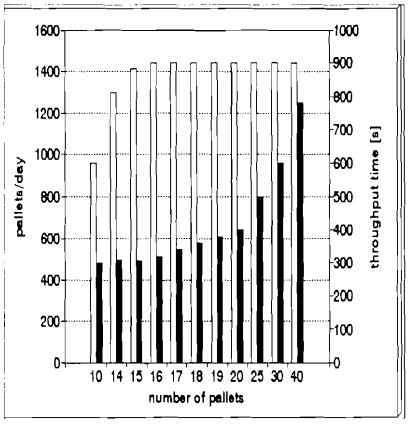


3. Results

When looking at the results given in the table below you find an optimum of 16 pallets with an average throughput time of 320 s. The maximum throughput varies between 1440 and 1441. In the model, the unloading and loading at A1 is seen as one operation. Pallets are counted when the operation starts. When collecting data from the 120th to the 600th minute it happens that a pallet is counted but not finished when the simulation stops. The only way to avoid this is to build a more detailed model.

For comments, questions or info please contact *Dirk Werner, F&H Simulationssoftware GmbH, Neubrückstraße 4, D-40213 Düsseldorf 1, Tel: +49-211-322151, Fax: +49-211-322897.*

number of pallets	production per day	throughput time [s]	utilization Ax [%]					
			A1	A2 (avg)	A3	A4	A5	A6
10	960	299.9	50.0	66.7	66.7	66.7	66.7	0.0
14	1299	310.4	67.7	90.2	90.2	90.2	90.2	0.0
15	1411	306.0	73.5	98.0	98.0	98.0	98.0	0.0
16	1440	320.0	75.0	100.0	100.0	100.0	100.0	0.0
17	1440	340.0	75.0	100.0	100.0	100.0	100.0	0.0
18	1441	360.0	75.0	100.0	95.2	100.0	100.0	7.1
19	1440	379.9	75.0	100.0	93.4	97.4	100.0	13.9
20	1441	400.0	75.0	100.0	87.8	94.3	97.8	29.9
25	1408	498.4	75.0	100.0	92.0	97.0	99.0	18.2
30	1440	598.1	75.0	100.0	90.3	94.6	97.6	26.2
40	1440	776.8	75.0	100.0	93.0	96.2	98.2	19.7



Comparison 6 - Slamsystem

1. The language description: We have used SLAM (Simulation Language for Alternate Modeling) language with Slamsystem software. It has been developed by Pritsker Corporation. Slamsystem is the only fully integrated simulation system for personal computer. All functions are linked through windows technology to support the entire simulation project from model building to analysis and results presentation. Slamsystem is a discrete event oriented language but it includes a network oriented approach and continuous features as well. Slamsystem is remarkably easy to use and it combines state of the art technology and animation.

2. The model description: The following model shows the utilization of different nodes. It includes two parts: the network file and the control file. The RESOURCE block defines a resource such as registration by its label REG and its initial capacity. The CREATE node is used to generate entities, in this case patients in the network. The AWAIT node delays an entity in a file until a unit of resource is available. The FREE node releases a unit of the resource. The ACTIVITY is used to delay entities by a specified duration. The ASSIGN node is used to assign values to Slam variables at each arrival of an entity to the node. For task c) the priority is set in the Control file. The PRIORITY statement is used to specify the criterion for ranking entities within the file. The criterion HVF(2) allows to rank the entities based on the high value of the 2nd attribute in first.

The Network:

```
RESOURCE/CW1(2),1/CW2(2),2/XRAY(1),3/PLASTER(1),4/REG(1),5;
   CREATE,,1;
   ALTER,CW1/-2;
   ALTER,CW2/-2;
   ALTER,XRAY/-1;
   ALTER,PLASTER/-1;
   ALTER,REG/-1;
   ACT,30;
   ALTER,CW1/+2;
   ALTER,CW2/+2;
   ALTER,XRAY/+1;
   ALTER,PLASTER/+1;
   ALTER,REG/+1;
   TERM;
   CREATE,EXPON(0.3),,3,250;
   GOON,1;
   ACT,,0.35,P1;
   ACT,,0.2,P2;
   ACT,,0.05,P3;
   ACT,,0.4,P4;
P1  ASSIGN,ATRIB(1)=1;
   ACT,,REG;
P2  ASSIGN,ATRIB(1)=2;
   ACT,,REG;
P3  ASSIGN,ATRIB(1)=3;
   ACT,,REG;
P4  ASSIGN,ATRIB(1)=4;
REG  AWAIT(5),REG/1;
   ACT/1,TRIAG(0.2,0.5,1); registration
   FREE,REG/1;
   ASSIGN,XX(1)=TRIAG(1.5,3.2, 5),XX(2)=TRIAG(2.8,4.1,6.3) ;
WARD  GOON,1;
   ACT,,NNQ(2).GE.20,T1;
   ACT,,NNQ(2).LE.5,T2;
   ACT,,T3;
T1  ASSIGN,XX(1)=TRIAG(2.4,4.1, 6.3),XX(2)=TRIAG(2.15,3.65, 5.65);
   ACT,,T3;
T2  ASSIGN,XX(1)=TRIAG(1.5,3.2, 5),XX(2)=TRIAG(2.8,4.1,6.3) ;
T3  GOON,1;
   ACT,,0.6,CW1;
   ACT,,0.4,CW2;
CW1  AWAIT(1),CW1/1;
   ACT/2,XX(1); cw1
   FREE,CW1/1;
   ACT,,TRA;
CW2  AWAIT(2),CW2/1;
   ACT/3,XX(2); cw2
   FREE,CW2/1;
TRA  GOON,1;
   ACT,,ATRIB(1).EQ.1.AND.ATRIB(2).EQ.0,XRAY;
   ACT,,ATRIB(1).EQ.3.AND.ATRIB(2).EQ.0,XRAY;
   ACT,,ATRIB(1).EQ.2,PLAS;
   ACT,,ATRIB(1).EQ.4,FIN;
   ACT,,ATRIB(1).EQ.1.AND.ATRIB(2).EQ.1,FIN;
   ACT,,ATRIB(1).EQ.3.AND.ATRIB(2).EQ.1,FIN;
XRAY  AWAIT(3),XRAY/1;
   ACT/4,TRIAG(2,2.8,4.1); xray
   FREE,XRAY/1,1;
   ACT,,ATRIB(1).EQ.1,WAR1;
   ACT,,ATRIB(1).EQ.3.AND.ATRIB(2).EQ.1,WAR1;
   ACT,,ATRIB(1).EQ.3.AND.ATRIB(2).EQ.0,PLAS;
WAR1  ASSIGN,ATRIB(2)=1;
   ACT,,WARD;
PLAS  AWAIT(4),PLASTER/1;
   ACT/5,TRIAG(3,3.8,4.7); plaster
   FREE,PLASTER/1,1;
   ACT,,ATRIB(1).EQ.2,FIN;
   ACT,,ATRIB(1).EQ.3,XRA1;
XRA1  ASSIGN,ATRIB(2)=1;
   ACT,,XRAY;
FIN  GOON,1;
   ACT,,ATRIB(1).EQ.1,COL1;
   ACT,,ATRIB(1).EQ.2,COL2;
   ACT,,ATRIB(1).EQ.3,COL3;
   ACT,,ATRIB(1).EQ.4,COL4;
COL1  COLCT,INT(3),TPS TYPE1;
   ACT,,FINS;
COL2  COLCT.INT(3),TPS TYPE2;
   ACT,,FINS;
COL3  COLCT.INT(3),TPS TYPE3;
   ACT,,FINS;
COL4  COLCT.INT(3),TPS TYPE4;
   ACT,,FINS;
FINS  COLCT,INT(3),TPS TOTAL;
   TERM,250;
   END;
```

The Control:

```
GEN,AD,,26/04/1993,5,Y,Y,Y/ Y,Y,Y/1,132;
LIMITS,5,3,1000;
;PRIORITY/1,HVF(2)/2,HVF(2) ;
NETWORK;
INITIALIZE;
FIN;
```

3. Results: The following results are agreed with the mean of five simulation runs. All values are minutes.

Mean of 5 runs	Task a	Task b	Task c
duration	402	416	402
mean of time per patient	184	191	172
std dev of time per patient	90	95	84
mean of time per patient type1	244	251	180
mean of time per patient type 2	146	156	175
mean of time per patient type 3	291	286	206
mean of time per patient type 4	132	141	160

With the task c) we decrease the mean of treatment time per patient and the standard deviation. The times for the patient type 1 and 3 are better but the times for the patient type 2 and 4 are increased.

The task b increases the treatment time because the queue for CW2 is longer than 20 most of the time.

Agnès Delamare, CTBA POle Productique, rue de Blénod, Maidières, 54700 Pont a Mousson, France, Tel: +33. 83. 83. 23. 33.

Comparison 7 - DESIRE/X

We solved the pendulum-and-peg problem as a sequence of concatenated simulation runs terminating and restarting whenever **phi=phip**. The real challenge was to combine results for the nonlinear and linearized pendulum without resorting to complicated file operations.

DESIRE/X simulates up to 2000 differential equations, plus neural networks, on Sun SPARCstations and DOS-extended 386/7, 486, and Pentium PCs. Unlike CSSL-Committee languages like ACSL, DESIRE has no "initial" and "terminal" blocks but implements the simulation experiment protocol with an interpreter program which calls quick-compiled DYNAMIC-segment simulation runs with **drun** statements. For this comparison program, DESIRE's interpreted experiment protocol executed a loop for concatenated runs and switched between the nonlinear and linearized cases. A second DYNAMIC segment then recovered and compared two time histories stored in binary arrays during the earlier concatenated runs.

We chose to implement the nonlinear and linearized cases in the same DYNAMIC program segment, but would not want to run both cases simultaneously, since partial runs terminated (hit the peg) at different times. To begin with the nonlinear pendulum, we set P=1, Q=0 in

```
d/dt phi=phidot | d/dt phi=-k*(P*sin(phi)+Q*phi)-r*phidot (1)
```

For the original long string, k=1, and ctrl=1. So the statement **`term ctrl*(phip-phi)`** terminates the first simulation run when the string hits the peg. Now **t** and **phi** run on, but **phidot** starts with the new initial value

```
phidot = phidot*a = phidot*(l/ls)
```

and k=ls. Also, ctrl=-1, so this run terminates when the short string, going the other way, is in line with the peg. At that point we switch back to the long-string case, with

```
phidot = phidot*A = phidot*(ls/l) | k=1 | ctrl=1
```

After a while, the string no longer hits the peg, since damping reduces the oscillation amplitude.

We display the run against the scaled compound-run time T = 0.2*t - scale (Fig. 1). When T >Tmax for the first time (i.e. while P=1, nonlinear case), we switch to P=0, Q=1. Equation (1) now represents the linearized pendulum. We repeat the entire looping procedure until T > Tmax again.

Up to now we employed the same DYNAMIC (compiled) program segment to deal with long and short string, nonlinear and linearized cases. We next use **`drun BUFFER`** to run a second DYNAMIC program segment labelled BUFFER, which recovers time histories of **phi** stored during the nonlinear and linear runs and displays them, together with their difference **delta** (Fig. 2).

Computing time for the two concatenated simulation runs required to produce Fig. 1 was 0.5 sec on a 486/33 notebook PC without external cache and a slow LCD display. About one-half this time is needed to produce Fig. 2.

```
      ARRAY BUF[1000],BUFlin[1000] |                          -- storage areas
      m=1.02 | l=1 | lp=0.7 | ls=0.3 | g=9.81 | d=0.2 | phip=-PI/12  -- problem parameters
      kl=g/l | ks=g/ls | r=d/m | a=l/ls | A=l/a
      TMAX=1 | DT=0.01 | NN=100 | scale=1                        -- simulation parameters
      display N15 | display C15 |          -- display colors
      irule 1 |                            -- 2nd-order RK integration
      P=1 | Q=0                            -- switch to nonlinear pendulum
      --                                   k, ctrl set for each string length
      Tmax=1 |                             -- length of compound run
label START
      phi=PI/6
label LONGSTR
      k=kl | ctrl=1 |                      -- long string
      drun | display 2 |                   -- keep display on!
      if T>Tmax then go to NONLIN | else proceed
      k=ks | ctrl=-1 |                     -- short string
      phidot=phidot*a
      drun
      phidot=phidot*A |                    -- run again with long string
      go to LONGSTR
      --                                   switch to nonlinear case, or are we done?
label NONLIN
      if P=0 then go to GETDATA | else proceed
      P=0 | Q=1 | reset | t=0 | phidot=0
      go to START |                        -- repeat loop for nonlinear case
            -- 2nd DYNAMIC segment gets data from buffers:
label GETDATA
      display 1 | NN=1000 | TMAX=NN
      irule 0 | STOP |                     -- no d/dt
      drun BUFFER
      DYNAMIC
      --          run repeatedly, store results, P,Q set nonlinear/linear cases
      d/dt phi=phidot
      d/dt phidot=-k*(P*sin(phi)+Q*phi)-r*phidot
      term ctrl*(phip-phi) |               -- change length!
      T=0.2*t-scale |                      -- compound-run time
      term T-Tmax |                        -- end of compound run
      store BUFlin=phi
      if PI: store BUF=Phi
            dispxy T,phi
      --                                   get results from buffers
label BUFFER
      get phi=BUF | get philin=BUFlin
      PHI=0.5*(phi+scale) |                --scale and offset
      PHIlin=0.5*(philin-scale)
      delta=phi-philin |                   -- the difference
      dispt PHI,delta,PHIlin
```

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Figure 1

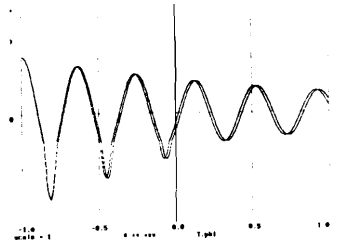
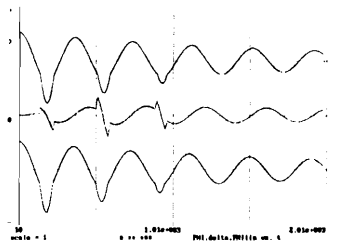


Figure 2



Comparison 7 - SIMUL_R

The Language: SIMUL_R (introduced in SNE 1 to 7) is a compiling simulation language for continuous and discrete systems, solving partial differential equations, too. The system offers graphical and textual modelling, using one or more models in one simulation program. Examinations are done by using menus and/or a strong runtime interpreter.

The interpreter allows the usage of loops, command files (recursive, too) and arbitrary expressions with assignments and displaying. Special featurse are user defined functions, a huge graphical library (supporting moving plots, 3D-plots, niveau lines, cross plots, animation). SIMUL_R is an open system as it allows data input and output from and to other systems, including user input during simulation (by keys or graphical) as well as hardware in the loop.

The Model: The DISCRETE sections are scheduled when the specified event (see SSCHEDULE) becomes true (an iteration takes place to find the right switching point).

```
UNIT kg, m, s;                  " declare units "
#set PI = 3.1415926536 #
nonlinear {
    CONSTANT [s] tend = 10;
    EXTERN [s] t, sin(1), cos(1);                          " time variables "
    CONSTANT [kg] m = 1.02, [m] l = 1, [m] lp = 0.7;
    CONSTANT [kg/s] d = 0.2, [m/s/s] g = 9.81, phi_0 = #PI/6#;
    CONSTANT phi_p = #-PI/12#, [1/s] dphi_0 = 0;           " model constants "
    float [m] ll, [m] ls;
    float [1] phi, [1/s] dphi;
    ls = l-lp;                                             " model variables "
    ll = l; phi = 0;                                       " scheduling "
    SSCHEDULE to_short_length: phi<=phi_p;
    DISCRETE to_short_length {
      ll = ls; dphi = dphi*l/ls;
      SSCHEDULE to_long_length: phi>=phi_p;
    };
    DISCRETE to_long_length {
      dphi = dphi*ls/l;
      ll = l;
      SSCHEDULE to_short_length: phi<=phi_p;
    };
    DYNAMIC {
      DERIVATIVE {
        dphi = INTEG(-g/ll*sin(phi)-d/m*dphi,dphi_0);
        phi = INTEG(dphi,phi_0);
      }
      TERMINATE t>=tend;
    } }
```

Fig. 1 contains the phi-plot over time for Task a,i), Fig. 2 the results for a,ii). In the last case the comparing operators '<=' and '>=' must be exchanged in the model.

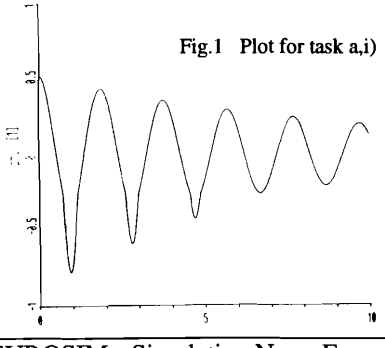


Fig.1 Plot for task a,i)

The linearized model can be written to the SIMUL_R program as second model *linear* behind the *nonlinear* model. It is built up similarly to the nonlinear model, using CONSTANT EXTERN for constants already declared in *nonlinear*. The names of variables remain the same.

To simulate both models in parallel we have to declare the state variables as LOCAL. Commands for the simultaneous simulation of the models and plots:

```
mstart nonlinear, linear;                          " parallel models "
prepare-; prepare t,nonlinear.phi,linear.phi;      " record both phis "
phi_0=PI/12; phi_p=-PI/24; d=0.2;                  " set values "
start;                                             " simulation run "
plot nonlinear.phi(-.5,.5), linear.phi(!),
        'diff'=(nonlinear.phi-linear.phi)(!);
" '!' means same scaling for all; diff is the new value defined as the
difference "
```

It is not necessary to compute the difference within a model, the plot command can do this for us! In SIMUL_R it would have been also possible to simulate the models sequentially, preparing data in two different data files, generating one new data file out of it (*compose_prep* command) and computing the difference.

The ZERO command can be used to compute the desired initial velocity. Within the model we declare a new variable *minphi* (initially 0), which is set in the DYNAMIC section within a DO block by `DO { if (phi<minphi) minphi=phi; } ;` (computing the minimum of phi for the current simulation run) and add PI/2 to minphi in the terminal section. We only have to search for a value of dphi_0 that makes minphi to 0: this is done by the runtime commands:

```
dphi_0=0;                       " initial value for dphi_0 "
dstep=0.001;zf_eps=1e-4;        " accuracy parameters for ZERO "
ZERO minphi:dphi_0;             " make minphi to 0, changing dphi_0 "
```

There are two reasonable solutions: with initial value dphi_0=0 we get the value +2.291 (the pendulum first swings a short time to the right, then to the pin); taking dphi_0=-1 initially we get the value -2.185 (direct swing to the pin).

The title page of this issue shows (for task a,i) the Cartesian coordinate plot of the pendulum), where the real movement of the pendulum can be seen.

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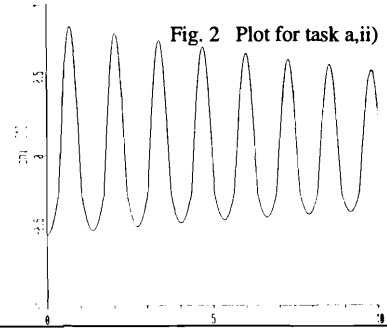

Fig. 2 Plot for task a,ii)

Comparsion 7 - ACSL

ACSL is a general purpose continuous simulation language. It models systems described by nonlinear differential equations and/or transfer functions and offers frequency analysis, too. ACSL runs on a wide variety of computers: PC, workstation, mainframes, supercomputers. ACSL is based on FORTRAN.

Model description: ACSL provides various operators for model description. For handling of discontinuities (time events and state events) ACSL offers DISCRETE SECTIONS for modelling the event and the SCHEDULE-operator which interrupts the integration if the event occurs. In case of a state event the ACSL state event handler starts an iteration procedure in order to find the time instant of the event.

In the following ACSL model the state event (the pendulum hits the pin) is described by **SCHEDULE hit .XZ. phi-phip**, causing the state event handler to find a zero crossing of $\varphi(t)-\varphi_p$ and to serve the **DISCRETE SECTION hit**, which calculates the new velocity and changes the lenght of the pendulum.

```
PROGRAMConstrained Pendulum
LOGICAL swil, swnonlinear
    CONSTANT pi = 3.141592654; pi6 = pi/6;     ! Calculate fractions of PI
     pi12 = pi/12; mpi2 = -pi/2; mpi6 = -pi6, mpi12 = -pi12; mpi24 = -pi/24
INITIAL
    CONSTANT l=1, m=1.02, d=0.2, g=9.81, lp = 0.7 ! Pendulum parameters
    CONSTANT phi0 = 0.3, dphi0=0,  phip = 0.2      ! Default initial values
! --- Determine initial position of pendulum ---------------------
    ls = l - lp; signphip = SIGN(1,phip); signphi0 = SIGN(1.phi0)
    la = RSW( (phi0-phip)*signphip .GE. 0. , ls, l )
    la = RSW( signpnip .NE. signphi0 , l, ls)
END  ! of INITIAL
DYNAMIC
    DERIVATIVE                    ! ---Dynamics of pendulum ----
     phim  = RSW (swnonlinear,SIN(phi),phi) ! Nonlinear or linear
     ddphi = -(g/la)*phim - (d/m)*dphi
     dphi  = INTEG(ddphi, dphi0); phi   = INTEG(dphi, phi0 )
     SCHEDULE hit .XZ. (phi-phip)                    ! Pendulum hits pin
    END  ! of DERIVATIVE
    DISCRETE hit ! --- Change of Velocity and length ----------
      swil = (phi-phip)*SIGN(1.,phip).GE.0.          ! Position before hit
      la = RSW(swil,ls,l); dphi= RSW( swil, dphi*l/ls, dphi*ls/l)
    END  ! of DISCRETE hit
TERMT ( t .GT. tend,'Stop on time limit')
END  ! of DYNAMIC; END  ! of PROGRAM
```

Results: Task a): The following commands SET the initial conditions, START a simulation run and PLOT the results. The time instants, when the pendulum hits the pin, are 0.703354, 1.15147, 2.5899, 2.9898, 4.54181, 4.86636, 6.4761, 6.7118. Figure 1 shows the results for task a,i):

```
PREPAR t, phi, dphi, la ! Data logging
SET phi0 = pi6, phip=mpi12; START; PLOT phi, dphi      ! --- Task a,i) ---
SET phi0 = mpi6,  d = 0.1; START; PLOT phi, dphi       ! --- Task a,ii) ---
```

Task b) This example allows a simple comparison of nonlinear and linear behaviour. SETting the switch swnonlinear=.FALSE. selects the linear dynamics. Because of the small initial angle, the plots show almost no difference, but PRINTing from the PREPAR file, which stores two consecutive runs (one nonlinear, one linear dynamics) indicates the differences:

```
SET phi0 = pi12, phip = mpi24; SET swnonlinear =.T.; START
SET swnonlinear =.f.; START; PLOT phi,la;
PLOT dphi,la
PRINT t,phi                          ! ... Print results from PREPAR - File
    T          PHI(nonl.)    PHI(lin.)
 0.            0.26179900    0.26179900
 0.02000000    0.26129200    0.26128600
 0.04000000    0.25977500    0.25975200
    .             .             .
 9.98000000    0.04513010    0.03814940
 10.0000000    0.0396914     0.03251720
```

Task c): ACSL offers no direct optimization at runtime level. Iteration or complex parameter loops can be programmed in the model description by jumping from the TERMINAL SECTION (calculations at the end of a simulation run) back into the INITIAL section. In the TERMINAL SECTION the initial value $\dot{\varphi}_o$ is iterated by the formula $\dot{\varphi}_o^{new} = \dot{\varphi}_o^{old} \pm \varepsilon(\varphi(\hat{t})-\frac{\pi}{2})$ up to convergence (reaching accuracy) or up to a maximum number of iterations. Each simulation run has to be stopped if the pendulum starts swinging back, i.e. if $\dot{\varphi}(\hat{t})=0$, which is determined by an additional TERMT-Statement.

The following commands solve task c):

```
SET phi0=pi6, phip=mpi12p, dphi0=-0.5                ! Set initial values
 SET switeration=.T.; START          ! Iteration of simulation runs
Iteration:  1  dphi0= -.5000 Error:  .74E+00
Iteration:  2  dphi0=-1.2409 Error:  .51E+00
   ...            ...            ...
Iteration: 10  dphi0=-2.1863 Error:  .24E-03
Iteration: 11  dphi0=-2.1866 Error:  .84E-04

DISPLAY  t ! Display termination time
       T 0.60999999
PLOT phi, mpi2 /SAME /OVER /XHI=t                    ! Plot all iterations
```

Figure 2 shows the iterations of the runs.

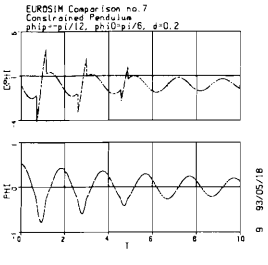

Figure 1

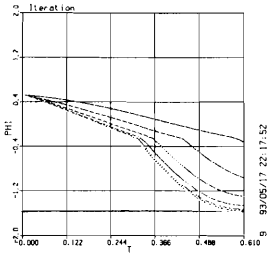

Figure 2

F. Breitenecker, Dept. Simulation Technique, TU Vienna, Wiedner Hauptstr. 8-10, A -1040 Vienna, Austria.

Calendar of Events

August 1993

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

September 1993

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

20-22 ***Fachtagung: Petri-Netze im Einsatz für Entwurf und Entwicklung von Informationssystemen***. Berlin, Germany
Contact: Prof. Dr. Gert Scheschonk, C.I.T. Communication and Information Technology GmbH, Ackerstr. 71-76, D - 13355 Berlin 65, Tel: +49-30 4 63 60 77, Fax: +49-30 4 64 16 10

20-22 **World Transputer Congress**. Aachen, Germany
Contact: Dr. R. Grebe, DeTAG, Inst. f. Physiologie, RWTH Aachen, Pauwelstrasse, W-52074 Aachen, Germany, Tel.: +49 241 8088822, Fax: +49 241 875992.

28-30 **ASIM 93. 8. Symposium Simulationstechnik**. Berlin, Germany.
Contact: R-P. Schäfer, GMD-First, Rudower Chaussee 5, D - 12489 Berlin, Tel: +49-(0)30 6392 1814, Fax: +49-(0)30 6392 1805.

27-October 1
Performance 93. Roma, Italy.
Contact: Dr. Bruno Ciciani, Dipartimento Ingegneria Elettronica, Università di Roma "Tor Vergata", Via Ricerca Scientifica, I-00133 Roma, Italy, Tel: +39-(0)6 72594477/78, Fax: +39-(0)6 2020519, Email: PERF93@irmias.bitnet or PERF93@tovvx1.ccd.utovrm.it

October 1993

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

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

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

December 1993

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

January 1994

4-7 **HICSS-27**. Hawaii International Conference on System Science. Maui, Hawaii
Contact: Dr. A. Verbrael, Detp. of Information Systems, TU Delft, P.O. Box 356, 2600 AJ Delft, The Netherlands, Tel: +31 15 783805, Fax: +31 15 786632, E-Mail: a.verbraeck@is.twi.tudelft.nl

24-26 **MASCOTS'94**. International Workshop on Modeling, Analysis and Simulation of Computer and Telecommunication Systems. urham, North Carolina
Contact: Salvatore Tucci, Dipartimento Ingegneria Elettronica, Università di Roma "Tor Vergata", Via Ricerca Scientifica I-00133, Roma, Italy, Tel: +39-(0)6-7259449, Fax: +39-(0)6-2020519 E-mail: TUCCI@tovvx1.ccd.utovrm.it

31- February 1
11th Spring Workshop of ASIM Working Group *"Simulation Technischer Systeme"*. Vienna, Austria
Contact: Prof. Dr.-Ing. Gerald Kampe, FHT Esslingen, Flandernstraße 101, D-73732 Esslingen. Tel: +49-(0)711/3511-3740 or 3741

February 1994

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

June 1994

21-23 **Massively Parallel Processing, Applications and Development**. EUROSIM Conference, Delft, The Netherlands.
Contact: Organization Secretariat EUROSIM 1994 International MPP Conference, Aula Conference Centre, P.O. Box 5020, 2600 GA Delft, The Netherlands,
Tel: +31 (0)15-788022, Fax: +31 (0)15-786755, E-mail: secretariaat@rc.tudelft.nl

August 1994

22-25 **1st Joint Conference of International Simulation Societies**. Zurich, Switzerland
Contact: Dr. J. Halin, ETH Zürich, Institut für Energietechnik, Clausiusstrasse 33, CH-8092 Zürich, Tel: +41-(0)1/256-4608, Fax: +41-(0)1/262-2158

September 1994

ASIM 94. 9. Symposium Simulationstechnik. Stuttgart, Germany.
Contact: Prof. Dr.-Ing. Gerald Kampe, FHTEsslingen, Flandernstraße 101, D-73732 Esslingen. Tel: +49-(0)711/3511-3740 or 3741

October 1994

9-14 3rd International Conference on Parallel Problem Solving from Nature (PPSN III). Jerusalem, Israel
Contact: H.P. Schwefel, University of Dortmund, E-Mail: schwefel@eval.informatik.uni-dortmund.de

September 1995

11-15 EUROSIM '95. Vienna, Austria

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