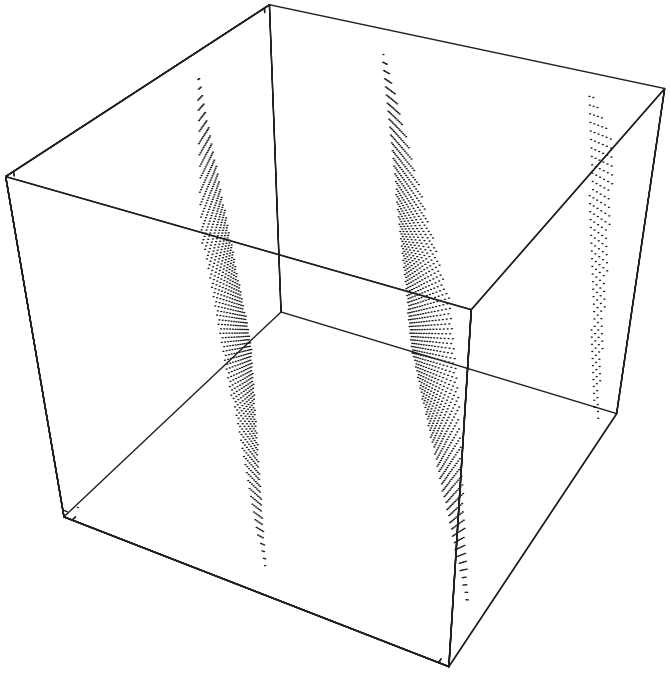
SIMULATION NEWS EUROPE

EUROSIM



Number 20 July1997

A EUROPEAN FORUM ON SIMULATION ACTIVITIES

Contents

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Deadline for the next issue will be October 6, 1997.

Editorial

*This is the second issue of **EUROSIM - Simulation News Europe** (SNE) according to the new production strategies that are effective since the beginning of this year. The non-profit working group ARGESIM in Vienna produces and distributes this simulation newsletter. We are happy about the positive reactions to the last issue and about the acceptance of individual subscriptions.*

SNE is distributed by most EUROSIM member societies to their individual members as part of the membership services. In addition individual subscriptions are available (see page 51). User groups of ACSL, GPSS and MicroSaint read SNE. In the world wide web parts of the contents of SNE as well as a PDF-version of this issue are available.

From the contents of this issue we would like to point out the essay on Pseudorandom Number Generators, which surprisingly shows that there exist no "safe" generators. The title page illustrates an interesting not independent behaviour of subsequences of a usually reliable generator.

The EUROSIM'98 congress is coming near. Please find a Call for Papers on page 6 and 7.

We are happy to publish two contributions from the simulation software industry within our series on the EUROSIM comparisons. At the moment we are testing an automated evaluation of the different solutions of all comparisons by means of a database.

More room has been given to book reviews in this issue, one review is especially dedicated to spreadsheet-based simulation.

We would like to thank all who contributed to this issue.

F. Breitenecker, I. Husinsky

What our readers say

.. SNE is looking better than ever these days ...

Dan Brunner, Systemflow Simulation, USA
March 1997

.. lower prices will not influence the quality, what has already been proved by SNE 19 ...

Borut Zupancic, SLOSIM society
March 1997

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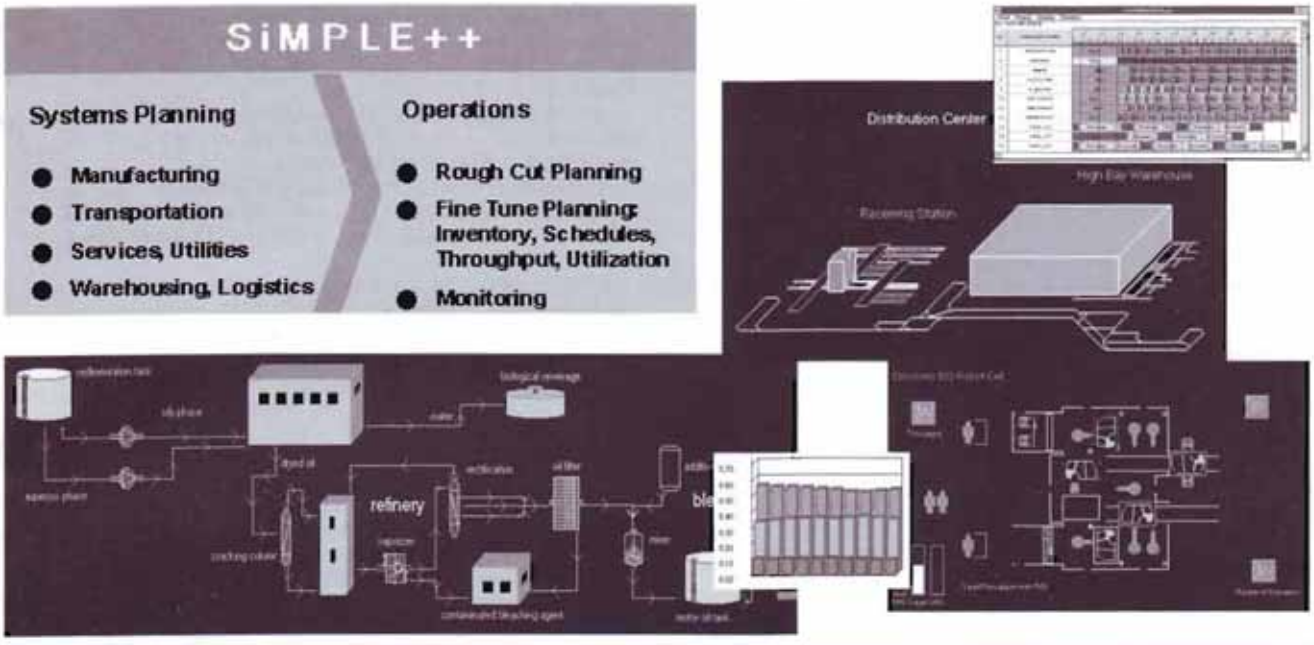

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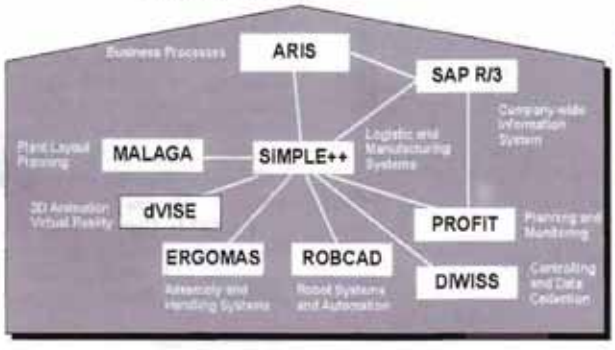

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Readership Information

The journal *EUROSIM - Simulation News Europe* (abbreviated SNE) is published three times a year (March, July, November) by ARGESIM (ARGE Simulation News), a non-profit working group. SNE is the membership newsletter for the EUROSIM societies (EUROSIM is the Federation of European Simulation Societies), and in general SNE is a newsletter on simulation activities in Europe. Circulation is 3000.

SNE is distributed by most EUROSIM member societies to their individual members as part of the membership services. At Congresses, Conferences, within Societies and Groups working in the area of Modeling and Simulation and within Software User Groups the journal spreads information on news and developments on modeling and simulation. Societies and Working Groups may give bulk orders (special rates are available).

SNE can be ordered by subscription from ARGESIM, based on a one year's subscription, on an anytime start basis.

In addition, parts of SNE can be found on ARGESIM´s WWW-Server http://argesim.tuwien.ac.at/sne/.

If you have any contributions, remarks, suggestions, etc. please contact the editors per mail, fax, or email. Deadline for the next issue will be **October 6, 1997**.

The production of the newsletter is financed by advertisements and grants covering current expenses for editing, running of the editorial office, promotion, maintenance of the EUROSIM WWW server and other editorial expenses.

Aims and Scope

The journal *EUROSIM - Simulation News Europe* (abbreviated SNE) publishes information related to modelling and simulation.

SNE's aims are: to inform about new developments in simulation methodologies, applications and software and hardware for modeling and simulation, to report news from European simulation societies and European simulation events (emphasizing SNE's role as *newsletter* of EUROSIM and of the European simulation societies) and from international simulation societies and working groups all over the world.

SNE contains news on EUROSIM, on the EUROSIM societies, on other international simulation societies and groups (and societies from related areas), on software user groups, on simulation centers, and contains a comprehensive calendar of events (congresses, conferences and workshops on modeling and simulation and related areas) and of classes on modeling and simulation.

SNE publishes essays dealing with new developments in a particular area and reports on software and hardware developments, new applications and new methodologies and their applications. The section on industry news contains the latest news available through press releases and announcements. Furthermore, there are book reviews and book news.

A special series on simulation comparisons (EUROSIM comparisons) gives a comprehensive overview on features and developments of simulation software and hardware, including parallelization techniques. These comparisons are also becoming standard benchmarks for simulation programs.

SNE is a printed journal as well as an electronic journal. A database (ARGESIM database) works as input server for structured information on the ARGESIM/EUROSIM WWW server. The database contains information about the EUROSIM comparisons (definition, solutions and evaluations), conferences, classes and books. A calendar of events and courses is available via WWW. EUROSIM/ARGESIM's WWW server can be found at http://eurosim.tuwien. ac.at/).

All contributions are selected and may be edited by the editors of the journal.

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EUROSIM News

General Information

EUROSIM, the **Federation of European Simulation Societies**, was set up in 1989. The purpose of EUROSIM is to provide a European forum for regional and national simulation societies to promote the advancement of modelling and simulation in industry, research, and development. EUROSIM members may be regional and/or national simulation societies. Two kinds of membership, full membership and observer membership, are available.

At present EUROSIM has ten full members and one observer member: ASIM - *Arbeitsgemeinschaft Simulation* (Austria, Germany, Switzerland), CROSSIM - Croatian Society for Simulation Modelling (Croatia), CSSS - Czech & Slovak Simulation Society (Czech Republic, Slovak Republic), DBSS - Dutch Benelux Simulation Society (Belgium, The Netherlands), FRANCOSIM - Société Francophone de Simulation (Belgium, France), HSS - Hungarian Simulation Society (Hungary), ISCS - Italian Society for Computer Simulation (Italy), SIMS - Simulation Society of Scandinavia (Denmark, Finland, Norway, Sweden), SLOSIM - Slovenian Simulation Society (Slovenia), UKSIM - United Kingdom Simulation Society (U.K.). AES - Asociación Española de Simulación (Spain) is observer member.

EUROSIM is governed by a **Board** consisting of one representative of each member society, plus the organizer of the last EUROSIM Congress (past president) and the organizer of the coming EUROSIM Congress (president). The Board elects officers, who are at present: K. Juslin (SIMS) - president, F. Breitenecker (ASIM) - past president, R. Zobel (UKSIM) - secretary, L. Dekker (DBSS) - treasurer.

EUROSIM Board Meeting

On the occasion of the UKSim Conference at Keswick end of April EUROSIM meetings took place. On Friday, April 25, 1997 the EUROSIM Executive Board met in order to prepare the EUROSIM Board Meeting (scheduled for Saturday, April 26) and to deal with administrative affairs. We were happy that the EUROSIM Board meeting was attended by many society representatives, especially from the youngest member SLOSIM (B. Zupancic) and from the youngest observer member CROSSIM (V. Ceric). Furthermore the President K. Juslin (SIMS) could welcome D. Möller (ASIM), F. Breitenecker (ASIM, Past President, Editor SNE), L. Dekker (DBSS, Treasurer, Editor SIMPRA) and M. Dekker (DBSS, Secretary to the Board), M. Savastano (ISCS), and R. Zobel (UKSim, secretary). Saturday afternoon a meeting of the SIMPRA Editorial Board took place.

The main topics discussed / decided were:

- CROSSIM became a full member of EUROSIM. The Board congratulated V. Ceric for having set up an effective simulation society in Croatia and the president personally congratulated Mr. Ceric (see photo).

- From 1998 on SNE and SIMPRA will be totally separated. SIMPRA will no longer contain SNE as addendum.
- For 1998, a cheaper offer for SIMPRA is planned. ARGESIM, which is producing and distributing SNE, will also organise the subscription orders for EUROSIM members.
- The co-operation between EUROSIM and SCS and other simulation groups will be intensified, e.g. in publishing and organising conferences. President and Past President will initiate discussions with representatives of these societies.
- Some of the internal rules were discussed and reformulated, in order to administrate EUROSIM more professionally. Also rules for EUROSIM Conferences (conferences organised by arbitrary groups under the EUROSIM flag) were discussed.
- K. Juslin presented the structure and further details of the next EUROSIM Congress in Helsinki (see also page 6), where we hope to meet most of the European and Overseas simulationists.

The president announced the next Board meeting to be held during the EUROSIM Conference in Helsinki. There new officers of the Board are to be elected, and DBSS will nominate the new EUROSIM president.

F. Breitenecker, Past President

E U R O S I M'9 8

3rd International Congress of the Federation of EUROpean SIMulation Societies
April 14-17, 1998, at Helsinki University of Technology, Finland

We call for papers, on all topics related to Modelling and Simulation, for full papers, short papers, and just in time posters. Posters may also be provided as an addition to a paper presentation. Publishers and software vendors are invited to demonstrate their products at the exhibition area and in a special session. Courses and user group meetings will be arranged. Special emphasis will be addressed to the following topics**:**

1. Use of Modelling and Simulation for CAE Purposes:
Industrial Processes, Pulp and Paper Engineering, Power Production, Electrical and Control Engineering.

2. Modelling and Simulation Software, and Evolving Standards:
Languages, Tools, User Interfaces, Virtual Reality, Software Developer and Vendor Presentations.

3. High Performance Computing and Networking in Simulation:
Computational Fluid Dynamics, Parallel Processing, Networking.

4. Use of Simulation for Training, Education and Entertainment:
Instructor, Teacher, Trainee, Student, and User Experiences.

5. Modelling and Simulation as a Science:
Review of Fundamentals, New Developments and Research, Tutorials.

EUROSIM'98 is the third conference of the Federation of European Simulation Societies. It brings together people from different organisations, interest groups and regional societies every three years to promote the advancement of modelling and simulation in industry, research, education, and development. The Conference is combined with events such as: simulation courses, user group meetings, technical tours, and visits. Options to visit St. Petersburg, Tallinn or Stockholm will be provided for. For skiing enthusiasts a tour is arranged to the snowy Northernmost parts of Finland, although the spring has arrived in Southern Finland.

Kindly consider the following deadlines:

Early Abstracts Submissions starts	September 15, 1997
Full Paper Abstracts Deadline	**November 15, 1997**
Strongly advised Early Registration to Congress, Hotels, and Post Congress Tours	December 15, 1997
Full Paper Submission, Short Paper Abstracts Deadline	**January 15, 1998**
Short Paper Submission	February 16, 1998
Late Registration and Poster Submission Deadline	March 16, 1998
Main Scientific Congress and Exhibition	April 14-15, 1998
Courses, Users' Group Meetings, Tours, and Visits	April 16-18, 1998

One page Abstracts shall arrive preferably by email at least one month before the deadline of relevant paper submission. Abstract acceptance will be notified by email within two weeks. The paper proposals shall be sent as complete WORD documents including pictures and figures in accordance with typing instructions. Full paper proposal is 5 to 8 full pages, Short paper is 3 to 5 full pages and Poster is 1 full A4 page. Paper contributions should arrive at latest 24:00 on the deadline day as uuencoded email attachments or on in due time mailed diskettes. Paper Acceptance Notification will be made by email in three weeks after the receipt of paper.

Please send all correspondence if possible to the Local Organisers by email to

EUROSIM98@vtt.fi

or by ordinary mail to

VTT System Dynamics,
P. O. Box 1301,
FIN-02044 VTT, Finland

or by fax to: +358-9-456 6752.

For up-to-date Congress information visit:

`http://www.vtt.fi/aut/tau/network/eurosim/eurocall.htm`

Join our mailing list NOW to ensure that you get all needed information in time. Accepted full papers, short papers and posters will be published in separate congress proceedings, subject to payment of congress fee. Vendors may arrange for the distribution of their own material during the vendor sessions or at the exhibition.

The EUROSIM'98 Simulation Congress is organised by SIMS - Scandinavian Simulation Society in cooperation with the other EUROSIM member societies: AES - Asociación Española de Simulación, ASIM - Arbeitsgemeinschaft Simulation, CROSSIM - Croatian Society for Simulation Modelling, CSSS - Czech & Slovak Simulation Society, DBSS - Dutch Benelux Simulation Society, FRANCOSIM - Société Francophone de Simulation, HSS - Hungarian Simulation Society, ISCS - Italian Society for Computer Simulation, SLOSIM - Slovene Society for Simulation and Modelling, UKSim - United Kingdom Simulation Society.

Sponsoring Societies: CASS - Chinese Association for System Simulation, JSST - Japanese Society for Simulation Technology, LSS - Latvian Simulation Society, PSCS - Polish Society for Computer Simulation, ROMSIM - Romanian Society for Modelling and Simulation, SCS - Society for Computer Simulation.

The International Scientific Advisory Committee is formed by the board members of EUROSIM.

General congress chair: Kaj Juslin, President of EUROSIM, email: Kaj.Juslin@vtt.fi

Simulation Practice and Theory

Simulation Practice and Theory (abbr. SIMPRA) is EUROSIM's scientific journal, published by Elsevier Science B.V.

The journal publishes original high-quality applied, research and tutorial papers across all facets of the discipline. Emphasis is on providing a diverse combination of studies on different applications of simulation – from biology and medicine to earthquake and civil engineering.

Editor-in-Chief: L. Dekker, Delft University of Technology

In 1997 the journal is published 8 times a year.

Reduced subscription rates for members of EUROSIM societies are available.

Special issues will appear on selected papers of the EUROSIM'95 Congress in Vienna (to be published in 1997 and 1998).

Further information can be found on the journal's home page: `http://www.elsevier.nl/locate/simpra/`

A selection of published papers (Simulation Practice and Theory Volume 5, Issue 3, 15-March-1997):

Fernando J. Barros, Maria T. Mendes, Forest fire modelling and simulation in the DELTA environment, Simulation Practice And Theory (5)3 (1997) pp. 185-197

M.T. Nihtilä, J. Tervo, J.P. Kaipio, Simulation of a nonlinear distributed parameter bioreactor by FEM approach, Simulation Practice And Theory (5)3 (1997) pp. 199-216

J. Figwer, A new method of random time-series simulation, Simulation Practice And Theory (5)3 (1997) pp. 217-234

Luigi De Luca, Roberto Musmanno, A parallel automatic differentiation algorithm for simulation models, Simulation Practice And Theory (5)3 (1997) pp. 235-252

Ki Hyung Kim, Yeong Rak Seong, Tag Gon Kim, Kyu Ho Park, Ordering of simultaneous events in distributed DEVS simulation, Simulation Practice And Theory (5)3 (1997) pp. 253-268

Jérôme Darmont, Ammar Attoui, Michel Gourgand, Simulation of clustering algorithms in OODBs in order to evaluate their performance, Simulation Practice And Theory (5)3 (1997) pp. 269-287

A Note on Pseudorandom Number Generators

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Introduction

After fifty years of mathematical research on random number generators (RNGs), we can guarantee practitioners the following: (i) unpleasant surprises in the form of wrong results in their stochastic modeling, and (ii) the fact that the first experience will be a rare event, provided that *good* RNGs are used.

Stochastic modeling on computers requires random numbers, sometimes in enormous quantities. In certain simulations, our results will depend heavily on the quality of the random number generator we use.

For several reasons, *deterministic* random number generators (so-called *pseudo*random number generators, "PRNGs") are preferred to physical devices like gamma ray counters. The main arguments are reproducibility of the results, the possibility to debug simulation programs, portability of the PRNGs, and the fact that physical devices are cumbersome and that their output tends to be unsatisfactory.

Good PRNGs come with "quality certificates". They have been checked with theoretical quality measures, so-called figures of merit, they have passed stringent empirical tests, and they fulfil many practical needs like long periods or the requirements of parallelization methods.

There exist mathematical transformation methods to obtain other distributions from uniform variates, see Devroye [1], and the software package "C-Rand" of Stadlober and Niederl [20]. For this reason, all system generators found in software libraries produce uniform random numbers in the unit interval [0,1[.

Are there "safe" generators?

It is easy to answer this question. The answer is simply "No". With PRNGs, *no guarantees* but only *only predictions* of their performance in a particular simulation problem are possible. This is not because the word "randomness" is involved but because the finitely many random numbers we generate and their transformed variates cannot fit every imaginable distribution well enough. Every PRNG has its regularities which, occasionally, may become deficiencies. Hence, in a given application, even reliable generators may fail.

Although there are no guarantees, there are *mathematical remedies* against wrong simulation results caused by inappropriate PRNGs.

The first remedy is *empirical testing* of generators. We may run *application-specific tests* with known theoretical results and compare them to our empirical results, see [21] for examples from physics. As an alternative, we may search the existing literature for tests that are similar to our simulation problem. We refer the reader to the surveys [19, 9, 12, 8] and the "Links"-page at the Web-site http://random.mat.sbg.ac.at/.

We may also submit the random numbers we want to use to a battery of empirical tests, see Knuth [7] and Marsaglia [14] for famous examples and L'Ecuyer [9, 8] for further information. It should be stated clearly that empirical tests cannot prove anything formally, like "randomness" for a random number generator. The only conclusion we are able to derive from the results of an empirical test is that the samples that have been used pass or fail this particular test. Nothing can be concluded for other samples, other dimensions, or other initializations of the generator under study. Of course, if the given generator passes many empirical tests, this will improve our confidence as well as our chances to get the right simulation results with this generator.

The second safety-measure is *theoretical support* for a PRNG. It means that we know the period length of the generator, know some of its structural properties, and its correlation behavior. The period length will limit the size of the samples we can use safely. The structural properties will help us to decide if there might be unwanted side-effects in the simulation. The correlation properties of a PRNG are of central importance for many stochastic simulations.

Practical aspects of PRNGs concern the speed of the algorithm, the ease of implementation, the possibility to use parallelization techniques, and the availability of portable implementations. One generator of a given type will not be enough for numerical practice. If we happen to work with high-performance computers, then we will also require that extremely large samples and, necessarily, large periods are available.

A good PRNG covers most of this catalog of safety standards. As a matter of fact, all available generators lack answers in certain subcategories of this checklist. It is up to the practitioner to decide which aspects of a generator are relevant for him and to select an appropriate generator.

Practical Aspects

In numerical practice, even reliable PRNGs may fail. For example, parallelization techniques (see Hennecke [6] and Masuda and Zimmermann [15]) often split the output stream of a PRNG into subsequences. Certain of these subsequences may be disastrous. To illustrate this fact, we plot pairs of consecutive random numbers of the sequence $(x_{23n})_{n\geq 0}$ generated by LCG(2^{48}, 55151000561141, 0, 1) of Fishman [3]. Here LCG(m,a,b,y_0) denotes the linear congruential generator defined by the recurrence $y_{n+1} \equiv ay_n + b \pmod m$, $n \geq 0$. We find that the points are not well dispersed in the unit interval. This computation is due to Entacher [2], who has carried out an extensive analysis of such dangerous "lags" for linear generators with the help of the spectral test.

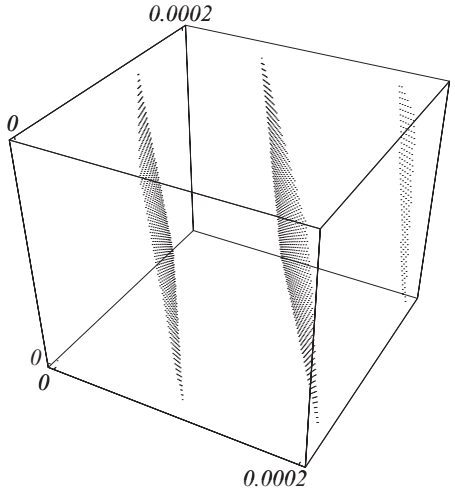

Figure 1
Points of a Subsequence of a LCG

If very long periods are needed, then one may combine PRNGs. In the simplest version of this technique, we combine two generators by adding their output sequences $(x_n^{(1)})_{n\geq 0}$ and $(x_n^{(2)})_{n\geq 0}$ to obtain a new sequence $(x_n)_{n\geq 0}$,

$$x_n := x_n^{(1)} + x_n^{(2)} \pmod 1, \; n \geq 0.$$

If the two generators are chosen properly, then the period of the sequence $(x_n)_{n\geq 0}$ will be the product of the periods of the components. Combining generators without theoretical support may lead to disastrous generators. In the case of linear and inversive methods, the theory is well-known, see L'Ecuyer [10, 12] for the linear case and Niederreiter [19] for inversive generators.

Below, we shall refer to recent advances in random number generation that merit a recommendation. For further information we refer the reader to Hellekalek [5].

Tausworthe generators can have unacceptably bad empirical performance. For this reason, in L'Ecuyer [11], combined Tausworthe generators ("cTG") were introduced to improve on the properties of single Tausworthe generators. This paper also contains an implementation in C of a cTG that has a period length of order 2^{88}.

It is well-known that generalized feedback shift-register generators ("GFSR") are fast, although a little bit tricky to initialize. Recently, a very interesting variant of this linear method has been presented by Matsumoto and Kurita [16, 17], the *twisted* GFSR ("tGFSR"). It produces a sequence $(x_n)_{n\geq 0}$ of w-bit integers by the rule

$$\mathbf{x}_{n+p} = \mathbf{x}_{n+q} \oplus \mathbf{x}_n A, \;\; n \geq 0,$$

where (w, p, q, A) are the parameters of the tGFSR, $\oplus$ denotes binary addition (i.e. XOR), and A is a $w \times w$ matrix with binary entries. This generator is fast and reliable if the parameters are chosen properly. The tGFSR "TT800" presented in [17] has a period length of 2^{800} and strong theoretical support. Recently, Matsumoto and Nishimura [18] have constructed a tGFSR with the extraordinary period length $2^{19937} - 1$ and with convincing theoretical support. This period length should suffice for the rest of this century.

Inversive generators were constructed to overcome one property of linear generators that may turn into a deficiency (depending on the simulation problem), the lattice structure of d-tuples of consecutive random numbers. There are several variants of inversive generators. Inversion certainly slows down the generation of random numbers. Compared to LCGs of the same size, inversive generators are three to ten times slower, depending on the processor's architecture (see Lendl [13]). The importance of inversive PRNGs stems from the fact that their intrinsic structure and correlation behavior are strongly different from linear generators. Hence, they are very useful in practice for verifying simulation results. We refer the reader to Hellekalek [4] for a concise survey of inversive generators in com-

parison to LCGs. A comprehensive discussion of all available nonlinear methods is contained in Niederreiter [19]. The implementation of inversive generators is discussed in Lendl [13]. This generic implementation in C is also available from the server `http://random.mat.sbg.ac.at/`.

Summary

PRNGs may be compared to antibiotics. Every type of generator has its unwanted side-effects. There are no safe generators. Good random number generators are characterized by theoretical support, convincing empirical evidence, and positive practical aspects. They will produce correct results in many – though not all – simulations.

Important open questions in this field concern reliable parallelization, the creation of good generators on demand, and the mathematical foundation of forecasting the empirical performance by theoretical figures of merit.

Three safety-measures for numerical practice are recommended: (a) check simulation results with widely different generators before taking them seriously, (b) avoid to combine, vectorize, or parallelize PRNGs without theoretical and empirical support, and (c) get to know the properties of your preferred PRNGs.

Acknowledgment. I would like to thank my research assistant Karl Entacher, who has contributed Figure 1. This research has been supported by the Austrian Science Foundation (FWF), project P11143/MAT.

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ASIM

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

Report from ASIM

ASIM Conference
and the first European Exhibition Simulation and Visualization S+V
in Dortmund
November 11 - 14, 1997

The preparations for the next annual ASIM conference, **ASIM'97**, the *11. Symposium Simulationstechnik*, are in good progress. It will take place in Dortmund and is organized by Prof. Axel Kuhn and Dipl.-Inform. Sigrid Wenzel, Fraunhofer-Institute.

On November 11th, the day before the official conference, user group meetings and tutorials will be held. User group meetings are planned for ACSL, ARENA, GPSS/H, MATLAB/SIMULINK, SPICE and other products. Anyone interested to organize a user group meeting please contact Mrs. Wenzel.

The following tutorials are scheduled: *Simulation und Animation im WWW, ARENA, Leitfaden Simulation für kmU, Menschen in Simulationsmodellen von Fertigungssystemen, Die High Level Architecture, Web-basierte Simulation und Visualisierung am Beispiel von GPSS/H und Proof Animation, SLX*.

The welcome party will be on the evening of November 11th. ASIM's general assembly (*Mitgliederversammlung*) will be on November 12th, the conference dinner on November 13th.

The scientific programme from November 12 - 14 will include Parallel Sessions with about 100 accepted papers from various areas, Invited Papers, Industrial Forums and Sessions about actual simulation research programmes.

During the conference (November 12 - 14, 1997) the first **European Exhibition Simulation and Visualization - S+V** will take place at the Westfalenhalle 5, in Dortmund. About 50 exhibitors of simulation and visualization software are expected.

For more information please contact: Dipl.-Inform. Sigrid Wenzel, Fraunhofer-Institut für Materialfluß und Logistik, Joseph-von-Fraunhofer-Straße 2 - 4, D-44227 Dortmund, email: wenzel@iml.fhg.de

ASIM Board Meeting

The ASIM Board met on May 23rd in Mainz. Main topics were the ASIM conferences, EUROSIM issues and the ASIM publications.

At the last meeting no vice speaker could be elected as the candidate Dr. Schäfer had to withdraw due to his new position at Daimler-Benz in California. At this meeting Dr. Ingrid Bausch-Gall was elected as new vice speaker, Dr. Wilfried Krug was elected as ASIM's representative at GI meetings. Decisions on changes concerning publication strategies were made. It was decided to start co-operation with SCS Europe in various areas.

The next meeting of the ASIM board will be on November 11th, the evening before the ASIM conference. Please contact the speaker or vice speaker if there are any issues to be discussed at that meeting.

ASIM *Mitgliederversammlung*

The next ASIM's general assembly will take place on November 12th, 1997, 18.00 at Westfalenhalle Dortmund, during the ASIM conference. All ASIM members are invited to come to the assembly, independent of conference participation.

ASIM-Mitteilungen

A complete list of all available *ASIM-Mitteilungen* can be obtained from Ingrid Bausch-Gall, where also orders can be placed. The list is also published in the *ASIM-Nachrichten*.

ASIM Book Series

The ASIM book series on Advanced Simulation is published in two different series.

Series ***Fortschritte in der Simulationstechnik,*** published by Vieweg in Wiesbaden, Germany. Up to now already 8 books have been published. Two more are finished and several more are planned to appear in the near future with focus on:

- Status Reports, presenting the state-of-the-art in simulation within each individual ASIM Working Group. These handbooks will be updated according to advances in simulation,

- Compendiums on simulation with general interest to the simulation community,
- Proceedings of the annual ASIM Symposium.

Series ***Fortschrittsberichte Simulation***, published by ARGESIM in Vienna, Austria. This publication series is a forum for

- Monographs on recent developments (e.g. PhD thesis, habilitation thesis),
- Workshop Proceedings of ASIM Working Groups,
- Description of simulation tools and their application.

Five books of this series are now available:

C. Westerkamp: *Anwendung der Mehrgrößen-Parameterschätzung zur Simulation von linearen passiven Netzwerken*.
M. Salzmann: *Genetische Algorithmen in diskreten Simulationen.*
J. Plank: State Events in Continuous Modelling and Simulation – Concepts, Implementation and New Methodology (in English).
P. Acel: *Methode zur Durchführung betrieblicher Simulationen – Effiziente Optimierung der diskreten Simulation.*
M. Kinder: *Stochastische Simulation biotechnischer Prozesse – Entwurf von Filtern und Reglern*.

The price is DM 40 plus mailing cost, with DM 10 reduction for ASIM members. Send orders to Dr. Ingrid Bausch-Gall. For detailed information or if you are interested to publish in the series, please contact the editors:

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ASIM Meetings to come

November 11-14, 1997: ASIM'97, *11. Symposium Simulationstechnik*, the annual ASIM conference, detailed information see above.

February 16-17, 1998: 8th Working Group Conference of the ASIM Working Group "*Simulation in Produktion und Logistik*", Berlin, Germany.

March 2-3, 1998: *Treffen der Fachgruppe "Simulation Technischer Systeme"* at FH Heidelberg. Contact: Dr. Ingrid Bausch-Gall.

September 15-18, 1998: ASIM'98, *12. Symposium Simulationstechnik*, the annual ASIM conference, Zurich, Switzerland. Contact: Dr. Veronika Hrdliczka.

ASIM'99 is planned to be held in Weimar in September 1999 and ASIM'2000 will be held at the Ebernburg castle in September 2000.

Working Groups (*Fachgruppen* FG)

"Verteilte Systeme und parallele Prozesse" (FG 1)

For a report of the joint meeting in Rostock see FG 5.

Speaker: Dr.-Ing. Peter Schwarz, Fraunhofer-Institut IIS/EAS, Zeunerstr. 38, D-01069 Dresden Tel: +49-351 4640 730, Fax: +49-351 4640 703, email: schwarz@eas.iis.fhg.de
Vice-speaker: Dr. Hans Fuss, GMD, D-53731 St. Augustin Tel: +49-2241 14 3125, Fax: +49-2241 14 3006, email: fuss@cartan. gmd.de

FG 2, FG 3, FG 4

Report on the joint meeting for FG 2, FG 3 and FG 4

The working groups "*Simulationsoftware und -hardware", "Simulation in Medizin, Biologie und Ökologie"* and *"Simulation und künstliche Intelligenz"* had their annual spring meeting from April 17-19, at the old castle of Ebernburg. Theme of the conference was "Soft Computing: Possibilities of a Paradigm Change on Modelling, Simulation and Analysis of Dynamical Systems". The tracks included cellular automata, soft computing methodology, medical applications, simulation software and hardware, ecology and artificial intelligence.

ASIM ASIM ASIM

ASIM - Buchreihen / ASIM Book Series

Reihe/Series **Fortschritte in der Simulationstechnik**

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- F. Breitenecker, H. Ecker, I. Bausch-Gall; Simulation mit ACSL
- Dj. Tavangarian; Simulation und Entwurf elektronischer Schaltungen
- Dj. Tavangarian (Hrsg.); Simulationstechnik, 7. Symposium in Hagen, September 1991
- O. Rathjen; Digitale Echtzeitsimulation
- A. Sydow (Hrsg.); Simulationstechnik, 8. Symposium in Berlin, September 1993
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- J. Biethan, J. Hummeltenberg, B. Schmidt, Th. Witte (Hrsg.); Simulation als betriebliche Entscheidungshilfe
- G. Kampe, M. Zeitz (Hrsg.); Simulationstechnik, 9. Symposium in Stuttgart, Oktober 1994
- W. Krug (Hrsg.); Simulationstechnik, 10. Symposium in Dresden, September 1996

Schwerpunkte / Topics:

- Statusberichte über Simulation in den ASIM Fachgruppen / Status reports
- Allgemeine Monographien / General monographies
- Proceedings der ASIM Tagungen / Proceedings of the ASIM conferences

Reihe/Series **Fortschrittsberichte Simulation**

ARGESIM, Wien, Österreich; erhältlich bei ASIM / available at ASIM

- C. Westerkamp; Anwendung der Mehrgrößen-Parameterschätzung zur Simulation von linearen passiven Netzwerken
- M. Salzmann; Genetische Algorithmen in diskreten Simulationen
- J. Plank; State Events in Continuous Modelling and Simulation - Concepts, Implementation and New Methodology
- P. Acel; Methode zur Durchführung betrieblicher Simulationen - Effiziente Optimierung der diskreten Simulation
- M. Kinder; Stochastische Simulation biotechnischer Prozesse / Entwurf von Filtern und Reglern (to appear 8/97)

Schwerpunkte / Topics:

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- Handbücher für Simulationssprachen / User Guides for simulation languages

Preis / Price: DM 40.- (ASIM-Mitglieder DM 30.-) + Versandkosten

Bestellungen, Informationen für Autoren / Orders:

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ARGESIM REPORT

ARGESIM REPORT

ARGESIM REPORT

The meeting started with a pre-conference tutorial on "Neuro-Fuzzy-Systems", given by D.P.F. Möller and M. Reuter on Thursday. The conference itself took place from Thursday afternoon – after a welcome coffee – to Saturday noon. With approx. 50 participants from Austria, Germany and Switzerland, the conference theme and location was well accepted.

Thursday evening a Congress Wine Tasting with local home-made dishes took place in the old cellar of the castle of Ebernburg. On Friday evening the Conference Dinner was held in the historical cellar of the castle of Ebernburg. This proved to be a very appropriate and impressive location for the highlight of the social programme. Unfortunately all good things come to an end and the participants left the castle of Ebernburg after a lunch, but they voted for the next meeting to be held again at the castle of Ebernburg in 2000.

"Simulationssoftware und -hardware" (FG 2)

As D. Möller is now speaker of FG 4, speaker and vice-speaker of this working group will exchange places preliminarily. During the ASIM conference in Dortmund elections for speaker and vice-speaker will take place.

Speaker (prel.): Prof. Dr. Felix Breitenecker, TU Wien, Abt. Simulationstechnik, Wiedner Hauptstraße 8-10, A-1040 Wien, Tel: +43-1 58801 5374, Fax: +43-1 5874211, email: Felix.Breitenecker@tuwien.ac.at
Vice-speaker (prel.): Prof. Dr.-Ing. Dietmar P.F. Möller, TU Clausthal, Institut für Informatik, Erzstraße 1, D-38678 Clausthal-Zellerfeld, Tel: +49-5323 72 2402, 2504, Fax: +49-5323 72 3572, email: moeller@ informatik.tu-clausthal.de

"Simulation und künstliche Intelligenz" (FG 3)

For a report of the joint meeting at Ebernburg see above.

Speaker: Prof. Dr.-Ing. Helena Szczerbicka, Universität Bremen, Rechnerarchitektur und Modellierung, Fachbereich 3 - Informatik, Postfach 33 04 40, D-28334 Bremen, Tel: +49-421 218 7389 or 7390, Fax +49-421 2187385, email: helena@informatik.uni-bremen.de
Vice-speaker: Dr. Thomas Uthmann, Johannes-Gutenberg-Universität Mainz, Institut für Informatik, Staudingerweg 9, D-55099 Mainz, Tel: +49-6131 39-3610, Fax +49-6131 39-3534, email: uthmann@informatik.uni-mainz.de

"Simulation in Medizin, Biologie und Ökologie" (FG 4)

The annual assembly took place on Thursday, April 17th, during the working group meeting. Speaker and vice speaker of FG 4 were elected. The members voted for Dietmar P. F. Möller as speaker and Otto Richter as vice-speaker. The newly elected speaker addressed his thanks to Prof. Björn Gottwald, former vice-speaker of FG 4, for his engagement for the working group. The members voted for the 8th Ebernburg Conference in 2000 to be held at the castle of Ebernburg, organised by Dietmar P. F. Möller and Otto Richter.

Speaker: Prof. Dr.-Ing. Dietmar P.F. Möller, TU Clausthal, Institut für Informatik, Erzstraße 1, D-38678 Clausthal-Zellerfeld, Tel: +49-5323 72 2402, 2504, Fax: +49-5323 72 3572,
email: moeller@ informatik.tu-clausthal.de
Vice-speaker: Prof. Dr. Otto Richter, TU Braunschweig, Institut für Geographie und Geoökologie, Langer Kamp 19c, D-38106 Braunschweig, Tel: +49-531 391 5627, Fax: +49-531 391 8170

"Simulation technischer Systeme" (FG 5)

The working groups FG1 and FG5 held their joint meeting on March 3rd and 4th in Rostock at the Institute of Prof. Tavangarian, organized by Dr. Michael Koch. 35 participants travelled to Rostock. The meeting started on Monday afternoon with presentations of the work of the institute of Prof. Tavangarian, talks on parallel computing and a report on the activities of the Institute of Prof. Grützner. On Tuesday so-called "*Arbeitsgespräche*" covered issues like: a meeting of the German Spice-Anwendergruppe, news on VHDL-AMS and parallel computing.

A dinner on Monday evening in a local restaurant gave all participants the chance for intense conversation. A walk through the historic city of Rostock and a visit of the "*Schiffahrtsmuseum"* surrounded the interesting meeting. A more detailed report with subjects of all talks will be found in the *ASIM-Nachrichten*. Most of the talks will be published as *ASIM-Mitteilungen Nr. 57*.

The next FG5 meeting will be at FH Heidelberg on March 2 and 3, 1998, hosted by Prof. Peter Schmidt. As in the years before, Monday afternoon will start with talks on special subjects, Monday evening there will be a meeting of the members of the FG with the election of speaker and vice speaker, Tuesday morning so-called "*Arbeitsgespräche"* will cover special issues in parallel sessions. An interesting industrial excursion programme is planned for Tuesday afternoon. Please contact the speaker if you are interested in organizing a "*Arbeitsgespräch*" or to contribute to the meeting.

Speaker: Dr. Ingrid Bausch-Gall, BAUSCH-GALL GmbH, Wohlfartstraße 21b, D-80939 München, Tel: +49-89 3232625, Fax: +49-89 3231063, email: 100564.302@compuserve.com
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"Simulation in Produktion und Logistik" (FG 6)

The next working group meeting will take place on June 11th, 1997, at the Fraunhofer Institute for Materialflow and Logistics, Dortmund, Germany.

Topics will be the production of the book titled "*Anwendungsorientierte Fallbeispielsammlungen*", the revision of the *ASIM-Mitteilungen Nr. 7a, Leitfaden für Simulationsbenutzer* and the organization of the 8th Working Group Conference.

The next biannual Working Group Conference of the ASIM Working Group "Simulation in Production and Logistics" will be held on February 16 -17, 1998 in Berlin, Germany. It will be organized by Dipl.-Phys. Markus Rabe, Fraunhofer Institute for Production Systems and Design Technology (IPK), Berlin. A more detailed announcement of this meeting can be found in the *ASIM-Nachrichten*. The Working Group Conference is a forum for users, suppliers and researchers. Suppliers will present their latest products in an exhibition during the conference. Abstracts of papers are due until September 15th, 1997. Conference language is German. For detailed information about call for papers and about the exhibition please contact: Markus Rabe, Fraunhofer Institut für Produktionsanlagen und Konstruktionstechnik (IPK), Pascalstr. 8-9, D-10587 Berlin, Fax: +49-30-39 32 503, email: Markus.Rabe@ipk.fhg.de, WWW: http://www-plt.ipk.fhg.de/ASIM-Fachtagung/

For detailed information about working group activities please contact: Mrs. Dipl.-Inform. Sigrid Wenzel, Fraunhofer-Institut für Materialfluß und Logistik, Joseph-von-Fraunhofer-Straße 2-4, D-44227 Dortmund, email: wenzel@iml.fhg.de

Speaker: Prof. Dr.-Ing. A. Kuhn, Fraunhofer-Institut für Materialfluß und Logistik, Joseph-von-Fraunhofer-Straße 2-4, D-44227 Dortmund, Tel: +49-231 9743 132, Fax: +49-231 9743 234

"Simulation in der Betriebswirtschaft" (FG 7)

Speaker: Prof. Dr. W. Hummeltenberg, Universität Hamburg, Institut für Wirtschaftsinformatik, Max-Brauer-Allee 60, D-22765 Hamburg, Tel.: +49-40 41 23-4023, Fax: +49-40 41 23-6441, email: wi@mba.uni-hamburg.de
Vice-speaker: Prof. Dr. Biethahn, Georg-August-University of Göttingen, Platz der Göttinger Sieben 5, D-37073 Göttingen.

"Simulation von Verkehrssystemen" (FG 8)

The *Fachgruppe Simulation von Verkehrssystemen* met on June 6th, 1997 at Mannesmann AG in Ratingen. For a report on the meeting see *ASIM-Nachrichten*. After 5 years activity K.-H. Münch resigned as speaker of the FG. Andre Graber was elected as new speaker, Thomas Schulze as vice speaker. The new speaker thanked Mr. Münch for his activities during the founding process of the FG. Mr. Münch ensured his future support for the activities to come.

Speaker: Andre Graber, CSC Ploenzke, Binzmühlestr. 14, CH-8050 Zürich, Tel: +41-1 302 23 23, Fax: +41-1 303 11 80, email: agraber@csc.com

Vice-speaker: Thomas Schulze, Univ. Magdeburg, Fak. f. Informatik, Universitätsplatz 2, D-39108 Magdeburg, Tel: +49-391 5592 2017, Fax: +49-391 5592 164, email: tom@isg.cs.uni-magdeburg.de

"Simulation in Umweltanwendungen" (FG 9)

Speaker: Prof.Dr.habil. Rolf Grützner, University of Rostock, Dept. of Computer Science, WG Modeling and Simulation, Albert-Einstein-Str.21, D-18056 Rostock, Tel: +49-381 4983369, Fax: +49 381 4983426, email: gruet@informatik. uni-rostock.de

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Simulation kontinuierlicher Systeme
Simulationskurs bei CCG
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20. - 22. Oktober 1997 in Oberpfaffenhofen bei München

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FIRST CALL FOR ABSTRACTS
to **EUROSIM'98** CONGRESS
AT HELSINKI UNIVERSITY OF TECHNOLOGY, see page 6 and 7

CROSSIM

CROSSIM (The Croatian Society for Simulation Modelling) was founded in 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. From April 1997 CROSSIM is a full member of EUROSIM.

Membership

CROSSIM currently has 64 individual members. The annual membership fee is equivalent of 8 German marks for regular members, and 2 German marks for students.

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Activities

- Co-organizing the 19th International Conference "Information Technology Interfaces" ITI '97, to be held in Pula, Croatia, from 17-20 June 1997. The conference has a strong modelling and simulation session and an international invited lecturer in the field of simulation (Prof. Ivan Futo, Hungary).
- Regularly organizing a simulation seminar held at the Faculty of Economics, University of Zagreb.
- Work on scientific projects in discrete and continuous simulation, and applications of simulation in such diverse fields as engineering, economy, medicine, ecology etc.
- Publication of papers in international and domestic journals and conference proceedings.
- Preparing the publication of a booklet about the CROSSIM society.

V. Ceric

CSSS

General Information

CSSS (The Czech and Slovak Simulation Society) has about 60 members in 2 groups connected to the Czech and Slovak national scientific and technical societies. The main objectives of the society are: development of education and training in the field of modelling and simulation, organizing professional workshops and conferences, disseminating information to its members about modelling and simulation activities in Europe, informing the members about publishing in the field of modelling and simulation.

Past Events

The 31st International conference on **"Modelling and Simulation of Systems" (MOSIS 97)** was successfully held on April 28 - 30, 1997 in the Moravian city Hradec nad Moravici, Czech Republic. The chairman of the international programme committee was Dr. Jan Stefan. 126 participants attended the conference (96 from Czech and Slovak republics and 30 from UK, Germany, Switzerland, Latvia, Poland and Bulgaria). 120 articles in the areas of Theory of modelling and simulation of systems; Simulation tools; Visualization and virtual reality; Information system modelling and simulation and Simulation case study were presented at the conference. The proceedings of the conference are published in 3 volumes.

Coming Events

The 19th International workshop on **"Advanced Simulation of Systems"** will be held on September 16 to 18, 1997 in the Moravian city of Krnov with the following topics: Simulation case study; Education of modelling and simulation; Modelling and simulation of control systems; Simulation tools; Parallel and Distributed simulation. Chairman of the workshop is Dr. Jan Stefan, TU Ostrava.

The international workshop **"Modelling and Simulation in Management, Control and Informatics"** will be held on October 6 - 8, 1997 in Zilina-Sulov, Slovak republic, with the following topics: Modelling and simulation of management systems; Modelling and simulation of Control systems; Information systems modelling and simulation; Transport and telecommunications modelling and simulation; simulation case study. The chairman of the conference is M. Alexik, University of Zilina, Slovak republic.

Contact Addresses

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M. Alexik

DBSS

General Information

The Dutch Benelux Simulation Society (DBSS) was founded in July 1986 in order to create an organisation of simulation professionals within the Dutch language area. DBSS has actively promoted creation of similar organisations in other language areas. DBSS is a member of EUROSIM and works in close co-operation with the other members and is affiliated with SCS International and IMACS.

Steering Committee as from July 1, 1997

Chairman	A.W. Heemink, Delft University of Technology
Vice Chairman	L. Dekker, Delft University of Technology
Member	W. Smit, AKZO NOBEL
Secretary/Treasurer	J.C. Zuidervaart, Delft University of Technology

DBSS-Membership

Both corporate entities (companies, institutes, etc.) and individuals are welcome to join DBSS as full corporate or individual member.

The contribution is divided in two options:

I. Dfl. 75,- individual member or Dfl. 150,- institutional member, which means that you will receive the newsletter Simulation News Europe three times a year.

II. Dfl. 150,- individual member or Dfl. 250,- institutional member, which means that you will receive the Journal Simulation Practice and Theory eight times a

year, including the newsletter Simulation News Europe three times a year.

Becoming member of DBSS includes automatically being member of EUROSIM, the overall organisation of European Simulation Societies. DBSS members enjoy reduction of the fees attending the "EUROSIM events" which include congresses, conferences, symposia,workshops etc.

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

Dutch Benelux Simulation Society
Secretariat: Computing Centre, P.O. Box 354
2600 AJ Delft, The Netherlands
Tel.: +31-15 2785698, Fax: +31-15 2783787
email: Zuidervaart@rc.tudelft.nl

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

Coming Events

DBSS will organise during the first two days of the EUROSIM 98 Congress (organised by the SIMS society in Helsinki, Finland, April 14-17, 1998) a parallel session with the provisional title "The impact of HPCN on parallel simulation". The provisional scientific committee for this session: J. Bruin, Corporate Communication TNO, NL, L. Dekker, TU Delft, NL; J. Halin, ETH Zürich, Switzerland, A.W. Heemink, TU Delft, NL; J. Keane, University of Manchester, UK; H.X. Lin, TU Delft, NL; E. Shapiro, USA; W. Smit, AKZO NOBEL, NL; J.C. Zuidervaart, TU Delft, NL.

For further information, please contact the EUROSIM '98 congress office: P.O. Box 1301, FIN-02044 VTT; Fax: +358-9 456 6752; email: eurosim98@vtt.fi

One day symposium Neural Networks

It is the intention to organise in the autumn of this year a one day symposium at the Delft University of Technology about Neural Networks. A neural network is a very popular simulation tool. It is a very user friendly black box procedure that is suitable for many types of applications. However, there are also some drawbacks. The resulting network seldom increases the insight into the process that is simulated. Furthermore the predictive capabilities of the network are not clear in case the circumstances change. As a result neural networks have to be used with great care.

On the one day symposium a number of presentations on applications of neural networks will be given. Also a few presentations on what is going on inside the black box have been scheduled. Both the practical and the theoretical presentations will increase the insight into possibilities as well as into the dangerous aspects of neural networks. More detailed information will be mailed in time to the DBSS members.

In June last year in Delft, the EUROSIM Board decided to accept the proposal of DBSS to be the organizer of the triennial EUROSIM congress in 2001. DBSS will organize the congress in Delft, The Netherlands. According to the bylaws of EUROSIM, DBSS nominated prof.dr. L. Dekker as the EUROSIM President in the period after the EUROSIM congress in Helsinki.

DBSS will set up their own home page soon.

In order to create a more detailed mailing list of the members of the DBSS, we would appreciate it very much to receive by email your email address, fax and telephone number.

The Steering Committee is also interested to know what are the fields of interest of their members, so we hope to receive that information too. Those interested to organize a DBSS event, are kindly requested to write to the secretary.

J.C. Zuidervaart

FRANCOSIM

FRANCOSIM was created in 1991 and aims to the promotion of simulation in research, industry and university fields. It has members from large French companies and famous Belgian and French universities.

Contact Addresses

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Avenue Pré-Aily
B-4131 Angleur
Tel: +32-43 67 83 75, Fax: +32-43 67 83 00

HSS

General Information

The Hungarian Member Society of EUROSIM was established in 1981 as an association promoting the exchange of information within the community of people involved in research, development, application and education of simulation in Hungary and also contributing to the enhancement of exchanging information between the Hungarian simulation community and the simulation communities abroad. HSS deals with the organization of lectures, exhibitions, demonstrations, round table discussions and conferences.

Activities

It is planned that in the Fall a demonstration on problem solving in various fields by artificial intelligence controlled simulation is to be held in the International McLeod Institute of Simulation Sciences Hungarian Center.

It is planned that an international conference on metrology is to take place in Hungary in April 1998 that the Hungarian Simulation Society is cosponsoring and organizing a session related to simulation. We shall be able to provide more details in the next issue of EUROSIM Simulation News Europe.

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András Jávor

ISCS

General Information

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

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

Franco Maceri (chairman)
Felice Cennamo (vice-chairman)
Vincenzo Grassi (treasurer)
Mario Savastano (secretary)

Membership

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

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

Contact Address

For further information or application for membership, please contact:

ISCS
c/o Dipartimento Ingegneria Informatica
Università di Roma "Tor Vergata"
Via della Ricerca Scientifica
I-00133, Roma, Italy
Tel.: +39-6 7259 4477
Fax: +39-6 2020519
email: grassi@info.utovrm.it

Activities

The ISCS promotes and sponsors various activities. We mention that ISCS is involved in

1. The sponsoring of the "*Seminario di Informatica*", a periodic scientific seminar held at the University of Roma "Tor Vergata". Main topics are simulation, performance evaluation, parallel and distributed computing, and high speed networks.

2. The organization of Working Group meetings among ISCS members interested in the same simulation field, in order to provide a forum for presentation of results, exchange of ideas and scientific discussions. At present, the following Working Groups have been established: Simulation in Industry and Management, Simulation in Agriculture and Environmental Sciences, Simulation in Training and in Education, Simulation in Biology and Medicine, Simulation in Electrical Engineering, Concurrent and Distributed Simulation, Software and Hardware for Simulation, Expert Systems and Simulation.

3. The organization of Summer Simulation Schools with the aim of extending the knowledge about simulation theory, tools, and applications. They are mainly ad-

dressed to graduate and PhD students or young researchers working both in industry and academia.

4. The organization and sponsoring of the annual workshop on computer simulation.

Notice to ISCS Members

The annual meeting of ISCS members is scheduled to be held in December 1997 in Rome, at the new building of the Department of Computer Engineering of the University of Rome "Tor Vergata".

We invite ISCS members to a large participation because a new Steering Committee has to be elected for the period 1998-2001.

On that occasion, the annual workshop on computer simulation will be organized. Papers are solicited from ISCS members describing their current activities in the general simulation field. Accepted papers will be included in the proceedings of the workshop.

Some copies of the 1996 workshop volume are still available and can be obtained from the ISCS Secretariat.

Michele Colajanni

SIMS

General information

SIMS is the Scandinavian Simulation Society with members from the four Nordic countries Denmark, Finland, Norway and Sweden. The SIMS history goes back to 1959. SIMS' matters are taken care of by a board, the ombudsman and the treasurer. SIMS' board has eight members – two from each country. The annual meeting takes place in connection with the conferences. Usually the board meets a second time per year. The bylaws are written in Swedish and have recently been proposed updated.

How to join SIMS?

From 1996 the basic membership is free. You may register as a member by sending a mail with personalia to the address

sims@ecy.sintef.no

As a member you will receive invitation to the conferences and other information related to simulation. You will also get a discounted conference fee on the SIMS conferences.

Individual subscriptions for a discounted price to *EUROSIM - Simulation News Europe* and *Simulation Practice and Theory* are available.

For more information visit the Internet address **http://www.itk.ntnu.no/SINTEF/sims.html**

SIMS Annual Conference 1997

The venue for the SIMS annual meeting 1997 will be Hanasaari Culture Center in Espoo nearby Helsinki. The date for the conference is October 2 - 4, 1997. Proposals for abstracts in the field of "Industrial Applications on Modeling and Simulation" are called for. Contributions and preliminary registrations should be sent to:

Hannu.Sippola@hut.fi

Immediately before the SIMS conference there will be in the same location a CSNI meeting starting on September 29 on "Simulators and Plant Analyzers". It is open for the SIMS meeting participants as well. More information will be sent by email to those who have indicated their interest.

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Fax. +47-73 59 43 99
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Torleif Iversen

SLOSIM

The Slovenian Society for Simulation and Modelling (SLOSIM) has currently 86 members, both from Slovenian universities and from industrial companies. SLOSIM was founded in 1994 and became a full member of EUROSIM in 1996.

Recent Events

SLOSIM is a co-operative society in the organisation of the traditional Electrotechnical and Computer Science Conference ERK'97 in Portoroz, Slovenia, on the Adriatic coast (September 25 - 27, 1997) and is responsible for the modelling and simulation sessions. So modellers and simulationists are kindly invited to send a camera ready paper before July 22 to:

Sasa Divjak
Faculty of Comput. and Inform. Science
Trzaska 25
SLO-1001 Ljubljana, Slovenia

A Call for papers has been already sent to our members.

On April 17, there was a regular group presentation meeting at the Faculty of Electrical Engineering, Ljubljana. The group Laboratory of Biomedical Engineering and Robotics was presented (see also presentation of simulation centers, page 46).

On April, 26 I participated in the EUROSIM Board meeting at Keswick, Great Britain, where I reported about SLOSIM activities. More information about this meeting is included elsewhere in this issue.

The Slovene Ministry of Research and Technology covered a part of the expenses for my participation in the EUROSIM Board meeting and for Simulation News Europe for our members.

Contact Address

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slosim@fe.uni-lj.si

Borut Zupancic

UKSIM

UKSim Conference Report

The society held its third national conference from April 23rd-25th, 1997 in Keswick, Cumbria. It was a success with twenty-seven papers presented on a variety of simulation topics. Applications of computer simulation were addressed with cellular telephone communications, molecular monolayers and crowd management in emergency evacuations just some of the subjects discussed. Real-time simulator integration algorithms were discussed as were image generation methods intended to give more realistic field of view displays using less computer power. Discrete event simulation topics included a comparison of different simulation software packages. Other topics included parallel computing for simulation, model validation, computer network simulation and fuzzy systems.

The conference keynote talk was presented by Steve Nevey, IT manager of the Stewart Formula 1 Grand Prix team. This was a fascinating introduction to the world of Formula 1 car engineering and how simulation and other engineering software is used in a leading edge technological environment.

UKSim AGM

After the AGM on 24th April, 1997, UKSim has a new General Secretary and a new Chairman. Russell Cheng was elected as chairman of the Society. The new General Secretary is

Dr. Gary J. Gray
Dept. Electronics and Electrical Engineering
University of Glasgow
GLASGOW G12 8LT
Tel: +44 141 339 8855 X2234
Fax: +44 141 330 6004
email: G.Gray@eng.gla.ac.uk

The Membership Secretary is

Dr. Gwyn Jones
Dept of Computing and Information Systems
London Guildhall University
100 Minories
London EC3N 1JY
Tel: +44 171 320 1716
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email: gjones@lgu.ac.uk

UKSim has a web page at
http://www.dcs.ed.ac.uk/home/rjp/UKSim/
with information about the society.

G.J. Gray

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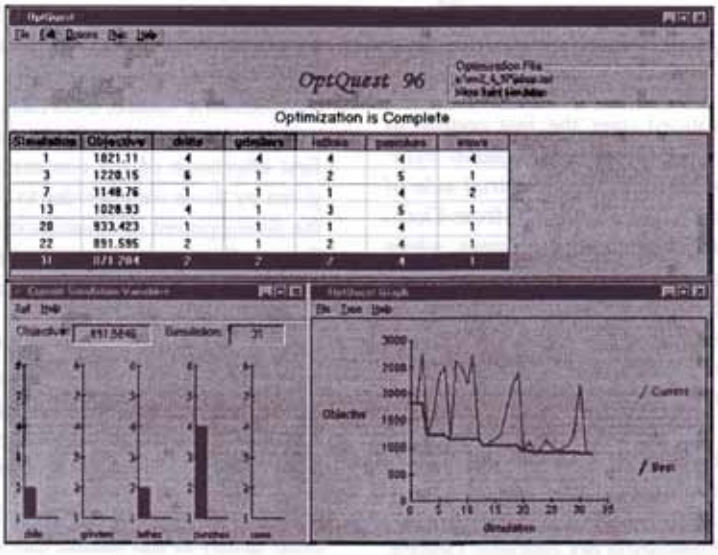

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SCS

The year 1996-1997 will be a year of consolidation for the European Office of SCS. After having invested heavily into starting a new conference on web applications and multimedia applications using simulation, SCS can now look forward to having four major events in Europe.

As you will have noticed over the last couple of years, the emphasis of the European Simulation Symposium has shifted towards more the industrial side of simulation use. This year's **ESS**, in Passau from October 19-23, will even focus more on this aspect, while appending it to an industrial exhibition. Some 85 simulation companies have been contacted to take part in the exhibition. The following subjects will be discussed: Simulation Methodology (featuring Object Oriented Simulation and Simulation Environments and Tools); Simulation in Industry (featuring Simulation in Manufacturing, Simulation in CIM & CAD, Simulation in Logistics, Simulation in Business and Simulation in Economy); Simulation in Engineering (featuring Simulation in Biomedicine, Simulation in Computer Design, Simulation in Telecommunication, Simulation in Electrical Engineering, Simulation in Energy Systems and Simulation in Power Plants).

Euromedia'97, has now moved from the December time slot to the January time slot . After its successful launch last year in London, the De Montfort University in Leicester, will be hosting the event from January 5-7, under the tutelage of Dr. Marwan Al-Akaidi. By the way, Dr.Al-Akaidi, in his position of SCS Middle Eastern Chair, will be responsible also for setting up the SCS Middle Eastern Simulation Council. A tentative date for a first workshop has been set on the 27th and 28th of December of this year for a first workshop to be held, either in Tunisia, Egypt, Bahrain or the UAE (this depends on the preference of the participants). If you would like to learn more about this activity please contact Dr. Al-Akaidi directly on his email address mma@dmu.ac.uk

Our Concurrent Engineering Conference, will be renamed from CEE to the European Concurrent Engineering Conference (**ECEC**), in keeping with the titles of our other events. The venue is again Erlangen, Germany and the time frame is April. We are also glad that Daimler Benz AG has been found willing to become the major sponsor for this event. The General Conference Chair for this event will be Dr. Uwe Baake of Daimler Benz.

And last but not least, we have the **ESM'98**, which will be in it's 12th year, and very special at that, because it will be held at the University of Manchester, over a four day period from June 16th to June 19th, in honour of the 50th anniversary of the first programmable computer ever made in the world at the department of computer science at the University of Manchester. Because of its historic nature, SCS has decided to hold a special session documenting the history of simulation on the first afternoon of the conference. This session will be given by those we consider to have been instrumental in the development of simulation technology, especially in Europe. Tentative subjects so far for the conference are: Hardware and Simulation, Real time simulation emphasizing DIS, HLA, Military * Simulation in Medical Informatics and Health Care * Simulation Methodology * AI and Robotics * Simulation in Education * Multibody Systems * Simulation and OR * History of Simulation (in the framework of the historical aspect of the event) * Session for Students.

So if you want to be nostalgic while keeping your head firmly in the future, this is the event for you!

Next to consolidating the conference, SCS has now built up quite some expertise in producing Proceedings in digital format on CD's. We will continue and expand this activity in the future by offering this service to others, who want to organise conferences and give the participants a digital version of the printed word. By the way, we have also increased through our **SCS European Publishing house** the number of simulation publications (there are now 12 new Publications you can choose from) and all of them can now be ordered online from our website (http://hobbes.rug.ac.be/~scs/)

As we wanted to increase the quality of the format in which our Summer School is foreseen, we have decided to postpone it for one year and offer everyone the chance to take part in July 1998.

For more information on this and other things please contact:
Philippe Geril, SCS,
University of Ghent, Coupure Links 653,
B-9000, Ghent, Belgium.
Tel: +32.9.233.77.90, Fax: +32.9.223.49.41,
email: Philippe.Geril@rug.ac.be, or visit our website: http://hobbes.rug.ac.be/~scs/

IMACS

15th IMACS World Congress 1997 on Scientific Computation, Modelling and Applied Mathematics

August 24-29, 1997
Berlin / Germany

The International Association for Mathematics and Computers in Simulation (IMACS) is preparing a world congress which aims to provide a platform for research work in the fields of scientific computing, modelling and applied mathematics. Researchers and interested participants the world over are warmly invited to attend the conference.

Topics:

Methods for ODE's, SDE's and PDE's * Integral Equations * Computational Linear Algebra * Parallel Computing * Computational Physics/Chemistry/ Biology * Computational Acoustics * Computational Fluid Dynamics * Computational Optimization * Nonlinear Science * Knowledge Based Systems * Symbolic Computation * Modelling and Simulation * Applications in Engineering, Control Systems, Robotics, Biology, Medicine, Economics, the Environment

General Chair: A. Sydow, GMD FIRST, Berlin

Honorary Chair: R. Vichnevetsky, President of IMACS

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email: imacs97@first.gmd.de

On-line Information:
http://www.first.gmd.de/imacs97/

Outstanding Simulation Publication Award

To recognize outstanding contributions to the simulation literature, the INFORMS College on Simulation annually sponsors an Outstanding Simulation Publication Award. Nominations for the 1997 Outstanding Simulation Publication Award should be sent by October 1, 1997, to the chair of the award selection committee:

Professor Peter W. Glynn
Dept. of EES/OR
Stanford University
Stanford, CA 94305-4023 USA
Tel.: +1-415 725-0554 (office)
Fax: +1-415 723-4107
glynn@leland.stanford.edu

The complete set of rules governing the Outstanding Simulation Publication Award appeared in Vol. 9, no. 2 of the INFORMS College on Simulation Newsletter in Fall 1985. In summary, anyone is eligible to win the Award. Journal articles, proceedings articles, books, and monographs copyrighted in 1994, 1995, and 1996 are eligible for the 1997 award. Technical reports, research memoranda, working papers, theses, and dissertations are not eligible. Nominations may be made by anyone, including the author(s), but they may not be made anonymously. Nominations should include: (a) a copy of the written work including all bibliographical information; (b) a short statement suitable for reading at the award ceremony if the work is chosen; (c) any other information thought relevant by the nominator.

If given, the award will be presented December 8, 1997, during the opening session of the 1997 Winter Simulation Conference in Atlanta, Georgia, USA.

The winner of the 1996 Outstanding Simulation Publication Award is Professor Perwez Shahabuddin of Columbia University for the paper entitled "Importance Sampling for the Simulation of Highly Reliable Markovian Systems", Management Science, 1994, vol. 40, no. 3, pp. 333-352. Previous winners may be found on the INFORMS College on Simulation website, accessible through http://www.wintersim.org/.

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 integration, steady-state calculation, distribution fitting, parameter sweep, output analysis, animation, complex logic strategies, submodels, macros, statistical features etc. Up to now 11 comparisons have been defined.

Comparison 1 (Lithium-Cluster Dynamics under Electron Bombardment, November 1990) deals with a stiff system of 3rd order.

Comparison 2 (Flexible Assembly System, March 1991, comments July 1991) for discrete simulation languages compares features for submodel structures, control strategies, and optimization of process parameters.

Comparison 3 (Analysis of a Generalized Class-E Amplifier, July 1991) focuses on simulation of electronic circuits and requires features for table functions, eigenvalue analysis, and complex experiments.

Comparison 4 (Dining Philosophers I, November 1991) is a more general task involving not only simulation but also different modelling techniques like Petri nets.

Comparison 5 (Two State Model, March 1992, revised July 1992) primarily addresses simulation tools with very high accuracy. It checks integration and state event handling with high accuracy.

Comparison 6 (Emergency Department - Follow-up Treatment, November 1992) addresses discrete simulation languages and tests features for modelling, concepts of availability, and complex control strategies.

Comparison 7 (Constrained Pendulum, March 1993) for continuous simulation languages, reviews features for model comparison, state events, and boundary value problems.

Comparison CP1 - Parallel Comparison (March 1994). Three test examples have been chosen to investigate the types of parallelisation techniques best suited to particular types of simulation tasks.

Comparison 8 (Canal-and-Lock System, March 1996) for discrete simulators reviews features for modeling complex logic, which has to be verified by deterministic datasets. Also variance reduction capabilities are checked.

Comparison 9 (Fuzzy Control of a Two Tank System, July 1996) asks for modules for fuzzy control or how such modules can be implemented efficiently.

Comparison 10 (Dining Philosophers II, redefinition of comparison 4, November 1996) reviews discrete simulators with respect to simultaneous (concurrent) access to resources and with respect to deadlocks.

We invite all readers to participate in this comparison. Please, simulate the model(s) with any tool of your choice and send a report to the editors in the following form (on diskette, any word processing format, or per email or transfer to our ftp-server):

- short description of the language,
- model description (part of 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.) Reports of solutions of the Parallel Comparison should not be more than one and a half page in length.

SNE	Comparison										
	C1	C2	C3	C4	C5	C6	C7	CP 1	C8	C9	C10
0	Def										
1	5	Def									
2	4	4	Def								
3	4	3	3	Def							
4	1	5	5	2	Def						
5	4	-	1	1	2						
6	-	2	-	2	1	Def					
7	1	2	1	2	-	1	Def				
8	-	1	-	-	-	1	3				
9	-	-	-	-	-	2	3				
10	1	2	-	-	-	1	2	Def/1			
11	2	2	1	-	1	-	-	2			
12	1	-	1	-	-	-	2	3			
13	-	-	-	-	-		3	1			
14	3	-	1	-	-	-	2	-			
15	-	-	1	-	1	-	-	-			
16	1	-	-	-	-	-	1	-	Def/1		
17	-	-	1	-	1	-	1	1	1	Def/1	
18	-	-	-	-	-	-	2	2	-	-	Def/1
19	-	-	-	-	-	-	-	1	1	1	3
20							1		1	1	2
Total	27	21	15	7	6	5	20	11	4	3	6

The definitions of all comparisons, and an overview on the solutions sent in may be found on our WWW-server: **http://argesim.tuwien.ac.at/comparisons/**. At present we are working on a project for an evaluation of the results of the comparisons via a database and WWW.

F. Breitenecker, I. Husinsky

Comparison 7 - SDX

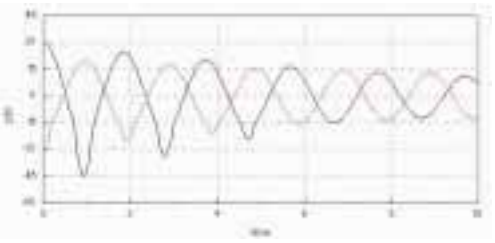
SDX modeling and simulation software is a general purpose Fortran based CAE environment. It offers a seamless workspace for solving problems characterized by differential, difference and algebraic equations. In addition, problem description (modeling) may coexist with experiment description (operations on the model) for an extended problem solving domain including multi-objective design optimization.

Model description: The simulation model shown is a complete implementation for the optimization in Task (c). Minor changes required for other tasks are excluded to avoid obscuring the program flow. The code is largely self explanatory due to free-form model structuring which maintains logical sequencing of the problem formulation. Particularly noteworthy is the absence of "special partitions" designated for discrete phenomena such as pin encounter events. This unique property is facilitated by accessing the entire model during every cycle of the simulation run, while the user controls which parts of the model are executed (also used for state events).

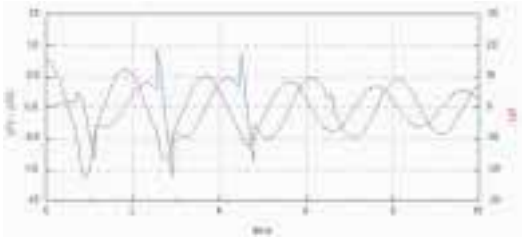
```
subroutine model
logical pinned
real Jx,lt,lp,le,m
equivalence (Jx(1,1),sc(1)),(x(1),phi),(x(2), phid)
dimension Jx(2,2),sc(24),ko(32),x(2),dx(2),range(2)
parameter (g=9.81,pi=3.141593,phip=-pi/12,phio=pi/6)
data
Jx/2*0,1,0/,ko/1,1,0,1,28*0/,m/1.02/,d/.2/,lt/1./,
&    lp/.7/,phido/0/,ne/1/,np/1/,tol/1.e-3/,iopt/1/
*---   Constrained pendulum   ---------
call optimal (iopt,isim,ne,np,phido,range,tol,pif)
if(iopt .eq. 0)  call quit
if(isim .eq. 1)  call oprtn          ! start
if(mode() .lt. 0) then               ! initialize
 phi  = phio
 phid = phido
 pinned = .false.
 le = lt
endif
if(.not.pinned .and. phi.lt.phip) then     ! event
 pinned = .true.
 le   = lt - lp
 phid = phid*lt/(lt-lp)
elseif (pinned .and. phi.ge.phip) then
 pinned = .false.
 le   = lt
 phid = phid*(lt-lp)/lt
endif
*        Define & integrate eom
Jx(2,1) = -g/le*cos(phi)
Jx(2,2) = -d/m
dx(1) =  phid
dx(2) = -g/le*sin(phi) - d/m*phid
call integral (mode(),dt(),2,Jx,ko,dmy,dmy,x,dx)
if(pinned .and. phid.ge.0.) then          ! reset
 isim = 0
 pif  = abs(phi + pi/2)
 call icrtn
endif
end
```

Results

Task a) It is typically more efficient to program for a given task rather than code for multiple scenarios – the route taken here. Substituting *optimal* with a function which drives the model for a specified time duration and a function which allows for changing the parameters either from the console or from a disk file sets up the model for this type of experiment.

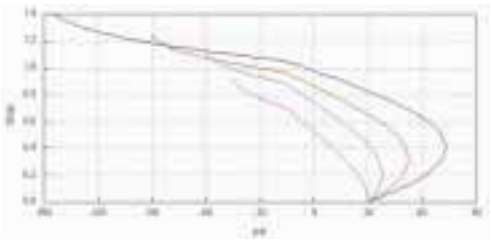


Task b) A linearized version requires two small changes (*cos(phi) ≥ 1 and sin(phi) ≥ phi*) to the model. Both sequential comparison and a single simulation run are possible. Since the latter requires a duplication of the model, either inline or encapsulated in a separate submodel, it is quicker to work with the former and generate the variation (*phi - phiL*) between the models by processing the output data.



Task c) Experiment functions defining operations on the model make procedural programming of complex experiments not only possible but also quite direct. The least squares estimator *optimal* controls the model via the variable `isim` – its occurrences provide a cue to how the model interacts with the optimization process.

The solution found was *phido = 2.2925 rd/s*. However, the physics suggests yet another solution which could be obtained by constraining the optimization to a negative range. Note that shadow trajectories due to evaluation of local Jacobian are not visible. i.e. actual trajectory count is triple.



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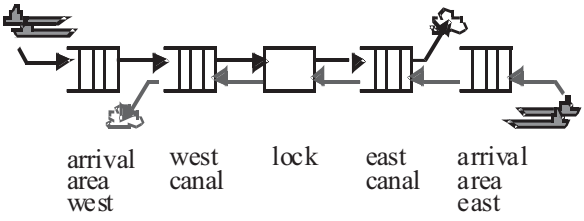
Comparison 8 - Simplex II

Simplex II is a simulation system which enables its user to apply an object-oriented model description to discrete and continuous models and which, over and above this, puts at his disposal the corresponding experimentation environment, together with the language needed to describe the experiment and the necessary graphic and analytical evaluation opportunities.

Model description: The two arrival zones, the canals and the lock have been modelled as five queues, on which there are a number of mobile components (barges) which bear as an attribute the direction in which they are travelling.



Queuing model of canal-and-lock system

The dynamic behaviour of the model is composed of seven events for each of the two directions.

The modularity and the availability of autonomous functions allow to set up a central control mechanism which also involves the various strategies etc. Within the control system, the strategy that has been opted for indicates how the control mechanism is to react to external signals or to changes in the status of the internal system. This means that strategies always form part of the control mechanism, whether the latter be decentralised or, as is the case here, centralised (see the following model code, which is used to extend the graphical model description above).

```
FUNCTION Strategy1
SUBUNITS OF CLASS Barge
DECLARATION OF ELEMENTS
  CONSTANTS
    EastMax     (INT)       := 2,
    WestMax     (INT)       := 3
  INPUT PARAMETERS
    W_Wait (LOCATION FOR Barge),#arriving zone west
    E_Wait (LOCATION FOR Barge),#arriving zone east
    ...
  OUTPUT PARAMETER
    Choice   (Direction) := 'none'
BEGIN
 IF (NTotal = 0
    AND NUMBER (W_Wait) > 0
    AND (NUMBER (E_Wait) = 0 OR
         NUMBER (E_Wait) > 0 AND CountW = WestMax))
    OR (NTotal > 0
        AND OldChoice = 'east' AND CountE < EastMax)
 DO Choice := 'east'; END
 ELSIF (NTotal = 0
    AND NUMBER (E_Wait) > 0
    AND (NUMBER (W_Wait) = 0  OR
         NUMBER (W_Wait) > 0 AND CountE = EastMax))
 OR (NTotal > 0
     AND OldChoice = 'west' AND CountW < WestMax)
 DO Choice := 'west'; END
 ELSIF (NTotal = 0
     AND NUMBER(W_Wait) = 0 AND NUMBER(E_Wait) = 0)
    OR (NTotal > 0
    AND ((OldChoice = 'east' AND CountE >= EastMax)
     OR(OldChoice = 'west' AND CountW >= WestMax))
 DO Choice := 'none'; END
 ELSE DO DISPLAY ("Error in Strategy"); END
RETURN
END OF Strategy1
```

The first rule determines what the conditions are under which eastbound barges from the waiting area West can enter the West Canal. The second rule corresponds to this rule, with East and West simply being interchanged. Another rule is needed to establish the conditions under which no barges are allowed to move. In the comments to this solution (see next page) some principles for the specification of strategies in simulation models are discussed in more detail.

Validation and Experiments: The model was tested with alternative settings of "Eastmax", "Westmax" and various barge (inter-)arrival times. The results corresponded exactly with those laid out in the problem as set.

The given exponential distribution, with an average time of 75 minutes, together with a maximum cycle of five barges, means that the queues are bound to get steadily longer. Therefore we took the liberty of assuming an average interarrival time of 85 minutes.

As there are a whole series of disadvantages associated with taking the method of Independent Replications to determine the confidence interval /1/, a procedure is used in SIMPLEX II which is based on an autoregressive process /2/. Years of experience have shown that this produces the best and most reliable results. Instead of taking 100 replications of 14,400 simulated minutes each, one replication of 1,440,000 minutes was executed, which required almost three minutes of real time.

With the aid of the autoregressive method, one obtains a mean time of 240.5 minutes and a figure of 30 minutes for one half of a 90% confidence interval, in the case that batches of five barges may pass the canal-and-lock-system.

Variance reduction techniques are not integrated into SIMPLEX II as standard software, since the user has had no need of that until the present. They could, however, be programmed as a process geared to the individual user in C and added to the Simplex library.

References:

/1/ Schmidt, B.: Die Bestimmung von Konfidenzintervallen; in: Elektr. Rechenanlagen, 3, 1982

/2/ Fishman, C.S.: Principles of Discrete Event Simulation; John Wiley & Son, 1978

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Comparison 8 - Comments

In Comparison 8 (Canal-and-Lock System) key significance is attributed to the modelling of the logic.For this reason we would like to state our fundamental thoughts to the art of modelling logic and strategies, with respect to the solution with SIMPLEX II.

Methodology for Strategy Definition

A good specification of strategies in simulation models should possess the following features:

- **Modularity**. It must be possible to implement strategies as autonomous modules which can be easily interchanged. The strategy's specification must not be distributed over the model itself.
  SIMPLEX II meets this condition by using autonomous functions to describe the various different strategies. Thus, changing the strategy merely involves switching or modifying this function.
- **Separation** between the condition for launching the strategy, the strategy and the operation segment. To begin with, the familiar demand that the underlying logic should be separated from what it controls obtains here, too: the control mechanism and the strategy must be clearly separated from the system that is to be controlled. On top of this, the condition for launching the strategy must be established: this determines under what conditions the control mechanism requires decisions on the basis of the strategy. (For more details, see /1/.)

Strategy Description

To specify the strategies, it makes sense to use a strategy description language that has been specially tailored to straightforwardly setting up strategies (in this context, see /2/). One of the decisions that have to be made in the model of comparison 8 is to choose the direction in which the canal-and-lock system can at any particular point of time be used in.

This has been realised as an autonomous function which takes in information via input-parameters and which then returns the execution order to the system, in this case the control of the lock, via the output-parameter Choice. The following section on the strategy description (see comparison solution) contains the rules which go to make up a strategy. In this case, there are three such rules, plus an additional rule in the event of an error.

***Rule 1*:** This determines what the conditions are under which eastbound barges from the waiting area West (W_Wait) can enter the West Canal. This is, to begin with, the case when a new cycle starts, when, in other words:

- the lock is empty and
- there are barges in the waiting area West and
- either there are no barges in the waiting area East
- or the maximum number of westbound barges in this cycle has already been reached.

On the other hand, this is also the case when the current cycle is not yet full, when, that is to say:

- the lock is not empty and
- the direction in which movement is currently permitted is "East" and
- the maximum number of eastbound barges for this cycle has not yet been reached.

Rule 2: The conditions under which westbound barges from the waiting area East (E_Wait) can enter the East Canal are established.

The conditions in this rule correspond to those in Rule 1, with East and West simply being interchanged.

***Rule 3*:** The conditions are established under which no barges are allowed to move. This is the case when the lock is not empty, but the respective cycle has already been reached.

Rule in the event of an error:

All possible conditions ought to be covered by rules 1 - 3. Should this not be the case, then an error must have been made.

The function Strategy 1 illustrated in the comparison solution contains the complete strategy description. It is launched up from the model and, in turn, supplies the model with the execution order choice. On the basis of this execution order, the corresponding events are triggered in the model (entry of the barges into the canals).

The clear separation between what is being controlled and the underlying logic makes it quite straightforward to test various strategies by switching over functions. Thus, the direction of movement could, for example, be changed over every half hour. The events would not be affected by the change in strategy, redundancies during implementation are avoided.

References:

/1/ Schmidt, B., Toussaint, A: "Das Referenzmodell SSA für Strategien" and "Strategien in Warteschlangenmodellen", in: SiP 3, 1996

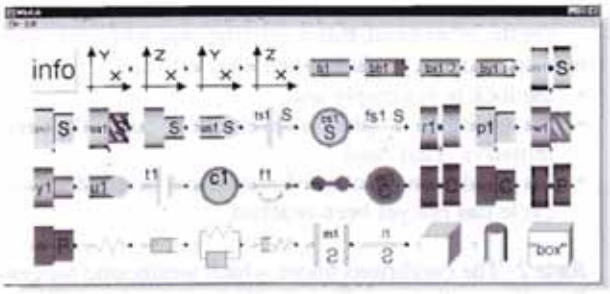
/2/ Toussaint, A.: "Strategien für Tom Schribers Schleuse", in: SiP 3, 1996

Schmidt, B., Toussaint, A., Chair for OR and Systems Theory, University of Passau, Innstr. 33, D-94032 Passau, Email: angela@fmi.uni-passau.de

Dymola

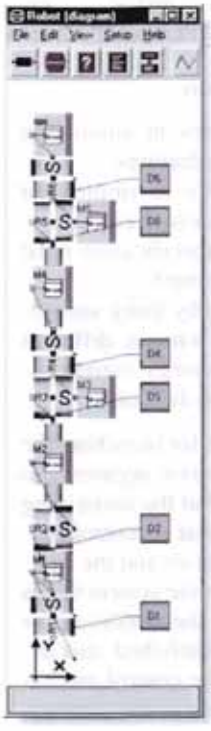
Dynamic Modeling Laboratory

for convenient model composition in physical terms
and efficient simulation by symbolic model manipulation



Model – Simulate – Animate

- Open library of reusable model classes: multibody-systems, electrical components, control blocks, drive trains, etc.
- Compose model graphically by dragging components from library
- Connect components according to physical coupling
- Double-click to open components for entering parameters like length and mass.
- Define experiment: simulation interval, initial conditions, etc.
- Simulate
- Animate dynamic results

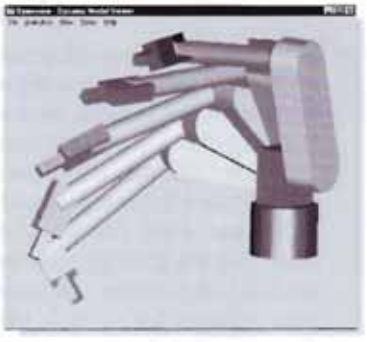


for multi domain modeling

Mechatronics · Mechanical · Drive trains
Electrical · Control systems · Thermodynamics
Aerodynamics · Switching devices
Hydraulics ...

for simulating complex systems

Robot optimization · Nuclear power plant
Hydraulic hammering unit · Biosphere 2 model
Bridge over Kiel channel · 12-cylinder engine
Lightweight robot · Biomechanical system
Thyristor control of DC motor
Automobile simulation ...



Object-oriented modeling

Dymola is an object-oriented language and a program for modeling of large systems. Models are hierarchically decomposed into submodels. Reuse of modeling knowledge is supported by use of libraries containing *model classes* and by use of *inheritance*. Connections between submodels are conveniently described by defining cuts which model physical coupling.

Equations

Model details are given by *ordinary differential equations* and *algebraic equations*. The user need *not* convert the equations to assignment statements. *Matrix equations* facilitate convenient modeling of 3D mechanical systems, control systems, etc.

Hybrid models

Discontinuous equations are properly handled by translation to discrete events as required by numerical integration routines. Dymola also supports *instantaneous equations* to model friction, impact and difference equations, etc. Dymola automatically generates the needed time and state events.

Symbolic model manipulation

Symbolic processing is used to make the simulation more efficient. Dymola converts the differential-algebraic system of equations symbolically to *state-space form* if possible, i.e. solves for the derivatives, or to reduced *DAE form*. Efficient graph-theoretical algorithms are used to determine which variable to solve for in each equation and to find *minimal systems of equations* (optionally using *tearing*) that have to be solved simultaneously (algebraic loops). The equations are then, if possible, solved symbolically. Linear systems of equations can be solved symbolically or numerically. Code is generated to handle the non-linear case iteratively. *Higher index DAEs*, typically obtained because of constraints between submodels, are handled by symbolically *differentiating* equations.

Dynasim

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Comparison 9 - MATRIX$_X$ / SystemBuild

SystemBuild is an interactive, graphical tool for building models of nonlinear systems. Continuous, discrete, multi-rate, enabled and triggered systems can be modeled in a hierarchical manner. The SystemBuild simulation environment generates information on the response and performance of the model using a wide range of integration algorithms.

SystemBuild belongs to the MATRIX$_X$ Product Family which provides tools able to deal with all the steps of a project development : analysis, modeling and simulation, automatic code generation, hardware integration and test, automatic documentation generation.

Model description: The model is composed of two parts (figure 1): the plant modeled with elementary blocks of the predefined library and the Controller using the Fuzzy Module. This module is a specific block of SystemBuild in which the user can design its fuzzy controller via an editor.

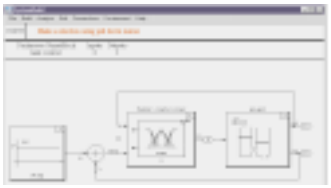


Figure 1

Figure 2

Results task a): (a1) The Fuzzy dialog box (figure 2) acts as a front end interface to the fuzzy logic system. The dialog's principal uses are selecting algorithms (connection, implication, defuzzication, aggregation), parameters, rules and data editing. Standard fuzzy algorithms are implemented in the Fuzzy block.

(a2) and (a3) The visualization of the FC1 surface (figure 3) is realized using an Xmath function. The computation time (PC Pentium with 120 MHz) is: ta_{fc1} = 104 seconds. The fuzzy block does not support singletons for the definition of membership functions so the emulation used for the singletons was a very narrow triangular function. The FC2 surface is shown on figure 4, computation time ta_{fc2} = 100 seconds, ratio = 1.04.

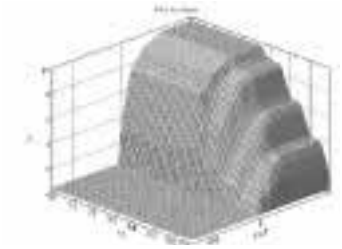


Figure 3

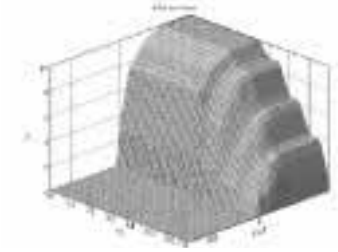
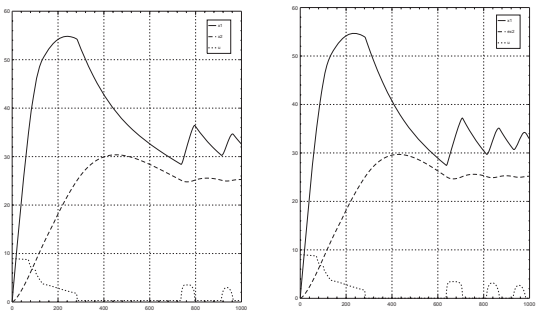


Figure 4

Task b : (b1) and (b2): Results of the simulation runs are shown figure 5. Computation time: tb_{fc1} = 1.42 second, tb_{fc2} = 1.39 second, ratio = 1.02.



Simulation run for FC1 Simulation run for FC2

Figure 5

Task c: (c1) FAM interference: the weight is specified using the keyword "weight" in the rule definition. The computation time is tc_{fc3}= 1.26 second.

(c2) The other features for this fuzzy block are:

- Specification of User Defined method for connection, implication, defuzzyfication and aggregation.
- Choice of the optimization preference: memory, speed or compromise. All the simulation runs above were done using speed optimisation. The computation time for **task (b1)** would be 26 seconds for memory optimization and 4 seconds for compromise, for **task (b2)** 25.4 seconds, 3.9 seconds.

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Comparison 10 - SIMPLE++

Description of SIMPLE++: SIMPLE++ is a simulation environment for fully object-oriented, graphical and integrated modelling, simulation and animation of systems and business processes. It is mainly used for the simulation of discrete processes, especially for flexible assembly systems.

Model description: The *Philosophers* are represented by submodels, which consist of a "production line" with four "stations" controlled by four "methods". On the "production line" an entity is moving from the station "Thinking" to "HungryL", to "HungryR", to "Eating" and back to "Thinking". These movements are controlled by methods.
i) The method that is called when the entity enters the station "HungryL" checks the availability of the left chopstick and marks it as occupied if it was free.
ii) Then the entity is able to move to "HungryR", where another method is called which checks the availability of the right chopstick. The philosophy of SIMPLE++ is that an entity may move as far as possible at a certain time (like in GPSS/H). Consequently in case of a simultaneous access to a chopstick the first philosopher who has already grabbed the left chopstick would get his "right" chopstick too (in contradiction to the description of the comparison). In order to force the simulator to take another priority, the action of grabbing the left chopstick is artificially delayed by a half time unit. If one of the chopsticks is already occupied the philosopher has to wait until it is released.
iii) After having taken both chopsticks the entity can leave the station "HungryR" and enters "Eating", where it stays for the "eating time". Then it leaves "Eating" and enters the station "Thinking", where it first calls the method "DropStick" (releasing both chopsticks).

Figure 1: Submodel of a philosopher

Each *chopstick* is also simulated by a submodel. These submodels consist of two Boolean variables: "stick", which is "false" if the chopstick is occupied, and "wait", which is marked "true" if a philosopher is waiting for the chopstick to be released.

The *main model* is composed of five instances of the philosopher submodel and of five instances of the chopstick submodel.

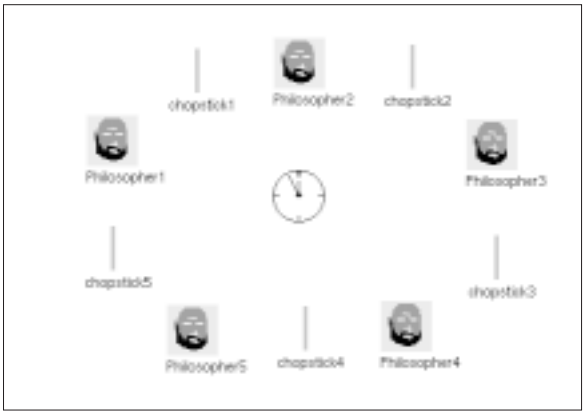

Figure 2: Main model

Results task i): It is very tricky to implement an integer clock, as SIMPLE++ automatically works with real time variables. SIMPLE++ is specialized for manufacturing modelling and it offers application oriented statistics. Statistics of the type needed in this example have to be programmed within the *methods* or by postprocessing (e.g. in EXCEL).

The following table shows the results from a simulation run with a deadlock at time 21:09:33:44 (about 22 hours real time on a SGI under IRIX 5.3):

	Thinking		Hungry		Eating	
	mean	stdev	mean	stdev	mean	stdev
P1	5.8873	2.8956	18.0567	9.6894	5.8852	2.9367
P2	5.8799	2.9376	18.0405	8.8349	5.8722	2.6843
P3	5.8770	2.8297	18.0143	9.3689	5.8869	2.4945
P4	5.8863	2.8489	18.0642	9.9385	5.8768	2.8063
P5	5.8867	2.9273	18.0619	9.0319	5.8837	2.7843

Results task ii): SIMPLE++ detects a deadlock and terminates the run without an error message. In order to validate time and status of this termination, the model was extended by a "deadlock observer" where a global variable counts the number of left chopsticks picked up. If the variable equals 5 the run is terminated. This yielded the same results as the automatic detection by the system.

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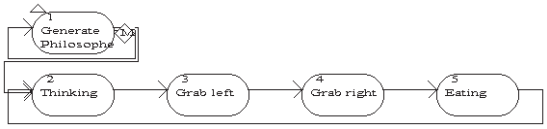
Comparison 10 - Micro Saint

Micro Saint is a process-oriented general purpose discrete simulator with a graphical user interface. It is available for MS Windows as well as for UNIX. Micro Saint Release 2.0 with Action View under MS Windows 95 was used to model the Dining Philosophers' problem. The basis for modelling are "tasks", which are passed by "entities". Tasks offer free definition of Release Condition, Time Distribution, and Beginning, Launch, and Ending Effect.

Model Description: The four activities the philosophers perform (thinking, grabbing the left stick, grabbing the right stick, eating) are modelled by one task each. Five entities (the philosophers) move through the tasks. One more task generates the entities at the beginning of the simulation. The availability of the chopsticks is controlled by an array variable. The chosen model structure allows an arbitrary number of philosophers (parameter change in task 1).



The tasks of the model

Micro Saint internally organises its event queue following exactly the FIFO principle (even if an entity could move further on at the same time instant, all other events scheduled for that time instant are serviced before), so no additional features had to be used to model the logic of the philosophers' behaviour.

Building the model took approximately 30 minutes, the same goes for the validation. An animation was created in an hour. The simulation runs, however, were quite slow, as Micro Saint works as an interpreter. An average 20 simulation runs could be performed in one day on a Pentium with 100 MHz.

Task i, single simulation run: The deadlock was reached at time 142962. This was a rather short run, but there are still more than enough data to draw statistical conclusions.

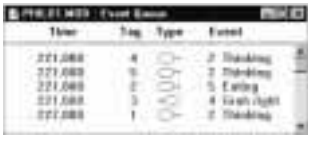
During the simulation, the time instants of starting and stopping eating and thinking were traced by snapshots. The following statistics have then been produced in MS Excel. Micro Saint itself offers statistical post-processing, but in order to create the desired statistics, the model would have had to be extended by tasks and variables for intermediate time values.

	thinking time		waiting time		eating time	
	mean	std.dev.	mean	std.dev.	mean	std.dev.
P1	5.4950	2.8582	11.425	8.0936	5.4769	2.8702
P2	5.5451	2.8644	11.430	8.0593	5.5450	2.8646
P3	5.5120	2.8684	11.408	8.1145	5.5122	2.8686
P4	5.4813	2.8585	11.470	8.1637	5.4807	2.8584
P5	5.5144	2.8861	11.379	8.1123	5.5143	2.8863
all	5.5094	2.8672	11.422	8.1083	5.5058	2.8696

Chopstick utilisation (in % of time):						
chopstick	1	2	3	4	5	all
held in hand	91.962	91.803	91.888	91.809	91.795	91.851
used f. eating	49.135	49.051	48.788	48.871	48.905	48.950

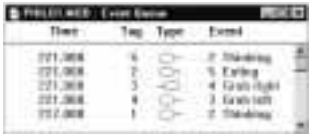
In this run at time 221 a conflicting situation ocurs: The philosophers 1, 4, and 5 are thinking, philosopher 2 is eating, philosopher 3 is waiting for his right chopstick.

Now philosophers 4 and 5 both stop thinking and want to start eating. MicroSaint's event handler works as follows: the philosophers 4 and 5 start to grab their chopsticks simultaneously. Both chopsticks of philosopher 5 are available, but the right chopstick of philosopher 4 has already been taken by philosopher 3 (it is his left one). The "event queue view" (a comfortable feature for debugging) looks like: (a).



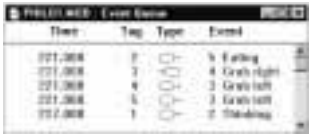
a

In the next step, philosopher 4 leaves the task "Thinking" and enters the task "Grab left", where he takes the left chopstick. A new event (leave "Grab left") is scheduled at the same time instant (queued as last): (b).



b

One step further, the same happens to philosopher 5: (c).



c

Task ii, 50 simulation runs: A deadlock in Micro Saint causes an error message. In order to verify this error as deadlock the number of left chopsticks picked up was assigned to a variable. When this variable reached the value 5, the simulation was stopped, giving the same time as the error message. The minimum time for a deadlock was 22611, the maximum time was 17025556 (in a batch of 50 runs). Unfortunately the error message stops not only the simulation run but also the "simulation job" itself, so that also batches are stopped. In order to overcome this problem for the batch of 50 runs the "explicit" deadlock termination had to be used.

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Book Reviews

An Introduction to Mathematical Modelling
N. D. Fowkes, J. J. Mahony
J. Wiley & Sons, Chichester, England, 1994
ISBN 0 471 93422 4, 447 + xi pages

This book is an expanded version of a course given by the authors to second year students on mathematical modelling. In order to facilitate an apprenticeship approach an informal conversational style is used (in writing the way they think the authors hope to overcome mathematical formalism which often cause difficulties in understanding for students). In general, analytical approaches are used, but for numerical approaches and for the description of analytical solutions of bigger problems programs in Maple are given. The three parts of the book, I - Mechanical Systems, II - Diffusion and III - Vibrations and Waves, can be dealt with in any order and in isolation, and chapters from each of the parts can be combined to provide an introduction to various modelling areas.

In detail, part I (Mechanical Systems) starts with scales, approximations and solutions by discussing the flagpole problem, followed by the "table fable", where the authors show their way of informal style ("we examine an imaginary situation in which a manufacturer seeks to design tables which would not rock"). The next chapter deals with the calculus of variations, with the energy principles and methods and with optimisation by discussing the mooring of the giant mother ships used in the oil industry. The last chapter of part I takes a closer look to the "table fable" introducing energy techniques and applied linear algebra for modelling and discussing how to organise numerical calculations.

Part II (Diffusion) discusses first the physical and mathematical backgrounds. The following two chapters introduce the classical fundamental solution and Fourier series techniques as well as boundary integral methods (for computational work) in the context of surface heating problems. Three applications follow, "the art of cooking", "aspects of the greenhouse problem" and "producing sheet steel".

Part III (Vibration and Waves) examines effects associated with resonant systems, finished by a discussion of signal speed and shock wave ideas.

Each chapter offers an extensive exercise set, and hints for solving them are provided both in the main body of the text and in the last chapter "Hints and Answers". Also here the bigger problems require to use Maple.

This book indeed can be highly recommended as introduction to mathematical / physical modelling, it combines ideally classical theory and modern approaches with software tools (Maple). Furthermore the authors promise to maintain the Maple programs given in the book as well as Maple programs for the solutions of the exercises at their web site http://maths.uwa.edu.au/~fowkws/homepage.html.

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Internationalization - Developing Software for Global Markets
T.V. Luong, J.S.H. Lok, D. J. Tailor, K. Driscoll
John Wiley & Sons, Inc. 1995
ISBN 0-471-07661-9

This book provides a complete hands on guide for efficient writing international software. It is addressed to developers with international markets for their products. Apportioned in four parts the authors point out the major objectives which must be considered in internationalizing software.

Part 1 (Chap. 1-3) discusses general issues of internationalization in organization and common company structure like building efficient department structures. Part 2 (Chap. 4-6) demonstrates how to implement features of internationalization in applications, documentation and how to guarantee international quality assurance. Part 3 (Chap. 7-9) points out advices for realizing local language requirements by samples. Part 4 (Chap. 10-14) presents various techniques for managing and performing localization in concrete case studies.

The appendix provides a rich collection of tools and tables for internationalizing your own software fast and efficient. Overall the book delivers a comprehensive overview for writing software for international markets.

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Finite-Element Modelling Of Unbounded Media
Wolf, J.P., Song, Ch.
John Wiley & Sons, Chichester 1996,
ISBN 0-471-96134-5, 331+xvii pages

The field of numerical simulation using FE methods has become relevant for many physical applications such as wave propagation, fluid dynamics, geophysics,

aircraft engineering, heat transfer processes, electromagnetism and lots more. Typically, modeling processes of that kind often leads to PDE-systems describing the properties on finite ranges with adjacent unbounded areas. Therefore the authors present three new FE-based concepts to model bounded-structured systems interacting with infinite-bounded media:

- The consistent infinitesimal FE cell method can be applied to unbounded domains governed by elliptic, hyperbolic and parabolic PDEs. It requires the discretisation of the structure-medium interface only.
- The damping-solvent extraction method provides means of analysis for a bounded medium.
- The doubly-asymptotic multi-directional transmitting boundary is rigorous for low- and high- frequency limits for plane waves which propagate at preselected angles.

Accordingly, the book is arranged within three sections containing 14 chapters. All methods are explained by using simple examples that the reader can follow step by step. The computer program SIMILAR was used to illustrate two- and three-dimensional analyses on bounded and unbounded media for both the wave and diffusion equation. Two appendices demonstrate benchmark applications and the usage of SIMILAR, which is also available on disk.

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The Finite Element Method in Heat Transfer Analysis
Lewis, R.W., Morgan, K., Thomas, H.R., Seetharamu, K.N.
John Wiley & Sons, Chichester 1996,
ISBN 0-471-93424-0; 279+x pages

The complexity of the problems related with heat transfer processes are such that closed form solutions are in most cases impossible. Hence, one has to make use of numerical solution techniques to obtain predictions about the possible shape of the results.

The finite element method is one of several possibilities to model problems where partial differential equations are involved. In the book this method is especially applied to heat transfer problems with the intention of a stepwise expansion of the governing equations.

First starting with the general heat conduction equation, the book then considers the solution of linear steady state heat conduction problems, transient analyses and non-linear examples. Problems of melting and solidification are then considered at length followed by a chapter dealing with convection. The application of heat and mass transfer to drying processes and the calculation of both thermal and shrinkage stresses conclude the book. Several numerical examples are used to illustrate the introduced basic concepts.

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Photographic Imaging Techniques in C++ - Windows and WindowsNT
Craig A. Lindley
John Wiley & Sons, Inc. 1995
ISBN 0-471-11658-1

As easy to imagine the book deals with various algorithms for image processing under Windows and NT. The book is shipped with a compact disc including all the discussed features implemented in C++ . So the major business of the book is to describe and explain the class library and features provided. For developers the book is a source for state of the art tools in image handling like acquisition, storage, manipulation, color reduction and printing, on Microsoft platforms. This allows to use techniques in your applications, which normally only supported in special graphic software. Additionally for scanning new images, there is a coverage of techniques using the new TWAIN devices.

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Photo-Based 3D Graphics in C++
Tim Wittenburg
John Wiley & Sons, Inc. 1995
ISBN 0-471-04972-7

The author provides an application oriented, how-to book on photo-based 3D graphics. It is addressed to developers, artists and freaks producing a realistic photomontage with 2D and 3D objects. Basis for these tools is a simple digitized photo from a CD or produced with a regular scanner. Starting at this point the reader is introduced to various techniques of 3D imaging and other special effects like composting, warping, alpha bending and even animation. The tools are on floppy disk shipped with the book. Additionally to the source code, there is an application called ICT, which allows the reader to work out the samples on his PC at the same time, while the author is explaining the features. This allows even beginners to profit from this package very fast without further knowledge of image processing.

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Elements of Simulation
B. J. T. Morgan
Chapman and Hall Texts in Statistical Science
Chapman and Hall, 1984 - 1995
ISBN 0 412 24590 6, 351 + xiii pages

"Oldies but Goodies" may summarise this fifth reprint of an introduction to statistical modelling and simulation. It follows the classical approach of using simulation in statistics, mainly as powerful operational research tool. Derived from a fifteen-hour lecture course given to third-year mathematics undergraduates, it can be used either as undergraduate textbook (using only the introductory chapters) or as postgraduate textbook (dealing also with the starred sections and with the more complicated examples).

"Inevitably simulation requires algorithms, and computer programs for the operation of those algorithms" already stated the first edition, and so illustrative computer programs are presented in order to show that seemingly complicated algorithms can be described (programmed) in a simple way. These programs are written in (minimal) BASIC, which was up-to-date in 1984, but nowadays perhaps C- or MATLAB programs would be more suitable. Furthermore, the book uses classical terminology from the eighties, and it is interesting that the distinction between the simulation of random processes and discrete simulation using randomness is clearly defined, whereby the approach by Markov chains is seen as bridge between these two approaches.

The first chapters deal with the simulation of random processes. After a summary of statistical background methods for generating pseudo-random numbers are discussed, followed by practical methods and general methods for non-uniform random variables, finished by a section on testing random numbers. The chapter on "Variance reduction and integral estimates" starts the part on modelling discrete processes with randomness, discussing simple queuing systems. In "Model construction and analysis" the author gives an introduction to time-dependent discrete modelling and simulation, discussing flow diagrams and book-keeping of event descriptions and Markov processes in continuous time. The section on simulation languages clearly only covers the area until 1984.

The last chapter gives an overview on applications, such as simulating finite Markov chains, simulation of multivariate analysis, chi-square test and Monte-Carlo methods. An appendix lists algorithms from NAG and IMSL library for pseudo random number generators and other related algorithms, which can be found in these libraries also nowadays.

It is difficult to recommend a relatively old textbook, especially if it makes use of languages and libraries being out of date. But the fact, that in 1995 the publisher had to do two reprints underlines that the textbook is a valuable introduction into the basic ideas of simulation in statistics and simulation with statistical background - it can be recommended up to now. The title itself may be misleading, for nowadays terminology it should be changed.

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***Simulation im Luftverkehr: Analyse - Modellierung - Implementierung - Ergebnisse* (in German)**
Martin Kaupp (ed.)
Deutscher Universitäts-Verlag, Wiesbaden, 1996.
ISBN 3-8244-6372-5

This book is a volume in the series of books "*Logistik und Verkehr*" (Logistics and Traffic) edited by Prof. Heinz Isermann. It is a collection of experiences with air traffic simulations carried out by a research group at the Johann-Wolfgang-Goethe University of Frankfurt am Main. These authors (including Martin Kaupp as editor of the book) illustrate different possibilities in developing simulation studies, their construction and implementation in air traffic using the theoretic foundation presented in part I of this book "*Simulation im Luftverkehr: Analyse - Modellierung - Implementierung - Ergebnisse*" (Simulation in air-traffic: analysis - modelling - realization - experiences).

In the first part "System-Simulation – *Systemsimulation*", the various programming methods for simulation problems (p. 61) and the examples of production control (pp. 63-93) are interesting. The definitions of the basic concepts of simulation are appealing from the operational and logistic point of view. The second part is based on a general description of production planning and control of an air traffic company. The description and simulation of scheduling of air crew employment of the German air carrier "Deutsche Lufthansa AG" are presented. The third part analyzes whether the reloading process in a big air cargo center can be rationalised by introduction of a working cell concept. In the fourth part, airport dispatching processes at the Rhein-Main-Airport Frankfurt are explored based on different model levels.

For all simulations the authors used the tool Witness. This book is relevant to business and economics students concentrating in logistic management and operational planning, to managers and industrial engineers working for air traffic companies as well.

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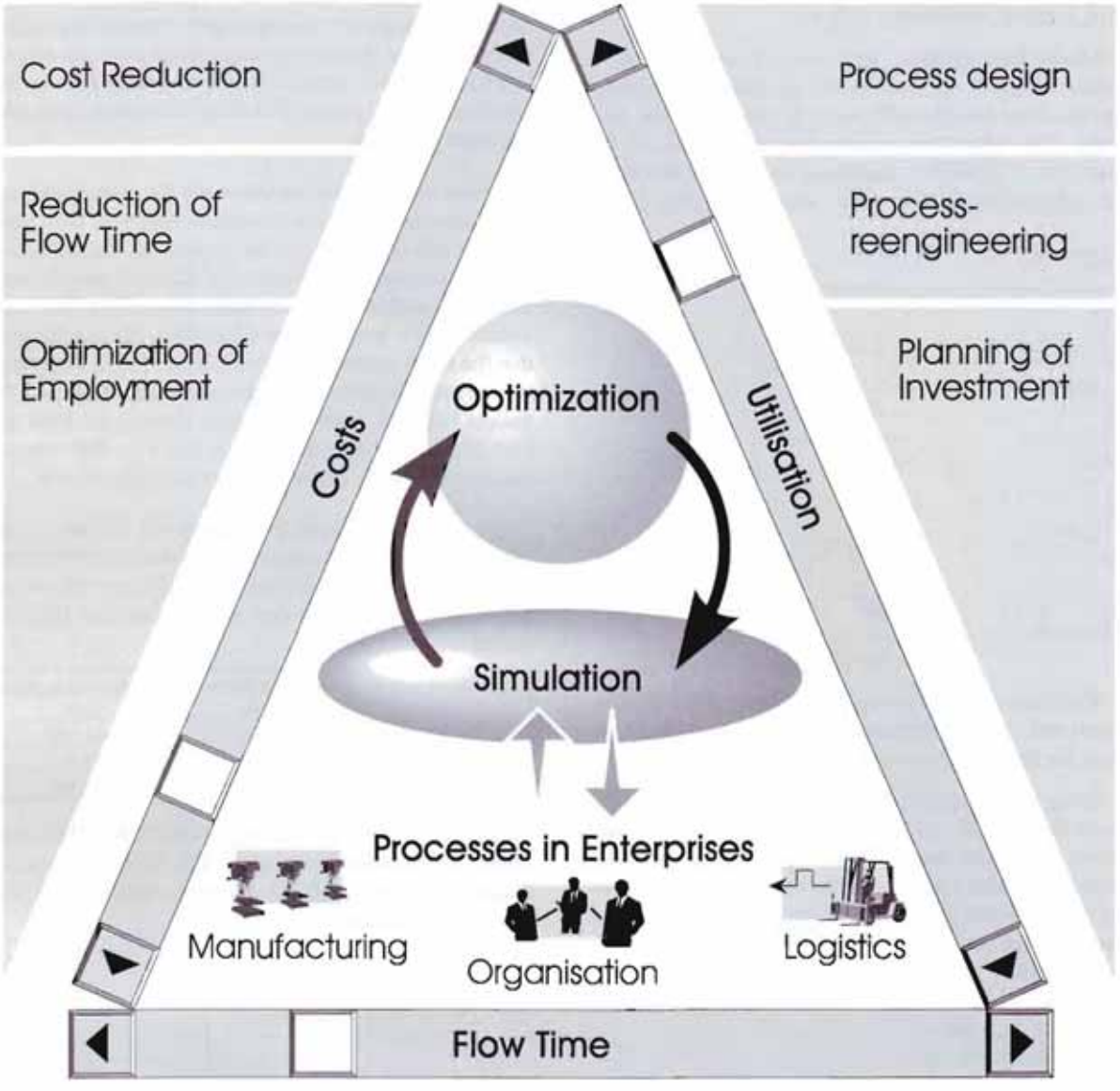

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Business Modelling and Simulation
Les Oakshott
Pitman Publishing, 1997, ISBN 0-273-61251-4

Business Modelling and Simulation by Les Oakshott is a delightful book that provides a solid base of literacy in modelling and especially simulation (spreadsheet-based and discrete-event) for readers with the need or potential need to become informed consumers of information produced by modelling and simulation professionals. As pointed out in the preface, "the ability ... to make sensible recommendations based on the output from ... models, and an understanding of how these models work, as well as their strengths and weaknesses, is an important skill a graduate can take to his or her future employer." Author Les Oakshott (with assistance from two co-workers in two of the book's thirteen chapters) seeks to induce this ability by providing a circa 370-page book on modelling and software with the intention "not to write a manual on using a particular package" but "to give examples of how software can be used to aid the modelling process." The modelling examples are based mainly on ARENA (Systems Modeling Corporation) and Excel (Microsoft Corporation) supplemented by the @RISK add-in (Palisade Corporation), with the author conceding that these software choices, although highly relevant, are only representative of "a large number of products on the market that can be used for simulation modelling," among which "most are excellent."

The first four chapters in the book set the stage with an outline of models and modelling, coverage of basic statistical and probability concepts, and discussion of a range of models that can be solved by analytical means (including solving mathematical programming models using Solver in Excel). The remaining nine chapters focus on various facets of simulation modelling. (The book is mostly about spreadsheet-based and discrete-event simulation, with broader-based modelling considerations taken up briefly at first to provide perspective on where simulation modelling fits into the larger universe of modelling.) Included in the nine simulation chapters are these topics: an introduction to simulation; situations appropriate for simulation modelling; more technical aspects of simulation; details of probabilistic spreadsheet modelling; phases involved in a simulation project; practical issues of data collection; validation of simulation models; statistical analysis of simulation output; and simulation software and its selection.

The book concentrates on applied rather than theoretical considerations, thereby appealing to a broader audience than would otherwise be the case. The application theme is carried by a series of two scenarios and four case studies introduced at various points and revisited where appropriate throughout the book. The two scenarios are based on real situations involving a medical clinic and a drive-through restaurant. The case studies involve the electrical utility industry, transportation, manufacturing, and health care.

Each chapter concludes with a set of exercises that mesh nicely with chapter material. References for further reading are also included with each chapter. Real applications of modelling are commented upon from time to time, giving credence to the practicality of modelling and simulation.

With "business modelling" in the book's title, it is appropriate that spreadsheet-based simulation is singled out for treatment and that a major add-in such as @RISK is included in the treatment. The number of business students (and business practitioners) for whom spreadsheet-based simulation can and should be of interest is perhaps greater than the number for whom discrete-event simulation is relevant. In this regard, significant treatment of spreadsheet-based simulation is now being included in books on "operations research and management science" (e.g., chapters 12 and 13 in Management Science: Spreadsheet Modelling and Applications, by Winston and Albright; Duxbury Press; 1997; ISBN 0-534-21774-5). In an academic setting, it would be quite feasible to use the Oakshott book in a course for balance and breadth and also delve more deeply into spreadsheet-based simulation to achieve specific depth. Alternatively, the Oakshott book could be used for balance and breadth and a discrete-event simulation language or package could be taken up as well to achieve specific depth. Used on a standalone basis, the Oakshott book could fit nicely into a one-semester course and would certainly bring about a degree of literacy in modelling and simulation that often seems to be lacking in the world of business.

One of the nice features of the book is the sense of accessibility and readability it provides. Although the book goes into technical details at a level and scope appropriate for its objectives, it doesn't have the look and feel of a "technical" book, and this should be a plus for the readership for whom the book is intended. In this regard, the book invites use for self-education as well as for more formal education in a course setting.

In conclusion, this book is a welcome addition to the business modelling and simulation textbook literature, standing as it does between "how to" software books on the one hand and more mathematically demanding textbook treatments of modelling and discrete-event simulation on the other.

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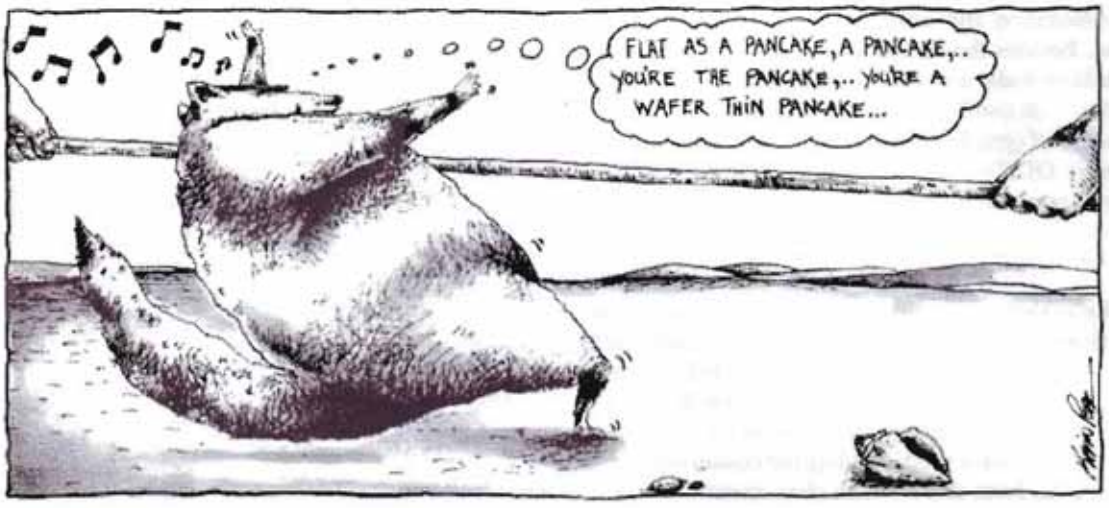

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Inverse Simulation Techniques: An Alternative Approach to External Validation?

Introduction

The external validation of a continuous system simulation model is a process which involves comparison of the behaviour of a mathematical model with that of a real system which it is intended to represent [1]. Usually this involves experiments in which the real system and the simulation model are both subjected to the same input conditions and the comparisons are based on selected output variables.

An alternative approach which has been discussed from time to time (e.g. [2], [3]), but does not appear to have been applied to many practical problems, involves comparison of the inputs to the model and the real system necessary to achieve a specific output time history.

It has been argued that the use of inverse simulation techniques for external validation could be particularly useful in dealing with cases in which the dynamics of the system under investigation involve low frequency characteristics which are dominated by a simple integrator [2]. In such situations any small offset at the input to the system tends to produce an output which diverges rapidly from the corresponding model response and this makes direct comparisons of output behaviour very difficult. No problems of this kind, which arise in many practical engineering systems, are encountered with the inverse approach.

A number of different methods of inverse simulation have been proposed [4], some of which have special features which make them particularly appropriate for specific applications such as helicopter flight mechanics modelling (e.g. [2], [4], [5]). In the context of external model validation it is assumed here that the measured system output vector is available at a series of time points The inverse simulation problem is then to find a solution for the input vector which will produce a value of the model output vector equal to the measured system output .

Inverse Simulation Methods

Methods of inverse simulation may be divided broadly into those which involve numerical differentiation and those which are based on numerical integration [4]. There are clear advantages in the numerical integration approach for external model validation because the differentiation methods tend to be somewhat model specific and are noise amplifying. This could present problems when applied to measured response data.

The most widely used integration-based approach is due to Hess, Gao and Wang [6]. The method is iterative in nature and is inherently discrete.

Experience with Inverse Simulation Methods

A recent paper [7] describes the application of inverse simulation methods to the external validation of a laboratory system which consists of two coupled water tanks. This system, which provides a basis for experimental work on liquid level control systems and is designed principally for teaching use, has also been used in investigations of other approaches to model validation (e.g. [8], [9]).

Measurement noise can present difficulties, even with integration-based methods, but it has been found that careful application of filtering techniques can help to overcome such problems. A further difficulty with inverse simulation techniques, in general, is that numerical instabilities can arise in the type of iterative algorithm used [5]. Simulation methods were used in a preliminary investigation of the two tank system to find an appropriate sampling interval to avoid such instabilities.

Undoubtedly the factor which provides the most serious limitation at present for the practical and routine application of inverse simulation methods for external validation of complex nonlinear dynamic models is the demand placed upon the computer. Even the simple model considered in this study required many minutes of central processor time on a modern personal computer to provide results from a single inverse simulation run. Investigations of the type required to fully investigate the accuracy and limitations of a complex engineering model and to suggest enhancements of the model structure and parameter values would be extremely time consuming using the inverse simulation approach outlined here. Further work on more efficient algorithms for inverse simulation could therefore be of considerable interest not only for the model validation type of application but also for other areas in which inverse simulation methods are attracting attention [5].

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Modelica - A Unified Object-Oriented Language for Physical Systems Modeling

As previously reported, a technical committee (EUROSIM TC1) has been formed for the purpose of designing and promoting a unified object-oriented language, Modelica, for physical systems modeling. The main purpose is to facilitate easy exchange of models and model libraries. Modern techniques including non-causal modeling with true equations, the use of object-oriented constructs to enable reuse of modeling knowledge and graphical representations, are available in the Modelica language. The most important recent issues in the design are constructs for hybrid modeling, i.e. time- and state- events, physical units, matrices, arrays of components and class parameters. The design document has been updated considerably with requirements within different application domains, design rationale and semantic specification of Modelica.

Information about the Modelica development is available on the world-wide-web: http://www.Dynasim.se/Modelica/. A mail server is available to register as a member of the *Modelica Special Interest Group* and to broadcast information to other members. We hope to be able to incorporate much of the experience available from simulation professionals into the language design. Requirements, proposals and other feedback are very welcome.

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GODYS-PC: An Interactive Continuous System Simulation Language

GODYS (graph oriented dynamic system simulator) continuous system simulation language was originally developed at the Jagiellonian University in Kraków, Poland, in the mid-1970s and has been installed on Honeywell, ICL 1900 and IBM 360 computers. It has been further developed in recent years and has been installed on PCs (GODYS-PC). Using the same basic approach as GODYS, GODYS-PC provides an interactive simulation facility and a number of advanced features. It has been developed for the purpose of modelling dynamic systems described by a set of algebraic and differential equations. GODYS-PC is written in FORTRAN and consists of two modules. One of them is the syntax-directed translator, which generates the object program in the language of some abstract machine. This machine is implemented by the effective interpreter, which is the main part of the second module. Typical areas in which GODYS-PC is currently applied come from a wide diversity of realistic situations in engineering, control system design, economics and biology.

Simulation using GODYS-PC: A GODYS-PC program consists of two parts: the model description and the runtime commands. Runtime commands can be entered interactively or in a batch process.

The model description consists of two parts: initial section (for calculations performed once before each dynamic run) and dynamic section (comprises a set of algebraic and differential equations defining the model). The equations defining the model can be written in any order. The translators sorts the equations. The sort algorithm is based on the theory of functional graphs. The language consists of a set of arithmetic, relational and logical operators, and standard functions. The functions consists of special GODYS-PC operators such as `INTEG` (integration function), `DERIVT` (derivative function), `STEP` (step function) and so on. The language provides over fifty standard functions. The user can define his own functions in FORTRAN.

As an example of GODYS-PC let us consider the spring damping model. The model can be written mathematically as follows:

$$\frac{dx}{dt} = v, \quad \frac{dv}{dt} = -\frac{k}{m}x - \frac{d}{m}v + \frac{f}{m}$$

The description of the model in GODYS-PC is:

```
MODEL spring
   PREPARE x, v
   PARAMT  k, d, m, a, t0
DYNAMIC
   x = INTEG(v; 0)
   v = INTEG((a/m)*STEP(t-t0)-(d/m)*v-(k/m)*x; 0)
END
```

```
LOAD spring
   DATA k=1, d=0.3, m=1, a=-1, t0=10
   EXECUTE (dt=0.1, tmax=50, comdel=0.1)
   PLOTXY(t = (0, 50), x)
FINISH
```

Parameter optimization in GODYS-PC: In the case of parameter optimization a finite number of parameters has to be determined such that a cost function of these parameters is minimal. Max. 8 parameters can be optimized in a cost function in GODYS-PC. The language provides four function minimization algorithms. The following control loop example illustrates the use of parameter optimization in GODYS-PC.

Control loop block diagram (T = 8).

The parameter k has to be determined such that the following cost function

$$f = \int_0^\infty e^2(t)dt$$

is minimal. The description of the model in GODYS-PC is the following:

```
MODEL contr
PREPARE x, y, e, f
PARAMT k, t0
DYNAMIC
    x = STEP(t - t0)
    e = x - y
   u = k*REALPL(e; 8, 0)
   y = REALPL(0.01*INTEG(u; 0); 2,0)
   f = INTEG(e*e; 0)
END
```

Runtime commands with parameter optimization:

```
LOAD contr
DATA k = 5, t0 = 20
EXECUTE(tmax = 175, dt = 0.1, comdel = 1, @
opt = (f(k = (5,25)), alg = mgs, lim = 10))
PLOTXY(t,e)
FINISH
```

The parameter `opt` initiates parameter optimization in the run. The parameter `alg` specifies the method for the function minimization algorithm. Each function evaluation involves a simulation run. The parameter `lim` specifies the number of runs during parameter optimization. The minimal value of the cost function (F = 9.958) has been found for k = 17.36.

GODYS-PC continuous simulation language for PC provides an integrated development environment and an interactive simulation facility running on MS-DOS with 640 K of RAM and 2 MB on the hard disk. GODYS-PC is easy to learn even for somebody who is not an experienced programmer.

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UK Simulation Study Group

The Simulation Study Group is a special interest group of the United Kingdom Operational Research Society. The group aims to provide a forum for the regular exchange of ideas on simulation theory and practice for academics, practitioners and software vendors. Having been dormant for some years the group has recently started holding quarterly meetings.

At the re-launch meeting held in January there were two presentations on the theme of "Simulation Should be Simple and Fun". John Salt of Brunel University drew upon his wide practical experience to provide a very entertaining talk in which he argued that simulation models should be kept as simple as possible. He concluded with "seven pillars of wisdom for simulation modellers". Stewart Robinson of Aston University then discussed the meaning of success in relation to simulation studies. He argued that the key to success is managing the customers' expectations of the simulation work.

The theme of the next meeting, held in March, was business process modelling. Two software vendors, the Lanner Group and the Cimulation Centre, discussed how they are using simulation to map and model business processes.

Further meetings are planned for the rest of this year on:

- project specification and model design
- simulation and the web
- parallel and distributed interactive simulation

It is also hoped that some future meetings will be held jointly with the UK Simulation Society.

If you would like further details on the activities of the Simulation Study Group, please contact the group secretary:

Stewart Robinson
Operations and Information Management Group
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Birmingham B4 7ET, United Kingdom
Tel: +44-121 359 3611 ext: 5036
email: s.l.robinson@aston.ac.uk

ARCS - Austrian Research Centre Seibersdorf

The *Austrian Research Centre Seibersdorf* (ARCS) is Austria's largest non-university research centre, engaged in applied research and development. In the *ARCS* there are five main divisions.

- **Instrumentation and Information Technology.** Main topics are instrumentation for process control, surface engineering, vacuum technology, environmental monitoring and networking, EMC testing and information technology, e.g. fault-tolerant real-time systems, distributed systems, multimedia and fast pattern recognition, system and software safety and security.
- **Process and Environmental Technologies.** The division is working on the main topics "water", chemical engineering (polymer chemistry) and waste disposal. One of the instruments is modelling and simulation in the industrial and environmental sector.
- **Engineering.** Industry is assisted by the development of manufacturing and plant engineering technologies and the testing of high-tech materials. Priorities in automation are quality inspection systems, flexible manufacturing cells and CAD/CAM robot applications. Biomedical engineering and rehabilitation technology offer promising opportunities for innovative developments.
- **Life Sciences.** The main objective is to protect life and environment. Services offered range from radiation monitoring to chemical analyses and toxicological examinations. Work in biotechnology and agricultural research focuses on environmental topics.
- **Systems Research Technology-Economy-Environment.** Government, authorities, trade and industry are supported in decision-making, with special emphasis on technology policy, innovation, regional policy and development, impact assessment and environmental planning.

Seibersdorf assists business enterprises in developing and introducing new technologies, working out solutions to specific, often complex problems jointly with its customers. Each division makes more or less extensively use of modelling and simulation for problem solving. Two special projects, in co-operation with the Department *Simulation Technique* (*SIMTECH*) of *the Vienna University of Technology* (*TU Vienna*) will be described in the following.

I. Communal disposal system for biological waste

The goal of this project is to simulate a bio-center which offers different possibilities to handle the waste problem. The project is run by the business field *Modelling and Simulation* of the division *Process and Environmental Technologies* (K. Faber, P. Krejsa, E. Rybin, M. Schönerklee) in co-operation with the Dept. *SIMTECH* of *TU Vienna* (F. Breitenecker, M. Holzinger, M. Lingl, M. Zimmermann).

The system to be modelled consists of several subsystems, such as sorting, composting, drying, and fermentation devices, a sewage, an incinerator, and a device for reducing biological substances with the help of bacteria, which is called "Aerobe Thermophile Stabilization (ATS)". The single devices are examined (where they already exist) or modelled continuously (where they do not) in order to gain data for a discrete simulation of the whole system.

ATS device and incinerator. These two devices need to be newly designed for this disposal system. They are modelled in detail as continuous systems.

The ATS device consists of two tanks, where the biological substances of sewage sludge are reduced by bacteria. The sludge is filled into the first tank and left there for one day. Then part of it is moved to the second tank, and the first tank is refilled with new sludge. After the second day, a certain amount of the sludge in the second tank, which is now finished, is taken away, and tank number two is refilled from tank number one, where fresh sludge is added. This batch process is repeated endlessly, thereby always keeping enough bacteria back in order to keep the process running. Parameters to be considered in this model are:

- concentration of organic substances (dry)
- share of water in the sludge
- concentration of oxygen
- temperature
- concentration of several other non-organic substances

This model is intended to supply data for the discrete model describing how the process works with different input parameters.

Modelling the inner range of the incinerator (waste burner) will be done by discretisation of the Navier-Stokes equations by means of finite differences. First, a two-dimensional approach is planned, but the inhomogenity of the problem should require a three-dimensional model.

The next step is to simulate the problem by regarding multiphase flows (e.g. cole, sand, waste, air, ...) and to describe the chemical reactions which cause phase transitions. The model will be identified by research furnace which will be erected by colleagues from the TU-Dresden, Germany. Finally, some changes of geometry of the incinerator are planned in order to optimise the burning process.

The overall discrete model. The discrete model shall grant a basis for strategic decisions, such as which devices should really be built and at which size. Moreover it shall work as a control tool for the finished system. To achieve these purposes different methods of optimisa-

tion will have to be used. As this system is too complex to use analytic methods, it will be necessary to use numeric methods as well as new methods of soft computing, such as fuzzy logic and genetic algorithms.

II. Modelling of the Human Arterial Network for Preoperative Predictions

The aim of this project is to develop a user-friendly software package for physicians that can be used as an advisor in vessel surgery and maybe as a training tool for medical students. The project is run by the business field *Biomedical Engineering and Rehabilitation Technology* of the division *Engineering* (K. Kaser, J. Krocza, M. Suda) in co-operation with the Dept. *SIMTECH* of *TU Vienna* (Ch. Almeder, F. Breitenecker, S. Wassertheurer).

The tool contains a graphical user interface, a mathematical model that describes the relationship of morphology and hydraulics in human arterial networks and an expert system for managing automatic parameter identification and bypass optimisation. With this system mean flow velocity, mean flux, flow direction and blood pressure at any point of a vessel network can be calculated. By changing the topology of a network the hydraulic effects of stenoses and bypasses are simulated. The results of these simulations may help physicians in their decisions, if an operation is necessary and which kind of operation has the best chance of success.

The model of the human arterial network. The human arterial network is identified with a hydraulic pipe network. This pipe network has the following specific properties:

- There is a reference node with a constant flow into it and a given pressure. The pulsing flow of blood is not taken into account.
- The flow out of all nodes is collected in one fictitious node. The flow out of this node is equal to the flow into the reference node, so that there is no loss of fluid within the system. The additional node is connected to the other nodes with fictitious vessels of the same length, but variable diameters. These fictitious arteries represent the microcirculation and the venous system.
- It is assumed that blood is a Newton fluid. Therefore only arteries with diameters down to about one mm are taken into account.
- The arteries are handled as hydraulic smooth pipes, (roughness of the walls of the arteries is set to zero).

The change to a hydraulic pipe network causes some simplifications but this is necessary to get a model that can be handled. These assumptions, together with the nonlinear hydraulic equations lead to a model consisting of non-linear equations. The number of unknowns depends on the number of nodes in the network (usually between 150 and 300).

The solution of the model equations is approximated by an iterative process. For each iteration step a linear system is solved using the successive over-relaxation method (SOR).

The precision of the results depends on the amount and quality of the data available for the identification of the parameters, but in most cases only few patient data are obtainable. Nevertheless tests have shown a mean difference of only up to 10% between calculated and measured data. This inaccuracy is insignificant, because the model is set up for giving fundamental statements on flow velocity, mean flow and blood pressure. For the decisions on the kind of operation no exact values but ranges are needed.

The model and the used algorithms are designed for fast calculation, because the process of parameter identification and the simulation experiments need a large number of calculations.

The Expert System. The expert system controls the interaction between the user and the mathematical model in two different ways:

- Automatic parameter identification:
  For easier and faster working, several preconfigured standard networks (e.g.: leg arteries, cerebral arteries, etc.) are included in the package. But the physiology of a patient can be quite different, therefore these standard models have to be changed into specific patient models by adapting them on data from ultrasonic Doppler measurements, X-ray pictures and diagnosis of the physicians.
- Automation of the simulation experiments and interpretation of the results:
  The expert system is also designed to support the physician in finding the optimal operation method. For this decision many simulation runs with varying parameters and comparison of the results is necessary. The expert system gives advises and interprets the results.

The User Interface. The tool for manipulating the patient models is the Graphical Editor. As the front-end is implemented in well-known Windows "Look and Feel" and state of the art usability, the user will get familiar with all features very fast, even if he is not a computer expert. Providing multiple features, the assistant allows to modify the models in a 2D workbench in different ways and to plot it in a 3D environment with various points of view. Furthermore the editor supports a complete patient-management for efficient and easy data handling. Additionally the user can interact with the expert system in a total menu-driven way by using the editor.

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J. Krocza, K. Faber, ARCS, A-2444 Seibersdorf, WWW: http://www.arcs.ac.at/

Laboratory of Biomedical Engineering and Robotics University of Ljubljana

The main research topic in the area of robotics is the development of robot cells for assembly in the electronics industry. One of the most important achievements of the group was the development of a robot cell for assembly of rectifier bridges. The main advantage of the robot cell was the possibility of testing of diode properties during manipulation. Another robot cell was associated with assembly of electronic hybrid circuits. Both robot cells are working in the Slovene semiconductor industry. Other robot applications were concerned with robot drilling, use of robots in chemical industry, robot glue dispensing, and assembly of SMT electronic components. The current project is involved into placement of the accumulator cover on the box. In the scientific work were in the recent past approached four topics: reducing object uncertainty by robot pushing, robot calibration, use of robot link support for improving robot properties and adaptive impedance control with open architecture Asea Irb6 robot.

An interesting area of robotics, where simulation is used extensively is dynamic control of robot mechanisms. Besides general control theory some robotics specific elements are included. One is designing true robotic mechanism kinematics and dynamic model. The former one is used for deriving the Jacobean and inverse Jacobean matrix which are essential to many control schemes. They are time variant matrices that describe the relation between the velocities as measured in different moving co-ordinate systems. The dynamic model computes the joint torque required to achieve the desired movement. The torque has contributions from several parts: gravitational, inertial, Coriolis and others. Of course the inverse dynamic model is also necessary: calculation of actual movement from the joint torque. Dynamic models are derived usually with recursive Newton-Euler approach. By omitting any of the mentioned contributions we can study the robustness of tested control scheme. Another important aspect is tuning of controllers. Tuning is performed in by applying well known recipes, which are quite robot specific. All these principles are wrapped into a MATLAB/SIMULINK user friendly environment, where actual simulations take place. Robot specific functions are available from Robotic Toolbox, which is a bunch of routines, freely available on the Internet. Simulation is a very useful tool in teaching of robot control as it is very easy to analyze the controller form all the aspects. Several control schemes are usually tested: PD controller, computed torque, computed acceleration. However simulation could also be extremely misleading for control schemes, where both direct and inverse dynamic model is utilized.

The research group is known for the use of Electrical Stimulation of paralysed lower-extremity muscles in paraplegics. Characteristic for this approach is the use of the surface electrodes with at least four stimulation channels, two for each leg. One of those two is used for muscle quadriceps stimulation in order to achieve standing, while the second channel triggers withdrawal reflex making leg to swing. The research is conducted together with the Institute for Rehabilitation of the Republic of Slovenia, where until today more than 100 complete spinal cord injured patients have been treated routinely with that methodology. In the last decade the approach was also accepted for therapy and rehabilitation in numerous medical centres world wide. Recently a sophisticated microcontroller based multichannel stimulator was developed including sensory electrocutaneous feedback, ultrasound distance/velocity gait measurement equipment and a wireless link between control module and rehabilitative system. Current basic research is directed toward enhancement of standing-up, standing and sitting-down procedures as well as toward improved synthesis of walking in completely and incompletely paralyzed persons. The current research also focuses on the development of four-point dynamically stable gait and hand-free standing of paralysed person.

Another activity of the laboratory is dedicated to the functional electrical stimulation including simulation and control work on unsupported standing of paraplegic persons which uses closed-loop control. Work was done at the University College London and in collaboration with researchers from Berlin. In the study all joints above the ankle are made rigid with a brace, thus making the body slightly leaned forward like a single inverted pendulum. The control system uses nested controllers with two inner Linear Quadratic Gaussian Controllers, one for left and one for right ankle plantaflexor muscles. The outer controller is adjusting position. All tests, including muscle identification, moment controller tests and position (whole system) tests were done in a specially designed apparatus named Wobbler. Muscles are modelled as static recruitment nonlinearity with linear transfer function.

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New Electrical Locomotive Real-Time Simulator with dSPACE

Thomas Keller,
ADtranz, Switzerland

Erich Scheiben
ADtranz, Switzerland

Motivation

The drive control has a major effect on the behavior of the locomotive on the rails. Therefore we give particular attention to the setting of the control parameters of the drive control to checking and the software functionality.

To test the controllers out the laboratory we use a simulation system from dSPACE. The simulator performs computation of the currents and voltages of the drive system which would be generated on the locomotive. The drive control of the motor converter and the line converter is directly connected to the simulator (Figure 1) and generates converter trigger pulses. This setup is called hardware-in-the-loop simulation.

This form of trial operation performed in the laboratory enables the first actual operation of the vehicle on the rails, resulting in a positive impact on costs. Moreover, operating conditions can be set on the simulator which could only be achieved at great cost and human risk on the rails.

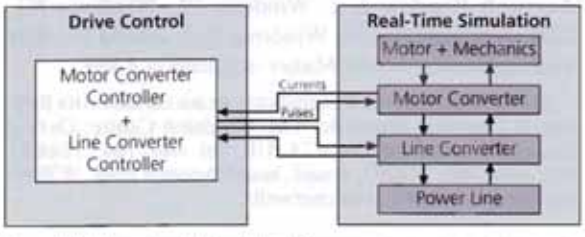

Figure 1: Hardware-in-the-Loop Simulation

Simulator Setup

Simulating the drive system requires a lot of computing power, as the entire model has to be computed every 30 µs. For this reason, the new digital simulator has been constructed of several dSPACE processor boards. The result is that vehicle model computation is distributed across several processors.

The combined computing power of the current simulator setup is 1.8 GFlops. This immense power comes from using two Alpha AXP™ processors and six digital signal processors (DSPs).

Communication with the world is via several dSPACE I/O boards. We use separate boards for reading in the trigger pulses, outputting the calculated voltage and currents as analog values, and generating the incremental encoder signals (Figure 2). The simulator can be programmed using MATLAB®/SIMULINK®.

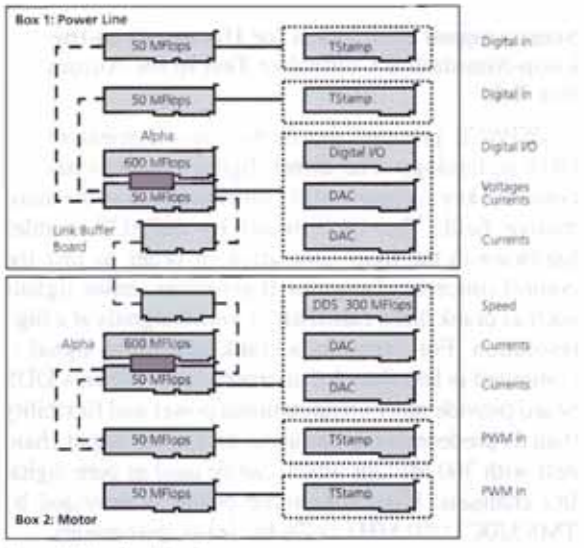

Figure 2: Simulator Topology

Simulation Control with COCKPIT

Once the model is running on the simulator, we need to be have control over the simulation process. We use the virtual instrument panel COCKPIT from dSPACE. With COCKPIT, parameters can be read and set, making a large number of convenient visualization options available to the simulation engineer.

Visualization with TRACE

Monitoring of variables of the simulated locomotive are also of interest. We use the data acquisition and variable display tool TRACE from dSPACE. Variables can be selected by mouseclick and are then displayed on screen (Figure 3).

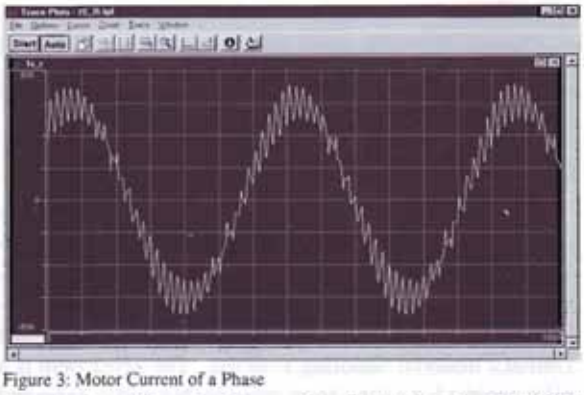

Figure 3: Motor Current of a Phase

See a replica of the simulator on the dSPACE booth at EPE'97!

dSPACE GmbH
Technologiepark 25
D-33100 Paderborn Germany
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Fax: ++49 5251-66529
e-mail: info@dspace.de

dSPACE

Sensor Signal Simulation for Hardware-in-the-Loop-Simulation Controller Test in the Automotive field

dSPACE presents the further development of the DDS technology. The direct digital synthesis has become the key component of controller tests in the automotive field. The DDS board by dSPACE enables hardware-in-the-loop simulation in order to test the control concepts of engines. It generates sensor signals such as crankshaft, camshaft or knock signals at a high resolution. For example, a crankshaft pulse signal is computed in less than 1.2 microseconds. The new DDS board provide more computational power and flexibility than its predecessor. It has up to six analog output channels with 360 MFlops which can be used as pure digital I/O channels. High computing power is provided by TMS320C31/60 MHz DSPs by Texas Instruments.

Contact: dSPACE digital signal processing and control engineering GmbH, Technologiepark 25, D-33100 Paderborn, Germany, Tel.: +49-5251 1638-0, Fax: +49-5251 66529, email: info@dspace.de

TRACE and COCKPIT as 32-bit application

Controller Development with Windows 95 and Windows NT 4.0

dSPACE announces the new 32-bit versions of its controller development software. TRACE 3.1 and COCKPIT 3.1 enable data acquisition and experiment control under Windows 95 and Windows NT 4.0. The look-and-feel from Windows 95 upwards is fully supported. The 3.1 versions speed up file operations up to factor seven. Several instances of the same program enable the support of different processor boards at the same time.

Contact: dSPACE digital signal processing and control engineering GmbH, Technologiepark 25, D-33100 Paderborn, Germany, Tel.: +49-5251 1638-0, Fax: +49-5251 66529, email: info@dspace.de

Cimtechnologies and Daifuku Sign Agreement

Cimtechnologies Corporation announced a development agreement with Daifuku Company, Ltd., a worldwide manufacturer of integrated material handling systems based in Osaka, Japan. Under this agreement, Cimtechnologies will develop specialized routines for Daifuku material handling systems. The agreement is a pilot project for a long-term relationship and is expected to lead into an expanded scope of development.

This joint effort will synthesize Daifuku's material handling equipment design strengths with Cimtechnologies' leading factory layout drafting and design software. The development agreement will benefit the customers of both Daifuku and Cimtechnologies by enabling customers to easily insert Daifuku material handling systems into AutoCAD facilities drawings via FactoryCAD and expand the use of Daifuku's innovative material handling equipment in the US market.

For more information, contact Helena Poist, Director of Marketing, Tel.: +1-515 296 9914, email helena@cimtech.com.

Major new version of ModelMaker released for one-stop simulation and model analysis

Cherwell Scientific announces the release of version 3.0 of ModelMaker, which is now available for Windows 95 and Windows NT. This major new version includes powerful new model development tools, such as sub-models and arrays of components, and more model analysis capabilities, such as optimization using multiple datasets, and Simplex and Marquardt optimization. The use of numerical simulation models is one of the most powerful methods for analyzing and understanding almost any type of process. ModelMaker lets users design experiments, demonstrate concepts, visualize complex systems and test the effects of change in ways that are impossible with spreadsheets and flowcharts.

System Requirements IBM-compatible PC running Microsoft Window 3. 1, Windows 95, Windows NT. 4MB recommended for Windows 3. 1, mouse or other pointing device. ModelMaker is priced at £349.

For a review copy or screenshots, please contact Ana Reynoso at Cherwell Scientific, The Magdalen Centre, Oxford Science Park, Oxford 0X4 4GA, UK. Tel: +44 -1865 784800, Fax: +44-1865 784801, email: ana@cherwell.com. WWW: http://www.cherwell.com/cherwell/.

Rapid Data Ltd European Distributor of AVDS

Rapid Data Ltd have just signed an exclusive agreement with Artificial Horizon, Inc. to distribute in Europe the AVDS (Aviator Visual Design Simulator) software. This is an animation software that provides interactive visualisation for immediate feedback and assessment of a specific design's effect on an aircraft's dynamics. AVDS will give for example flight control designers a sophisticated visual tool to test interactively a control system, and save critical cycle time, as well as improve their designs.

For further details, contact Rapid Data Ltd, Amelia House, Crescent Road, Worthing, West Sussex BN11 1RL, UK, Tel +44-1903 821 266, Fax +44-1903 820 762, email: info@radata.demon.co.uk

Classes on Simulation

July 1997

16-18 **Micro Saint Course**, RDL, Worthing, UK
Contact: Rapid Data Ltd., Amelia House, Crescent Road, Worthing, West Sussex, BN11 1RL, UK, Tel: +44-1903 821266, Fax: +44-1903 820762, email: info@radata.demon.co.uk

23-25 **SIMSCRIPT Course**. Camberley, U.K.
Contact: CACI Products Division, Suite 11, Coliseum Business Centre, Riverside Way, Camberley, Surrey GU15 3YL, UK, Tel:+ 44 1276 671 671, Fax:+ 44 1276 670 677

August 1997

6-8 **COMNET III Course**. Camberley, U.K.
Contact: CACI Products Division

13-15 **MODSIM III Course**. Camberley, U.K.
Contact: CACI Products Division

26 One-day free seminar on **Flight Simulation with AVDS and Aerosim**. RDL, Worthing, UK
Contact: Rapid Data Ltd.

September 1997

3-5 **SIMPROCESS Course**. Camberley, U.K.
Contact: CACI Products Division

16-17 ***MATLAB-Kurs***. Munich, Germany.
Contact: BAUSCH-GALL GmbH, Wohlfartstr. 21b, D-80939 München, Tel: +49-89 3232625, Fax: +49-89 3231063, email: 100564.302@compuserve.com

16-18 **COMNET III Course**. Frankfurt, Germany
Contact: CACI Products Division

23-25 **MODSIM III Course.** Paris, France.
Contact: CACI Products Division

October 1997

7-8 **ACSL, Graphic Modeller.** Munich. Germany.
Contact: BAUSCH-GALL GmbH

8-10 **COMNET III Course**. Camberley, U.K.
Contact: CACI Products Division

9 ***Objektorientierte Modellierung mit DYMOLA***.
Munich, Germany.
Contact: BAUSCH-GALL GmbH

14-15 ***Simulation mit SIMULINK***. Munich, Germany.
Contact: BAUSCH-GALL GmbH

14-16 **COMNETT III Course.** Paris, France
Contact: CACI Products Division

15-17 **Micro Saint Course.** RDL, Worthing, UK
Contact: Rapid Data Ltd.

16 ***Effektive Simulation von Schaltnetzteilen.***
Munich, Germany.
Contact: BAUSCH-GALL GmbH

17 ***Effektive Regelung von Schaltnetzteilen.***
Munich, Germany.
Contact: BAUSCH-GALL GmbH

20-22 *CCG Kurs.* ***Simulation kontinuierlicher Systeme***.
Oberpfaffenhofen, Germany.
Contact: Carl-Crantz-Gesellschaft e.V., Postfach 1112, D-82235 Oberpfaffenhofen, Tel: +49-8153 282413, Fax: +49-8153 281345 or Prof. F. Breitenecker, TU Wien, Abt. Simulationstechnik, Wiedner Hauptstr. 8-10, A-1040 Wien, Tel: +43-1 58801 5374, Fax: +43-1 5874211, Email: Felix.Breitenecker@tuwien.ac.at

21-23 **MODSIM III Course**. Frankfurt, Germany
Contact: CACI Products Division

29-31 **ACSL Course:** RDL, Worthing, UK
Contact: Rapid Data Ltd.

29-31 **MODSIM III Course**.Camberley, U.K.
Contact: CACI Products Division

November 1997

4-6 **COMNET III Course**. Sweden
Contact: CACI Products Division

12-14 **SIMPROCESS Course**. Camberley, U.K.
Contact: CACI Products Division

18-19 ***MATLAB-Kurs***. Munich, Germany.
Contact: BAUSCH-GALL GmbH

25-27 **COMNET III Course**. Camberley, U.K.
Contact: CACI Products Division

December 1997

2-3 ***Simulation mit SIMULINK***. Munich, Germany.
Contact: BAUSCH-GALL GmbH

4 ***Objektorientierte Modellierung mit DYMOLA***.
Munich, Germany.
Contact: BAUSCH-GALL GmbH

Calendar of Events

July 1997

13-17 **SCSC '97.** The 1997 Summer Computer Simulation Conference. Arlington, Virginia, USA
Contact: SCS - The Society for Computer Simulation, P.O. Box 17900, USA-San Diego, CA 92177-7900, Tel.: +1-619 277 3888, Fax: +1-619 277 3930, Email: scsc97@scs.org, WWW: http://www.scs.org/

27-August 1
AMS'97. IASTED International Conference on Applied Modelling and Simulation. Banff, Canada
Contact: IASTED Secretariat, 4500-16 Ave. N.W., Unit 80, Suite 101, CDN-Calgary, Alberta, T3B 0M6, Tel.: +1-403 288 1195, Fax: +1-403 247 6851, Email: iasted@cadvision.com, WWW: http://www.iasted.com/

August 1997

11-14 **MSO'97.** IASTED International Conference on Modelling, Simulation and Optimization. Singapore
Contact: IASTED Secretariat, 4500-16 Ave. N.W., Unit 80, Suite 101, CDN-Calgary, Alberta, T3B 0M6, Tel.: +1-403 288 1195, Fax: +1-403 247 6851, Email: iasted@cadvision.com, WWW: http://www.iasted.com/

24-29 **IMACS WC'97.** 15th IMACS World Congress. Berlin, Germany
Contact: Congress Office IMACS WC'97, GMD FIRST, Rudower Chaussee 5, D-12489 Berlin, Tel.: +49-30 67045610, Email: sydow@prosun.irst.gmd.de

September 1997

1-4 **WCSS97.** 1st World Congress on System Simulation. Singapore
Contact: Doris Yee, Secretariat of the, 1st World Congress on System Simulation, c/o IEEE Singapore Section, 59D Science Park Drive, The Fleming, SGP-118243 Singapore, Tel.: +65 773 1141, Fax: +65 773 1142, Email: ieeesgp@pacific.net.sg, WWW: http://www4.informatik.uni-erlangen.de/~rimane/wcss97.html

8-11 **14th ITG/GI.** Conference Architecture of Computer Systems 1997. Rostock, Germany
Contact: Prof.Dr. Djamshid Tavangarian, Universität Rostock, FB Informatik, Albert-Einsteinstr. 21, D-18056 Rostock, Tel.: +49-381 4983369, Fax: +49-381 4983426, Email: tav@informatik.uni-rostock.de

16-18 **Advanced Simulation of Systems**. Krnov, Czech Republic
Contact: Jan Stefan, FEI -VSB TU, tr. 17. listopadu, CZ-708 33 Ostrava Poruba, Email: Jan Stefan@vsb.cz

17-19 **6th IFAC.** 6th IFAC Symposium on Automated Systems Based on Human Skill. Kranjska gora
Contact: J. Cerenetic, J. Stefan Institute, Jamova 39, POB 3000, SLO-1001 Ljubljana, Tel.: +386 61 177 3759, Fax: +386 61 219 385, Email: janko.cernetic@ijs.si

17-19 **MMB'97.** Messung, Modellierung und Bewertung von Rechen- und Kommunikationssystemen. Freiberg, Germany
Contact: Tagungsbüro MMB'97, TU Bergakademie Freiberg, Institut für Informatik, Berhard-von-Kotta-Str. 1, D-09596 Freiberg, Tel.: +49-3731 39-3334, Fax: +49-3731 39-2645, Email: mmb97@informatik.tu-freiberg.de, WWW: http://www.tu-freiberg.de/mmb97.html

22-24 **21st Century Vehicle.** 5th European Cars/Trucks Workshop Symposium. Aschau, Germany
Contact: Moshe Heller, ASIMUTH GmbH, Planegger Straße 26, D-81241 München, Tel.: +49-89-8345073, Fax: +49-89-8347575

25-27 **ERK'97.** Electrotechnical and Computer Science Conference. Portoroz, Slovenia
Contact: Baldomir Zajc, University of Ljubljana, Faculty of Electrical Engineering, Trzaska 25, SLO-1001 Ljubljana, Slovenia, Tel.: +386-61 1768349, Fax: +386-61 1264 630, Email: baldomir.zajc@fe.uni-lj.si

October 1997

2-4 **SIMS Annual Conference 1997**. Espoo, Finland
Contact: Email: Hannu.Sippola@hut.fi

6-8 **Modelling and Simulation in Management and Control**. Zilina, Slovak Republic
Contact: Dr. Mikulas Alexik, University of Zilina, Dept. Technical Cybernetics, Velky Diel, SK-010 26 Zilina, Slovak Republic, Tel.: +42 - 89 - 54042, Fax: +42 - 89 - 54806, Email: alexik@frtk.utc.sk

19-23 **ESS 97.** European Simulation Symposium (ESS '97). Passau, Germany
Contact: Philippe Geril, SCS European Simulation Office, University of Ghent, Coupure Links 653, B-9000 Ghent, Tel.: +32-9 233 77 90, Fax: +32-9 223 49 41, Email: Philippe.Geril@rug.ac.be, WWW: http://hobbes.rug.ac.be/~scs

November 1997

11-14 **ASIM 97.** *11. Symposium Simulationstechnik*. Dortmund
Contact: Dipl.Inform. Sigrid Wenzel, Fraunhofer IML, Joseph-von-Fraunhofer-Str. 2-4, D-44227 Dortmund, Tel.: +49-231-9743 237, Fax: +49-231-9743 234, Email: wenzel@iml.fhg.de

12-14 **S + V.** Trade Fair for Simulation and Visualization. Dortmund, Germany
Contact: Dipl.Inform. Sigrid Wenzel, Fraunhofer IML, Joseph-von-Fraunhofer-Str. 2-4, D-44227 Dortmund, Tel.: +49-231-9743 237, Fax: +49-231-9743 234, Email: wenzel@iml.fhg.de

December 1997

7-10 **WSC '97.** 1997 Winter Simulation Conference. Atlanta, GA
Contact: Barry L. Nelson, Northwestern University, Dept. Industrial Engineering and Management Sciences, 2225 N. Campus Drive, USA-Evanston IL 60208-3119, Tel.: +1-847 491 3747, Fax: +1-847 491 8005, Email: nelsonb@random.iems.nwu.edu, WWW: http://www.wintersim.org/

8-11 **MODSIM 97.** International Congress on Modelling and Simulation. Hobart, Tasmania
Contact: MODSIM 97 Congress Secretariat, attn. Dr. A. David McDonald, c/- CSIRO Marine Laboratories, PO Box 1538, AUS-Hobart Tasmania 7001, Tel.: +613-6232-5482, Fax: +613-6232-5000, Email: MODSIM97@ml.csiro.au, WWW: http://www.ml.csiro.au/modsim97

January 1998

5-7 **EUROMEDIA '98.** Multimedia, Telematics Conference. Leicester, U.K.
Contact: Philippe Geril, SCS European Simulation Office, University of Ghent, Coupure Links 653, B-9000 Ghent, Tel.: +32-9 233 77 90, Fax: +32-9 223 49 41, Email: Philippe.Geril@rug.ac.be

11-14 **International Conference on Web-Based Modeling & Simulation**. San Diego, CA USA
Contact: Paul A. Fishwick, University of Florida, Dept. of CISE, Room 301, CSE Building, USA-Gainesville, FL 32611, Tel.: +1-352-392-1414, Fax: +1-352-392-1414, Email: fishwick@cise.ufl.edu, WWW: http://www.cise.ufl.edu/~fishwick/webconf.html

February 1998

16-17 **8th ASIM Working Group Conference „*Simulation in Produktion und Logistik*“**. Berlin, Germany
Contact: Markus Rabe, FhG-IPK, Pascalstraße 8-9, D-10587 Berlin, Fax: +49-30-3932503, Email: Markus.Rabe@ipk.fhg.de, WWW: http://www-plt.ipk.fhg.de/ASIM-Fachtagung/

FIRST CALL FOR ABSTRACTS
to **EUROSIM'98** CONGRESS
AT HELSINKI UNIVERSITY OF TECHNOLOGY, see page 6 and 7

18-20 **MIC'98.** 17th IASTED International Conference on Modelling, Identification and Control. Grindelwald, Switzerland
Contact: IASTED Secretariat, 1811 West Katella Avenue, Suite 101, USA-Anaheim, CA 92804, Tel.: +1-714-778-3230, Fax: +1-714-778-5463, Email: iasted@cadvision.com, WWW: http://www.iasted.com/

March 1998

2-3 ***Treffen der ASIM Fachgruppe „Simulation Technischer Systeme"***. Heidelberg, Germany
Contact: Dr. Ingrid Bausch-Gall, BAUSCH-GALL GmbH, Wohlfartstraße 21b, D-80939 München, Tel.: +49-89 3232625, Fax: +49-89 3231063, Email: 100564.302@compuserve.com

April 1998

14-18 **EUROSIM '98.** European Simulation Congress. Helsinki, Finland
Contact: EUROSIM'98, P.O.Box 1301, FIN-02044 VTT, Fax: +358-9-456 6752, Email: eurosim98@vtt.fi, WWW: http://www.vtt.fi/aut/tau/network/eurosim/eurocall.htm

May 1998

13-16 **MS'98.** IASTED Int. Conf. on Modelling and Simulation. Pittsburgh, PA USA
Contact: IASTED Secretariat, 1811 West Katella Avenue, Suite 101, USA-Anaheim, CA 92804, Tel.: +1-714-778-3230, Fax: +1-714-778-5463, Email: iasted@cadvision.com, WWW: http://www.iasted.com/

June 1998

16-19 **ESM '98.** 12th European Simulation Multiconference. Manchester, U.K.
Contact: Philippe Geril, SCS European Simulation Office, University of Ghent, Coupure Links 653, B-9000 Ghent, Tel.: +32-9 233 77 90, Fax: +32-9 223 49 41, Email: Philippe.Geril@rug.ac.be

September 1998

15-18 **ASIM'98.** *12. Symposium Simulationstechnik*. Zürich, Switzerland
Contact: Dr. Veronika Hrdliczka, ETH Zürich, Institut f. Werkzeugmaschinen u. Fertigung, Tannenstr. 3, CH-8092 Zürich, Tel.: +41-1-632 5252, Fax: +41-1 632 1125, Email: hrdliczka@iwf.bepr.ethz.ch

30-October 2
International Conference on Simulation.
Contact: Mrs. Hudson Louise, IEE Conference Executive, Email: lhudson@iee.org.uk

EUROSIM - Simulation News Europe

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

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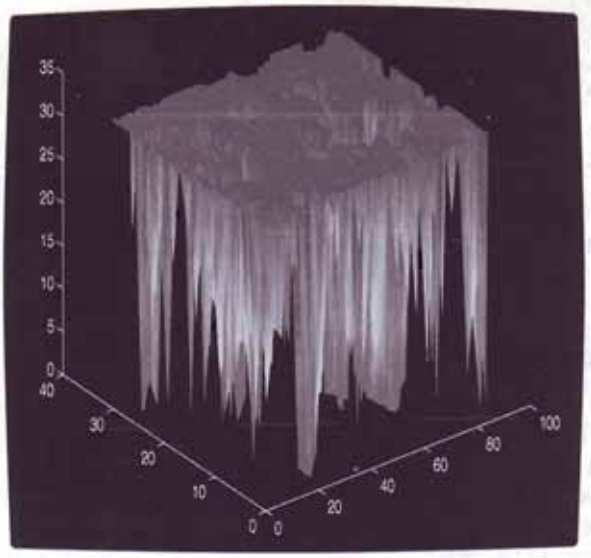

Dieser Oberflächenplot zeigt Stoßbeschädigungen einer Hubschrauber-Verbundwerkstoffstruktur. Zur Automatisierung zerstörungsfreien Prüfens klassifizierte die MATLAB Neural Net Toolbox Echos von Ultraschallsignalen. Die Daten wurden freundlicherweise von McDonnel Douglas unter einem AATD contract zur Verfügung gestellt.

Mit den MATLAB-Toolboxen, die von anerkannten Fachleuten entwickelt werden, können erprobte, dem neuesten Wissensstand entsprechende mathematische Vorgehensweisen erlernt und auf eigene Aufgabenstellungen angewandt werden.

Visualisierung kombiniert mit mächtigen Analysefunktionen

Leistungsfähige objektorientierte Grafik erlaubt interaktive Analyse und dynamische Modellbildung. Die umfangreichen Visualisierungsfunktionen umfassen 2-D, 3-D und 4-D Darstellung sowie Beleuchten von Oberflächen und Schattieren.

MATLAB

für ingenieurtechnische Aufgaben

MATLAB
MATLAB Compiler
MATLAB C Math Library
MATLAB C++ Math Library
Anwendungs-Toolboxen für:
Signalverarbeitung
Reglerentwurf
Financial Engineering
Bildverarbeitung
Datenanalyse & Modellbildung

Entwicklung von MATLAB-Programmen und standalone-Anwendungen

Umfangreiche GUI-Entwicklungswerkzeuge erlauben das individuelle Gestalten interaktiver MATLAB-Anwendungen.

Man kann MATLAB mit C und FORTRAN Programmen linken, Toolboxen einbeziehen, Daten mit anderer Software austauschen und MATLAB als ein Analyse- und Visualisierungs-Werkzeug einbauen.

Mit dem neuen MATLAB Compiler und der C Math Library lassen sich automatisch MATLAB-Algorithmen in standalone Programme umwandeln.

MATLAB 5 IST DA!

Weitere Informationen...

Nehmen Sie mit uns Kontakt auf, und fragen Sie nach kostenlosen, technischen Unterlagen zur MATLAB-Produktfamilie:

Tel.: 089/995 901 0
Fax: 089/995 901 11
http://www.scientific.de

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Die Sprache der Ingenieure

MATLAB—eine leistungsfähige, schnelle, interaktive Software—ist das beste Bindeglied zwischen Forschung und technischer Ausführung.

MATLAB ist eine Programmierumgebung für die Entwicklung von Algorithmen, Simulation und Analyse mit Visualisierung, numerischen Berechnungen und einer technischen Sprache.

Mächtig für Untersuchungen und Prototyping

In MATLAB werden Aufgabenstellungen und Lösungen so formuliert, wie es in der Mathematik üblich ist—ohne eine Zeile C oder FORTRAN Code zu schreiben.

Hunderte mächtiger Funktionen, die auf Effizienz und Zuverlässigkeit optimiert sind, sind mit einer leistungsfähigen und intuitiven Programmiersprache gekoppelt.

Fachwissen in MATLAB verfügbar

Toolboxen bieten eine große Auswahl an optimierten Funktionen für Datenreduktion, Analyse, Modellierung und Systementwurf.

Hinter vielen technologisch fortschrittlichen Entwicklungen steht die Sprache der Ingenieure und Wissenschaftler:

MATLAB

McDonnell Douglas verwendet MATLAB zur Entwicklung von automatischen zerstörungsfreien Prüfprozessen für Hubschrauber, wie z.B. den Longbow Apache

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