SIMULATION NEWS EUROPE

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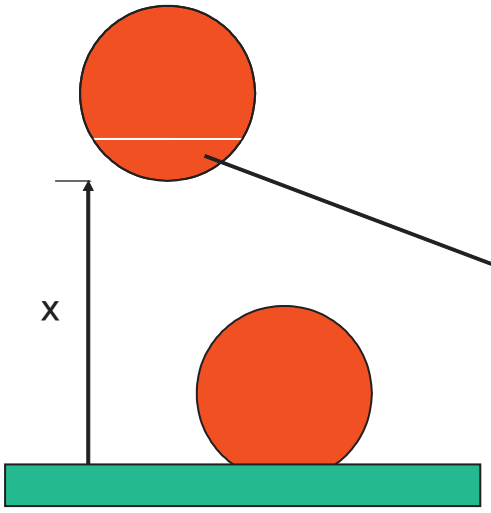
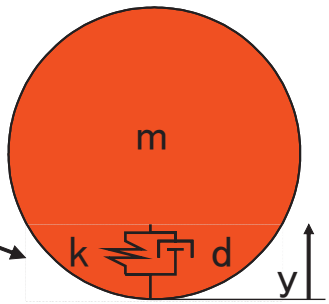
A European Forum on
Development in Modeling and Simulation






```
DERIVATIVE  ! ACSL MODEL
sprgfrc = k*( -x)*onof; CONSTANT k = 1.e6
dampfrc = d*(-xd)*onof; CONSTANT d = 500.
contfrc = sprgfrc + dampfrc
  xdd = - g + contfrc    ! Eq. of motion
  xd  = INTEG(xdd, xd0);    x = INTEG(xd , x0 )
  yd = -k*y/d*(1.0-onof) -xd*onof
  y   = INTEG(yd,y0)    SCHEDULE beg_contact .XN.
(x+y)
  SCHEDULE end_contact .XN. contfrc
END
DISCRETE beg_contact
 onof   = 1.0 ;  cint   = cint_contact
 bcnt   = 1 + bcnt ;  tlastb = t
END ! of beg_contact
DISCRETE end_contact
 onof  = 0.0 ;   cint  = cint_freeflt
     y = -x
END ! of end_contact
```

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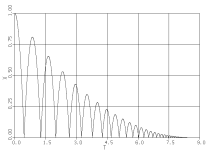

$$e(n) = \min_{x,y,z} \left| x^n + y^n - z^n \right|$$

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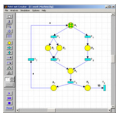

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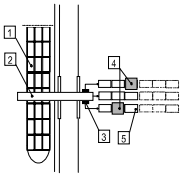

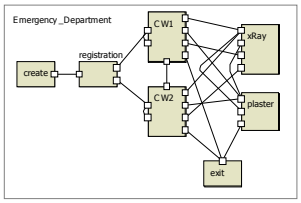

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Impressum

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EDITORIAL

Dear readers,

It can be observed, that modelling and simulation has become a widespread method, which is not only dealt with in simulation societies. Furthermore, simulation societies usually do not cover the whole spectrum of applications. Many application societies are running themselves successful working groups on simulation.

*Another fact is, that simulation societies, publishers of simulation journals, etc. put more and more emphasis in the area of modelling. For instance, the worldwide **SCS** society has extended her name to **Society for Modeling and Simulation**, EUROSIM's journal SIMPRA has changed to **Simulation Modelling Practice and Theory**. This emphasis on modelling indeed broadens the view and the themes for simulation societies, as now also applied mathematics, computational fluid dynamics (all kind of computational engineering), etc. should be included.*

Both facts – application societies deal with modelling and simulation, simulation societies open to computational engineering via modelling methods – are natural developments, which on the one hand open a new chance for a bigger potential in research and application of modelling and simulation, which on the other hand may also lead to senseless competition.

***SNE** observes and documents this development:*

- *by publishing technical notes and short notes on new methods and new applications - the authors often are no "born simulationists"- (in this issue e.g. cellular automata and Petri nets),*
- *by introducing simulation activities from "application societies" (in this this issue e.g. biomedical engineering, and mathematical modelling),*
- *comparing and evaluating in the ARGESIM comparisons not only features of simulators, but also - nowadays mainly - different modelling methods (in this issue e.g. comparison solutions to C1, C10 and C12 with new approaches)*
- *searching and announcing conferences and events, where simulation societies and application societies can meet and benefit from each other (in this issue announcement of SIMPAT'2003, a trade fair with computer engineering tools combined with conferences), etc.*

*I hope, you enjoy this issue, and I thank all authors and members of editorial boards for their cooperation. We are sorry for the delayed publishing, but we had problems to get information from some societies in time. The next issue, the double issue **SNE** 35/36 will be published in November 2002.*

Felix Breitenecker, editor-in-chief
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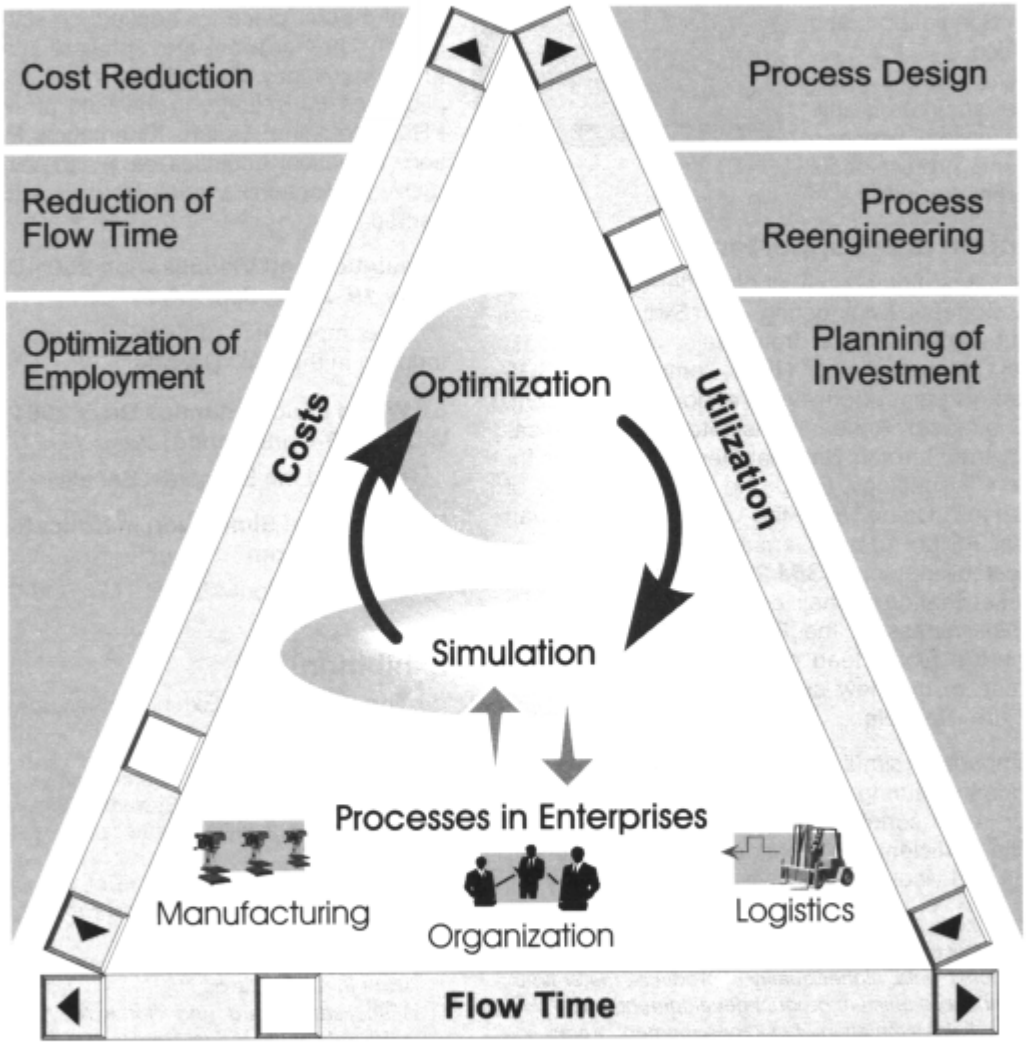

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Aims & Scope

The journal **SNE - S**imulation **N**ews **E**urope – is intended i) to inform about new developments in modelling and simulation and ii) to report about news from European simulation societies and events from International Simulation Societies and Simulation Groups all over the world. SNE is the also the official membership journal of **EUROSIM** and **SCS Europe**.

SNE reports in the *News Section* about EUROSIM, EUROSIM societies, SCS Europe and about other International Simulation Societies and Simulation Groups. A calendar of simulation conferences, industry news, etc. concludes the *News Section*.

SNE's *Archive Section* publishes technical notes and short notes on general overviews or new developments, new software and hardware, new applications and methods. Furthermore **SNE** presents *Simulation Centres,* introduces *Simulationists* and reviews t recent books on modelling and simulation and related topics. **SNE**'s special series *Comparison of Modelling and Simulation Technique and Tools* (**ARGESIM Comparisons**) gives a comprehensive overview on developments in application and implementation.

Parts of **SNE** can be also found on the web. News from societies is published at EUROSIM's web server (www.eurosim.info). Contents, archive and an evaluation of the Comparisons are available at www.argesim.org/sne/.

All contributions are selected and may be edited. For news publication, please contact a member of SNE's News Editorial Board (p. XXVII), for publication of technical notes, short notes, etc. please contact a member of SNE's General Editorial Board (p. 40) or the Editor-in-Chief.

TECHNICAL NOTES

Cellular Automata for Environmental Modelling

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…. Sketches basics of cellular automata and cellular systems (generalisation of cellular automata)
…. discusses problems in modelling with cellular systems, i.e. raster data versus vector data, and geographical vs. logical neighbourhoods of cells
…. concludes with hints for the practitioner, which approach to build a model with geographical related objects using cellular approaches fits the aim.

Abstract

By the growing use of geographic information systems (GIS) the use of cellular approaches for modelling and simulation spatial and especially geographical processes and systems gains more and more importance. This paper gives an overview over the basic definitions and emphasizes a proper differentiation between the very tight definition of real *cellular automata* and the very universal one for *cellular systems*.

On the base of these definitions typical problems are discussed, which raise for modelling spatial objects given by raster or vector data and by representing spatial relationships between these objects. Furthermore the difference in semantics between neighbourhood relation in GIS and neighbourhood relations needed for modelling purposes are elaborated.

Cellular Automata and Cellular Systems

For a long number of years cellular automata serve as a paradigm for modelling real world systems. In the late 60th J.H.Conway developed the automaton "Life" to model processes such as cell nascence and death caused by aggregation and isolation. Later on a theoretical foundation for the model class of cellular automata has been developed (e.g. Banks [1] and Wolfram [5]).

For the application area of environmental modelling these approaches recently re-gained actuality. Because of their acquaintance to the raster data offered by geographic information systems (GIS) a large number of models dealing with geographical processes are developed on the base of cellular automata. A representative selection of examples for this type of models is found in the anthology by Goodchild [2].

However, within these examples and most of the application models found elsewhere in literature, the term cellular automaton is used for a very broad range of modelling approaches which suggests an engagement with the goal of more precise differentiations and definitions.

But the following definitions do not only serve theoretical purposes. For the practitioner the mathematical formalism this paper gives in the following section opens the range of successively more detailed model specification between the rigid and close definition of cellular automata themselves and the very general definition of a so-called cellular system.

On the one hand, giving these definitions the modeller will obtain a feeling for potential problem fields in transferring real system dynamics to cellular systems and on the other hand he gets a guideline how to use the mathematical concepts to model system behaviour more detailed in a formally proper way.

Doing so, the next section gives two definitions, which will be our base for a discussion of practical modelling problems later on.

Definitions

A classical definition for a cellular automaton is given by Wunsch in [6]:

A ***cellular automaton*** is a 5-tupel

$$\sum = \left(Z, \underline{Z}, R^m, f, \lambda\right)$$

with:

1. $\boldsymbol{Z}$ is a set of states, with elements coming from the state alphabet $\underline{\boldsymbol{Z}}$.
2. $\underline{\boldsymbol{Z}}$ is a non-empty set with $\left|\underline{Z}\right| \le \left|\boldsymbol{N}\right|$, with $\boldsymbol{N}$ as the set of natural numbers.
3. R^m is the spatial extension of the automaton with $R^m \subseteq G^m$, m=1,2,3, ... and G the set of whole numbers.

4. f is called the state transition function with

$$f : \{R^m \to Z\} \to Z$$

5. The neighbourhood relation λ lists for every space element a set of space elements which are neighbours to the given one: ($\wp$ - power set**):**

$$\lambda : R^m \to \wp\left(R^m\right)$$

This definition describes an equidistant raster on the (geographical) space $\boldsymbol{R^m}$ with equal cells. In each of them works a state automaton with an individual internal state and a state transition function. All the cells work with the identical state transition function. The states of the cells change discrete in time and value going from state k to state $k+1$. The states of the neighbours of a cell may influence the state transition.

To apply this concept for real world problems in environmental modelling the following problems will arise:

1. The discrete alphabet given by the definition opposes to the need of real value variables for system quantities.
2. Each cell can hold only one state variable. A typical geographic space unit is characterized by a set of parameters, however.
3. The automaton only models a sequence of states without any further relation to the time axis.
4. The cells do not have any outputs and inputs in contrast to input- and output functions given by system theoretical concepts.

Caused by these restrictions a more general definition for a so-called cellular system is given, which meets all the requirements of spatial modelling. Again we define in accordance to Wunsch ([6]):

A ***cellular system*** is a 6-tupel

$$\sum = \left(T, Z, R^m, \lambda, f, \leq\right)$$

with:

1. time base $\boldsymbol{T}$ is a non empty set with the relation $\leq$ defining an order on its elements.
2. $\boldsymbol{Z}$ is a freely definable set called the state set for the system.
3. R^m is the spatial extension of the automaton with $R^m \subseteq G^m$, m=1,2,3, ...
   and $\boldsymbol{G}$ the set of whole numbers.
4. f is called the state transition function with

$$f : \{R^m \to Z\} \times T \times T \to Z$$

It transfers a state z at a space element $r \in R^m$ and at a point in time t to a state z' of the same state element at time t' ($t \leq t'$).

5. The neighbourhood relation λ lists for every space element a set of space elements which are neighbours to the given one: ($\wp$ - power set**):**

$$\lambda : R^m \to \wp\left(R^m\right).$$

In comparison to the cellular automaton we notice the following extensions:

- By the additional time set and its ordering relation time-related processes as needed for system simulation can be mapped.
- All the model variables used in the definition are interpretable as vectors.
  Doing so, the restriction of only one state variable per cell is revoked.
- The variables are defined without any relevant restriction and therefore can be used for universal modelling purposes.
- The neighbourhood relation is unrestricted as well.
- There is no advice concerning the spatial collocation of the cells.

From these observations we can state that this definition gives really a non-restrictive formal frame for modelling. On the other hand, however, it gives only few constructive advise how to build a (spatial) model. The modeller gets all freedom to fill the frame individually, but just this range of freedom leads to conceptual problems, which shall be discussed in the following sections.

Basic problems in modelling with cellular systems

By practical reasons, the semantics of space used in modelling environmental systems is mostly prespecified by the concepts given by geographic information systems. The simple cause is that all the data to use within the model will come from there. So we first will have a look on the means to model spatial systems and relationships given by recently used GIS.

Geographic information systems provide two very different basic concepts for describing spatial objects: raster data and vector data.

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Modelling with raster data

In the case of raster data a free choosable but equidistant raster is put over a geographic region. It is obvious to identify each of these raster cells with one of the cells of a cellular automaton.

So the advantages of this representation are perspicuously:

- easy to handle
- GIS data are easily transformed into model data
- Free scalable model accuracy by free scalable raster width.

In addition to these arguments the approach is easily adaptable to higher dimensions of space by going from squares to cubes, from cubes to hypercubes and so on.

Problems using raster data are:

The raster has to be equidistant and perpendicular and the width of the raster determines the scale of the model.

In the first case the problem lies in the effect of discretisation if an object lies cross to the raster. Caused by this argument the modeller will be forced to work with a quite small raster width to reach sufficient accuracy.

But doing so, another problem arises: There will be some real world objects to model, which spatially extend over a set of cells. Figure 1 gives an impression of the situation for the modeller between raster representation and vectorized objects.

For those real world objects, which extend over a set of raster cells, a transformation function is needed: Firstly to summarize the values for this spatial object from the attribute values of the cells covered by the object.

This has to be done by a separate aggregation function, which is not mentioned in the standard-definition of a spatial system.

The analoguous problem has to be solved for the other direction: An attribute value of a spatial object has to be mapped on the set of cells the spatial objects consists of. Not in all the cases a simple homogenous distribution models the real world circumstances correctly.

A typical example for these problems are population distribution over a geographical and administrative region such as a municipality: To work with statistical data the extension of the spatial unit has to be the cummunity itself, the distribution of the people within this region will not be homogenous at all and will be one of the main interests of the model.

Let us transform this situation to raster GIS in which the municipality is represented by a set of raster cells:

1. First direction, the aggregation function: The overall population is the sum of the population of all the cells.
2. Second direction, the distribution function: How does the population distribute over the cells representing the municipality?

Both functions have to be modelled in addition to the definitions of cellular systems and / or cellular automata!

As these deliberations show, in this modelling task lies the complete scaling problem which is very well known from the geographic modelling part. The aggregation functions and the distribution functions are not trivial at all (for a more detailed discussion of this renge of problems see Ortmann in [3] or Wittmann in [4]) and lead to hard complications in contrary to the seemingly very simple modelling approach by cellurar systems.

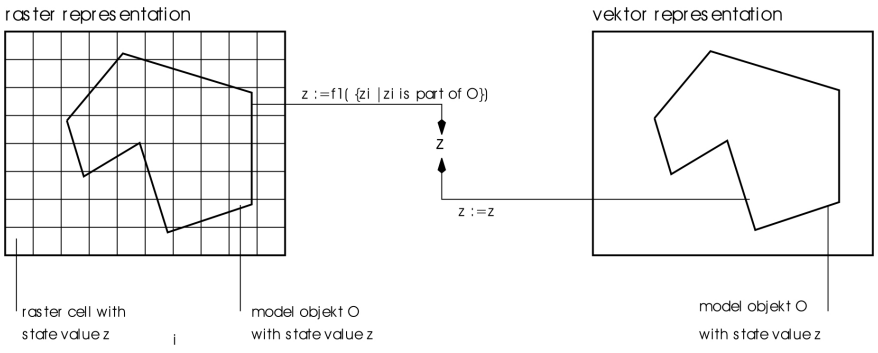


Figure 1: Values of model quantities in raster and vector representation

Modelling with vector data

The alternative is given by a vector-representation of geographical objects as used for vector-GIS. It is obvious that the discretisation problems will completely disappear using this approach. The modelling accuracy is determined by the accuracy of the defining vector line.

An aggregation function and/or a distribution function between the different scales of spatial object and raster cells is no longer necessary.

However, this modelling approach suffers under the free editable border line of a spatial model object. Without any regularity given by a raster, these borders are freely editable now. The consequences are:

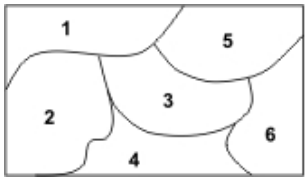
1. Regions of different sizes:
   The values for all the variables used in the model have to be normalized before brought into relation to values of any other spatial model object.
2. Very complicated neighbourhood relations because of the irregular size of the objects: The number of neighbours of a cell will be variable which causes a much more complicated specification in the model description part. The necessary information strongly exceeds the simple definition of cellular automata.

This first argument requires the attention of the modeller but can be solved with reasonable effort. The second argument shall be discussed in detail by the following section.

Neighbourhoods

For cellular automata and for the corresponding raster-GIS representation the selection of a suited neighbourhood relation is normally restricted to a selection among the classical relations (von Neumann, Moore, …). It should be remarked here that the modeller has much more freedom in modelling concerning the neighbourhood relation, however. Any relation which can be expressed by a filter or a window given by a set of cell indices in relation to the index of the cell under observation is allowed by the definition. This can be done very simply by the regularity of the raster.

For cellular systems and vector GIS the neighourhood specification will change substantially: There is a completely irregular mosaic over the geographical space given by free definable border lines of the spatial objects. The neighbourhood is no longer defined by indices of raster cells but by an individual set of neighbours for each cell.



	1	2	3	4	5	6
1	-	1	1	0	1	0
2	1	-	1	1	0	0
3	1	1	-	1	1	1
4	0	1	1	-	0	1
5	1	0	1	0	-	1
6	0	0	1	1	1	-

Fig. 2: An example for a neighbourhood matrix for a spatial area with six sub-regions

Beneath these implementational remarks using vector representation substantial conceptual problems will arise at two points:

A typical formal (and mathematical) representation of the neighbourhood relation for all the spatial objects used within a model would be a neighbourhood matrix as shown exemplarily in figure 2.

Geographical versus logical neighbourhood

All neighbourhood relation given by cellular automata has to be interpreted as a geographical neighbourhood. This might result in some discrepancies for modelling. One could imagine that two cells are near neighbours concerning a Moore-neighbourhood but concerning the semantical relation needed for the model they are completely isolated to each other.

To give an example: two rural regions are spatial neighbours but separated by a motorway. Therefore the logical neighbourhood which models reachability is completely different to the one given by the geographical position of the regions under observation. Because of the regularity of the cellular automaton, this situation can not be modelled by this concept. Only one neighbourhood relation is allowed. And this neighbourhood is given by the spatial adjacency of the cells.

Using cellular systems this situation could be represented by an individual mark in the neighbourhood matrix. The matrix could be set by the logial neighbourhood relation needed for the modelling purpose. Again this concept is open for any interpretation (logical neighbours) but requires additional information (specification of the semantical neighbourhood) on the other hand.

Differentiating logical neighbourhoods

The second problem deals with the differentiation of the neighbourhood relation for the different components of the state vector of a cell in space. Because the vectorization is only allowed for cellular systems, this problem will appear for this more extended concept only.

To give an example for the problem: A model for the settlement of a population over a geographical region will refer to the attributes “shopping facilities” and “leisure facilities” for a given cell. The facilities are determined in relation to the existence of shopping centers and recreational facilities in the neighbourhood of the cell under observation. It is obvious that the inhabitant of a cell feels the shopping neighbourhood completely different to the leisure neighbourhood.

People will accept a quite long car ride to practice leisure activities but they like the comfort bying their bread rools in direct neighbourhood to their residence. Cellular automata cannot express this differentiation.

The mightiness of cellular systems would allow a mathematical representation of this situation: For each of the attributes given in the state vector a differentiated neighbourhood relation can be given. The mathematical apparatus allows this by specifying a vector of neighbourhood matrixes.

For practical reasons the expenditure in defining all these neighbourhoods has to be taken into account, however. Although GIS functionality can support this task technically, much deliberation is necessary for a reasonable specification of the attribute-dependent neighbourhood relationship between the cells. This should a modeller take into account considering the cost –value ratio for his model.

It should be pointed out that there is a fundamental difference between modelling in GIS and systems modelling with dynamical processes. GIS administers the geographical relations of spatial objects. Simulation models extend this specification to logical attributes and relations, which should be stored separately. Under this point of view the geographical neighbourhood represents just one of the open set of "logical" or "semantical" neighbourhoods needed for system modelling.

Conclusion

For the practitioner in modelling there are two general ways to build a model with geographical related objects using cellular approaches:

First would be the "easy-to-do-approach" by cellular automata. This formal concept gives a very strict frame for the modelling task and can easily be handled algorithmically. However, for most of the applications its formal expressiveness does not fulfil the needs of the modeller.

So for real world modelling projects more or less extensions are necessary. These extensions can be summarized under the formal concept of cellular systems. All restrictions are revoked by this definition. The modelling task however gets much more complicated by the design decisions the open concept of cellular systems demands. Taking into account the deliberations about the representation of spatial objects and the neighbourhood relations the modeller has to decide the following two points of interest:

1. Homogeneous cells versus individually sized cells.
2. Homogeneous neighbourhood for all the components of the state vector versus attribute specific "logical" neighbourhoods for each state variable representing the situation of a cell.

In dependence on the decision between the free specifiable cellular system and the restrictive cellular automaton the expense for implementation of the simulation algorithm and for setting a consistent initial state for the model has to be considered.

This paper has the intention to give an overview over the range of modelling spatial systems using cellular formalisms. Main intention was

- to give criteria for proper use of the terms cellular automaton in contrary to cellular system and
- to give hints for a developer of such models by showing on the one hand the options in modelling and on the other hand the difficulties the respective decisions will cause, and
- to give an impression about the dangers when GIS data structures are used for modelling purposes without thinking about the consequences on semantics in model specification.

Especially for modelling and simulation environmental models the concepts given by cellular systems form a proper formal and mathematical frame, which should be used to approach spatial modelling problems.

However, nothing is as easy as it seems in the beginning: Even using the easy understandable concept of cellular systems, the necessary extensions for modelling real world problems lead to complex and highly sophisticated model specifications!

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The Bouncing Ball Problem - Modeling and Simulation Aspects

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... introduces a simple mathematical model for a ball bouncing on a hard surface

… compares exact analytic results with results obtained from simulation models

…. discusses advantages and pitfalls of a couple of contact models

Introduction

Probably anyone who has ever played table tennis was fascinated at some time when (s)he observed the ball vertically bouncing back from the hard surface of the table over and over again with slowly decreasing height and increasing frequency of bounces. The most interesting part in this little experiment is the finale. The bouncing height of the ball gets smaller and smaller and finally it is hard to see it at all. However, the impacts on the table are easily recognized accoustically until the frequency gets so high that the sound from the individual impacts merge and a kind of rattling noise with fading volume is percepted. This final stage lasts only for less than a second and then sound and motion stop all of a sudden.

After repeating this experiment several times, the first questions that almost everyone asks are simple and straightforward:

- Can you tell how many bounces did occur ?
- When exactly did the ball stop bouncing ?

Usually one doesn't have a measurement system at hand to get an answer directly from the experiment. It would require some equipment to do a precise time measurement to detect e.g. every instant when the ball gets in contact with the surface, ends contact on rebound and finally gets in permanent contact.

Measuring the contact force would be even more challenging, since the force transducer must be able to deal with a force range of several magnitudes.

A Simple Simulation Model

Being familiar with numerical simulation one is certainly tempted trying to answer these questions by a simulation experiment. It doesn't need extensive knowledge in mechanics to establish, in a first step, a simple model for the problem outlined above.

The motion of a free falling mass in a gravitational field without any resistance is governed by two almost trivial differential equations

$$\dot{v} = -g, \quad \dot{x} = v$$

with the constant $g = 9.81$ m/s^2 valid on our planet earth. Initial conditions $v(0) = v_0$ and $x(0) = h_0$ define the velocity v_0 and the initial height h_0 above the table at $t = 0$. Any integration routine will give satisfactory results for the continuous part of the problem.

When the ball contacts the table, a discontinuity in the motion of the ball will occur, and the integration of the equations of motion as stated above has to be interrupted. The detection and treatment of events that depend on a state variable, (here it is the height x of the ball above the table), is a business of it's own kind. We will come back to this issue later.

Once the state event is located, arbitrary impact models for the ball and the surface can be employed. The most simple approach is to apply Newton's 3rd law and introduce a coefficient of restitution ε to account for energy losses.

The velocity v_i^- of the ball prior to impact is related to the velocity v_i^+ after contact according to

$$v_i^+ = -\varepsilon v_i^-$$

It is assumed that the exchange of momentum occurs instantaneously and therefore the contact process does not consume any amount of time.

This model of a bouncing ball is definitely the most simple model one can establish. It is easy to add more complexity to the scenery. By simply moving the table harmonically in the vertical direction a completely new situation can occur.

Now the motion of the ball does not need to stop after a limited period of time. The moving table acts as an excitation source and can keep the ball bouncing and bouncing for ever. The resulting motion can be periodic, quasi-periodic or even chaotic, depending on the parameters of the system.

However, even an implementation of the simple model with stationary table can produce useful results and lead to some insight how to treat discontinuous systems. Therefore it is not a surprise that major simulation languages use this model in example programs to demonstrate the usage of language features.

Implementation in ACSL

The first implementation shown of the model outlined above is based on the simulation language ACSL [1]. The program code listed here is taken from the documentation "Beginner's Guide" [2], where the Bouncing Ball Program is developed step by step.

The source code printed below is almost identical to the version in [2], except for some modifications, mainly of the model parameters in order to obtain comparable results.

```
PROGRAM bouncing ball
!------------------model constants (SI units)
CONSTANT   vic = 0.00, hic  =  1.0
CONSTANT     g = 9.81, tend = 10.0
CONSTANT  nstp = 1    ! Steps within CINT
CINTERVAL cint = 0.01 ! Integration stepsize
ibounce = 0
DERIVATIVE
  v = INTEG(-g, vic) ! acceleration is gravity
  x = INTEG(v, hic)  ! integrate velocity
  !----------find point at which ground is hit
  SCHEDULE bounce .XN. x
  TERMT(t.GE.tend)
END ! of derivative
DISCRETE bounce
CONSTANT k = 0.9 ! coefficient of restitution
  v = -k*v
  ibounce = ibounce + 1
END ! of discrete bounce
END ! of program
```

Even if one is not familiar with ACSL, the code is easy to read and almost universal for languages adhering to the CSSL-standard.

State events are scheduled in ACSL with the **SCHEDULE** command and program flow will divert to the **DISCRETE** section "bounce", when the height of the ball crosses zero from positive to negative.

A simulation result obtained with the above program is shown in Figure 1. First all goes well and the ball bounces back from the horizontal plane a number of times, but all of a sudden it "falls through the table". Obviously the event detection fails and does not stop integration when the height of the ball gets negative.

This is a typical result that occurs when a fixed integration step size is used throughout the simulation.

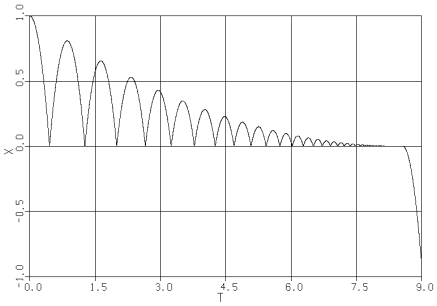

Figure 1: Simulation of a bouncing ball that fails for short bouncing intervals due to incorrect integration stepsize.

Since the period of time between two bounces gets shorter and shorter with every bounce it eventually falls below the integration stepsize. Then the zero-crossing event has already been passed after the first integration step is completed and will not be detected.

An improved version of the discrete section bounce is suggested in [2] and fixes this problem. The key is to adjust the integration stepsize **cint** after each bounce such that the following period of free flight is subdivided into **ndp** steps, based on the anticipated duration of flight

$$t_f = \frac{2\left|v_i^+\right|}{g}$$

until the next bounce. With this modification a new stop criterion has to be implemented, otherwise the simulation might not terminate. One can either limit the number of bounces or stop the simulation at a certain minimum integration stepsize.

The example DISCRETE bounce2 listed below uses the latter criterion and introduces a minimum stepsize **cintmn**. In combination with an accordingly modified main program one gets correct results as plotted in Figure 2.

```
DISCRETE bounce2
CONSTANT k = 0.9
CONSTANT ndp = 10.0 , cintmn = 0.001, nstp=1
  v = -k*v
  ibounce = ibounce +1
  cint = (2*ABS(v)/g)/ndp ! cint to next bounce
!------------stop when cint too small
 TERMT(cint .LE. cintmn, 'Stop on small cint')
END ! of discrete bounce2
```

Does this program help us to find an answer for the questions that we asked initially? Yes and no. For the simulation result above we count **ibounce = 43** and the last bounce occurs at $t = 8.48164$.

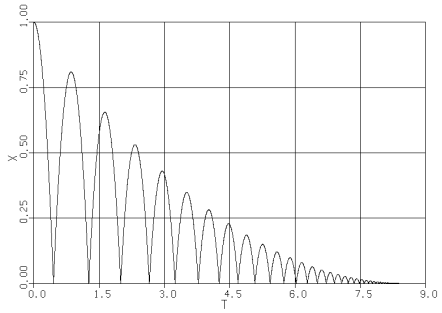

Figure 2: ACSL simulation result of a bouncing ball with dynamic stepsize control.

However, this result depends mainly on our choice **cintmn=1.0e-3** of the chosen minimum stepsize. If this value is reduced by several magnitudes to **cintmn=1.0e-6** we get 109 bounces that take $t = 8.57885$ seconds and we know that there would be more if we would lower the limit again. Actually this cognition should not really be a surprise.

The mathematical model in use will perform an infinite number of bounces within a limited period of time. No wonder that any continuous simulation will get in trouble at some time.

To sum up the results obtained so far, Table 1 contains the results of simulation runs with the improved ACSL model and decreasing minimum stepsizes. Duration of the bouncing process is obviously converging, whereas the number of impacts steadily increases.

For comparison with results presented later the CP-time consumed to obtain these results by a 800 MHz Pentium Computer is also listed.

Adaptive stepsize **cint** (**cint_start**=0.05), approx. number of steps between bounces **ndp**=10			
cint_mn	Impacts	Length (sec)	CP-time (sec)
1.0 e-03	43	8.481641	0.160
1.0 e-04	65	8.569364	0.240
1.0 e-05	87	8.578003	0.315
1.0 e-06	109	8.578854	0.390
1.0 e-07	131	8.578938	0.460
1.0 e-08	152	8.578946	0.521

Table 1: Simulation results obtained with ACSL

Analytical Solution for the Simple Model

For the simple model of a free falling mass in a gravitational field with rebounds from a stationary surface an analytical solution can be derived, see Stronge [3].

For a mass falling a distance h_0 in a gravitational field g without drag, the velocity v_1 at the first impact can be obtained from conservation of energy:

$$v_1 = \sqrt{2gh_0}$$

The coefficient of restitution ε then gives the separation speed $v_i^+ \equiv -\varepsilon v_i^-$ for this impact and subsequently the rebound height h_1 for the first bounce:

$$h_{m+1} = \varepsilon^2 h_m = \varepsilon^{2(m+1)} h_0 \qquad m = 0 \ldots n$$

The time between falling from the initial height h_0 and reaching rebound height h_m after m rebounds is obtained from

$$t_m = \sqrt{\frac{2h_0}{g}}\left(-1 - \varepsilon^m + 2\sum_{j=0}^{m}\varepsilon^j\right) \quad m = 0 \ldots n$$

and the total time of bouncing t_{tot} is the limit value when the number of bounces reaches infinity:

$$t_{tot} = \lim_{m\to\infty} t_m = \frac{1+\varepsilon}{1-\varepsilon}\sqrt{2h_0/g}$$

Applying these handy formulas we can check our first results from the simulation model. The exact total time for the bouncing process (parameters as used in the simulation model) is $t_{tot} = 8.578949$. The simulation result obtained for a final minimum integration stepsize of **cintmn=1.e-6** is $t = 8.578854$ (see Table 1).

Accuracy is, although not very high, quite satisfactory. With **cintmn=1.e-8** our result is almost at the theoretical value (with 7 digit accuracy). Of course we are far off with the number of bounces, which should be infinity.

So it turns out that the bouncing ball example can be quite useful as a benchmark problem to test simulators with respect to numerics and event handling. In fact there is a related problem of multiple bouncing balls in the suite of ARGESIM comparisons, see [4].

In continuation of the analytical results we can calculate values for the exact length of the free flight phase between two bounces. From this we can also calculate the truncation error that will occur with respect to the exact solution. These results can be compared with actual simulation results and are helpful to optimize the integration parameters as well as tolerances and termination criteria. Results are given in Table 2.

From Table 1 and Table 2 one can see that the analytical results match the results from numerical simulation quite nicely. Note that the algorithm of **`DISCRETE bounce2`** to calculate the adaptive stepsize subdivides each interval between two bounces into approximately **`ndp=10`** integration steps.

The results in Table 2 are based on the following model parameters:

$g = 9.81$ m/s^2, $h_0 = 1$ m, $v_0 = 0$, m/s, $\varepsilon = 0.9$

Rebound m to height h_m	$\Delta t_m = t_m - t_{m-1}$	$\Delta t_\infty = t_\infty - t_m$
21	1.043e-1	9.387e-1
43	1.027e-2	9.244e-2
65	1.011e-3	9.103e-3
86	1.107e-4	9.961e-4
108	1.090e-5	9.809e-5
130	1.073e-6	9.660e-6
152	1.057e-7	9.531e-7
174	1.041e-8	9.368e-8

Table 2: Results obtained from analytical solution

Bouncing ball with SIMULINK

Simulink is an extension to the MATLAB software package [5]. It is known as a popular simulator with a graphical user interface. A quick look at the list of demo-files brings the file *bounce.mdl* to light. Figure 3 shows a screen shot of the block diagram of the bouncing ball model after parameter adjustments.

The Simulink-model “bounce” is an implementation of the mathematical model as outlined before. Contrary to the previous implementation this simulation model uses an integrator with limited output. By restricting the output of the position integrator to positive values the numerical effect of the ball “falling through” is avoided.

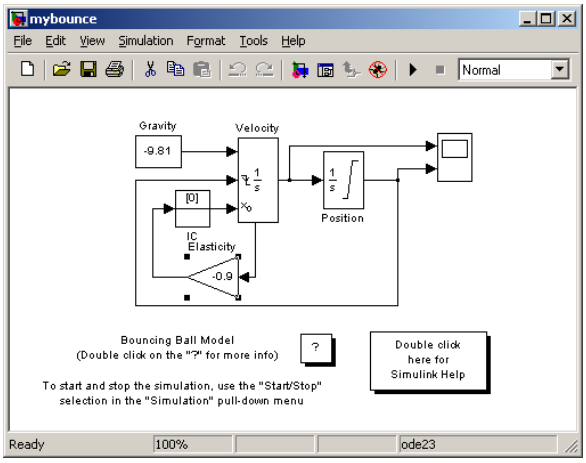

Fig. 3: Block diagram of original Simulink model “bounce”

However, since no provisions are made in this demo to terminate the simulation other than by a stop time the program hangs in a loop if the stop time is set beyond the duration of the bouncing process. Of course this behaviour can be avoided by adding an appropriate termination function to the model.

After adjusting the model and its parameters, it will produce similar results as obtained before. A typical screen shot of the Simulink result displayed by the scope block is shown in Figure 4.

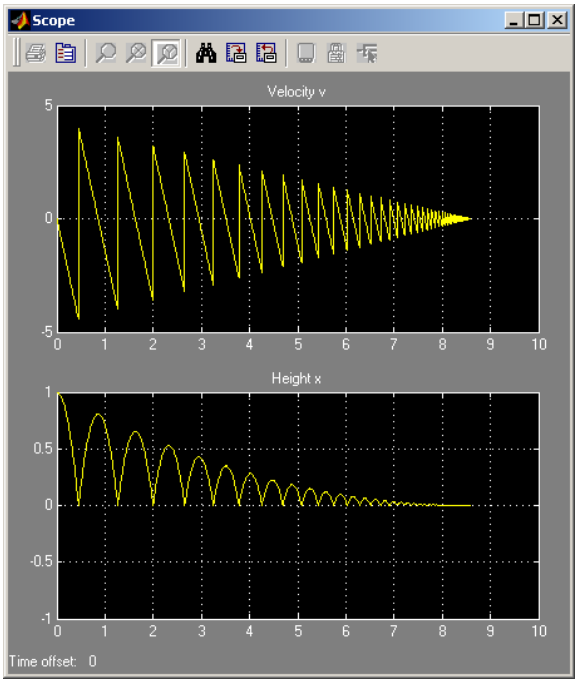

Figure 4: Screen shot of Simulink output
Velocity v on top, height x below.

MATLAB – Bouncing ball demo

As a last example on our "tour" on ready-to-use demos let us have a brief look at MATLAB itself. The m-file **`ballode.m`** contains a function ballode to run a demo of a bouncing ball and was recently revised (2001/04/15). It is provided as an example of repeated event location, where the initial conditions are changed after each terminal event. The demo computes ten bounces with calls to **`ode23`** and a trajectory is plotted using the output function **`odeplot`**.

In order to get again comparable results, a few modifications have to be made to the original code. The most significant change is to remove all plot commands when the CP-time is measured. Default parameters or options of the integration routine have not been altered. The essential MATLAB code to integrate from one bounce to the next is shown below.

```
options = odeset('Events',@events,'OutputSel',1,...
                 'Refine',refine);
[t,y,te,ye,ie]=ode23(@f,[tstart tfin],y0,options);
```

Two functions have to be defined, one for the set of differential equations

```
function dydt = f(t,y)
     dydt = [y(2); -9.81];
```

and one for the event detection

```
function [value,isterminal,direction] = events(t,y)
value      = y(1);     % detect height = 0
isterminal = 1;        % stop the integration
direction  = -1;       % negative direction
```

Since the integration from one bounce to the next is placed within a for-loop with a predefined number of passes it is easy to set the number of bounces according to the analytical results. Some results from MATLAB simulation runs are shown in Table 3. The time **`T_end`** to complete the indicated number of rebounds (bounces) is almost identical to results obtained with ACSL (see Table 1) and matches very well with the analytical results.

Rebounds	T_end	CP-Time (avg.)
21	7.640249	0.645
43	8.486509	1.230
65	8.569846	1.850
86	8.577953	2.455
108	8.578851	3.030
130	8.578940	3.640
152	8.578948	4.250

Table 3: Results from MATLAB simulation

The significant advantage of ACSL over MATLAB with respect to CP-time is due to the fact that ACSL code is fully compiled whereas MATLAB is basically an interpretative system. No attempts were made to use MATLAB features to accelerate integration since this would have been beyond the scope of this note.

Bouncing ball with compliant contact region

With respect to the duration of the bouncing process the impact model as described so far works well for impacts with little deformation and very short contact time, i.e. for a rather stiff ball bouncing on a rigid surface. However, if these presumptions are not fulfilled, the shortcomings of the impact model become apparent. Bouncing of a softball cannot be simulated with comparable accuracy using that impact model.

A more realistic model is needed that takes into account the compliance in the contact region. If we still want to keep the model as simple as possible we have the choice between two different models: A serial connection of a damper and a spring, frequently referred to as the *Maxwell model*, or a parallel arrangement, also called the *Kelvin-Voigt solid*. Although the Maxwell model has some advantages for single impacts, see [3], it is difficult to apply on repeated impacts. Therefore we will use the Kelvin-Voigt model as depicted in Figure 5.

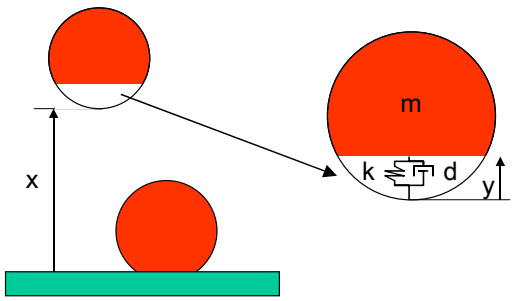

Figure 5: Sketch of a ball with compliant contact region using a spring k and a damper d as an elementary viscoelastic model (Kelvin-Voigt solid).

In the equation of motion of the ball the normalized contact force $f_c = F_c / m$ is added as an external load that becomes effective during contact.

$$\dot{v} = -g + f_C, \quad \dot{x} = v$$

Because of the unilateral contact between ball and surface, the contact force cannot be negative.

$$f_C = \max(-kx - d\dot{x}, 0)$$

The viscoelastic element is represented by an additional state equation for the deflection y of the ball in the case of free flight. During contact the order of the model is reduced and the independent state disappears.

$$\dot{y} = \begin{cases} -y\,k/d & f_C = 0 \\ -\dot{x} & f_C \neq 0 \end{cases}$$

Finally conditions for onset and termination of contact are needed. The begin of contact is defined by a geometric condition

$$(x + y) = 0\,,$$

while the contact ends when the contact force disappears, i.e. $f_c = 0$.

An implementation of the model equations in ACSL is shown below. Only the **dynamic** section is listed, since this is the most interesting part of the simulation program. Note that two events have to be scheduled, one at the beginning of contact and one when contact ends. The integration stepsize is adjusted depending on contact or non-contact to account for the change of eigenvalues when the contact situation changes.

```
DYNAMIC
  DERIVATIVE
  sprgfrc = k*( -x)*onof; CONSTANT k = 1.e6
  dampfrc = d*(-xd)*onof; CONSTANT d = 500.
  contfrc = sprgfrc + dampfrc
    xdd = - g + contfrc   ! Eq. of motion
    xd  = INTEG(xdd, xd0);   x = INTEG(xd , x0 )
    yd = -k*y/d*(1.0-onof) -xd*onof
    y   = INTEG(yd,y0)   SCHEDULE beg_contact
.XN. (x+y)
   SCHEDULE end_contact .XN. contfrc
  END
  DISCRETE beg_contact
   onof   = 1.0 ;  cint   = cint_contact
   bcnt   = 1 + bcnt ;  tlastb = t
  END ! of beg_contact
  DISCRETE end_contact
   onof  = 0.0 ;   cint  = cint_freeflt
       y = -x
  END ! of end_contact
  TERMT(t.GE.tend)
END   ! of Dynamic
```

The stiffness parameter **k** mainly determines how long the contact lasts. The new damping parameter **d** replaces the coefficient of restitution of the previous impact model. To demonstrate the capabilities of the improved model a much higher dissipation at contact is chosen by setting **k=1.E6** and **d=500**.

After six bounces the final stage of the ball motion is shown in Figure 6. Now the model is capable of performing a limited number of bounces until decreasing oscillations end in a permanent deflection of the contact element. Finally, time series of characteristic parameters during a single contact are shown in Figure 7.

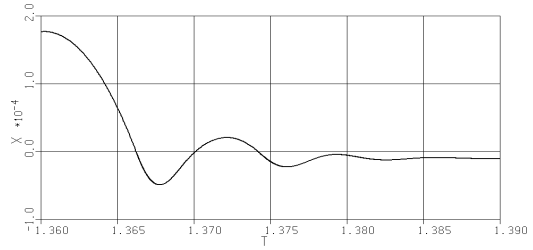

Figure 6: Final stage of bouncing motion of a ball with compliant contact model.

Note that the contact force jumps from zero to a certain level at the onset of contact. This somewhat unrealistic behavior is due to the linear viscous damper, which generates a force jump. Also one can see that zero contact force occurs before full restitution of deflection is reached, due to first-order lag behaviour of the contact element.

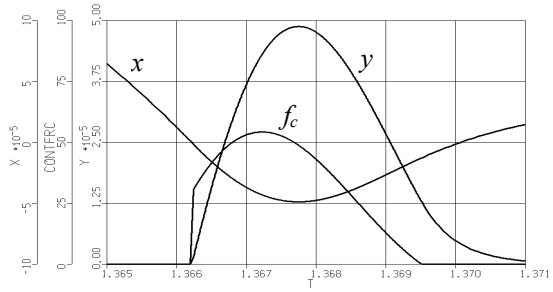

Figure 7: Time series of ball displacement x, contact force f_c and ball deflection y during contact.

Conclusions

The experiment described and simulated can be seen as the "*Basic* Bouncing Ball Problem". Several modifications to the original problem, like e.g. a periodically moving table, are presented and discussed in the literature and lead in most cases to a highly complex dynamic behaviour. However, even the basic problem is very instructive and teaches a lesson, when precise simulation results are sought and event handling capabilities of simulators are to be examined.

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SHORT NOTES

Petri Net Modelling in MATLAB – The PetriNet Toolbox

.... sketches briefly Place / Transition - type Petri nets (P / T nets)
…. introduces a MATLAB Toolbox, which allows to model a P / T net graphically
…. discusses features of this Toolbox for analysing and simulationg the P / N net

In a large number of technical systems a proper operation sequence is the main specification requirement. In such cases, designers are mostly interested in the discrete behaviour of a system, which can be described by discrete states, discrete events and their orderings. A system that is modelled and studied at this level of abstraction is a logical discrete event dynamic system.

Discrete event systems and related modelling and control issues gained a large attention within the research community in the past few years. Many successful applications of developed theoretical tools, such as Petri nets [1], are reported in modelling, design and management of various types of systems.

Much work has been devoted to the supervisory control of discrete event systems introduced by Ramadge and Wonham [2]. Their work is based on automata and formal languages. Several supervisory control approaches based on Petri net models have also been developed in the last years [3].

The Petri net modelling framework and the supervisory control concept are combined in a set of functions that may be used within the MATLAB computing environment – the PetriNet Toolbox for MATLAB.

Petri nets

Petri nets as a tool for modelling and specification of manufacturing systems are described in a number of sources. Different classes of Petri nets were developed that have a different descriptive power and are suited for various applications. Here we use the Place/Transition form of Petri nets (P/T nets).

A Petri net structure can be described as a bipartite graph consisting of two types of nodes, places and transitions. Directed arcs interconnect nodes. State of the system is denoted by distribution of tokens (called marking) over the places. Formally, a Petri net is a five-tuple $PN = (P, T, A, w, m_0)$, where

- $P = \{p_1, p_2, \ldots, p_j\}, j > 0$ is a finite set of places,
- $T = \{t_1, t_2, \ldots, t_k\}, k > 0$ is a finite set of transitions (with $P \cap T \neq \varnothing$ and $P \cup T = \varnothing$),
- $A \subseteq (P \times T) \cap (T \times P)$ is a finite set of arcs,
- $w : A \rightarrow \{1, 2, \ldots\}$ is a weight function,
- $m : P \rightarrow \{0, 1, 2, \ldots\}$ is a marking, m_0 is the initial marking.

The switching rule of a Petri net is given by:

i) a transition is enabled if each of the input places of this transition is marked with as many tokens as the weight of the corresponding arc,
ii) an enabled transition may or may not fire, which may depend on an additional interpretation,
iii) a firing of a transition is immediate (includes no delay) and removes a number of tokens equal to the arc weight from each of the input places and adds as many tokens to each of the output places as the weight of the corresponding arc.

The structure of the Petri net can be also given in a matrix representation. We define an input matrix $\boldsymbol{I}$, with as many rows as the number of places and as many rows as the number of transitions. An element i_{jk} of the matrix $\boldsymbol{I}$ is the weight of the arc from p_j to t_k. If there is no arc between the two nodes we set the corresponding element of the matrix to zero. Similarly we define an output matrix $\boldsymbol{O}$ of the same size with an element o_{jk} equal to the weight of the arc from t_k to p_j.

Matrices $\boldsymbol{I}$ and $\boldsymbol{O}$ precisely describe the structure of the Petri net and enable to explore the structure by linear algebraic techniques. Furthermore, if we adjoin the marking vector $\boldsymbol{m}$ where m_i is the marking of the place p_i, and a firing vector $\boldsymbol{u}$ with a single nonzero entry element $u_j = 1$, which indicates a transition that fires, we can write a state equation of the Petri net (the subscript k denotes a k-th firing in some firing sequence):

$$m_k = m_{k-1} + (O - I) \cdot u_k$$

Several properties of Petri net models have been defined and investigated by different authors. Some of the most important properties are liveness, boundedness (safeness) and reversibility. Definition and meaning of these properties can be found in [1], [4]. Some of the properties can be investigated by linear algebraic techniques.

Despite the compact representation the practical applications of Petri nets result in complex models. Such models can only be built and analysed by the use of computer-aided tools.

PetriNet Toolbox

As indicated above the Petri net structure can be described in a matrix notation. This motivated the investigation of the applicability of MATLAB, a general purpose engineering computing software, to the synthesis and analysis of Petri net models.

A set of functions has been implemented for this purpose forming a simple Petri net toolbox. It is mainly characterised by its good integration into the MATLAB environment and its simplicity. It has been developed under MATLAB 5.3 and is being adapted to MATLAB 6.0 and MATLAB 6.1.

Although initially designed as a set of command line MATLAB functions for analysis of Petri net models and supervisory control synthesis, the toolbox has been upgraded by a graphical user interface - a *Petri-Net Creator*. The graphical user interface was developed by the use of MATLAB **`handle graphics`** routines. Figure 1 shows the working environment and a simple Petri net model.

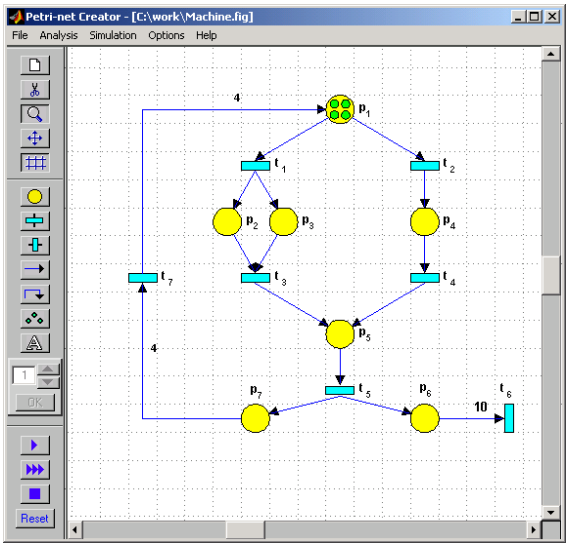

Figure 1: The Petri net editor in MATLAB

Inserting places and transitions, arcs and arc weights build a Petri net model graphically. Tokens corresponding to initial marking are inserted in the places and shown graphically for small numbers and numerically for larger numbers. Layout of the net can be re-arranged and the net can be saved to disk for a later use.

The structure of the model can be exported into the MATLAB Workspace where it is available for further manipulation and analysis. E. g., for the example in the fig. 1 we get the following MATLAB structure:

```
>> pn

pn =
     P: {'p1' 'p2' 'p3' 'p4' 'p5' 'p6' 'p7'}
     T: {'t1' 't2' 't3' 't4' 't5' 't6' 't7'}
     I: [7x7 sparse]
     O: [7x7 sparse]
    m0: [7x1 sparse]
```

Analysis functions

A set of analysis functions has been implemented and may be called either from the graphical user interface or directly from the MATLAB Command Window.

A simple visual analysis of the built model is possible by a token game simulation. A very basic algorithm is implemented. All transitions that are enabled are triggered simultaneously and the new marking of the net is displayed. In case of a conflict the firing transition is chosen randomly. The firing of the transitions is repeated by an adjustable rate.

A true analysis of the model is possible by another set of functions. Both coverability tree and invariant analysis are supported. The results of an analysis are displayed in the MATLAB Command Window.

Supervisory control synthesis

A method of supervisory control is implemented that enables to enforce marking constraints on the subsets of places in the Petri net [4]. The result of the synthesis is a set of additional places that are linked to existing transitions of the model. Some of the transitions may be defined as uncontrollable, which means their firings must not be directly affected by added places.

The synthesis is driven interactively by the Controller Wizard. Places that are affected by a marking constraint are selected by the mouse and the corresponding weights and marking bound are added. Several constraints may be defined. In the next step, uncontrollable transitions are selected. Then the required markings of the supervisory places are calculated as well as the arcs between the supervisory places and existing transitions. Resulting places must be manually positioned in the drawing workspace; corresponding arcs and markings are added automatically.

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Using Simulations in Material Flow Processes and Machine Design

.... presents material flow simulations, where simulation give both harmonised construction and controlling test

.... shows combined use of discrete software (Taylor) and mechanics software (ADAMS)

Development of computers and high-graded software has made it possible for engineers to model processes and machine workability in the space (closest to the real conditions), in order to simulate the real and dangerous work conditions.

This paper gives an analysis of material flow processes as a complex problem, which is a part of a business system. The starting point is at the simulations of different technically acceptable options, which are basis for technical performances of both the system and equipment. On the basis of the mentioned starting point simulations go on for previously accepted parameters and after that the previous concept is either accepted and put into designing or it is taken back to the starting point (FB) in order to make corrections upon system parameters. In this way the compatible construction of equipment altogether with the system requirements is achieved, and that is the way to optimisation.

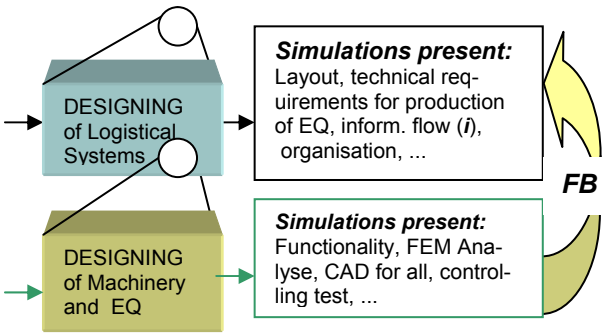

Figure 1. Simulations in technical systems

This paper will treat warehouse as logistic system and storage and retrieval machines (SM/RM).

Simulations

For the analysis of the conception and work of warehouse (figure 2) this paper deals with the example of a complex model in software Taylor. Input of pallet is modelled by any kind of real options; pallets are transported to the storage place by an appropriate device (transporters) and according to a probability rule they switched off at the control point.

In each warehouse cell, independent SM/RM operate take and transport pallets from the entrance transporter to the storage place according to a previously determined criterion (ABC or other). In this way it is also possible to simulate an output of pallets from warehouse. During simulations all statistics in all important points are obtained in order to monitor congestion and the need for buffers, analyses of working and waiting time of machines, for the sake of their handling efficiency and warehouse fulfilment, etc.

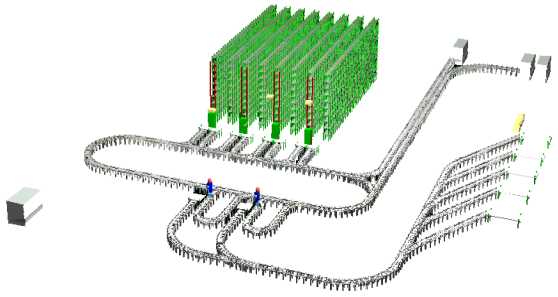

Figure 2. Warehouse (software Taylor)

For more technical options simulations offer:

- comparative analyses of conceptions,
- required equipment for each conceptions,
- technical parameters of equipment (work speed, buffer size and etc.),
- congestion points, requiring additional analyses and corrections,
- requirements for information flow in the system,
- handling efficiency of each part of equipment and warehouse,
- foundation of techno-economical analyses and evaluation e.g. of pallet storage place cost per day, which could impose redefinition of the beginning requirements.

All the mentioned requirements in the way, which could be, called optimisation process (that is looking for the best technical solutions within given limits), impose some specific technical solutions both for layout and for the equipment.

It means that the performances of each machine must be adaptable to the requirements of an accepted option. The following development of the problem and systematic but not specific approach starting from the previously defined technical performances for e.g. SM/RM (or for any other part of equipment EQ) become design task for designer.

In the figure 3, the animation of SM/RM operation is shown, using the software ADAMS (Automatic Dynamic Analysis of Mechanical Systems).

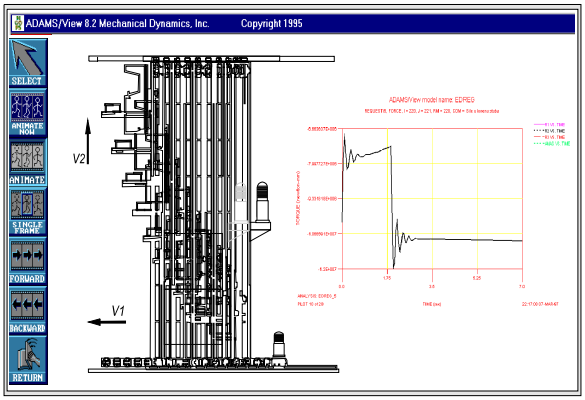

Figure 3. Animation of SM/RM operation (software ADAMS)

For modelling of machine operations, the bases are in the theory of elasticity and controlling. Practically all-important elements on the construction are elastic (matrices 12x12), and it gives simulation models with more hundreds degrees of freedom and which are described by more hundreds or thousands differential equations.

Described animation gives both simultaneous motion of SM/RM and lifting of the pallet. Motions are modelled either by motion equation or by changing forces during time (which is more precise) according to controlling rules.

For interesting construction points it is possible to get forces (and moment), motion, velocity and acceleration changes in the time domain. In the figure 3 bending moment change of SM/RM must in the connection point with under girder during the simulation has been shown.

Simulations of machine operations results in:

- visual display of machine functions, which is kinematics control,
- load spectrum in all important points, cross sections of the machine or devices,
- load peaks and dynamic factors which point to suspected points in construction or kinematics,
- load spectra which are bases for calculating fatigue,
- bases for spectral analyses,
- controlling tests from manual through all optimisation levels to active control,
- connections between load spectrum and control,
- knowledge of the consequences of damage situations.

If the simultaneous of the machine and equipment operation as a result give enormous technical demand of system projects which imposes specific technical solutions, less reliability and costs increase, the process goes back to the beginning towards examination of both system conception and performances (FB on figure 1).

Acceptable machine and control concepts make the way towards CAD and CAM.

Conclusion

The paper's example shows an approach, in which problem imposes direct simulations connecting of different fields because of great spectrum of limitations harmony (systematic and designing type) and reaching the aim in the sense of an appropriate conception and technical solutions which satisfy set demands (for example of standard and investor) which is iterative way to sufficiently good solution (optimisation).

The one who uses software as a tool must know its power limitations and be prepared to model details by using his own programs (e.g. subroutine) acceptable by the software. Demands for the specific fields of high-graded software application have come to the modules, which have additional possibilities within specific field.

The author had concept ADAMS Crane in 1991, and since some years ago there have been modules such as Tyre, Car, Rail, ...

In the domain of material flow simulation, Taylor Warehouse Optimiser has been expected, and the author is interested in the development of Port Crane atom, suitable for applications in port terminals.

The development of programmes for direct connections of different software for simulations would give a significant benefit.

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A set of functions has been implemented for this purpose forming a simple Petri net toolbox. It is mainly characterised by its good integration into the MATLAB environment and its simplicity. It has been developed

Crossing into Uncharted Territory - The Concept of Approximate X

.... Lofti A. Zadeh, father of fuzzy logic and soft computing, continues the development of concepts of uncertainity
…. Defines the concept of ***approximate X*** *as generalisation of theorems (****approximate theorem****), ...*
…. gives an example by a ***approximate Fermat's theorems***

In science - and especially in mathematics - it is a universal practice to express definitions in a language based on bivalent logic. Thus, if C is a concept, then under its definition every object, u, is either an instance of C or it is not, with no shades of gray allowed.

This deep-seated tradition - which is rooted in the principle of the excluded middle - is in conflict with reality. Furthermore, it rules out the possibility of graceful degradation, leading to counterintuitive conclusions in the spirit of the ancient Greek sorites paradox.

In fuzzy logic - in contrast to bivalent logic - everything is, or is allowed to be, a matter of degree. This is well known, but what is new is the possibility of employing the recently developed fuzzy-logic-based language **PNL** (Precisiated Natural Language) as a concept-definition language to formulate definitions of concepts of the form ***approximate*** X, where X is a crisply defined bivalent-logic-based concept.

For example, if X is the concept of a linear system, then ***approximate*** X would be a system that is approximately linear.

The machinery of **PNL** provides a basis for a far-reaching project aimed at associating with every - or almost every - crisply defined concept X a PNL-based definition of ***approximate*** X, with the understanding that ***approximate*** X is a fuzzy concept in the sense that every object x is associated with the degree to which x fits X, with the degree taking values in the unit interval or a partially ordered set.

A crisp definition of ***approximate*** X is not acceptable because it would have the same problems as the crisp definition of X.

As a simple example, consider the concept of a linear system. Under the usual definition of linearity, no physical system is linear. On the other hand, every physical system may be viewed as being approximately linear to a degree. The question is: How can the degree be defined?

More concretely, assume that I want to get a linear amplifier, A, and that the deviation from linearity of A is described by the total harmonic distortion, h, as a function of power output, P.

For a given $h(P)$, then, the degree of linearity may be defined in the language of fuzzy if-then rules - a language which is a sublanguage of PNL. In effect, such a definition would associate with $h(P)$ its grade of membership in the fuzzy set of distortion/power functions which are acceptable for my purposes.

What is important to note is that the definition would be local, or, equivalently, context-dependent, in the sense of being tied to a particular application. What we see is that the standard, crisp, definition of linearity is global (universal, context-independent, objective), whereas the definition of **approximate linearity** is local (context-dependent, subjective).

This is a basic difference between a crisp definition of X and PNL-based definition of ***approximate*** X. In effect, the loss of universality is the price, which has to be paid to define a concept, C, in a way that enhances its rapport with reality.

In principle, with every crisply defined X we can associate a PNL-based definition of ***approximate*** X. Among the basic concepts for which this can be done are the concepts of stability, optimality, stationarity and statistical independence.

But a really intriguing possibility is to formulate a PNL-based definition of ***approximate theorem***. It is conceivable that in many realistic settings informative assertions about ***approximate*** X would of necessity have the form of ***approximate theorems,*** rather than theorems in the usual sense. This is one of the many basic issues which arise when we cross into the uncharted territory of approximate concepts defined via PNL.

A simple example of ***approximate theorem*** is an approximate version of Fermat's theorem. More specifically, assume that the equality $x^n + y^n = z^n$ is replaced with ***approximate equality***. Furthermore, assume that x, y and z are restricted to lie in the interval $[1, N]$. For a given n, the error, $e(n)$, is defined as the minimum of a normalized value over all allowable values of x, y, z:

$$e(n) = \min_{x,y,z} \left| x^n + y^n - z^n \right|$$

Observing the sequence $\{ e(n) \}$, $n = 3,4,\ldots$, we may form perceptions described as, say, "for almost all n the error is small;" or "the average error is small;" or whatever appears to have a high degree of truth.

Such perceptions, which in effect are summaries of the behavior of $e(n)$ as a function of n, may qualify to be called ***approximate Fermat's theorems***.

It should be noted that in number theory there is a sizeable literature on approximate Diophantine equations. There are many deep theorems in this literature, all of which are theorems in the usual sense.

In a sense, an ***approximate theorem*** may be viewed as a description of a perception. The concept of a fuzzy theorem was mentioned in my 1975 paper "The Concept of a Linguistic Variable and its Application to Approximate Reasoning." What was missing at the time was the concept of PNL.

About BISC – BISC Mailing List

Lotfi A. Zadeh, the father of fuzzy logic and soft computing, is Professor in the Graduate School and director Berkeley Initiative in Soft Computing (BISC), Computer Science Division and the Electronics Research Laboratory.

The BISC Mailing List distributes information about current work in soft computing. It is is administrated by M. Nikravesh, BISC:

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SIMULATION CENTRES

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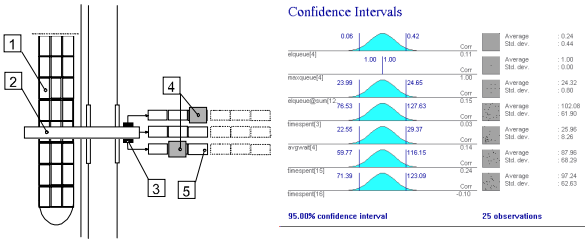
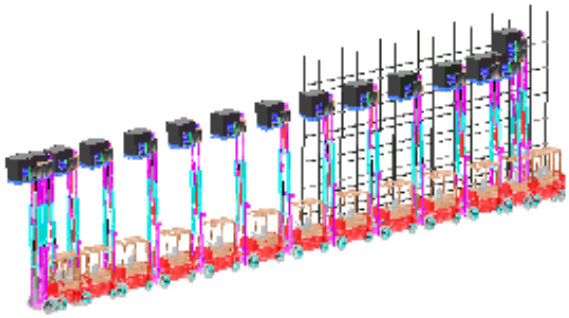
Since we have had a springboard from transportation technique, besides machines by the time our activity field has enlarged to materials flow and logistics. Simulations of machine operations have come to use since twenty years, and we have been using the software ADAMS for about fifteen years. We are the ones of the first users in the field of lifting machines in Europe about what we have many published papers in the German magazines.



Simulation of port terminal oper. (software Taylor)

With the computers and software powers have become much greater simulations of machine operations have developed from dynamic analyses and load spectrum to a tool for controlling tests and feedback of mechatronic, that is mechanic and electro-energetic part of the system with controlling and all towards an aim of dynamically harmonising machine operation. During the last years simulations for system (machine) analyses with active control have been in power, as for e.g. cranes and forklift trucks, which are manipulated robot.

By development of high-graded software for materials flow simulations, a logistic approach and solving of the problem as a whole, has been made possible and that from the application of simulations in domain of system designing on which the application of simultaneous of machine and device designing has been added to. Educational part of the work should make an emphasis and show to users that besides simultaneous software power there are limitations too and a need that they themselves should make a program for a detail in a problem. Our experiences with the software Taylor show that an atom for port cranes would be useful, since they are in use with great number of port terminals. Since we are interested in its development we call for co-operation.



Simulation of fork lift track operation
(software ADAMS, master paper M. Kostic)

Analysing of the fields in which someone deals with simulations at the University of Novi Sad, shows that there are users who write programs on their own, as well as the ones who use software:

- mathematics and computer science where within the course GPSSH language is studied,
- controlling in great number of fields and that in robotics, electro-hydraulic systems, traffic, distributive electric system, electric circuit, ….
- circulating of turbomachines and pipe system,
- logistics (marketing),
- polymerisation processes,
- biomechanics in sports.

There is an interest for simultaneous in the field of medicine and other spheres. Both individuals and groups deal with simulations also in other university centres, such as in e.g. Niš (about what has been already written in **SNE** and where they have tried to form an organisation within existing conditions), Belgrade, etc.

The complete chaos in Yugoslavia, which finished with the bombardment, has influenced the economy fall, which is financial basis for university, and impossibility for organised work upon simulations, software and literature supply, etc. With our involvement in EU research projects, the real conditions for increasing work quality would be created especially for young people as well as the possibility to provide us with equipment and literature by our work not donations. What is suggested, is organising the conference on simulations in our country, with the help and active presence role of the **EUROSIM** representatives from various fields which would be an opportunity for gathering of all interested in the matter and the beginning of organised work, which is integration in **EUROSIM**.

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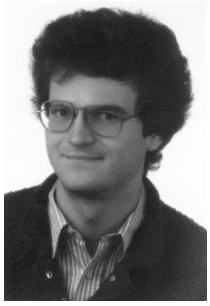
SIMULATIONISTS PERSONALITIES

This new SNE corner – introduced in December 2000 in SNE 29 - follows two aims: to introduce young simulationists or simulationist of the rising generation, resp., and to report about awards and personal events.

In both cases a curriculum vitae gives inside into the carrier of the simulationist:

- A young researcher or simulationist of the rising generation will be introduced in this corner, if e.g. his Ph.D. thesis is outstanding, or if he has got a research position, if he has got his first professorship or leading position, etc.
- Simulationists with high reputation often receive awards, or they are honoured in symposia, etc - these events will be reported here too.

Jochen Wittmann



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Dr. Jochen Wittmann is Speaker of the **ASIM** - Fachgruppe *Simulation in Umwelt- und Geowissenschaften* (*Simulation in Environmental Systems and Geoscience*) since 1999 and recently Scientific Assistant (Senior Research Assistant) at the Chair of Technical Information Systems (Head: Prof. D.P.F. Möller) at University Hamburg.

Being fascinated by the methods for modeling and simulation, all my scientific work stays in contact with this favourite topic:

The studies in computer science in Erlangen brought an early contact to simulation enthusiasts: the research group of Prof. Bernd Schmidt (now Passau University)! Without any hesitations and together with my additional interests in biology and medicine the diploma thesis dealt with a model for artificial respiration.

The chance to continue simulating was the simulation system SIMPLEX II, which has been developed in Erlangen this time. To be a proper computer scientist, I extended this system by a self-designed specification language: the experiment description language SIMPLEX EDL. This was the topic of my thesis in 1993.

Furthermore, the time in Erlangen has been influenced by a broad range of application studies to test the self-made system: transport systems, warehouses, and all kinds of continuous systems such as human heart beat, combustion engines and so on.

In 1994 there was a short interlude as a freelancing consultant for database applications. Naturally the database contained data to simulate: elements for controlling transport systems!

However, the scientific bacillus still was valid and so I seized the chance to work as a Scientific Assistent at Rostock University in 1995 and joined the group of Prof. Grützner.

My work in Rostock concentrated on modeling and simulation (what else!) in the context of environmental systems. Environmental models need data, especially data with a spatial and/or geographical dimension. This determined my research on the relation between geographical information systems and simulation tools and the mutual use of data and models in GIS, database and simulation.

Additional to lots of teaching activities I engaged in the working group *Simulation in Environmental Informatics* which elected me as its speaker in 1999.

Last year I changed again university and so I am now working in Hamburg in the group of Prof. D.P.F.Möller. The aura of medical applications lured me and so I am working in a project about integrating simulation methods into learning environments on the base of a common data management in the application area “medicine”!

To look retrospectively at my scientific work done so far, all projects emphasize the relation of modelling and simulation to other disziplines: firstly to a broad range of application areas for simulation, secondly to optimization and statistics for executing simulation experiments and thirdly to related software systems such as database systems, learning environments and geographic information systems. Despite of always dealing with “simulation and …” - topics, I feel as a “genuine” simulationist and hope I can stay in touch with modelling and simulation some more time!

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JOURNAL NEWS

IJS³T

International Journal of SIMULATION: Systems, Science & Technology

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UKSIM, the United Kingdom Simulation Society, has started an International Journal: IJS³T, printed at Nottingham Trent University. ISSN: 1473-8031 Print, 1473-804x Online.

Aims and Scope

The aim of the journal is to present high quality papers which are relevant to simulation researchers, practitioners, teachers, students and users of simulation systems, and which cover the practice, scientific theory, history or technology of simulation.

Contents Special Issue on Business Process Modelling (Dec. 2001)

- Editorial Paper: Current Trends in Business Process Modelling. Vlatka Hlupic
- An Analytical Framework and a Development Method for Interorganisational Business Process Modelling. G. M. Giaglis, D. A. Papakiriakopoulos, G.I. Doukidis
- Simulation Modelling Towards E-Business Models Development. V. B.Vuksic, M. I. Stemberger, J. Jaklic
- A Study of the Impact of Information Technology on Business Processes Using Discrete Event Simulation: a Reprise. Julie Eatock, Ray J. Paul, Alan Serrano
- Business Renovation: from Business Process Modelling to Information System Modelling. Andrej Kovacic, Ales Groznik, Marjan Krisper
- Dynamic Business Process Modelling (BPM) for Business Process Change. Nayna Patel, Vlatka Hlupic
- Business Processes Modelling and Automation in the Banking Sector: a Case Study. Mara Nikolaidou, Dimosthenis Anagnostopoulos, AphroditeTsalgatidou

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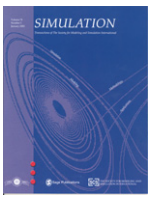
SIMULATION



Transactions of The Society for Modeling and Simulation International

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Editors-in-Chief: Adelinde Uhrmacher, University of Rostock, Germany; Tag Gon Kim, Korea Advanced Institute of Science & Technology (KAIST), Korea

... devoted to theory and to applications, all with clear relevance to general modelling and simulation issues.

Change of Publisher – from SCS to Sage. The Society for Modeling and Simulation International (SCS) is pleased to announce that as of January 2002, all the research articles previously published in both *SIMULATION* and *TRANSACTIONS* will be combined into a single, archival, peer reviewed monthly journal called *SIMULATION: Transactions of The Society for Modeling and Simulation International.*

Published on behalf of the SCS, the leading society devoted to advancing the discipline and profession of modelling and simulation *SIMULATION: Transactions of The Society for Modeling and Simulation International* will include articles devoted to theory and applications, all with clear relevance to general modelling and simulation issues. In addition to building the knowledge base in theory, methodology and technology, the journal also aims to help professionals and researchers (particularly those involved in multidisciplinary projects) apply advances in modelling and simulation to their application areas.

Free Electronic Access. Individual members of SCS who take out a subscription to *SIMULATION: Transactions of The Society for Modeling and Simulation International* will be provided with electronic access absolutely free of charge.

Introductory Offer. SCS members are entitled to a 30% discount on the cost of the standard membership subscription rate to *SIMULATION: Transactions of The Society for Modeling and Simulation International* for a limited time only. Subscribe before October 1st and Sage Science Press will reduce the cost of your subscription by $30! You'll still get free electronic access in addition to a printed copy of the journal delivered straight to your door every single month.

SCS - The Society for Modeling and Simulation International, P. O. Box 17900
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www.scs.org, www.sagepub.co.uk

EUROSIM SOCIETIES

EUROSIM
Federation of European Simulation Societies

www.eurosim.info

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.

At present **EUROSIM** has ten full members and three observer members:

- **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 (UK, Ireland)
- **AES** – Asociación Española de Simulación (Spain; observer member)
- **PSCS** – Polish Society for Computer Simulation (Poland, observer member)
- **ROMSIM** - Romanian Society for Modelling and Simulation (Romania; observer member)

The EUROSIM Congress is arranged every three years in Europe. **EUROSIM'01**, the 4th EUROSIM congress, took place in Delft, The Netherlands, June 26-29, 2001. The next congress, **EUROSIM'04**, the 5th EUROSIM Congress, will take place in September 2004 in Paris.

EUROSIM is governed by a Board consisting of one representative of each member society, plus the organizer of the last and next EUROSIM Congress (past president and president).

At the **EUROSIM'01** Congress the Board elected new officers for a three years period: Y. Hamam (president), L. Dekker (past president), M. Savastano (treasurer), P. Fritzson (secretary), J. Halin (SIMPRA), F. Breitenecker (SNE), F. Maceri (member).

The Executive Board met in June 2002 in Paris in order to discuss daily affairs and to prepare the Board Meeting (planned for autumn 2002). At this occasion SLOSIM and ASIM presented their application for organisation of **EUROSIM'07** (suggested for Sept. 2007 in Slovenia).

SNE. EUROSIM societies are offered to distribute to their members the journal **Simulation News Europe** (**SNE**) as official membership journal:

www.argesim.org/sne, www.eurosim.info/sne/

SIMPRA. Furthermore members can subscribe the scientific journal **Simulation and Modelling, Practice and Theory** (**SIMPRA**) at a significantly reduced price:

www.elsevier.nl/locate/simpra/

More information about EUROSIM and EUROSIM societies may be found at EUROSIM's WWW Server.

Due to technical reasons the web address of EUROSIM has changed. Instead of a .org – domain now a .info domain is used: http://www.eurosim.info/

For personal information you may contact the EUROSIM president, Mr. Y Hamam: hamamy@esiee.fr.

AES
Spanish Simulation Society

No news received.

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ASIM German Simulation Society
Arbeitsgemeinschaft Simulation

www.asim-gi.org

ASIM (Arbeitsgemeinschaft Simulation) is the association for simulation in the German speaking area. ASIM was founded in 1981 and has now about 700 individual members, and 20 institutional or industrial members.

News and Developments

The ASIM board met in April 2002 at FH Esslingen, Stuttgart, and in December 2001 at University Rostock. Main discussion points were: conferences ASIM'2002 and ASIM'2003, co-operation with SIMPAT'2003, other conferences to come, the activities of the working groups, ASIM publications, co-operation with SCS Europe and some organisational issues. The board also welcomed Dr. Böhnlein as new member. He represents the Working Group *Simulation in der Betriebswirtschaft*. A detailed report about this working group can be found in **ASIM –Nachrichten 1/2002**. Furthermore the board decided to apply for organisation of the EUROSIM Congress 2007 jointly with SLOSIM (ASIM co-organiser, Congress to be held in Slovenia).

Next meeting of the ASIM board will be in September 2002 in Rostock, on occasion of the ASIM'2002 conference. Subject will be preparation of ASIM 2003, cooperation amongst the working groups, cooperation with other organizations, etc. Please contact the speaker, if you feel an important issue should be discussed there.

ASIM Working Groups

A discussion on working groups is taking place. While some working groups are very active and consequently have many members, some working attract only few people to workshops and cannot attend more members, due to various reasons.

The big working groups organise themselves workshops and conferences, and they cooperate with societies and groups of their application area, regionally and internationally. In order to promote ASIM, and in order to support the small working groups, ASIM will be present at some conferences of application areas and ASIM will try to contact groups or societies in the specific application area.

The bigger working groups (Methods, Technical Systems, and Production and Logistics...) cooperate with VDI/VDE and partly with other groups from GI (ASIM itself is a subgroup of GI, the German Society for Informatics). Cooperation with GOR (Society for Operation Research), with societies in area of biomedical engineering and with KI - groups of GI could provide support for the smaller ASIM working groups.

It is also discussed either to combine small working groups, or to put them as subgroup into a big working group.

ASIM Promotion

ASIM is aware of the fact, that modelling and simulation has become a widespread method, which is not only found in simulation groups. Many application societies are running themselves successfully working groups on modelling and simulation. If in the German speaking area such groups in application societies exist, it makes no sense to set up a new ASIM working group with the same focus. It also turns out, that the smaller ASIM working groups are faced with such working groups in other societies.

As it makes no sense to reinvent the wheel again,

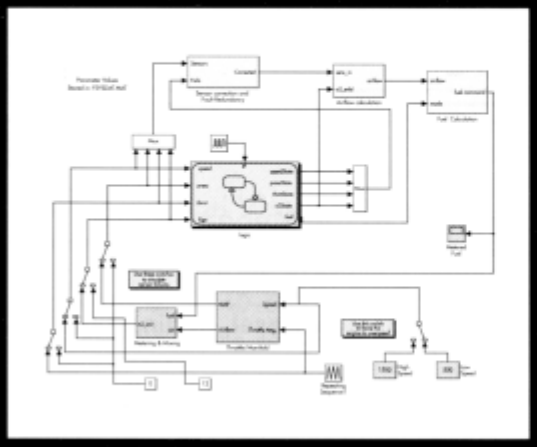
- ASIM intends to co-operate with such working groups on level of ASIM working groups,
- and ASIM will actively seek contacts with other societies and groups, **also at international level**.

Last year the first steps have been done. ASIM took part at the international Trade Fair and Knowledge Exchange on Applied Simulation and Visualisation SIM'2001, Freiburg / Breisgau, Germany, June 2001. This event opened the doors to cooperation with people from CFD (computational fluid dynamics). Furthermore ASIM organised there a workshop on *Education in Simulation*. This co-operation will be continued during the **SIMPAT'2003** Trade Fair and Conferences, Nuremberg, Germany, Mai 13-15, 2003 (see announcement in this **SNE** issue).

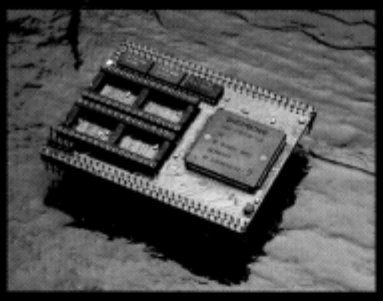
Conferences

ASIM organises the annual ASIM Conference, the ASIM Working Groups organise workshops (up to 100 participants) and conferences (more than 100 participants. ASIM cooperates in organising the three-annual EUROSIM Congress.

ASIM and SCS Europe will continue the co-operation at conferences based on co-sponsoring of ESM and ESS conferences (but not of the many other conferences of SCS Europe BVBA). Some organisational problems are to be solved, e. g. the co-operation with local chairs and conference fees.



Das Bild oben zeigt ein Modell für eine Einspritzanlage in Simulink und stellt die Möglichkeit dar, ereignisorientierte Blöcke aus Stateflow mit dynamischen Blöcken in einem Modell zu verbinden.
Mit dem Real-Time Workshop und dem Stateflow Coder kann aus einem solchen Modell automatisch ANSI-C-Code generiert werden. Durch die offene Architektur des Real-Time Workshop ist es möglich, diesen Code auf unterschiedlichster Echtzeit-Zielhardware (DSP-Boards, Microcontroller etc.) zu implementieren.



MATLAB 6

ECHTZEIT PER MAUS-KLICK!

Simulink-Modelle für Echtzeitimplementierungen in C-Code übersetzen.

Echtzeit- und Stand-alone- Simulation.

Mit dem vom Real-Time Workshop erzeugten Code können sowohl Stand-alone Simulationen mit maximaler Geschwindigkeit als auch Hardware-in-the-Loop-Simulationen im Echtzeitbetrieb durchgeführt werden.

Rapid Prototyping.

Die automatische Codegenerierung und Automatisierung von Kompilieren, Linken und Laden gibt Ihnen eine sehr schnelle und effiziente Möglichkeit, den grafisch entwickelten Algorithmus direkt in Verbindung mit der Zielhardware zu testen und zu optimieren.

Unterschiedliche Zielhardware.

Der Real-Time Workshop ermöglicht durch seine offene Architektur Echtzeitimplementierungen auf unterschiedlichsten Zielplattformen, vom Microcontroller über PCs bis hin zu verschiedenen DSP-Boards.
Die Besonderheit für die Microcontrollerimplementierungen ist die Generierung eines rein integerbasierten C-Codes mit dem CONTI-Tool, ohne daß sich der Benutzer mit Skalierungen und Wertebereich-einschränkungen befassen muß.

NEU!
Power System Blockset für elektrotechnische Systeme

Informationen zur MATLAB-Produktfamilie:
www-europe.mathworks.com

scientific COMPUTERS

ASIM also supports other annual international conference series, the long-running series *SIMVIS Simulation and Visualisation* (Magdeburg, Germany), and the new series *Agent-Based Simulation* (Passau, Germany).

With respect to international simulation conferences, the board suggested again,

- that the competition of too many simulation conferences (especially how it happened around the EUROSIM Congress 2001 in June 2000) is contraproductive,
- that the EUROSIM Congress should be scheduled in September (as from 1993 - 1995) in order to have more ASIM participants – and as it is planned for EUROSIM Congress 2004 in Paris,
- and that it would be of advantage to combine simulation conferences with conferences from application areas and / or to organise simulation conferences on the occasion of trade fairs

In order to support this plans, ASIM is willing

- to skip the annual ASIM conference in 2004, if the EUROSIM Congress EUROSIM'04 (Paris) takes Place in September,
- to co-operate with other EUROSIM societies in organising conferences (CROSSIM and ASIM have sent an application to the EUROSIM board for organising jointly the EUROSIM Congress 2007 in Slovenia,
- to organise working group meetings on the occasion of the SIMPAT Trade Fair and Conferences, and
- to continue this conference strategy for further years.

Because Modelling and Simulation is dealt with not only in ASIM and other simulation societies, ASIM will be present also at simulation tracks of conferences from various applications and on trade fairs and exhibitions.

Conferences / Coming Events

ASIM 2002 will be held in Rostock, Sept. 10 –13, 2002. We expect an exciting conference, also with touristic highlights. A preliminary program is mailed with this SNE issue. Detailed information can be found at the web.

Also the 1st Call for ASIM'2003 is available, which will take place in September 2003 in Magdeburg.

ASIM will co-organise or participate at the SCS Conferences **ESS'2002** (Oct. 2003, Dresden) and **ESM'2003** (June 2003) - please refer to www.scs-europe. org – and at the SIMPAT Trade fair and Conferences (May 2003, Nuremberg) – please refer to www.simpat.de.

Sept. 10-13, 2002	**ASIM'2002. 16. ASIM - Symposium Simulationstechnik.** Rostock. asim.informatik.uni-rostock.de
Oct. 23-26, 02	**ESS 2002** European Simulation Symposium. Dresden, www.scs-europe.org
Nov.11, 2002	**Fachgruppentreffen SPL.** Smartville, Hambach (Micro Compact Car Smart GmbH); Info: ASIM
Feb. 5 – 7, 2003	**4th MATHMOD Vienna** Int. Symp. on Mathematical Modelling; Vienna, simtech.tuwien.ac.at/MATHMOD
	ASIM-GMMS FG Sitzung on occasion MATHMOD 2003 (vs. 5.2.)
March 6-7,03	**SIMVIS 2003**. Simulation and Visualisation 2003. Magdeburg, www.simvis.org
March 2003	**ASIM-SUG 2003.** Workshop „Simulation in Umwelt- und Geowissenschaften. Cottbus. Info: ASIM
March 2003	**ASIM-SKI 2003** Treffen FG „Simulation und KI" Humboldt-Univ. Berlin; Info: ASIM
May 13 – 15, 2003	**SIMPAT 2003** Int. Exhibition & Conferences „Simulation und Visualisation in Processes, Applications and Technologies. Nürnberg, Info: www.simpat.org
	ASIM – FG-Workshops on occasion SIMPAT Working Groups planned: ***GMMS, STS, SPL***
June 2003	**ESM 2002** European Simulation Multiconference. Nottingham, Info: www.scs-europe.org
Sept. 16-19, 2003	**ASIM'2003. 17. ASIM - Symposium Simulationstechnik.** Magdeburg. asim2003.cs.uni-magdeburg.de

ASIM Publications

ASIM is publishing (co-publishing) **ASIM-Nachrichten** and **SNE** (Simulation News Europe). Both journals are regularly published and sent to all AIM member (as part of their membership 700 issues) and spread for promotion (500 issues).

Furthermore, the ASIM working groups report in so-called **ASIM - Mitteilungen** about their meetings, about special developments, etc - either as ASIM self-publication or as publication is series of other publishers (e.g. **ARGESIM Reports**).

ASIM co-operates with SCS Europe and with **ARGESIM** (TU Vienna) in publication of two book series:

- ASIM / SCS book series „Fortschritte in der Simulationstechnik – Frontiers in Simulation"
- ASIM / ARGESIM / SCS book series „Fortschrittsberichte Simulation – Advances in Simulation"

For detailed information see advertisement in this SNE issue or go to ASIM's web server.

Reports from the Working Groups

Many ASIM Working Groups met in spring 2002 – detailed reports may be found in **ASIM – Nachrichten** 1/2002.

The Working Group *Grundlagen und Methoden der Modellierung und Simulation* met on May 23rd and 24th at the Fraunhofer-Institut in Dresden. The broad program covered almost all issues of this working group.

The meeting of the Working Group *Simulation in der Umwelt- und Geowissenschaften* took place on March 07-08 in Cottbus. 35 persons, amongst them also researchers from foreign countries, reported and discussed actual trends and tasks.

The Working Group *Simulation Technischer Systeme* met in Bielefeld on March 4th and 5th. Topics were: Modelling methods and tools, Overview over applications of computer algebra, a presentation of the state of the art in simulation of production and logistics, Simulation in vehicle development and as a highlight presentations of examples modelled in VHDL-AMS.

As a highlight of the work, the Working Group *Simulation in Production and Logistics* held their conference *10. ASIM-Fachtagung Simulation in Produktion und Logistik* on March 06-08, 2002 at the Gerhard-Mercator-Universität Duisburg. The conference proceedings are already sold out. If there is enough interest, they can be reprinted. Please contact Rainer Rimane, if you are interested.

The Working Group *Simulation in der Betriebswirtschaft* organised their bi-annual Braunlage-Conference from March 11th -13th. The conference was well visited and led to interesting discussions. The working group restructured her anew and elected a new leader team. The representative for ASIM will be re-elected at their next meeting. ASIM hopes to welcome a strong and active group again in their midst.

Contact Addresses of Working Groups

GMMS *Grundlagen und Methoden in Modellbildung and Simulation (Methods in Modeling and Simulation)*
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SKI *Simulation und künstliche Intelligenz (Simulation and Artificial Intelligence)*
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SUG *Simulation in den Umwelt- und Geowissenschaften (Simulation of Environmental Systems)*
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SMBB *Simulation in Medizin, Biologie und Biophysik (Simulation in Medicine, Biology and Biophysics)*
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SPL *Simulation in Produktion und Logistik (Simulation in Production and Logistics)*
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Email: wenzel@iml.fhg.de, http://www.spl.asim-gi.org

SBW *Simulation in der Betriebswirtschaft (Simulation in OR)*
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Email: boehnlein@wiinf.uni-wuerzburg.de
http://www.asim-gi.org/sbw

SVS *Simulation von Verkehrssystemen (Simulation of Transport Systems)*
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http://www.asim-gi.org/svs

Annual Conference ASIM 2002

16. Symposium Simulationstechnik, Rostock, Sept. 10-13, 2002

ASIM.informatik.uni-rostock.de

The ASIM 2002 will take place at the University of Rostock from September 10-13. The organizing committee is chaired by Prof. Dr.-Ing. Djamshid Tavangarian (Department of Computer Science).

The topics of the conference cover all aspects of modelling and simulation. This includes:

- Modelling and Simulation Methods,
- Simulation Hardware and Software,
- Simulation Tools, Applications

The ASIM 2002 offers:

- Plenary lectures for new developments and trends
- Lectures and posters on all topics of modelling and simulation
- Practitioners forums for special applications
- Workshops about all current topics
- Exhibition of simulation soft- and hardware
- Tutorials
- User group meetings

Apart from the general poster session an additional poster session for student contributions will be organised. There graduates will have the possibility to present the results of their research.

Social program. Welcome Party – Conferences Dinner – Guided Tours, etc .

Location Rostock. Medieval foundation of the town in the year 1218. The town used to be a member of the "Hanse", a league of towns, which formed and influenced the political and economical life in Northeast Europe for more than three centuries. In the late Middle Ages and the Renaissance, Rostock won a lot of cultural influence mostly due to the foundation of the first university of North East Europe in 1419. Since the time of the Hanse, Rostock is the most important economic centre in Mecklenburg. Today, the town counts about 200.000 inhabitants, about 14000 students study at the university. Rostock offers its visitors a widespread range of cultural events.

INFO: ASIM.informatik.uni-rostock.de
www.asim-gi.org

Helena Unger
Helena.Unger@informatik.uni-rostock.de

ASIM 2003 - Magdeburg

17. Symposium Simulationstechnik

Rostock, 16.-19. September 2003

Organiser. ASIM and Otto-von-Guericke-Univ. Magdeburg, Institute for Simulation and Graphics, Prof. Dr. R. Hohmann

Conference Office: Otto-von-Guericke-Univ. Magdeburg, Fr. P. Janka, Universitätspl. 2, D-39106 Magdeburg, Tel +49 (0)391 67-18772, Fax - 11164

Deadlines: March 30, 2003 Deadline for Paper Abstracts (1-2 pages A4; 12 pt; 1,5-rows; pdf-File via e-mail); May 15, 2003 Notification of acceptance; June 15, 2003 full paper due

INFO: asim2003@isg.cs.uni-magdeburg.de
asim2003.cs.uni-magdeburg.de

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WWW-Information: *www.asim-gi.org*
Email: *info@asim-gi.org (for information)*
admin@asim-gi.org (for administration)

CROSSIM

Croatian Society for Simulation Modelling

http://rudjer.irb.hr/~crossim

General Information

CROSSIM (The Croatian Society for Simulation Modelling) was founded in 1992 and became a full member of EUROSIM in 1997. This year we celebrate the 10th anniversary of the Society.

CROSSIM is a non-profit society with the goal to promote knowledge and use of simulation methods and techniques and development of education and training in the field of simulation modelling. The Society is engaged in organization of professional meetings and publishing in the field.

The Society is represented by president, vice-president and a representative in international organizations and governed by the executive board consisting of the president and 8 members. Prof. Vlatko Ceric was the founding president of CROSSIM, and Asst. Prof. Jadranka Bozikov is the present woman president. The General Assembly of the Society meets once a year and every third one is electoral.

Membership

CROSSIM has only individual members and three categories of membership are recognized according to the statute: regular, honorary and student members. Currently, CROSSIM has 70 regular members who are coming mainly from the University of Zagreb and other three Croatian universities in Split, Rijeka and Osijek as well as from branch schools in Varazdin. There are also members from institutes, industry, and governmental institutions and a few international members as well. Annual membership is 60 kunas (equivalent to 8 Euro) for those receiving Simulation News Europe, and 20 kunas for others.

Information, Contact Address

The e-mail distribution list serves for communication among the members. To spread the information to all members you are invited to send an e-mail message to the following address: crossim@list.carnet.hr

Initial CROSSIM www site: rudjer.irb.hr/~crossim.

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Activities

Journal CIT. The Society co-operates with the University Computing Centre, Zagreb, in organization of international conference *Information Technology Interfaces* (*ITI*) that traditionally has a strong modelling and simulation section and in publishing *The Journal of Computing and Information Technology* (*CIT*). The journal covers the area of computer science and engineering, modelling and simulation, and information systems and publishes original scientific and professional papers, short notes, review articles and surveys, as well as book reviews.

All the information concerning CIT is available at cit.srce.hr/home.html.

Simulation Seminars. The Society organizes simulation seminars and workshops on a regular basis. Members are encouraged to present their ongoing work in order to discuss the problems and exchange experience. The last seminar was an overview of simulation modelling applications in veterinary medicine and was held at the School of Veterinary Medicine in Zagreb.

Past events

The **Third European Ecological Modelling Conference** was held in September 10-15 in Dubrovnik: 46 participants from 18 countries attended the conference; 49 oral and poster contributions were presented. Most papers are being considered for publication in *the Ecological Modelling Journal*. Prof. Tarzan Legovic, Vice-president of the *International Society for Ecological Modelling* and *CEO of the European Chapter*, organized the conference on behalf of CROSSIM.

From 25 to 30 March, Prof. T. Legovic organized a **Course** at the R. Boskovic Institute, Zagreb, on **Statistical Ecology**. There were 34 participants, mainly graduate students from various universities in Croatia. A CD was created by T. Legovic and B. Hackenberger to help the participants perform statistical analyses targeted, but not limited to, statistical ecology.

From 6 to 11 May, a **Course on Ecological Modelling** was organized at the R. Boskovic Institute, Zagreb by Prof. T. Legovic. Graduate students and young researchers are invited to attend. The course covered: Dynamics of one population in peaceful, periodic and stochastic environment. Optimum exploitation and the maximum sustainable yield in the above environments. Dynamics of two populations: prey-predator, competition, cooperation and epidemics. Dynamics of a food chain and an application to interplanetary agriculture. Food webs and cycles of matter. More info: Prof. T. Legovic t legovic@rudjer.irb.hr

ITI 2002 24th Conference Information Technology Interfaces, June 24-27, 2002, Cavtat

24th Conference *Information Technology Interfaces ITI 2002* was held in June 24-27, 2002 in Cavtat near Dubrovnik. Cavtat was the host of the conferences from 1980 to 1991 when the war against Croatia started. Later the conference moved to Pula on the Northern Adriatic.

Now after 10 successful, memorable years in Pula the conference returned to a small, charming town Cavtat. The Conference venue was a luxurious five-star Croatia Hotel.

Croatia Hotel in Cavtat, a venue of 24th ITI

The session *Modelling, Simulation and Optimization* was one among thirteen topics and Asst. Prof. Vesna Bosilj Vuksic from the Faculty of Economics, University of Zagreb was acting as chairwoman.

The conference was organized by the University Computing Centre, Zagreb, and sponsored by IMACS (The International Association for Mathematics and Computers in Simulation) and co-sponsored by CSC (The Society for Computer Simulation International).

Invited papers and original contributed papers were published in the Conference proceedings indexed in the INSPEC database. Selected papers from Conference proceedings will be considered for publication in the special issues of the IMACS journal *Mathematics and Computers in Simulation* or *Journal of Computing and Information Technology* (CIT).

Further information about *ITI 2002* is available at iti.srce.hr.

Jadranka Bozikov
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DBSS Dutch Benelux Simulation Society

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 cooperation with its members and is further affiliated with SCS International, IMACS, and the Chinese Association for System Simulation and the Japanese Society for Simulation Technology.

The Steering Committee of DBSS exists of:

A.W. Heemink (TU Delft): Chairman
L. Dekker: Vice-Chairman
M.J. Dekker-Genemans: Secretary
W. Smit (AKZO NOBEL): Treasurer
Th.L.van Stijn (Min. of Public Works/RIKZ): Member

Membership - Information

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:

1. Euro 34,- individual member or Euro 68,- institutional member, which means that you will receive the newsletter Simulation News Europe two times a year (one double, one single issue).
2. Euro 68,- individual member or Euro 114,- institutional member, which means that you will receive the Journal Simulation Practice and Theory eight times a year, and Simulation News Europe two times a year (one double, one single issue).

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. For institutional members counts that they can join national "DBSS events" with three persons against the reduced fee.

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

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CSSS

Czech and Slovak Simulation Society

General Information

CSSS (The Czech and Slovak Simulation Society) has about 150 members in 2 groups connected to the Czech and Slovak national scientific and technical societies (Czech Society for Applied Cybernetics and Informatics, Slovak Society for Applied Cybernetics and Informatics -SSAKI). The main objectives of the society are: development of education and training in the field of modelling and simulation, organising professional workshops and conferences, disseminating information about modelling and simulation activities in Europe to its members, informing the members about publishing in the field of modelling and simulation. Since 1992 CSSS is a full member of EUROSIM

Past Events

The 35th International Conference on *Modelling and Simulation of Systems* (MOSIS'2001) that took place on the 9th to 11th of May 2001 in Hradec nad Moravicí, Czech Republic, was organised by the Department of Computer Science FEEI VŠB – Technical University Ostrava and Department of Computer Science of FEECS University of Technology Brno and sponsored by CSSS, ASU EUROSIM and SCS. Technical journal AUTOMATIZACE Praha was a medial sponsor. The Conference was connected with two Workshops: workshop ISM'2001 -Modelling of Information System and workshop MANAM'2001 - Modelling in Manager Works. Some 95 participants from Czech republic, Slovakia, Poland, Germany, Greece, Russia and Great Britain attended the workshop

The XXIII International Colloquium on *Advanced Simulation of Systems* (ASIS 2001) that took place on the 11th to 13th September 2001 in Velké Losiny, Czech Republic was organised by the Department of Computer Science FEEI VŠB – Technical University Ostrava and Department of Computer Science of FEECS University of Technology Brno. The chairman of the international program committee was Dr. Ing. Jan Štefan. Some of the interesting point in topic were "Simulation in Hydrodynamics", "Education of Modelling and Simulation in Education", Parallel and Distributed Simulation", New Modelling Paradigm", "Simulation Case Studies". Some 55 participants from Czech republic, Slovakia and Poland attended the workshop. The Colloquium was connected with annual meeting of CSSS.

The 3rd International Workshop *Modelling and Simulation in Management Informatics and Control* (MOSMIC'2001) took place on October 9-10, 2001 Zilina- Suľov, Slovak republic.

It was organised by the Faculty of Management, Control and Informatics - University of Žilina, Slovak Society for Applied Cybernetics and Informatics, Bratislava and CSSS. The chairman of the international program committee is Prof. Mikulas Alexik. Proceeding of the workshop has 165 pages with 23 reviewed papers. Over 25 attendants participated. The CSSS boar meeting has taken place during workshop.

The 36th International Conference on *Modelling and Simulation of Systems* (MOSIS'2002) took place on April 22-24, 2002, Rožnov pod Radhoštěm, Czech Republic. The Conference was connected with two Workshops: workshop ISM'2002 -*Modelling of Information System* and workshop *MANAM'2002 - Modelling in Manager Works*. The chairman was Dr. Ing. Jan Stefan jan.stefan@vsb.cz.

The *3rd International Carpatian Control Conference ICCC'2002* took place on May 27-30, 2002, Ostrava - Beskydy (Malenovice, Hotel Petr Bezruč), Czech republic. One of parallel sesions of conference was also "Identification, modelling and simulation of processes and systems". The president of International Program Committee was Prof. Ing. Antonín Víteček, Phd, dean of faculty of Mechanical Engineering, Technicval University of Ostrava, Czech republic. More information: www.icc-conf.cz

Coming Events

The 24th International Workshop „Advanced of Simulation Systems" (ASIS'2002) will take place in the Moravian town Krnov, Czech Republic on September 10-12, 2001. The chairman of the international organising committee is Dr. Ing. Jan Stefan. The workshop will be connected with annual meeting of CSSS.

The 5th International Scientific Conference on *Electronic Computers and Informatics'2002* will take place on October 10-11, 2002, in Herlany Slovak Republic. One of the topics is concentrating on Modelling and Simulation of the Systems. The general chair of the conference is prof. Jelšina, Technical university of Košice. More information hornad.fei.tuke.sk/kpi/eci

CSSS Information

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Francosim

Société Francophone de Simulation

FRANCOSIM was founded in 1991 and aims to the promotion of simulation and research, in industry and academic fields. Francosim operates two poles.

Pole "Modelling & simulation of discrete events systems"

To improve the necessary synergy between industry and academia workers in the area of system modelling, the pole co-organises the series of conferences "MOSIM" (Modelling and Simulation). The third conference took place in April this year: *MOSIM'01, Industrial systems design, analysis and management, April 25-27, 2001, Troyes (France)* - see www.univ-troyes.fr/mosim01

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Pole "Modelling & simulation of continuous systems"

This pole has launched in 1999 a series of conferences on modelling and simulation in medicine and biology (BioMedSim). The first was organised in April 1999 (BioMedSim'99) and has led to the selection of several papers to appear in a special issue of SIMPRA. The pole has also co-organised in June 2001 the 2nd BioMedSim'01 in parallel with EUROSIM'2001.

This pole will organise the next BioMedSim Conference on the 27th-30th of May 2003 at the University of Balamand, Lebanon (see call for papers below).

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BioMedSim2003 - Call for Papers

BioMedSim2003 is the third of a series of conferences to be held every 2 years (the first was held in Paris, France in 1999 and the second took place in Delft, Netherlands in June 2001). These conferences are intended to be an opportunity for researchers and industrials to present fundamental work and applications in fields related to the modelling and simulation in living systems. As both biological and mathematical aspects are involved, the organizers expect that this series of conferences will offer researchers and developers in both fields an opportunity to meet, exchange information and establish contact.

In that regards, the Conference committee is delighted to issue a letter of invitation to the biomedical community and to every person interested in the field from all over the world to the 3rd Conference on "Modeling and Simulation in Biology, Medicine and Biomedical Engineering". The event will be held at the main campus of the University of Balamand located in the North of Lebanon.

The conference is concerned with, but not limited to, the following themes:

- Mathematical modelling in biology, medicine, biophysics and biochemistry;
- Mathematical modelling in immunology, neurophysiology, population dynamics, enzyme kinetics;
- Mathematical models for drug administration;
- Modelling and design of control, assist. devices;
- Signal and image processing chains for biological and medical applications (emphasis on diagnosis);
- Biomechanics and artificial organs, study of muscular motion;
- Models, techniques and simulation tools to case integrated understanding of living organisms functions;
- Knowledge based systems and knowledge driven data processing for biological and medical applications with emphasis on aids to explicit diagnostic process and diagnosis rule formation;
- Systems for educational purposes in sub-fields of biology and medicine with explicit emphasis on mathematical models, simulation and display tools.
- Mathematical models and simulation studies on cancer and screening infectious diseases.
- Regulation of gene Expression
- Virtual Reality Assisted Surgery

Furthermore, all related topics will be considered in the scientific program. The submission of papers in areas other than the ones indicated above is highly encouraged provided that they are related to the theme of the conference: Simulation in Medicine, Biology and Biomedical Engineering.

Deadlines:

- Extended abstract (2 pages) submission: 30th of November 2002.
- Notification of extended abstract acceptance: 30th of January 2002.
- Submission of full paper: 15th of February 2003.
- Acceptance of final paper: 15th of March 2003.
- Author's registration: 15th of April, 2003.

For more information visit the conference web site: www.balamand.edu.lb/docs/biomedsim.html

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HSS Hungarian Simulation Society

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 Budapest University of Technology. At the Department of Information and Knowledge Management on the Faculty of Economic and Social Sciences of the Budapest University of Technology and Economics classes "Simulation and Modelling in Economy" and an other "Decision Making and Management using Simulation" as well as simulation laboratory practices are held for graduate and postgraduate students studying economy, informatics and electrical engineering. Ph.D. students participate in various simulation research projects aimed at methodological basic research as well as applications.

The establishment of a new doctoral school where simulation and knowledge management is to become a formal program under the leadership of the chairman of HSS is in preparation. These R&E activities are coordinated by the Int. McLeod Institute of Simulation Sciences Hungarian Center (MISS/Hungary).

Activities University Gyor. In the town of Gyor at the Szechenyi Istvan University simulation is also taught. Here undergraduate students of informatics, electrical and traffic engineering study the class „Simulation Methodology and Applications". The Hungarian MISS Satellite Center is located in this university. The establishment of a doctoral school with a program on simulation is in preparation, where cooperation with the MISS Center at TU Vienna (Prof. Dr. F. Breitenecker) is envisaged. Our efforts are intended to contribute to the dissemination of the various aspects of simulation for the young generation.

We have participated at EUROSIM and SCS conferences and presented our simulation results. Our members have been and are successfully participating in national and EU simulation projects.

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ISCS
Italian Society for Computer Simulation

www.iscs.it

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, which recently was elected anew. New chairman is Mario Savastano from University Napoli. Detailed information will be given in the next **SNE.**

Membership

At present ISCS counts 129 members: 13 institutional, 4 honorary, 110 regular and 2 affiliate.

Information, Mailing List, Website

For further information or application for membership, please contact (prel. info address):

ISCS - c/o CNR - IRSIP
Mario Savastano
Via Claudio 21, I – 80125 Napoli, Italy
mario.savastano@unina.it

We recall that an electronic mailing list has been constituted for persons interested in the ISCS activities. In order to be included in such list, it suffices to send an E-mail message (Subject: ISCS mailing list) containing name, affiliation and address (surface and electronic) to the following address:

cortelle@info.uniroma2.it

To spread information to Italian simulation community, you are invited to send E-mail messages to above given email address; your information will be forwarded to all the addresses of the mailing list.

Please have a look at the new designed website of ISCS: www.iscs.it

Mario Savastano
mario.savastano@unina.it

PSCS
Polish Society for Computer Simulation

General Information

PSCS (The Polish Society for Computer Simulation) was founded in 1993 in Warsaw. PSCS is a scientific, non-profit association of members from universities, research institutes and industry in Poland with common interests in variety of methods of computer simulations and its applications.

At present PSCS counts 247 members. The Board of third cadence consisting of the following persons directs the affairs of the PSCS:

- Andrzej Tylikowski - President
- Leon Bobrowski - Vice President
- Andrzej Chudzikiewicz - Vice President
- Zenon Sosnowski - Secretary
- Kazimierz Furmanik- Treasurer
- R. Bogacz, J. Rybicki, Z. Strzyzakowski

Activities. The main activities of the Polish Society for Computer Simulation are annual conferences known as „PSCS Workshops on Simulation in Research and Development". The PSCS Workshops were organized in: Mielno (1994), Warszawa (1995), Wigry (1996), Jelenia Gora (1997, 1998), Bialystok & Bialowieza (1999), Zakopane – Koscielisko (2000).

Past Events. The annual PSCS Workshop on *Simulation in Research and Development* took place on August 30 – September 1, 2001 in Gdansk-Sobieszewo, Poland. For reports, see last **SNE** issue. Proceedings of the 7th PSCS Workshop see R.Bogacz, E. Kolodzinski and Z. Strzyzakowski (Eds.), Warsaw, 2000, (in Polish, price is 20,- PLN).

The general assembly of PSCS members was held at the last PSCS workshop on August 31, 2001. This meeting, besides representing an interesting forum to discuss and promote the activity of the society, was the occasion to present and approve the new PSCS Bylaw.

Coming Events. Prof. T. Krzyzynski will organize the 9th PSCS Workshop on „Simulation in Research and Development" on August 28-31, 2002. For information please contact Prof. T. Krzyzynski directly: tkrzyz@tu.koszalin.pl

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SIMS
Scandinavian Simulation Society

browse.to/sims.
www.ida.liu.se/~pelab/sims

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 practical matters are taken care of by the SIMS board consisting of two representatives from each Nordic country.

The general goals for the society are the following:

- Further the science and practice of modelling and simulation in all application areas
- Be a Scandinavian forum for information interchange among modelling and simulation professionals and non-professionals in Denmark, Finland, Norway and Sweden
- Be a channel for information exchange between the Scandinavian modelling and simulation community and the international modelling and simulation communities.

The society pursues its goals by:

- Arranging technical and scientific meetings and symposia
- Supporting lecturing and publication
- Collecting and disseminating information
- Maintaining contacts with national and international organizations with similar purposes

The SIMS annual meeting takes place at the annual SIMS conference or in connection to international simulation conferences arranged in the Nordic countries.

Coming Events

SIMS 2002 will be held in Oulu, Finland, Sept. 26-27 2002. Info at http://ntsat.oulu.fi/sims, further details see below.

VRForum 2003, 05.11.03 - 05.11.03.The *Forum on Virtual Reality, Modelling and Simulation*, will be held in May 2003 in Linköping, Sweden. Info:www.ida.liu.se/~pelab/VRForum/

SIMS Structure

SIMS is organised as federation of regional societies. There are **FinSim** (Finnish Simulation Forum) and **MoSis** (Society for Modelling and Simulation in Sweden).

Nnow SIMS has also national organisations in Norway and Denmark as members.

Membership, SIMS Board

Peter Fritzson, chairman
Sture Alexandersson, Esko Juuso,
Brian Elmegaard, Kim Sørensen,
Kaj Juslin, Anne Elster, Bernt Lie

You can contact the chair of the SIMS board, Prof. Peter Fritzson (Linköping University, Sweden),

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To become a member of SIMS you should join one of the **SIMS** member organizations, as specified on the SIMS web page, e.g. **MoSis** or **FinSim**.

Contact Address, Information

Updated SIMS web page with news and recent information:

http://browse.to/sims
http://www.ida.liu.se/~pelab/sims

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SIMS 2002

43rd Scandinavian Conference on Simulation and Modeling

Oulu, Finland, September 26-27, 2002.

Conference organiser is the Finnish Society of Automation together with the University of Oulu. The conference will be held in autumn, which is one of the most beautiful seasons in Northern Finland. In the autumn, the nature in Northern Finland is characterized by colourful trees; the phenomenum that we call “ruska” in the Finnish language

http://www.laplandtravel.fi/english/index.html

Oulu is an attractive, high-quality conference city. It is known for high-level technology expertise and rapid growth with 120 000 inhabitants. Oulu hosts a well-known science park and university with 12000 students. Oulu locates by the sea - on the coast of the Bothnia Gulf and 220 kilometers from the Arctic Circle. See following web pages:

http://www.ouka.fi/english/index.html
http://www.oulu.fi/ english/index.html
http://www.technopolis.fi/

There are a high number of direct flights from all over the world to Helsinki, the capital Finland that is only one hour’s flight from Oulu. The flight connections between Oulu and Helsinki are good, close to twenty flights per day. Between Stockholm and Oulu there are three direct flights per day.

The aim of this conference is to cover broad aspects of modeling and simulation and scientific computation. It will thus be of interest for model builders, simulator personnel, scientists, engineers, vendors, etc. The scientific program will consist of technical sessions with submitted and invited papers, and is open for poster sessions and vendor demonstrations.

Conference themes include, but are not limited to, the following topics:

- Modelling Tools
- Numerical methods for simulation
- Simulation Tools and Technology
- Visualization of Modelling and Simulation Results
- AI in Simulation
- Parallel simulation
- Simulation of distributed parameter systems
- Training Simulators and Real-Time Simulation
- Simulation in Control Engineering
- Process Plant Simulation
- Simulation in Pulp and Paper Industry
- Simulation in Metallurgical Industry
- Simulation in the Energy Sector
- Power Station Design
- Simulation in Chemical Engineering
- Simulation in Biological and Environmental Engineering
- Simulation in Electronic Manufacturing
- Simulation of Electronic Systems
- Simulation in Mechanical Engineering
- Simulation of Marine Systems

Presented papers will be considered for publication in the EUROSIM scientific journal "Simulation and Modelling – Practice and Theory (SIMPRA)".

Authors should submit draft papers (maximum 6 pages) as a single PDF (Portable Document Format) or PS (Postscript) file (ZIP compression is encouraged in this case) as e-mail attachments to the Secretariat to the address office@atu.fi. Abstracts will be reviewed by members of the Scientific Committee, and notification of acceptance or rejection will be sent out by May 17th, 2002. Final version of accepted "camera-ready" papers are due by June 17th, 2002.

An Exposition for books, commercial simulation programs and small-scaled experimental equipment used for simulation purposes will be held in conjunction with the Conference to provide an opportunity for organizations to display their products or services to Conference delegates. Fur further details, please, contact the Conference Secretariat.

Further information: on SIMS'2002

SIMS2002
43rd Conference on Simulation and Modelling
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ROMSIM Romanian Modelling and Simulation Society

General Information

ROMSIM has been founded in 1990 as a non-profit society, devoted to both theoretical and applied aspects of modelling and simulation of systems.

ROMSIM currently has about 100 members from both Romania and Republic of Moldavia. The main objectives of ROMSIM are: development of new methods and instruments of modelling and simulation of systems, development of new application of modelling and simulation of both natural systems and those created by man, development of education and training in the field of modelling and simulation of systems. Organization of national scientific events in the field of modelling and simulation and participation at international conferences is an other important objective of ROMSIM. In April 1999 ROMSIM has been accepted as an observer member of EUROSIM.

Past Events

ROMSIM was involved in the organization of 4th EUROSIM Congress, held in Delft in June 2001. The contribution of ROMSIM at this event has been presented in a previous issue of SNE. ROMSIM helped the organization of the 9th IFAC/IFORS/IMACS/IFIP Symposium on Large Scale Systems: Theory and Applications, held in Bucharest in July 2001.

Several members of ROMSIM presented communications in the frame of this Symposium and/or chaired Technical Sessions. Several members of ROMSIM presented communications at CSCS-13th International Conference on Control Systems and Computer Science, held in Bucharest in May 2001. Some members of ROMSIM attended ECC-European Control Conference, held in Porto, Portugal, in September 2001.

Coming Events

ROMSIM is involved in organization of the periodic scientific seminary titled Fuzzy Systems and Fuzzy Logic; 15 to 20 specialists attend the reunion of the seminary. The seminary present and discuss both theoretical and applied contributions of participants, in the field of fuzzy sets, fuzzy logic and fuzzy systems. We emphasize that the founder of this seminary was the well-known fuzzy expert Prof. C. V. Negoita.

An important future activity of some ROMSIM members will be developed in the frame of 15th IFAC World Congress to be held in Barcelona, Spain and where several members of ROMSIM will present scientific communications. Taking into account the prestige of IFAC-International Federation of Automatic Control the acceptance of some papers of ROMSIM members to be included in the program of the IFAC Congress can be seen as a success.

We emphasize also the activity of ROMSIM members in the field of publishing books, monographs and articles in international and/or Romanian journals. Some monographs are to be published in a new Series titled Technologies of Information, of Technical Publishing House, Bucharest and articles will be published in the Romanian journals SIC-Studies in Information and Control and RRIA-Romanian Journals of Informatics and Automatics. ROMSIM members ensure the reviewing of articles submit by authors to Editorial Staff of these journals.

At the demand of Prof. Yskandar Hamam, EUROSIM President, a ROMSIM member was proposed for international programme committee of BioMedSim03 conference.

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SLOSIM Slovenian Society for Simulation and Modelling

msc.fe.uni-lj.si/SLOSIM

General information

SLOSIM (Slovenian Society for Modelling and Simulation) was established in 1994 and become the full member of EUROSIM in 1996. It has 90 members from both Slovenian universities, institutes and industry as well and aims the promotion of modelling and simulation in industrial and academic environments and to facilitate communication among corresponding groups. Members of SLOSIM are automatically members of the federation of European simulation societies EUROSIM.

News

ERK Conferences. SLOSIM cooperated in the organization of the traditional ELECTROTECHNICAL AND COMPUTER CONFERENCE ERK'2001 in September 2001 in Portorož, where three simulation sessions which covered methods and algorithms in continuous and discrete event area but also applications in both areas were organized. The ERK'2002 conference will be in Sept. 2002 in Portorož (see below).

Military Simulations. In April the Department for Research and Simulation within the Center of Military Education organized a presentation for SLOSIM members. Both sections: the Section for Battle Simulations and the Section for Military Operation Research participated. The regular SLOSIM board meeting took place. The visit will be presented in November issue.

Contributions SNE. The significant improvement of the renewed version of Simulation news Europe gives also SLOSIM members a variety of new possibilities for contributions. These are:

EUROSIM Societies
Industry news
Conference reports
Simulation centres
Book reviews
Simulationists
Books and Journals
Technical notes
Short notes

Please send by email the possible contributions for items 1-7 to Borut Zupančič (member of SNE News Editorial Board) (borut.zupancic@fe.uni-lj.si) and for items 8 and 9 to Rihard Karba (member of SNE Editorial Board) (rihard.karba@fe.uni-lj.si). The WORD templates for all contributions are available.

ERK'2002 11 th Electrotechnical and Computer Science

The conference will be held on September 23-25, 2002 in Portorož, Slovenia. Videoconferences, invited lectures, presentations and tutorials will be held in conjunction to the basic scientific program. The Conference is bilingual, with presentations in English and Slovenian.

The following areas will be represented at the conference:

electronics,
telecommunications,
automatic control,
simulation and modelling,
robotics,
computer and information science,
artificial intelligence,
pattern recognition,
biomedical engineering,
power engineering,
measurements,
didactics.

Camera-ready paper due: 22 July 2002
Notification of acceptance: end of August 2002
Additional information: www.ieee.si/erk02

Conference Chairman

Baldomir Zajc
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(member of the SNE News Editorial board)
http://msc.fe.uni-lj.si/SLOSIM/

UKSIM
United Kingdom Simulation Society

ducati.doc.ntu.ac.uk/uksim/

General Information

The UK Simulation Society (**UKSIM**) has over 100 members throughout the UK from both universities and industry. It is active in all areas of simulation and it holds a biennial conference as well as regular meetings and workshops.

Conferences and Workshops

The UK Operational Research Society's **Simulation Study Group/UKSim Workshop** was held in Hornton Grange, Birmingham University on March 20 and 21 2002. It was well attended (70 participants) and addressed many issues of current interest in simulation.

The Keynote Address was given Professor Richard Nance with the title of The Simulation Research Agenda: Hope, Hype and Hyperbole. In the talk he defined criteria for problems that might be eligible as 'Grand Challenges' in simulation and gave a number of examples. Professor Nance also joined Professor Ray Paul, Professor Mike Pidd and Dr Simon Taylor in a Panel that discussed the merits of model reuse.

There were ten sessions in all including ones on the GROUPSIM network, Simulation in Defence, Simulation and Artificial Intelligence. John Ladbrook of Ford gave an especially interesting account of the measurement of factory breakdowns and the need to include human factors in the modelling process. Tony Waller gave a dramatic presentation showing the rapid advances in virtual world simulation.

The workshop also had a vendor exhibition that showcased some of the best examples of simulation tools and consultancy.

The conference chairs were Dr Stewart Robinson (UKSim/OR Society, Warwick Business School) and Dr Simon Taylor (OR Society, Brunel University), and the Programme Chair was Dr Tillal Eldabi (Brunel University).

The workshop was sponsored in part by the GROUPSIM Network, a community representing the rapidly expanding area of collaborative simulation modelling (see www.groupsim.com for further details).

UKSIM biennial conferences. The next biennial UKSim conference will be held in March 2003 in Cambridge. Further details will be available on UKSIM Web site in due course.

Publications

The UKSIM is publishing the **International Journal of Simulation: Systems, Science & Technology** (IJS^{3}T). At begin of 2002 a special issue on Business Process Modelling (ed. V. Hlupic) was published. For more details please refer to the corner *Journal News* in this **SNE** issue or to the web site:

ducati.doc.ntu.ac.uk/
uksim/journal/issue-1/cover.htm

UKSIM Website

UKSIM has updated the society's website. Amongst information on UKSIM the website offers links to journals, to simulation tools (partly free), etc.

Membership, Information

Membership of the UK Simulation Society is very good value at only £20 per year including a subscription to Simulation News Europe.

Those who attend the biennial conferences get free two-year membership untill the next conference. For more information about the Membership please contact the Membership Secretary:

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SCS

Society for Modeling and Simulation International

www.scs.org

www.scs-europe.org

SCS Structure

SCS is the international multidisciplinary forum dedicated to research, development, application and education in modelling and simulation. Since it's founding in 1952 as Society for Computer Simulation, the world changes and topics related to simulation become more complex and methodology oriented. Due to that the Society decide during the annual Board of Directors Meeting at the Summer Computer Simulation Conference 2000, held at Vancouver, to change its name to Society for Computer Modeling and Simulation.

The Society operates since 1952 a headquarter in San Diego, California, USA and since 1985 a European SCS Office in Ghent, Belgium. The later was changed in 1994 into SCS Europe, which now is the organisational and financial organisation behind the SCS European Council, which was established in 1991.

SCS Europe

SCS Europe runs the SCS European Publishing House, which cooperates very close with ASIM, the German speaking Simulation Society, with members from Austria, Germany and Switzerland. Moreover SCS Europe organises international recommended scientific conferences on computer modelling and simulation and related fields.

The flagships of which are the "European Simulation Multiconference" (**ESM**) and the "European Simulation Symposium" (**ESS**), and several smaller conferences on specific topics. ESM and ESS are very well accepted by conference participants, shown by the figures of about 180 to 250 participants.

In 2000 SCS Europe and ASIM agreed, due to the successful cooperation in the common publication activities, to start a closer cooperation in international conferences. The first ESS/ASIM Joint Conference was the ESS 2000, held in Hamburg. From there on, ASIM acts as co-sponsor of all ESM and ESS conferences.

Conferences ESM, ESS, SIMVIS and Agent Based Simulation

ESM and ESS. SCS Europe is running the almost classical conference series **ESM** (European Simulation Multiconference; in June) and **ESS** (European Simulation Symposium; in Oct./Nov.). Sites (prel.) are:

- 16th ESM 2002 Darmstadt
- 14th ESS 2002 Dresden
- 17th ESM 2003 Nottingham
- 15th ESS 2003 Delft
- 18th ESM 2004 Marseille
- 16th ESS 2004 Venice
- 19th ESM 2005 Riga
- 17th ESS 2005 Magdeburg

ESS'2002. Some 190 submissions have been accepted for presentation at the ESS'2002 conference, hold in Dresden, October 23-26, 2002.

Next to the Conference Themes of ESS'2002, the conference will also feature **two special workshops** on Simulation and Optimisation and on Modelling and Simulation in the Textile Industry. For more info see http://biomath.rug.ac.be/~scs/conf/ess2002/index.html

SIMVIS. SCS Europe is co-organising the conferences **SIMVIS** – Simulation and Visualisation, organised by Inst. f. Simulation and Graphics, Univ. Magdeburg. After successful conferences in the last years SIMVIS'2003 is scheduled for March 6 – 7, 2003.

One main goal of the conference is the presentation of new concepts, tools, and applications of simulation and visualization as well as their integration in complex IT projects.

The conference *Simulation and Visualization 2003* is open to all fields in which simulation and visualization techniques are used, especially on new and promising yet less developed application areas. The conference shall serve as a platform for experts from science and industry and give a fresh impetus to the fields of research, development, and application. More information at www.simvis.org.

Agent Based Simulation. SCS Europe also co-organises the Workshop series Agent Based Simulation, which take regularly place in April at University of Passau.

The workshop is intended to offer a forum for all interested in agent-based simulation to discuss methodologies, techniques and applications. Topics are, Basic Methodology, Agent Architectures, Model Specification and Languages, Mobile Agents, Multi-Agent Systems: Communication and Cooperation, Multi-Level Simulation, Decision Making, etc.

Furthermore there are Applications in Ecology and Environment, Psychology, Cognitive Science and Artificial Intelligence, Sociology and Artificial Social Systems, Economics and Market Systems, Business Process Management, Industry, Manufacturing and Logistics, Health Care, Transport. More information at www.or.uni-passau.de/workshop2002/

ASIM, the German Simulation Society, is co-sponsoring as well as the ESM and ESS conferences as well as the SIMVIS and Agent Based Simulation conferences.

Other conference series. SCS Europe is organising also the following conference series: ECEC - European Concurrent Engineering Conference (April), EUROMEDIA - Multimedia, Telematics, and Web Technology conference (January, will shift to April), GAME-ON - Simulation and AI in Computer Games (November-December), FOODSIM - Simulation in the Food Industry (every 2 years June-July), SCS conferences in the USA, MESM - Middle East Simulation and Modelling Symposium.

If you plan to attend any of the conference mentioned above please contact for more information:

Rainer Rimane, SCS-Europe Secretariat
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Cauerstr. 6, 91058 Erlangen, Germany
Tel / Fax + 49 9131 66247
rimane@cs.fau.de, www.scs-europe.org

SCS European Publishing House

The SCS European Publishing House publishes monographs and Proceedings in all areas of Modelling and Simulation.

Furthermore, two series, **Advances in Simulation** and **Frontiers in Simulation** are published in cooperation with **ASIM**, the German Simulation Society.

This co-operation is still running well, new books have been published. In the following a list of the most recent books:

- Bernd Schmidt: SIMPLEX 3 -The Art of Modelling and Simulation. ISBN 3-936150-06-0, 524 pages, hardbound, English
- Bernd Schmidt: The Modelling of Human Behaviour. 105 pages, hardbound, full colour, English, ISBN 3-936150-11-7 Th.
- Th. Fent: Applications of Learning Classifier Systems for Simulating Learning Organizations
- Y. Monsef: Modelling and Simulation of Complex Systems. ISBN 1-56555-118-4, 296 pages, hardbound, English
- Helena Szczerbicka, Thomas Uthmann: Modellierung, Simulation und künstliche Intelligenz. ISBN 1-56555-128-1, 471 pages, softbound, German
- Sigrid Wenzel: Referenzmodelle für die Simulation in Produktion und Logistik. ISBN 3-936150-07-9, 282 pages, softbound, German
- Wolfgang Borutzky: Bondgraphen - Eine Methodologie zur Modellierung multidisziplinärer dynamischer Systeme. ISBN 3-936150-09-5, 414 pages, softbound, German
- Ingrid Bausch-Gall: Simulation technischer Systeme - Berichte aus der Fachgruppe, ISBN 3-936150-08-7, 278 pages, softbound, German
- Ch. Almeder: Hydrodynamic Modelling and Simulation of the Human Arterial Bloodflow
- K. Panreck, F. Dörrscheidt (Hrsg.): Proc. 15. Symp. Simulationstechnik, Paderborn, 2001
- Dj. Tavangarian (Hrsg.): Proc. 16. Symp. Simulationstechnik, Rostock, 2002
- S. Pawletta: Erweiterung eines wissenschaftlich-technischen Berechnungs- und Visualisierungssystems zu einer Entwicklungsumgebung für parallele Applikationen
- Th. Preiß: Relationale Datenbanksysteme als Basis für Modellbildung und Simulation von kontinuierlichen Prozessen
- E. Hajrizi: Intelligentes Online – Planungs- und Steuerungssystem für Flexible Produktionssysteme basierend auf Simulation und Optimierung mit genetischen Algorithmen

SCS Publisher Bears
(by Jutta Rimane)

If you are interested in the SCS / ASIM book series please refer to the SCS Europe website (web order possible) or to ASIM's website, or contact directly the managing editor.

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INTERNATIONAL SOCIETIES & USER GROUPS

MATHMOD Conference Series

www.argesim.tuwien.ac.at/MATHMOD/

The MATHMOD Conference Series was started with 1st MATHMOD Conference in February 1994. In 1997 and 2000 the series was successfully continued by 2nd and 3rd MATHMOD. The series has established as well-accepted and high-standing tri-annual conferences on mathematical modelling and simulation. It will be continued with 4th MATHMOD conference in February 2003.

The scope of the conferences covers theoretic and applied aspects of the various types of mathematical i.e. formal modelling (equations of various types, Petri nets, bond graphs, qualitative and fuzzy models etc.) for systems of dynamic nature (deterministic, stochastic, continuous, discrete or hybrid, etc.).

Comparison of modelling approaches, model simplification, modelling uncertainties, validation, automation of modelling and software support for modelling etc. will be discussed in special sessions as well as applications for control, design or analysis of systems in engineering and other fields of application, and learning networks in modelling, fitting models to real processes, model reduction.

4th MATHMOD Vienna, Feb. 2003

Fourth International Symposium on Mathematical Modelling, February 5 - 7, 2003, Vienna

The 4th MATHMOD will continue the conference series in Vienna, February 5 – 7, 2003.

Conference Publications

There will be regular Conference Proceedings, eds. I. Troch and F. Breitenecker, published in series ARGESIM-Reports, ISBN 3-901608-24-9, and Post Conference Publication in special issues of journals.

- Conference Proceedings Part 1: Printed abstract volume (with a one page abstract of each full paper and each poster)
  Conference Proceedings Part 2: CD ROM with full papers (up to t0 pages)
- Poster Conference Publications:
  After the conference, the IPC will invite - after special reviewing - excellent papers for publication in special issue of the journals IMACS-MCS, JIRS, and MCMDS (details are given in the Copyright Regulations – see website)

Contributions

Contributions fitting into the scope of the conferences (given above) are welcomed. 4th MATHMOD offers full papers and posters.

Full Paper Submission: Full papers will be published in Proceeding Part 1 (1-page abstracts of full papers; printed) and in Proceedings Part 2 (full text of paper up to 10 pages; CD ROM). Deadlines are:

- Submission of Full Paper Abstracts: Sept. 1, 2002
- Notification of Authors: October 15, 2002
- Full Paper due: December 15, 2001 (full version and abstract)

Poster Submission: Posters will be on display during the whole congress, and 1-page abstracts of the posters will be published in Proceeding Part 1 (printed). Deadlines are:

- Submission of Poster Abstracts: Oct. 1, 2002
- Notification of Authors: October 15, 2002
- Abstract of Poster due: December 15, 2001 (full version and abstract)
- Poster due: begin of conference

Invited Lectures (prel.)

- Modeling, Analysis and Control of Parallel Hybrid Vehicles. N. A. Kheir, Oakland University, USA
- Modelling and Simulation in Snow Science. K. Kleemayr, Univ. Agricultural Sciences, Vienna
- Modelling and Simulation in Mechatronics. P. Breedveld, Univ. Twente, The Netherlands

Social Programme / Accommodation

A very attractive social programme will be offered to participants and accompanying persons: Welcome Party, traditional Heurigen Evening, Reception, guided City Tours, etc.

AUSTROPA Interconvention will manage accommodation for participants. Hotels chosen are close to the conference site. Booking info and direct booking at https://secure.verkehrsbuero.at/tak/mathmod.htm

Conference Fees

Members of IMCAS or Co-sponsoring Societies	€ 310.-
Non – Members	€ 340.-
Students (restrictions; please ask for conditions via email)	€ 70.-
Accompanying Persons	€ 90.-

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argesim.tuwien.ac.at/MATHMOD/

WSC Winter Simulation Conference Organisation

www.wintersim.org

The Winter Simulation Conference (**WSC**) is the premier international forum for disseminating recent advances in the field of system simulation, with the principal focus being discrete-event simulation and combined discrete-continuous simulation. In addition to a technical program of unsurpassed scope and quality, WSC provides the central meeting place for simulation practitioners, researchers, and vendors drawn from all disciplines and from the industrial, governmental, and academic sectors.

The congress is co-organised by various groups, e. g. **INFORMS** and **SCS**.

Report WSC'01

The 2001 Winter Simulation Conference (WSC) took place December 9–12, 2001, at the Crystal Gateway Marriott in Arlington, Virginia, U.S.A. The conference theme was **2001: A Simulation Odyssey**. Five hundred attendees participated in 3 days of presentations, exhibits, and meetings.

The conference program began on Sunday afternoon with 3 vendor training sessions, the Ph.D. Student Colloquium, and the Poster session. Dr. Ingolf Ståhl was the keynote speaker for the Ph.D. Student Colloquium; his presentation was entitled "Simulation Prototyping." Sixteen Ph.D. students participated in the Colloquium and there were 23 Poster Session participants.

At the conference opening session on Monday, December 10, 2001, the INFORMS–College on Simulation (INFORMS-CS) presented its Lifetime Professional Achievement Award to Tom Schriber, and the Outstanding Publication Award to Averill Law and W. David Kelton for *Simulation Modeling and Analysis, 3rd edition*. Dr. David G. Stork of Ricoh Innovations, Inc, gave the keynote address. His presentation, "The HAL 9000 Computer and the Vision of *2001: A Space Odyssey*" compared the film's visions of computer technology with the realities of today.

Attendees were impressed with the scope and quality of the conference program, which featured 3 tutorial tracks (Introductory, Advanced, and Software/Modelware), 2 methodology tracks (Modelling and Analysis), and applications tracks

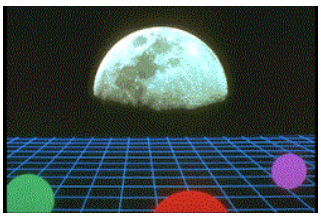
The application tracks included Military, Manufacturing, Transportation & Logistics, Semiconductor Manufacturing, Business Process Modelling, Telecommunications, Construction Engineering & Project Management, Web-Based Simulation, Simulation Education, General Applications, and Future of Simulation.

Twenty-two booths in the Exhibit area demonstrated the latest simulation software and showcased simulation-related publications and societies.

The *Proceedings of the 2001 Winter Simulation Conference* contains 224 papers; for 53 of these the corresponding author was based outside the United States. The *Proceedings* totals 1748 pages, and is published in both hardcopy and CD-ROM format. Abstracts and full papers may also be accessed from the INFORMS-CS website, www.informs-cs.org.

Mark your calendar now for WSC '02, which will be held in sunny San Diego, California on December 8 - 11, 2002. The theme for this year's conference is *Exploring New Frontiers* featuring new tracks in risk analysis and simulation-based scheduling. For more information, visit the conference website at www.wintersim.org, or contact the General Chair, Jane Snowdon wsc2002@us.ibm.com, or the Program Chair, John Charnes jmc@ukans.edu.

WSC'02 – December 2002, San Diego



The 2002 Winter Simulation Conference (**WSC'02**) will be held December 8–11, 2002, at the Manchester Grand Hyatt San Diego in San Diego, California, USA.

The Winter Simulation Conference (**WSC**) is a premier international forum for disseminating recent advances in the field of system simulation, with the principal focus being discrete-event simulation and combined discrete-continuous simulation.

In addition to a technical program of unsurpassed scope and quality, WSC provides a central meeting place for simulation practitioners, researchers, and vendors working in all disciplines and in the industrial, governmental, and academic sectors.

From another perspective, the Winter Simulation Conference represents a remarkable collaborative effort that has been led entirely by volunteers for over three decades, resulting in a unique, longstanding cooperative arrangement among eight major professional organizations.

Highlights of WSC '02

This year's conference features a comprehensive program ranging from introductory tutorials to state-of-the-art research and practice. There are 13 tracks with over 200 presentations focused on simulation uses across the enterprise from supply-chain integration to e-commerce, customer service, modelling and analysis methodology, and applications in manufacturing, military, healthcare, transportation, logistics, and distribution. All of the sessions and tracks are documented in the highly esteemed WSC Proceedings, which each registrant receives on compact disk (CD).

WSC offers an invaluable educational opportunity for novices and experts alike, with a large segment of each program devoted to introductory and advanced tutorials that are carefully designed to address the needs of simulation professionals at all levels of expertise and that are presented by prominent individuals in the field. For Ph.D. students, the conference offers the INFORMS/CS-sponsored Ph.D.-student colloquium and poster session. Of particular interest to virtually all attendees are the software tutorials by software vendors, which highlight new and special features of their software. Also, the exhibits area has displays by the leading simulation software vendors, which cover the full spectrum of commercial simulation products and services.

Rounding out the conference are social gatherings as well as meetings of several professional societies and users' groups, and all these events give attendees the opportunity to get acquainted and to become involved in the ongoing activities of the international simulation community. Further, the Manchester Grand Hyatt San Diego has an ideal prime waterfront location on San Diego Bay because of its proximity to San Diego International Airport and it is located next to Seaport Village with nearby restaurants, entertainment and shopping. There is also easy access to local sites, such as the San Diego Zoo, Sea World and historic Old Town, so consider bringing your family for a wonderful vacation.

Conclusion

With its blend of cutting-edge research and state-of-the-art applications, WSC '02 will have something of interest for everyone. For more information about the conference, on-line conference registration, exhibit opportunities for vendors or sponsorship opportunities, please visit the WSC web site at www.wintersim.orgor contact Talley Management Group, Inc. Meetings Department by calling them at +1-856-423-7222 ext 360 or by email meetings@talley.com.

Jane L. Snowdon, John M. Charnes, J. R. Wilson, Catherine M. Harmonosky, cmhie@engr.psu.edu

I M A C S

IMACS - The International Association for Mathematics and Computers in Simulation

www.cs.rutgers.edu/~imacs/

IMACS - The International Association for Mathematics and Computers in Simulation is an organisation of professionals and scientists concerned with computers, computation and applied mathematics, in particular as they apply to the simulation of systems. This includes numerical analysis, mathematical modelling, approximation theory, computer hardware and software, programming languages and compilers. IMACS also concerns itself with the general philosophy of scientific computation and applied mathematics.

IMACS is one of the international scientific organisations (with **IFAC**, **IFORS**, **IFIP** and **IMEKO**) represented in FIACC, the five international organisations in the area of computers, automation, instrumentation and the relevant branches of applied mathematics.

IMACS Congresses

The main congress of IMACS is the tri-annual IMACS World congress. IMACS organises and co-sponsors local and international scientific symposia and conferences, e. g.:

- 4th MATHMOD Vienna, 4th International Symposium on Mathematical Modelling, Feb. 5 - 7, 2003
- 17th IMACS WORLD CONGRESS; Lille (France), 1July 4-20 2003

IMACS Publications

IMACS publishes three journals. The main journal is *Mathematics and Computers in Simulation*, published by Elsevier Science Publishers, containing articles of general interest in the fields of modelling and simulation, a book review section and the "News of IMACS".

The other journals are *Applied Numerical Mathematics and Journal of Computational Acoustics*.

Information on IMACS

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SIMPAT Conference and Trade Fair

www.simpat.de

In June 2001, **SIM 2001**, the first Industrial Trade Fair and Knowledge Exchange on Applied Simulation and Visualisation took place in Freiburg / Breisgau, Germany, June 2001.

The basic idea of this SIM event was and of the continuing SIMPAT event is:

- to organize a trade fair with hardware and software for modelling, simulation and visualisation
- and to gather around conferences on modelling, simulation and visualisation – from methodology to applications.

SIM'2001 has proven successful, and Löffler and Associates, organisers of SIM'2001, continued with this idea and could set up the biennial series of trade fair with conferences, now called **SIMPAT**:

SIMPAT International Exhibition and Conferences Simulation and Visualisation in Processes, Applications and Technologies

SIMPAT 2003, May 2003 Nuremberg

May 13 – 15, Congress Center Messe Nuremberg

After checking a lot of places for a trade fair, Löffler and Associates together with the SIMPAT advisory board (consisting of representatives of the main sponsors) decided for Nuremberg, where NürnbergMesse Gmbh offered the best infrastructure for the event.

The first event, SIM'2001, was focussed on comptutational fluid dynamics and visualisation – mainky because of the big accompanying 5th WUA-CFD Conference in Applied Fluid Dynamics. The new SIMPAT event opens to exhibitors of hardware, software and services in the following basic technologies for many applications in numerous branches of industry:

- · Acoustics
- · Animation
- · Boundary Element Method (BEM)
- · Computer Aided Design (CAD)
- · Casting
- · Circuit Layout
- · Computational Fluid Dynamics (CFD)
- · Continuous Simulation
- · Crash Simulation
- · Discrete Simulation
- · Electrodynamics
- · Finite Element Method (FEM)
- · Forging, Molding, Extrusion
- · Heat, Ventilation and Climate (HVAC)
- · Molecular Modeling
- · Optics
- · Recasting
- · Robotics, Automation
- · Virtual Reality, 3D Visualisation

The organisers hope for more than 100 exhibitors, and conference will accompany the trade fair.

Call for exhibitors. It is hard to imagine business, science and industry without process simulation and visualisation. The applications are very complex and the products numerous. The necessary hardware and software forms a promising market with an annual growth potential of 25%. These subjects will be dealt with at SIMPAT'2003.

Highly qualified decision-makers will gather information here about the state of the art in simulation technology and its use in their own companies. Experts, manufacturers and potential customers will discuss future possibilities and developments at conferences and events. SIMPAT therefore offers you as software and hardware supplier a high-caliber environment for the presentation of your products and services.

As international exhibition venue, Nuremberg with its outstanding location and site advantages creates the ideal conditions for establishing SIMPAT as a worldwide forum in Europe.

Löffler & Associates GmbH of Basel, Switzerland, as competence partner ensures the quality of the contents. NürnbergMesse GmbH as organizer of specialized trade fairs guarantees you a smooth organization with competent planning support and a comprehensive exhibition service.

Interested exhibitors are kindly requested to contact Löffler and Associates for more information, www.loeffler.ch, info@loeffler.ch.

Sponsors (preliminary):

Trade visitors. SIMPAT is an interdisciplinary meeting-place for international experts in Planning/Design, Engineering/Construction, Manufacturing, Logistics, Training and Communication in all conceivable application fields (cf. nomenclature in Application form). The main applications are in the following domains of:

- Aerospace and Aeronautics
- Automotive Electronics
- Mechanical Engineering
- Medical Engineering
- Chemical Engineering ·
- Power and Electricity
- Transport, Materials
- Engineering and Logistics.

SIMPAT Conferences

SIMPAT Trade Fair will be accompanied by two big conferences and by smaller workshops. Almost traditionally, the world fluid dynamics community will gather to its biennial congress, and a conference on simulation and visualisation – with invited speakers – will intriduce into the area and will show the trends for the future. Smaller workshops, e.g. meetings of ASIM Working Groups will emphasise on special themes. ASIM, the German Simulation Society, together with ARGESIM Group from Vienna will be also exhibitor ans sponsor of SIMPAT.

World Fluid Dynamics Days 2003

6th WUA-CFD Conference in Applied Fluid Dynamics

In today's drive towards optimisation of product life cycle, integrated product development imposes high demands on engineering designs. The 2003 conference focuses on how CFD is to be strategically embedded in the most appropriate way into the product development cycle. In this context three questions are of crucial importance:

- What makes CFD indispensable in the product development cycle and what are the industrial applications that would impossibly have been developed without CFD ?
- How does the interfacing between CFD and other simulation tools work and what are the technical prerequisites in order to achieve an appropriate work flow?
- Can CFD – as presently widely discussed – become an automated tool that eventually fits a so called "Template-Philosophy"?

Specialists from manufacturing industry and software vendors will discuss the integration process and present most advanced applications.

SIMPAT 2003 Conference *Simulation and Visualisation Technologies in Product Development, Production and Logistics*

The conference as part of SIMPAT 2003 will become the special meeting-place for discussions on the use of the potential offered by simulation and visualisation.

Simulation and visualisation are the instruments that make it possible to view and test the functionality of complex processes in all engineering domains and production and logistic flows. For example, the construction of prototypes can be distinctly reduced in future and complex "just-in-time" planning can be optimized in many organisational domains.

The SIMPAT 2003 Conference – like the complete exhibition – reflects the vital importance of this technology of the future. It deals especially with applications in Aerospace and Aeronautics, Automotive Engineering, Electronics, Materials, Mechanical Engineering, Chemical and Medical Engineering, Power and Electricity, Transport, Engineering and Logistics.

Further information on the conferences are available at **www.simpat-conferences.de**.

ASIM – ARGESIM Presentation / Workshops

ASIM and ARGESIM will be present at SIMPAT'2003 with a booth and with organising meetings of ASIM Working Groups. Fixed are up to now two workshops, in dicussion further two meetings:

- Simulation of Technical Systems (fixed)
- Methods in Modelling and Simulation (fixed)
- Simulation in Production and Logistics (planned)
- Education in Modelling and Simulation (planned)

For more information, refer to www.asim-gi.org.

SIMPAT Info and Contact

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www.simpat.de, www.simpat-conferences.de

www.nuremberg-tradefair.com

B. Löffler, info@loeffler.ch

IFMBE

International Federation for Medical and Biological Engineering

www.ifmbe.org

The International Federation for Medical and Biological Engineering, IFMBE, is primarily a federation of national and transnational organisations. These organizations represent national interests in medical and biological engineering.

Conference EMBEC'02, Dec.2002, Vienna

www.embec.org

The 2nd EMBEC'02 is the second joint meeting of the European constituents of the International Federation for Medical and Biological Engineering (IFMBE) with nearly 1100 participants from 55 countries.

EMBEC'02 2nd European Medical & Biological Engineering Conference

Vienna (Austria), December 04-08, 2002

The 2nd EMBEC'02 will again be hosted by Vienna, this unrivalled city with its still living tradition in culture, music, architecture and science. Due to its unique position in the heart of Europe, Vienna is the right place to welcome the worldwide Biomedical Engineering community.

All BME related topics will be considered in the scientific program. Distinguished experts will present the most recent state of science and technology. The European IFMBE constituents have been invited to use the EMBEC'02 as platform for demonstrating their special activities. Presentations may be either in oral or poster form. The main program will be supplemented by special sessions, workshops, and tutorials

Special Sessions. Special sessions will be provided on challenging subjects. All European IFMBE constituents as well as other organizations or individuals are requested to organize special sessions in the framework of EMBEC'02.

Tutorials. As with EMBEC'99, Tutorials will be offered for applications, techniques, software, and other subjects. Among them, the tutorial „Modelling in Biomedical Engineering -Biomedical Systems Modelling" will give an introduction in the area of modelling and simulation of biomedical systems.

Keynote Lecture. The Key Note Lecture in the Opening Ceremony will be held by Professor Dr. Manfred Eigen (Goettingen, Germany) on Molecular Diagnostics in Medicine and Biotechnology. In 1967 Professor Eigen was awarded the Nobel Prize in Chemistry for his "studies of extremely fast chemical reactions, effected by disturbing the equilibrium by means of very short pulses of energy".

Information

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ACSL, DYMOLA, ISSOP, MATLAB, SPICE and TAYLOR-ED User Groups at Conference ASIM'2000

On occasion of the annual ASIM conference – this year in Rostock, Germany – User Group Meetings the following User Group Meetings will take place on Tuesday, September 10, 2002:

User Group	Organiser
ACSL – Continuous Simulation	I. Bausch-Gall BauschGall@compuserve.com
DYMOLA - OO Continuous Simulation	I. Bausch-Gall BauschGall@compuserve.com
ISSOP Optimisation and Discrete Simulation	W. Krug wkrug@dualis.net
MATLAB / SIMULINK	F. Breitenecker Felix.Breitenecker@tuwien.ac.at
SPICE Analysis of Circuits	H. Gall info@bausch-gall.de
TAYLOR – ED OO Discrete Simulation	M. Klug mklug@arcs.ac.at

Users interested in attending the meetings please contact the organiser (email given in table above) or contact the conference organiser.

It is intended to organise User Group Meetings with European character in 2002 on occasion of SIMPAT'2002, *International Exhibition and Conferences Simulation and Visualisation in Processes, Applications and Technologies*, (Nuremberg, May 2002).

www.asim-gi.org
asim.informatik.uni-rostock.de

INDUSTRY NEWS

DSPACE – New Products, New European Offices

www.dspace.de

dSPACE opens European Offices

dSPACE GmbH has opened two new European offices to provide sales and service support for its high-tech development tools for electronic control units (ECUs). The new European offices, located in Bièvres, near Paris, and Huntingdon near Cambridge, started business on November 1, 2001.

The French and British offices will support dSPACE's entire range of products and their integration into customers' development processes, which include the prototyping of electronic control units (ECUs), production code generation and comprehensive system testing. On-site engineering services in these fields are also available through the new offices.

dSPACE is partnered with The MathWorks whose French and UK subsidiaries have successfully sold dSPACE products for many years. For the French and British markets, both companies decided to transfer the distribution arrangement for dSPACE products to the dSPACE European Offices. dSPACE and The MathWorks will continue their successful technical co-operation and partnership.

dSPACE presents MotionDesk 1.0

Hardware-in-the-loop simulation (HIL) plays a vital role in testing electronic control units (ECUs). As a rule, the results of this type of real-time simulation are displayed in abstract form only. However, this is not satisfactory when movements are simulated. This problem is solved by MotionDesk, which displays the results in animated form.

MotionDesk takes a vehicle that is simulated in a real-time application and displays it in a virtual 3-D world, on a PC monitor. Combining real-time simulation and visualization in this way means that changes made during the simulation immediately show up on the screen. Creating the visual world is child's play: you simply drag and drop objects from a 3-D library to a scene. The 3-D library contains all the objects needed to create a scene for a driving simulation, such as roads, houses, trees, pylons, car bodies, wheels. If you require different objects, for example, to run a robot or flight simulation, you can easily extend the 3-D library , as its objects comply with the VRML2 standard.

Once the scene is set up, the virtual journey can commence. Depending on how precise the representation needs to be, or on the computing power available, MotionDesk has a choice of rendering techniques, from simple wire frame models right through to textures. Force vectors superimposed on the scene by MotionDesk visualize the forces that arise, for example, between the wheels and the road. The developer observes the scene through cameras, which are either in fixed locations in the virtual world or move along with objects.

MotionDesk can handle up to four windows, in other words the scene can be observed from four different perspectives simultaneously. For more detailed analysis, the simulation can be recorded and then replayed in segments. MotionDesk 1.0 is available since spring 2002.

Furthermore, dSPACE has released a new version of the TargetLink automatic code generation software, which is now compatible with MATLAB Release 12.1.

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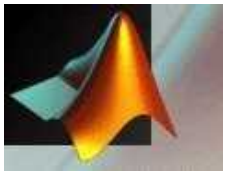
33100 Paderborn
Tel +49-5251-1638-0, Fax -66529
info@dspace.de, http://www.dspace.de

MATLAB: New Products - Mac Support

www.mathworks.de



MATLAB's return to the Mac meets growing demand from scientific and engineering communities.

Natick, MA - (05/06/2002). The MathWorks today announced its intention to make MATLAB, the industry's leading technical computing software, available on Mac OS X, Apple's advanced Unix-based operating system, with the next release of the MathWorks product line. With MATLAB on Mac OS X, users will be able to use powerful, sophisticated technical computing tools in a graphical and intuitive environment.

New Products. The Mathworks released the following new products: xPC TargetBox, Aerospace Blockset, Embedded Target for Motorola® MPC555, SimMechanics for mechanical modelling, MATLAB Excel Builder. For more info see website.

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Tel +49 -241-47075-0, Fax – 12
info@mathworks.de, www.mathworks.de

Integration of SIMPLORER and ADVISOR

www.simplorer.com

SIMPLORER is a sophisticated, multi-domain simulation tool for a wide range of system-level designs and analyses in automotive applications. SIMPLORER is constructed around a robust coupling technology that allows analysing circuits, block diagrams, and state machines simultaneously.

Ansoft Corporation announces the integration of SIMPLORER(R) with ADVISOR (Advanced Vehicle SimulatOR), a widely used software tool created by the National Renewable Energy Laboratory (NREL). The combined solution, which enables engineers to evaluate and optimise new energy-efficient vehicle technologies, is available now.

The new automotive system design solution combines the strengths of SIMPLORER, which accurately predicts electrical system behaviour, and ADVISOR, which performs overall vehicle system analysis. The integrated solution enables engineers to evaluate and analyse advanced propulsion and electrical systems technologies.

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Scientific Computers shipping Maple 8 and OPNET 8.0

www.scientific.de

New Release Maple 8. Scientific Computers, distributor for the German speaking area, is pleased to present Maple 8, the newest version of the widely adopted Maple mathematical computation product line.

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Nonlinear ODEs. Enhancements to dsolve include a new implementation of integrating factor methods that can systematically determine integrating factors of varied types and perform multiple reductions of order in one step when more than one integrating factor is found.

Furthermore, MAPLE 8 offers numerical solutions to PDEs and new versions of the Mathematics Packages, with extension and advanced features; the Graphical User Interface has been improved, and much more. Maple 8 is available for all supported platforms, including Windows (from XP to 95), Linux and UNIX.

New Release OPNET 8.0 Scientific Computers also distributes OPNET.

OPNET 8.0 is unique in its ability to understand networks in their entirety, including applications, routers, switches, servers, and protocols for traditional, wireless, and optical technologies. OPNET sells focused software solutions to three distinct markets: ServiceProvider Guru is marketed primarily to service providers; IT Guru to enterprises; Modeler and Netbiz to equipment manufacturers.

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In Germany and Austria ExpertControl is distributor of the MathSoft products. The Mathcad 2001i Premium Suite consists of the following products: Mathcad 2001i Professional, AXUM 7.0, SmartSketch 4.0, VisSim, and Solving and Optimization Ext. Pack.

ExpertControl also distributes the (MATLAB) Toolboxes ACD, IDCON linear, IDCON nonlinear, Conti, Micromon, CANbus, Hydraulic (developed by Delzer Kybernetik, www.delzer.de). The Toolboxes ACD and IDCON are now also available for EXCEL (developed by Delzer) and for MATHCAD (developed by Expertcontrol)

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CALENDAR OF EVENTS

Simulation Conferences

August 2002

06 – 09: IMACS Workshop on Adaptive Methods for PDEs
Toronto,Canada, guo@net67.maths.unimanitoba.ca

25 – 30: MONTREAL 2002 IFIP World Computer Congress,
Montreal, wcc2002@cips.ca , HTTP://WWW.WCC2002.ORG

27 – 31: 9th PSCS Worlkshop 'Simulation in Research and Development'
ikrzyz@tu.koszalin.pl

September 2002

02 – 05: OR'2002 International Conference on Operations Research OPERATIONS RESEARCH'2002
Klagenfurt, Austria,http://www.scl.uni-klu.ac.at/or2002

10 – 10: ASIM '02 UG Meetings User Group Meetings on ACSL, DYMOLA, ISSOP, MATLAB, SPICE, TAYLOR-ED, Rostock, Germany

10 – 13: ASIM 2002 16. ASIM - Symposium Simulationstechnik, Rostock, Germany,
INFO@ASIM-GI.ORG, HTTP://WWW.ASIM-GI.ORG

10 – 12: ASIS 2002 24th Int. Workshop 'Advances of Simulations Systems'
Krnov, Czech Republic, jan.stefan@vsb.cz

23 – 25: ERK 2002 11th Electrotechnical and Computer Science Conference
Portoroz, Slovenia, http://www.ieee.si/erk02/

23 – 27: SCAN 2002 10th GAMM-IMACS Symposium on Scientific Computing, Computer Arithmetic and Validated Numerics, Paris, FGrance, http://scan2002.lip6.fr/

26 – 27: SIMS 2002 43th Scandinavian Conference on Simulation and Modeling,
Oulu, Finland, office@atu.fi, http://ntsat.oulu.fi/sims

28 – 30: MESM 2000 4 th Middle East Symposium on Simulation and Modelling
Sharjah, U.A.E., http://www.scs-europe.org/

October 2002

03 – 05: HMS 2002 Harbour, Maritime & Multimodal Logistics Modelling and Simulation, Bergeggi, Italy,
HTTP://ST.ITIM.UNIGE.IT/HMS2002

10 – 11: 5th International Scientific Conference on Electronic Computers and Informatics 2002
Herlnay, Slovac Republic,
http://://horand.fei.tuke.sk/kpi/sci/

23 – 26: ESS 2002 European Simulation Symposium 2002,
Dresden, Germany, HTTP://WWW.SCS-EUROPE.COM

November 2002

03 – 06: ICSC 2002 Fifth International Conference on System Simulation and Scientific Computing
Shanghai, China, icsc2002@mail.shu.edu.cn

11 -11: ASIM-SPL WG Meeting ASIM Workgroup Meeting 'Simulation in Production and Logistics', Smartville, Hambach, Germany
http://www.spl.asim-gi.org/

Dezember 2002

04 – 08: EMBEC'02 2nd European Medical and Biomedical Engineering Conference, Vienna, Austria
EMBEC02@mondial.at, http://www.embec.org/

08 – 11: WSC 02 Winters Simulation Conference
San Diago, California, USA,
HTTP://WWW.WINTERSIM.ORG

February 2003

05 - 07.02.03 4th MATHMOD
4th IMACS Symposium on Mathematical Modelling - 4th MATHMOD, Vienna, Austria, INGE.TROCH@TUWIEN.AC.AT
HTTP://SIMTECH.TUWIEN.AC.AT/MATHMOD

05 – 05: ASIM – GMMS WG Meeting ASIM Working Group Meeting'Methods in Modelling and Simulation'
Vienna Univ. of Technology, Austria
http://www.gmms.asim-gi.org

19 – 21: VIth Conference on Computer Simulation and Industry Applications
Tijuana, Mexico, stanracz@netservice.com.mx

March 2003

ASIM – SUG 2003 ASIM Working Group Meeting 'Simulation of Environmental Systems', Cottbus, Germany
http://www.asim-gi.org

UKSIM 2003 UKSIM Conference on Modelling and Simulation, Cambridge, UK
http://ducati.doc.ntu.ac.uk/uksim/

ASIM – SKI 2003 ASIM Working Group Meeting 'Simulation and KI, Humboldt Univ., Berlin, Germany
http://www.asim-gi.org

06 – 07: SIMVIS 2003 Conference on Simulation and Visualisation, Magdeburg, Germany
http://www.simvis.org

May 2003

13 – 15: SIMPAT 2003 Int. Exhibition & Conferences Simulation and Visualisation in Processes, Applications and Technologies, Nuermburg, Germany
http://www.simpat.org

14 – 15: ASIM – STS/GMMS/SPL 2003 ASIM Joint Working Group Meetings at SIMPAT 2003
Nuermburg, Germany
http://www.asim-gi.org

27 – 30: BioMedSim 2003 3rd Conference Modelling and Simulation in Medicine and Biology
Univ. of Balamand, Lebanon
http://www.balamand.edu.lb/docs/biomedsim.html

June 2003

ESM 2003 17th European Simulation Multiconference
Nottingham, UK, http://www.scs-europe.org

July 2003

14 – 20: 17thIMACS WORLD CONGRESS
Lille, France, http://www.cs.rutgers.edu/~imacs

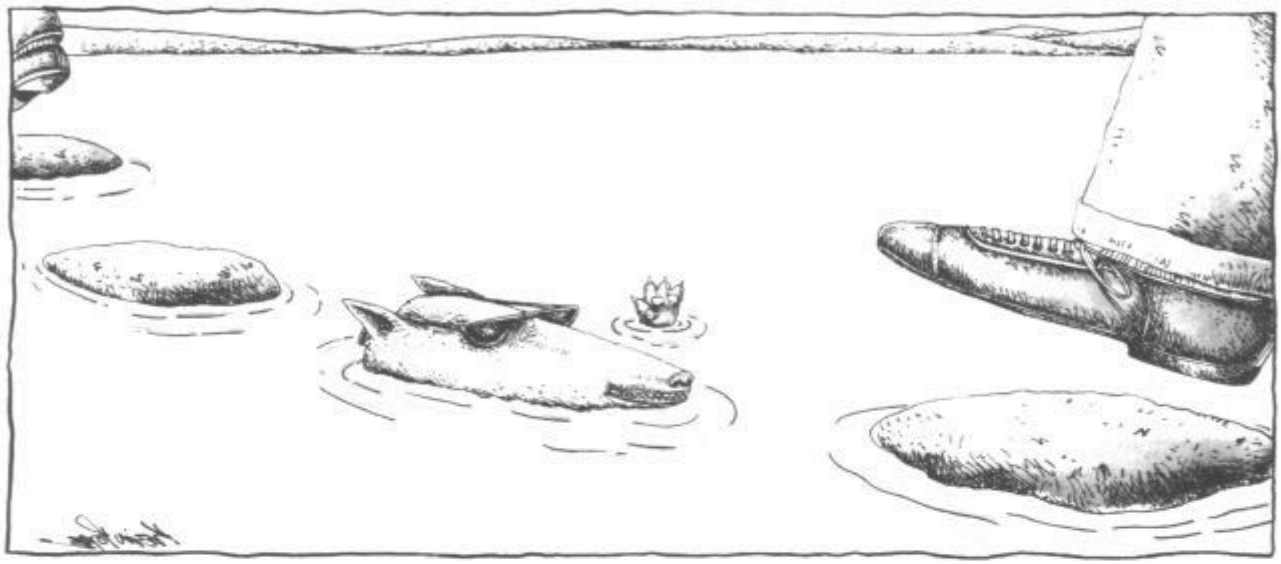
14 – 17: MODSIM 2003
Integrative Modelling of Biophysical, Social and Economic Systems for Resource Management Solutions
Townsville, Queensland, Australia
http://mssanz.cres.anu.edu.au/modsim2003.html

September 2003

09 – 12: Mathematical Modelling of Ecosystems
Almaty, Kazakhhstan, usultann@srl.academset.kz

16 – 19: ASIM 2003 17th Symposium Simulation Technique,
(Annual ASIM Conference)
http://asim2003.cs.uni-magdeburg.de/

THE dependability of THE WOLVERINE is WELL-known in THESE parts.



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ARGESIM COMPARISONS

Comparisons of Modelling and Simulation Techniques and Tools

www.argesim.org/comparisons

Simulation News Europe (**SNE**) started in 1990 to publish a series on comparison of simulation software. These software comparisons developed towards benchmarks not only for simulation tools but also for modelling tools and, more generally, for modelling techniques. Furthermore, the solutions – many of them with source codes in various simulators – may be used as examples in simulation courses, etc.

ARGESIM, the Working group Simulation at Vienna University of Technology takes care on definition of these comparisons, on publication of the solutions and of evaluation of the solutions.

The principle idea of the comparison is a mixture of a general simple compassion of features within "yes/no" – tables and the well-known benchmark problems (like PHYSBE):

Based on relatively simple, easily comprehensible models different modelling techniques and their implementation as well as features of modelling and experimentation within simulation languages, also with respect to application area, are compared.

Definitions

Up to now 16 comparisons have been defined.

C1 Lithium-Cluster Dynamics, **SNE 0** (11/90), checks integration of stiff systems, parameter variation, and steady state calculation.

C2 Flexible Assembly System, **SNE 2** (3/91), discrete system, compares features for submodel structures, control strategies, and optimisation.

SNE		Comparisons															
	Sum	C1	C2	C3	C4	C5	C6	C7	CP1	C8	C9	C10	C11	C12	C13	C14	C15
0		Def															
1	5	5	Def														
2	8	4	4	Def													
3	10	4	3	3	Def												
4	13	1	5	5	2	Def											
5	8	4	-	1	1	2											
6	5	-	2	-	2	1	Def										
7	7	1	2	1	2	-	1	Def									
8	5	-	1	-	-	-	1	3									
9	5	-	-	-	-	-	2	3									
10	7	1	2	-	-	-	1	2	Def/1								
11	8	2	2	1	-	1	-	-	2								
12	7	1	-	1	-	-	-	2	3								
13	4	-	-	-	-	-	-	3	1								
14	6	3	-	1	-	-	-	2	-								
15	2	-	-	1	-	1	-	-	-								
16	3	1	-	-	-	-	-	1	-	Def/1							
17	6	-	-	1	-	1	-	1	1	1	Def/1						
18	5	-	-	-	-	-	-	2	2	-	-	Def/1					
19	6	-	-	-	-	-	-	-	1	1	1	3					
20	5	-	-	-	-	-	-	1	-	1	1	2					
21	10	-	1	-	1	-	1	5	-	-	-	2					
22	10	1	-	1	-	1	-	5	-	1	-	-	Def/1				
23	5	-	2	-	-	-	-	-	-	-	2	-	1				
24	7	1	-	-	1	-	-	2	-	-	-	1	2				
25	7	-	1	-	-	1	-	-	-	-	3	1	1				
26	11	2	1	2	1	1	-	1	-	-	1	1	1				
27	6	-	-	1	-	-	-	-	-	-	2	1	-	Def/2			
28	7	-	-	2	-	1	-	-	-	-	2	-	-	2			
29/30	11	1	1	1	1	-	3	-	-	-	-	1	-	3			
31	6	-	-	-	-	-	-	1	-	-	-	-	1	3	Def/1		
32/33	10	-	1	-	-	-	-	1	-	-	2	1	-	4	-	Def/1	
34	5	1	1	-	-	-	1	-	-	-	-	1	-	1	-	-	
35/36	12	2	1	-	-	2	-	3	-	-	-	-	-	-	2	2	Def/1
Total	***232***	**35**	**30**	**22**	**11**	**12**	**10**	**38**	**11**	**5**	**15**	**15**	**7**	**15**	**3**	**3**	**1**

C3 Generalised Class-E Amplifier, **SNE 2** (7/91), simulation of electronic circuits, table functions, eigenvalue analysis, and complex experiments.
C4 Dining Philosophers I, **SNE 3** (11/91), general comparison, involving not only simulation but also analysis e.g. by Petri nets and, etc.
C5 Two State Model, **SNE 4** (3/92), checks high accuracy features and state event handling).
C6 Emergency Department - Follow-up Treatment, **SNE 6** (11/92), discrete system, tests features for modelling, concepts of availability, and complex control strategies.
C7 Constrained Pendulum, **SNE 7** (3/93), checks features for hybrid modelling, comparison of models, state events, and boundary value problems.
CP1 Parallel Simulation Techniques, **SNE 10**, (3/94), deals with the benefits of distributed and parallel computation for simulation tasks; three test examples test parallelisation techniques.
C8 Canal-and-Lock System, **SNE 16** (3/96), discrete system, checks features for complex logic control, validation and variance reduction.
C9 Fuzzy Control of a Two Tank System, **SNE 17**, (7/96), asks for approaches and for implementations of modules for fuzzy control.
C10 Dining Philosophers II, **SNE 18** (11/96), reviews discrete simulators with respect to concurrent access to resources and with deadlocks.
C11 SCARA Robot, **SNE 22** (3/98), deals with implicit and hybrid systems with state events.
C12 Collision of Spheres, **SNE 27**, November 1999, allows numerical or analytical analysis as well as continuous or discrete approaches
C13 Crane Crab with Embedded Control, **SNE 31**, checks techniques and features for digital control and linearisation
C14 Supply Chain, **SNE 32/33** (11/2001), **SNE 34** (7/2002) addresses discrete simulators - features for supply chain systems (messages, strategies)

Solutions

We invite all readers to participate in this comparison. Please, simulate the model(s) with any tool of your choice and send in a solution.

A solution should consist of: 1. a short description of the simulator, 2. modelling technique, model description, 3. results of the three tasks. Additionally we ask for: 1. suggestion for classification (see WWW), 2. model codes, if available. The solution should fit into one page of SNE – templates. Solutions sent in are reviewed. Source codes of model and / or experiment description are highly appreciated.

Felix Breitenecker
Felix.Breitenecker@tuwien.ac.at

C14 Supply Chain Management Definition

This comparison addresses discrete modelling and simulation. Supply Chain Systems are usually straight forward, but they have different downstream and upstream flows between factories, distributors and wholesalers. While the downstream flow characterises the flow of materials, the upstream flow represents the various orders, which often depend not only on the local material flow downstream, but also on the global status of the system.

The flow of orders may be modelled in many different ways:

- Templates for chain supply
- Message channels for modelling flow of orders
- Timeless orders represented by events directly
- Planning tables control order sequences

This comparison considers a relatively simple Supply Chain, consisting of four factories, of four suppliers, and of a group of wholesalers (Figure 1.)

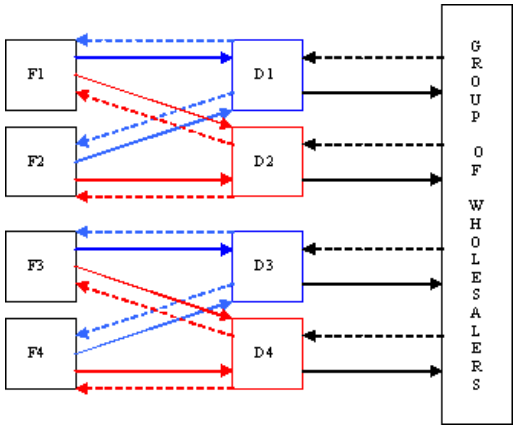

Figure 1: Supply chain with 4 factories, 4 distributors and a group of wholesalers

Factories

The 4 factories F_i are supposed to be supplied with unlimited raw materials. The factories produce 12 different products p_k (uniformly distributed) and supply the distributors. The factories do not produce all types of products; each factory only produces 6 different types of products (Table 1). The interarrival time of products is distributed exponentially with parameter 600 seconds (independent of type of product).

The investigations consider a time horizon of 30 days, beginning at 00.00 at the 1st day and ending at 24.00 at the 30th day. The factories produce all the time around the day, starting at the 1st day, 00.00, ending with 30th day, 24.00 (after 720 hours).

F_1	F_2	F_3	F_4
p_1	p_7	p_4	p_{10}
p_2	p_8	p_5	p_{11}
p_3	p_9	p_6	p_{12}
p_4	p_{10}	p_7	p_1
p_5	p_{11}	p_8	p_2
p_6	p_{12}	p_9	p_3

Table 1: Production Plan

Distributors

The 4 Distributors D_i supply a group of wholesalers and order from the factories, following different order strategies. First, the factories produce for 7 days, so that they have a stock of products. Then the distributors start with their orders (i.e. on the 8th day, 00.00, or after 168 hours); at this time all distributors order 10 pieces per product, regardless of the ordering strategy used, to fill their storages.

Further orders are placed once a day, at 00.00. If an order cannot be fulfilled, it is postponed until the next day. An order is only considered fulfilled, if the whole amount of ordered products of one type is available. Furthermore, a supply lead time T_{ji} between distributor and factory (Table 2) is must be taken into account.

T_{ij}	F_1	F_2	F_3	F_4
D_1	16	22	20	12
D_2	15	16	13	19
D_3	14	16.5	20	17
D_4	22	13	16.5	18

Table 2: Supply Lead Time in hours

Group of Wholesalers

A group of wholesalers orders stochastically products from the distributors (one product per order):

1. Distributor D_j is stochastically chosen, where $j \in \{1, 2, 3, 4\}$ is uniformly distributed
2. Time in between orders is uniformly distributed over the interval [600,3600] seconds (discrete)
3. Type of product (number k) is uniformly distributed, where $k \in \{1, 2, \ldots, 12\}$

The wholesalers start to place their orders to the distributors at the 9th day, 00.00 (after 192 hours).

All orders that cannot be fulfilled are neglected; the wholesalers do not repeat them some time later. But they are regarded at the distributors: the distributor, who could not deliver products of an order, orders these products additionally from the factories at next order time (00.00, next day), regardless which order strategy the distributor uses.

Delivery time from distributor to wholesalers is of no importance, this delivery time does not influence the behaviour of orders.

Products

The products p_k have no specific attributes, as weight or size. They are ordered from factories due to a fixed plan, (Table 3, task a and task b) or depending on supply lead time (task c)

	D_1	D_2	D_3	D_4
p_1	F_1	F_1	F_4	F_4
p_2	F_1	F_1	F_4	F_4
p_3	F_1	F_1	F_4	F_4
p_4	F_1	F_1	F_3	F_3
p_5	F_1	F_1	F_3	F_3
p_6	F_1	F_1	F_3	F_3
p_7	F_2	F_2	F_3	F_3
p8	F_2	F_2	F_3	F_3
p_9	F_2	F_2	F_3	F_3
p_{10}	F_2	F_2	F_4	F_4
p_{11}	F_2	F_2	F_4	F_4
p_{12}	F_2	F_2	F_4	F_4

Table 3: Fixed order of products by distributors from factories

Each component in the supply chain tries to meet the demand (order) of the downstream component. Also, each supply chain member orders some amount from its upstream supplier. Once the order arrives, the supplier fills it only if the whole amount of products is available.

Model Approach

Give a short explanation of the model approach, especially how the orders and the order strategy are managed or implemented resp. (messages, events ?).

Task a: Simple Order Strategy

If a distributor has sold at least one piece of a product during the last day, he orders two pieces of the same product: D_1 and D_2 place orders at F_1 and F_2, D_3 and D_4 at F_3 and F_4 (Table 2).

Costs. Transport from factory F_i to Distributor D_j costs 10 € per hour of delivery per order (independent of number of products), the distributor's D_j storage costs are 1 € per product per day (essential is the number of stored products at next order time, where the storage costs are calculated as cost/day times number of stored products, independent from arrival or leaving time of an individual product).

Task a1: Simulate the system once for 30 days and show the stock of distributor D_1 over time.

Task a2: Perform 100 simulation runs, calculating maximum, minimum, mean and deviation of

- C = total cost of distributor D_1
- N = number of products delivered by distributor D_1, and
- R = relative costs of distributor D_1, R = C / N

Task b: On Demand Order Strategy

Of certain interest in this model is the influence of different ordering strategies of the distributors.

Instead of ordering a constant number of products (Task a), now the distributor orders as much as needed to meet the demand of the downstream component:

Each distributor accumulates the orders (for each product) of the wholesalers – fulfilled and not – over 24 hours (from 00.00 to 24.00 each day) and orders than this amount from the factories at the next order time (00.00, next day).

Task b1. Simulate the supply chain once for 30 days and show the stock of distributor D_1 over time.

Task b2. Perform 100 simulation runs, calculating maximum, minimum, mean and deviation of

- C = total cost of distributor D_1
- N = number of products delivered by distributor D_1, and
- R = relative costs of distributor D_1, R = C / N

Task c: Order Delay

In the previous tasks the distributors place their orders at fixed factories (table 3). Now a distributor D_j tries to order at the factory F_m with the minimal supply lead time T_{jm}, (T_{jm} = min (T_{ji}, i =1,..,.4).

If the desired amount of products is not available, the factory next in ranking in regard to minimal supply lead time is chosen, and so on. If no factory can deliver, the order is postponed to the next day.

Task c1. Perform 100 simulation runs, calculating maximum, minimum, mean and deviation of

- C = total cost of distributor D_1
- N = number of products delivered by distributor D_1, and
- R = relative costs of distributor D_1, R = C / N

Task c2. Compute a comparative table, showing mean and deviation of C, N and R for all three order strategies.

Further info: www.argesim.org/comparisons

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C1 Lithium-Cluster Dynamics under Electron Bombardment – SDX

Numerical approach

Simulator: SDX™ (System Dynamics) is a programmable Windows environment for technical computing, modelling and simulation. It runs applications written and compiled as **`dlls`** in the Fortran compiler **IDE**. **SDX** is available for PCs running under Win 9x and Win NT 4.0 or later.

Model: The FORmula TRANslated model is a straightforward one-to-one transcription of the mathematical model aided by the built-in SDX modelling functions. The **`include`** file, not shown, specifies and exports the model variables for interactive run-time access. It is produced by the SDX Code Generator, a separate *Win utility* program. The **`model dll`** is loaded into SDX where simulation experiments are conducted as a native windows application.

```
subroutine model
*      Lithium cluster dynamics
       include 'sdx_gui.inc'
       external rate
       parameter (n = 3, init = -1)
       real x(n),mo
       data ro/84.99/, mo/1.674/, fo/9.975/,
      &     pc/1.e4/, tend/10/, inix/1/, inie/1/
       if(mode() .eq. init) then
          x(1) = ro
          x(2) = mo
          x(3) = fo
       endif
       t = time()
       p = (1 - sgn(t))*pc
       call integ (rate,x,p,n,inix)
       call esched (inie,tend)
       end
*-------------------------------------------------
       subroutine rate (x,p,t,dx)
*      eom:  dx/dt = f(x,u,t)
       include 'sdx_gui.inc'
       real x(*),dx(*),m,
   &     dr/.1/, kr/1/, dm/1/, kf/.1/, lf/1.e3/
    r = x(1);  m = x(2);  f = x(3)
    dx(1) = -dr*r + kr*m*f
    dx(2) =  dr*r - dm*m + (kf*f - kr*m)*f
    dx(3) =  dr*r + 2*dm*m-(kr*m + 2*kf*f + lf)*f+p
    end
```

Task a Simulation of the System. Set **`inie`** -- from *Edit Variable* dialog -- timer option in the event scheduling function. The timing results, extracted via a log *file view* facility, reflect the compiled speeds (GUI updates turned off). On AMD K6-II, 333MHz system:

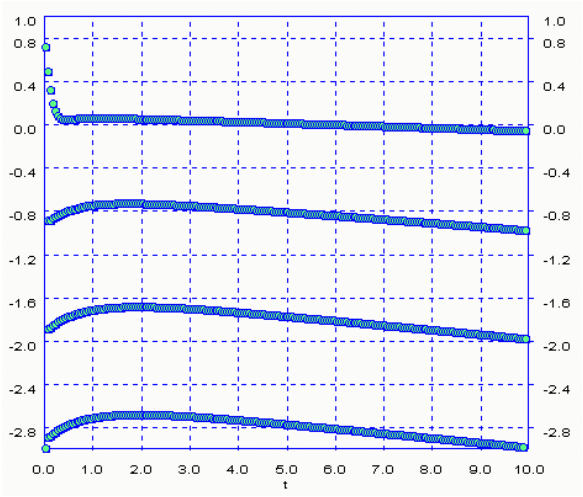
Algorithm	timing (ms)
adaptive step predictor/corrector	80
recursive state space solver	10

The difference in performance is due to the recursive algorithm, which requires a single derivative evaluation per step; efficiency may thus be measured against the ideal lower bound for numerical integration:

$$\frac{dx}{dt} = f(x,u) = A \cdot x + g(x,u)$$

$$x_{k+1} = x_k + T(A,dt) \cdot f(x_k, u_k)$$

Task b. Parameter variation Set **`lf`** -- from *Edit Variable* dialog -- parameter for **`log(lf)`** stepped 1:4, select variables for graphics display, and make the run(s). Overlaid run-time graphics, **`log(f)`** vs. **`t`**, was exercised in real-time computational mode. It shows the dominant dynamics and indicates a rapid initial transient (**`~1/lf`** sec) – see figure below.



Task c. Calculation of Steady States: Set **`inix`** - from *Edit Variable* dialog - **`trim`** option in the integrate function, and likewise for the **`pc`** parameter. The system trimmed states, shown in the table, may be viewed via the *numeric display* facility.

pc	r	m	f
0	0	0	0
10000	1000	10	10

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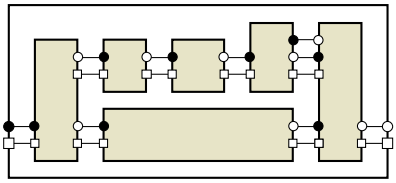
C2 Flexible Assembly System - AnyLogic

Object / Process-oriented Modelling

Simulator: AnyLogic (www.xjtek.com) is a general-purpose simulation environment for discrete, continuous and hybrid systems. It employs UML-RT structure diagrams for building hierarchical models in object-oriented way and *hybrid statecharts* for behaviour specification. Java is used for data types / operations.

Model: The assembly subsystem model consists of five objects: Conveyor (B), Station (Ax), Fork (Sx), Join (Sy), and Subsystem (structure shown below.



Structure of the Subsystem Class

Problem encountered: Due to specification, it is only possible to place up to 40 empty pallets on conveyors B1 and the conveyors connecting subsystems. Therefore, simulation of the model with more than 40 empty pallets circulating is not possible.

Analysis used for model validation: The minimal total time of a pallet processing can be obtained using total length of path the pallet travels in a single loop, that is 22.4m (*2.0m*2+1.6m*6+0.4m*16+0.4m*6*), its total operation time at stations 135s, and total shifting time 20s (*2.0s*5*2*). This gives us 229.667s (*22.4/0.3+135s+20s*).

As long as pallet entrance to the processing station takes 1.333s (*0.4/0.3*), the utilization of stations cannot exceed the following values:

U_{A1}: 0.918, U_{A2}: 0.978, $U_{A3/A4/A5}$: 0.938, U_{A6}: 0.957.

Using stations operational time (*OT*) and the formula $\lambda_A = N_A/(OT_A+1.333)$, the maximal throughputs (pallets per second) for each operation type are:

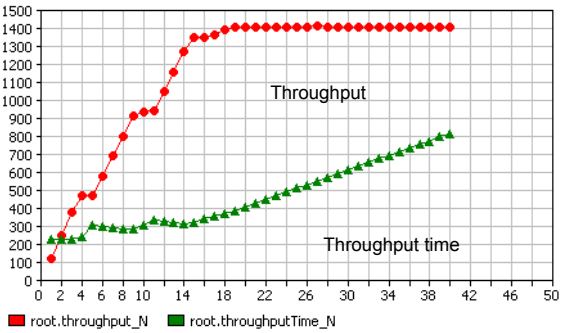
λ_{A1}: 0.0612, λ_{A2}: 0.0489, $\lambda_{A3/A4/A5}$: 0.0468, λ_{A6}: 0.0319.

Assuming the A6 station acting as A3/A4/A5 with equal probability, their actual throughputs are 0.0574 (*0.0468+0.0319/2*). Therefore, the task A2 is the bottleneck of the system. Given this, it is possible to calculate utilization of A1 when the bottleneck is reached: $U_{A1} = OT_{A1}/((OT_{A2}+1.333)/N_{A2}) = 15/(61.333/3) = 0.734$.

A single A2 station can process up to 470 pallets in 8 hours (*8*3600/61.333*). Then, all three A2 stations can process up to 1410 pallets (*470*3*), which is the maximal possible throughput of the assembly system.

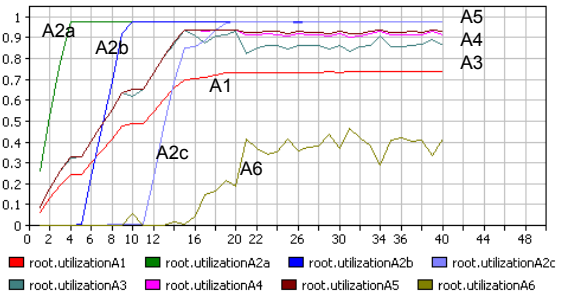
Task a Control Strategy – Statistical Evaluation. A local control strategy was used in the model. It allows us to abstract from implementation details of particular components when combining them together. Statistics are collected within the model and can be observed using AnyLogic Viewer.

Task b Simulation Results – Troughput. The diagram below shows system properties depending on the number of pallets in the system.



Task c Simulation Results – Optimisation. A parameter loop was used for optimisation with respect to total throughput and average throughput time (optimal number of pallets is 19). The following Table is an extraction from the simulation results. Both minimal throughput time (229.667) and the maximal throughput (1410) conform to the analytical results. Utilisation of stations depending on the number of pallets in the system is shown on the diagram below.

N	Time	Throughput	U_{A1}	U_{A6}
1	229.667	125	0.0651	0
12	329.330	1050	0.5464	0
18	373.015	1390	0.7206	0.1653
19	**388.437**	**1407**	**0.7295**	**0.2149**
20	409.066	1408	0.7304	0.1896
40	815.792	1410	0.7379	0.4169



Utilizations of processing stations when the bottleneck is reached (19+ pallets) are: U_{A1}=*0.7379*, U_{A2}=*0.9782*, which conforms to the predicted values.

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C6 Emergency-Department - Follow-up Treatment – AnyLogic

Object-Oriented Approach

Simulator: AnyLogic is a virtual prototyping environment for complex systems with discrete, continuous, and hybrid behaviour.

There is no proprietary script or block diagram language the user needs to learn to use AnyLogic. The modelling technology is entirely based on UML-RT, Java, and (for those who wish to model continuous time behaviour) algebraic-differential equations. This is what the most advanced user will know

Model: In an emergency department four different types of patients pass through the system of casualty ward, X-ray and plaster room. As the main building block of an AnyLogic model is the `active object`, all facilities (registration, CW, X-ray, plaster room) are represented by `activ object classes`.

Furthermore there are two external java classes, `global.java` for setting global parameters such as the queuing strategy and the doctor change, and `patient.java`, which includes all information of the patient.

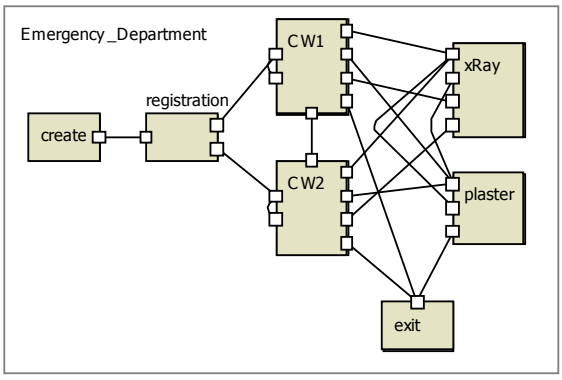

Figure 1: AnyLogic Model Layout with instantiated objects representing servers, connections via ports show flow of messages representing the entities

The `activ object` *create* contains a chart timer which simulates the arrival of patients and distributes them among the four types, the object exit performs bookkeeping for statistical analysis.

In the model patients start to arrive at 7.30 a.m. and queue for registration, doctors start work at 8.00 a.m. Because of this it was necessary to increase the treatment time of the first patient by thirty minutes, for the second and all other patients the treatment time is normal.

According Task b there is a connection between *CW1* and *CW2.* The port *queueMsg* implements the doctors´ exchange: in case the queue from *CW2* is larger than twenty patients, the treatment times of one doctor in *CW1* and one in *CW2* are exchanged - shrinks the number down to 5 patients, this process is returned.

Task a: Simulation- Average Treatment Times. The following results could be obtained for Task a: the mean treatment time takes between 161 and 225 minutes, depending on the type of patients.

type of patient	mean time	min time	max time	count
type 1	225,41	111,03	327,17	94
type 2	164,44	38,45	251,39	48
type 3	220,17	156,19	326,34	11
type 4	161,28	35,13	245,60	97
total	180,74	35,13	327,17	250
overall treatment time: 395,45 minutes				

Task b: Doctors´ Exchange Strategy. This strategy doesn't really change the result: it yields a little improvement for type 3 patients; the time for type 2 and 4 is increased unessential.

Type of patient	mean time	min time	max time	count
type 1	224,73	102,82	330,01	86
type 2	166,26	38,45	265,93	48
type 3	212,04	137,09	327,10	8
type 4	163,46	35,13	259,29	108
total	180,71	35,13	330,01	250
overall treatment time: 396,12 minutes				

Task c: Priority Ranking. This seems to be the best strategy: it shows an obvious decrease in treatment time for patient of type 1 and 3, time for the others doesn't really change. Furthermore the total treatment time is decreased, too.

type of patient	mean time	min time	max time	count
type 1	167,85	45,40	290,43	88
type 2	162,60	38,45	285,23	50
type 3	156,08	62,18	295,32	10
type 4	160,88	35,13	273,42	102
total	163,97	35,13	295,32	250
overall treatment time: 364,02 minutes				

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C10 Dining Philosophers II – AnyLogic

Simulation / Process Flow

Simulator: AnyLogic (www.xjtek.com) is a general-purpose simulator for simulation of both discrete and continuous systems. AnyLogic is fully based on the programming language Java and with knowledge of Java one can write own code and extend the features of AnyLogic.

Model: Five philosophers are sitting around a table. They are all going through the same cycles, starting out with a *thinking-phase*, followed by a *hungry state* and then *eating-phase*. The problem is that every philosopher needs two chopsticks to eat, but between the philosophers it is only one available: each philosopher must share chopsticks with his neighbours, leading to simultaneous access to the same chopstick and occurrence of deadlock.

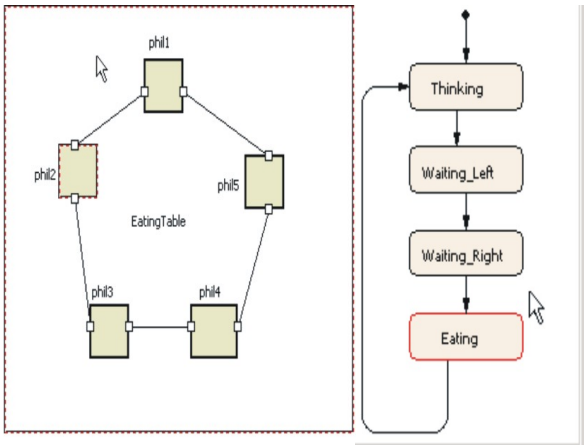

Fig.1: Philosopher objects, communicating with messages to the neighbour (left), state chart for each philosopher (right)

Implementation. We chose to implement our model in an object-oriented manner. First we defined the philosopher object containing a statechart with four different states being: *Thinking*, *Waiting left*, *Waiting right*, *Eating*. Then we defined eating table as the root object with five philosophers as encapsulated objects (Figure 1).

The philosophers are communicating with their neighbours through public ports through which they are sending and receiving message. We defined three message classes: *Left free*, *Right free*, *Block*

The philosophers start with a thinking period, which follows a discrete uniform distribution in the interval [1,10]. When one finishes his thinking period he continues into the waiting left state.

In entering this state he sends a message to his neighbours saying that the chopsticks are free. Him self waits for the same message from his left side. After receiving this message he goes on the waiting right state signalling his right that the chopstick is still free and blocking the left. When he gets the right free signal from his right he starts eating blocking his neighbours. The eating period follows the same discrete distribution as the thinking period after which he returns to the thinking phase.

Task a. Simulation until Deadlock with Utilisation Statistics. The first simulation run, after compiling into Java, stopped with a deadlock at t = 19180; results are shown in the following tables.

	Thinking	Waiting	Eating
Phil1	5.04±2.58	13.98±6.20	5.37±2.54
Phil2	5.07±2.57	13.81±6.12	5.39±2.53
Phil3	5.19±2.51	13.71±6.13	5.25±2.56
Phil4	5.11±2.51	13.71±6.20	5.21±2.58
Phil5	5.19±2.58	13.75±6.16	5.23±2.55
Average	**5.02±2.57**	**13.76±6.25**	**5.29±2.34**

Table 1: Average Times for thinking, waiting and eating for each philosopher and for all together

Ch1	Ch2	Ch3	Ch4	Ch5	ChAll
0.218	0.219	0.217	0.217	0.219	0.2186

Table 2: Average Usage rate of each chopstick and of all chopsticks together

Task b. Handling Simultaneous Access to Chopsticks. AnyLogic handles simultaneous events on a random basis. This means that when two philosophers try to access the same chopstick at the same time, AnyLogic chooses randomly between the two. If the event granted access schedules another event, this event is placed behind the event, which was fighting for access to the chopstick.

Task c. Batch of Simulation Runs with Deadlock Statistics. AnyLogic detects a deadlock when no new events are scheduled and the event list becomes empty. This causes the simulation to stop, in our case when all the philosophers are waiting for the chopstick to the right of them, already having grabbed the left one (results given in Table 3.

Number of runs	50
Maximum time of termination	49465
Minimum time of termination	1417

Table 3: Maximum and minimum deadlock time, batch of 50 simulation runs

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C12 Spheres' Collision – Maple

Numerical approach / hybrid simulation

Simulator: Maple V has been developed as a symbolic formula-manipulation program and became one of the most used programs in this area. In the last years the adding of numerical algorithms formed this program to a software suitable to perform simulation of rather complex processes.

Model: In SNE 28 Almeder used a symbolic approach where the differential equations have been explicitly solved. With an explicit formula for the position and velocity of each sphere he implemented a state event finder. In this work a numerical approach is used and the Maple state event finder is tested.

This comparison solution requires a numerical treatment of differential equation being able to capture state events. Maple V has implemented this feature in two standard numerical solvers for differential equations; these are a Runge Kutta Fehlberg algorithm of 4^{th} order for nonstiff system (RKF45) and a Rosenbrock method for stiff systems.

Maple is no typical simulation software for continuous processes, therefore the implementation of the solution algorithm requires a different attempt compared to "classical" simulation languages like ACSL, Dymola, etc. In these programs one typically implements an algorithms-section where the events and differential equations are defined. The numerical treatment of the events is hided from the user. The programmer defines the event and the actions on that event. The handling is then the task of the simulation software.

Maple does not offer such high-level abstractions. Although the detection of an event is part of the numerical algorithms stated above, the actions after this event have to be implemented by the user. The whole implementation is necessary, not only the definition. In the case of this comparison the treatment of the spheres' collision can be treated by Maple's easy to use interface for event detection. One simply defines the stop condition **`stopcond`** and adds it as an option to the **`dsolve`** command:

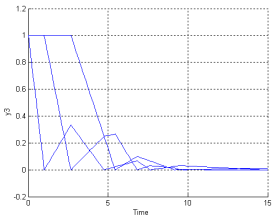
```
dsys:={diff(y1(t),t)=y1p(t),
       diff(y1p(t),t)=0 ,….};
ic:={y1(0)=y10, y1p(0)=y1p0,….};
stopond := y1(t);
s:=dsolve(dsys union ic, numeric,
   stop_cond=stopcond);
```

If an event is detected it returns all necessary information to set actions on this event. **`dsolve`** returns a list of the all variables. After event detection three different cases can occur in our case.

We assume that within the accuracy limits only one event, that is one sphere's collision at the same time, can occur:

```
if (abs(y1) < tol) then
   … set new initial condition
elif (abs(y2) < tol) then
   … set new initial condition
elif (abs(y3) < tol) then
   … set new initial condition
end if;
s:=dsolve(dsys union ic, numeric,
   stop_cond=stopcond);
```

Task a. Simulation in Time Domain / Final Values of Velocities. The following figure shows the distance-time function for the parameter value e=0.2. The RKF45 algorithm has been used (the equations are not stiff). With the standard option the event finder was not able to detect all the collisions. An increase of the relative and absolute error tolerances up to 10^{-12} was necessary. For e=1 the final velocities are $v_1=v_2=v_3=0$ and $v_4=1$.



Task b. Variation of Restitution Coefficient. The quasiplastic case is reached for e=0.154304556. The figures below show the number of collisions (left) and the final velocities (right) as a function of e, which is varied from 1 to the quasi-plastic case.

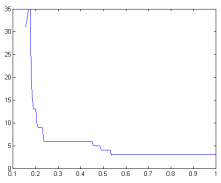


Figure 2

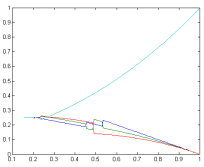


Figure 3

Task c. Boundary Value Problem / Statistical Deviation of Restitution Coefficient. With help of the standard Maple functions **`random`** and **`normald`** the value e=0.587401 results in an end velocity $v_4 = v_0/2$.

For a normally distributed e the end velocity of the fourth ball is normally distributed with m = 0.4243, s = 0.0421. The confidence intervals are [0.4216<mu< 0.4269] and [0.0403<s< 0.0440].

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BOOK REVIEWS

Random Number Generation and Monte Carlo Methods

Gentle, J. E.
Springer., 1998, 243 pp., ISBN 0-387-98522-0

Random number generation is the in core of any stochastic simulation and most discrete event simulations. If you want to know all about random numbers the books of Tezuka (1995) on uniform and Devroye (1986) on non-uniform random number generation can be recommended which cover all aspects of random number generation from theory to practice.

However if you are only interested in practical aspects of random number generation, a survey of recent results and algorithms that work efficiently then Gentle's book is the better choice because it does the job on much fewer pages. It concentrates on practically useful algorithms and references to other books for the proof of theorems. Moreover some basic Monte Carlo methods are covered in one chapter without becoming too sophisticated.

The book is well written and can be recommended to any practitioner who is already familiar with the basic concept of pseudo random numbers.

Beginner	Intermediate	Expert
	●	
Theory	**Mixed**	**Practice**
		●
Lecture Note	**Monograph**	**Proceedings**
	●	

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Compartmental Modeling with Networks

G.G. Walter, M. Contreras

Birkhäuser, 1999. 250 pp., ISBN 0-8176-4019-3

Compartmental models are an important class of differential equation systems that have broad applications in biology, medicine, ecology, epidemiology and economy. This introductory book presents compartmental modeling in the context of general networks and finite markov chains. This is an interesting cross-relation that is frequently overlooked from a simulationist viewpoint. The book starts with an introduction to the theory of directed graphs and their associated matrices, continues with the basics of finite markov chains and finally introduces linear and nonlinear compartmental models.

The last chapter briefly introduces to the system dynamics of general linear compartmental models.

The short and clearly written chapters are well organized and can be highly recommended as an introductory text on network modeling. Although – from a simulationist viewpoint – compartmental models can be introduced much more directly it is the unfamiliar approach that makes this book a valuable source even for the specialist.

Beginner	Intermediate	Expert
●		
Theory	**Mixed**	**Practice**
	●	
Lecture Note	**Monograph**	**Proceedings**
	●	

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Optimisation, Operation Research, Game Theory: Mathematical Foundations (In German)

Optimierung, Operations Research, Spieltheorie. Mathematische Grundlagen.

Karl Heinz Borgwardt, Birkhäuser 2001
ISBN 3-7643-6519-6, 622 pages, EUR 44,99

This book – in german language – provides a mathematical introduction into several aspects of optimisation and game theory.

The manuscript is based on the author's lectures on these subjects. This influences the character of the book. Right from the beginning the text has a very strong formal appearance. Sometimes the definitions, theorems, and proofs are put together in a rather compressed way. In some cases technical terms were even used before their definition.

The chapter about duality, which is a very important concept of linear programming, is one of the highlights of the book. The text quickly approaches to the most relevant findings. Moreover, comprehensive tables are provided to give an overview of all cases that may appear. This makes this chapter a valuable reference. The chapters about game theory approach this field in a very formal and abstract way. Well-known concepts like evolutionary stability or trembling-hand perfectness are left out. The index of the book lacks completeness. For instance the Karush-Kuhn-Tucker conditions, which are also often referred as Kuhn-Tucker conditions cannot be found when looking for the latter.

The book strongly emphasizes the mathematical theory but almost neglects practical applications. For example there is nothing mentioned about such typical optimisation problems like lot-size planning, scheduling, and inventory management.

The level of abstraction often is higher than necessary. Therefore, the book can be recommended for mathematicians interested in theorems and proofs related to optimisation and game theory but not to technicians or managers who are interested in finding a quick way to solve a certain problem.

Beginner	Intermediate	Expert
	●	
Theory	**Mixed**	**Practice**
●		
Lecture Note	**Monograph**	**Proceedings**
	●	

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Neural Networks and Analog Computation – Beyond the Turing Limit

Hava T. Siegelmann, Progress in Theoretical Computer Science, Birkhäuser Boston 1999; ISBN 0-8176-3949-7, 181 pages, Hardcover

This book introduces an interesting concept linking and exceeding Turing Machines within the field of Neural Networks. It covers almost all computational developments to reach the goal. Starting from the early beginning of computational theory (Turing Machine) the reader passes analog computation and also has to deal with the commonly widespread of von Neumann computers.

Therefore, the reader has to get used to Turings idea of computation, which is quite a difficult task to take, especially for those, who are used to von Neumanns numerical methods. Starting from integer weights, using rational weights and ending up with real weights, the author tights the concept of Turing machines to neural networks. Some introduced concepts of the beginnig are becoming clearer during the later chapters.

This book can be recommended to comuter scientist and all, who are interested in the differences and common areas between analog and digital computation, and also the differences between von Neumann and Turing machines. It might be of interest to those, who like to expand their knowledge in computing history, because of the large bibliography at the end. This book is not recommended for beginners.

If one is not used to the concepts, it is quite dfficult to get familiar with all the different concepts used within 180 pages.

Beginner	Intermediate	Expert
		●
Theory	**Mixed**	**Practice**
●		
Lecture Note	**Monograph**	**Proceedings**
	●	

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Learning SIMUL8 – The Complete Guide

Jaret W. Hauge and Kerrie N. Paige, Volume I and II, Plain Vu Publishers 2001; ISBN 0-9709384-0-3, 768 + 170 pages, Softcover

CD-Rom included

The book covers SIMUL8 Release 7, the latest one available. The two volumes are divided into a very large tutorial / guide book and into a very small reference manual, containig mainly Visual Logic and DDE command references. Volume I includes also a CD-Rom with a 21 days trial version of SIMUL8 and all sample files from the books. Additional software can be found on the CD-ROM.

The guide (Volume I) is divided into four parts, and a fifth for appendices. The first part “Getting Started” takes 115 pages divided into four chapters to read, Part II “Building the Model” and part IV “Putting it all Together” have 300 resp. 220 pages.

Topics worth to know for doing good simulation like Random Number Generators are mentioned roughly. There the book references to common, widely known literature. The way of working of the integrated event handler is not described in any way.

Because of the large amount of stuff one has to deal with, the 21 days trial version doesn’t reach with respect to the time one has to get involved with the program. A time unlimited evaluation version with limited size of the model might has fitted better on the CD-Rom. The business player is worth to mention in the sense, that a model can be demonstrated without running the whole engine. Other simulation programs lack in that.

The given examples are focussing on production systems. Because SIMUL8 can be regarded as a gerneral discrete event simulator, other examples from the field of logistics or transportation systems or business processes would have extended the readers view.

Because of the consulting and operational researchl background of the authors, the statistical and analytical parts of a model are well developed and give a good insight into result analysis. Positively the authors do not spend too much effort on the visualisation capabilities of the software package.

Beginner	Intermediate	Expert
	●	
Theory	**Mixed**	**Practice**
		●
Lecture Note	**Monograph**	**Proceedings**
●		

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Monte Carlo Strategies in Scientific Computing

J.S. Liu, Springer, 2001, 338 pp.
ISBN 0-387-95230-6

Monte Carlo methods are an important research area of scientific computing that has made great progress in recent years. In particular they are closely related to stochastic simulation although MC is basically not a simulation method. Unfortunately, the terminology of the Monte Carlo community is quite unfamiliar if not cryptical to those people coming from the classical disciplines of numerical mathematics.

Essentially any Monte Carlo method has the purpose to estimate a multidimensional integral. It is shown that surprisingly many problems can be reduced to the computation of certain integrals. While the computational complexity of numerical integration algorithms grows with dimension the Monte Carlo method does it with a convergence rate of C/sqrt(N) for any dimension (N is the sample size). However it is the constant C that must be kept small by a sophisticated setup of the Monte Carlo algorithm.

The book gives a good introduction to current Monte Carlo methods and explains the terminology on a moderate level of abstraction. It becomes clear that any specific problem needs a tailored algorithm to be efficient. This is the reason for the emergence of variance reduction methods, importance sampling, rejection, sequential MC, Metropolis algorithms, Gibbs samplers, Markov Chain MC (MCMC), or hybrid MC with molecular dynamics.

The book is not easy to read but it is one of the fisrt attempts to show the general principles behind an apparent zoo of methods.

Beginner	Intermediate	Expert
	●	
Theory	**Mixed**	**Practice**
	●	
Lecture Note	**Monograph**	**Proceedings**
	●	

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Reference Models for Mapping Personal Control in Simulation (in German)

Referenzmodelle für die Abbildung von Personalsteuerung in der Simulation

Angela Klinger, Advances in Simulation, ASIM Fortschrittsberichte Simulation, SCS Europe BVBA, Ghent Belgum 1999; ISBN 1-56555-129-X, 276 + XLIX pages, Softcover

This book is written in german language. It deals with the modelling of employees and bases on widely used simulation environments. The author tries to develop reference models for that task. Those models can be found at the end of the book.

A detailed review can be found in **ASIM -Nachrichten** 1/2002.

Beginner	Intermediate	Expert
	●	
Theory	**Mixed**	**Practice**
	●	
Lecture Note	**Monograph**	**Proceedings**
	●	

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Workshop 2000 Agent Based Simulation

Christoph Urban (editor)
AISM, SCS-Europe BVBA, Ghent, Belgium 2000
http://www.or.uni-passau.de/workshop2000/

This volume contains the written contributions to the workshop 2000 on agent-based simulation, which took place in May 2000 in Passau, Germany.

The collection starts with a brief overview of contemporary state of the art research in that field by Bernd Schmidt. He briefly sketches the differences and the intersections of applications of agent-based simulation in empirical science, engineering science, and theory.

After that the book becomes a relatively unstructured collection of articles ranging from high to law quality covering many fields such as e-commerce, negotiation, process control, production planning, traffic simulation, etc.

Ordering the contributions according to the handled topics could have extended the usability of the book and, thus, facilitating the search for readers who intend to find material matching their own research interests.

Nevertheless, since the range of the book is very broad, almost everybody working in the flied of agent-based simulation will find some ideas or references that may be useful stimuli for further work.

Beginner	Intermediate	Expert
	●	
Theory	**Mixed**	**Practice**
	●	
Lecture Note	**Monograph**	**Proceedings**
		●

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Environmental Computer Science (in German)

Berichte aus der Umweltinformatik: Simulation in Umwelt- und Geowissenschaften

Volker Wohlgemut, Albrecht Gnauck, Jochen Wittmann, Bernd Page (Hrsg.), Shaker - Verlag, Aachen 2000, ISBN 3-8265-7776-0, 277 pages

This book summarises both the contributions to the 10th workshop "Werkzeuge für Modellbildung und Simulation in Umweltanwendungen" which took place on March 20th 2000 in Hamburg and those to a second workshop "Theorie und Modellierung von Ökosystemen" which was held in October 1999 in Kölpinsee.

Sections of this book contain topics on model-based balances of greenhouse gas - emissions, simulation of atmospherical processes, simulation in environmental epidemiology, comparisons of different simulation tools for the water quality of rivers, ecological equilibrium and much more.

The contributions in this book give a good overview on the different ways of application of modelling in environmental science. On the other hand they illustrate how one can analyse daily problems and how simulation software can help to solve the problems.

Beginner	Intermediate	Expert
	● ●	●
Theory	**Mixed**	**Practice**
		●
Lecture Note	**Monograph**	**Proceedings**
		●

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Calculated Bets: Computers, Gambling and Mathamtical Modeling to win

Steven Skiena, Cambridge University Press, The Edinburgh Building, Cambridge CB2 2RU; ISBN 0-521-80426-4 hardpack , ISBN 0-521-00962-6 paperback

This book introduces a gambling system. With humor and enthusiasm it describes how computer simulations and mathematical modeling techniques are used to predict the outcome of jai alai matches and bet on them successfully. It shows the similarity of such gambling games to miniature stock trading systems and discusses other gambling strategies, both successful and unsuccessful, for such games as lotto, blackjack, roulette and the stock market.

The book focuses on the following topics:

- The joys of jai alai, a spectator sport and gambling forum
- The power of mathematical modelling: The author uses the jai alai system to explain how mathematical models are designed, built and validated.
- The mathematics of money: how program-trading systems work and the future of Internet gambling
- The craft of computer programming: explainations to the layperson about parsing and random number generation, why programmers hate Microsoft and the glories of the Internet

It's an interesting and understandable written book even to those with little background.

Beginner	Intermediate	Expert
●	●	●
Theory	**Mixed**	**Practice**
	●	
Lecture Note	**Monograph**	**Proceedings**
	●	

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Discrete – Event Simulation: Modeling, Programming and Analysis

George S. Fishman, Springer – Verlag
ISBN 0-387-95160-, 537 pages

Since students often learn about discrete-event simulation through particular software's modelling, sampling, analysis and reporting capabilities, their skills for overcoming impediments may be severely limited unless they are well versed in the basic concepts of discrete-event simulation. On of these impediments could be the absence of a needed distribution. The simulationist's possibilities are: first to revert to a programming language like C or second to use what is offered in the simulation software and ignore the distribution that the problem setting dictates.

This book supplies a mean for providing the needed background. It gives a relatively detailed account of the principal methodologies of discrete-event simulation.

In Chapter 1 an introduction to discrete-event simulation is given. In Chapter 2 modeling is described. Chapter 3 offers an excursion in the underlying models of data collection. Programming and execution is the topic of Chapter 4. Chapter 5 represents another excursion, this time into the topic of computing time versus size of problem. Chapter 6 is about output analysis. Making sense of the output is the topic of Chapter 7. in Chapter 8 and 9 the random versions are specified: Chapter 8 has its main focus at the probability distributions, against number generation in Chapter 9. Chapter 10 deals with preparing the input.

At the end of nearly all chapters are exercises, which are well described. They are a well completation of the treated topics.

Although the book describes the basics of discrete-event simulation it is only suitable for advance undergraduates and graduate students in the management, mathematical and physical and in the engineering sciences because a background in calculus, probability theory and statistics is necessary.

Beginner	Intermediate	Expert
	●	●
Theory	**Mixed**	**Practice**
	●	
Lecture Note	**Monograph**	**Proceedings**
	● ●	

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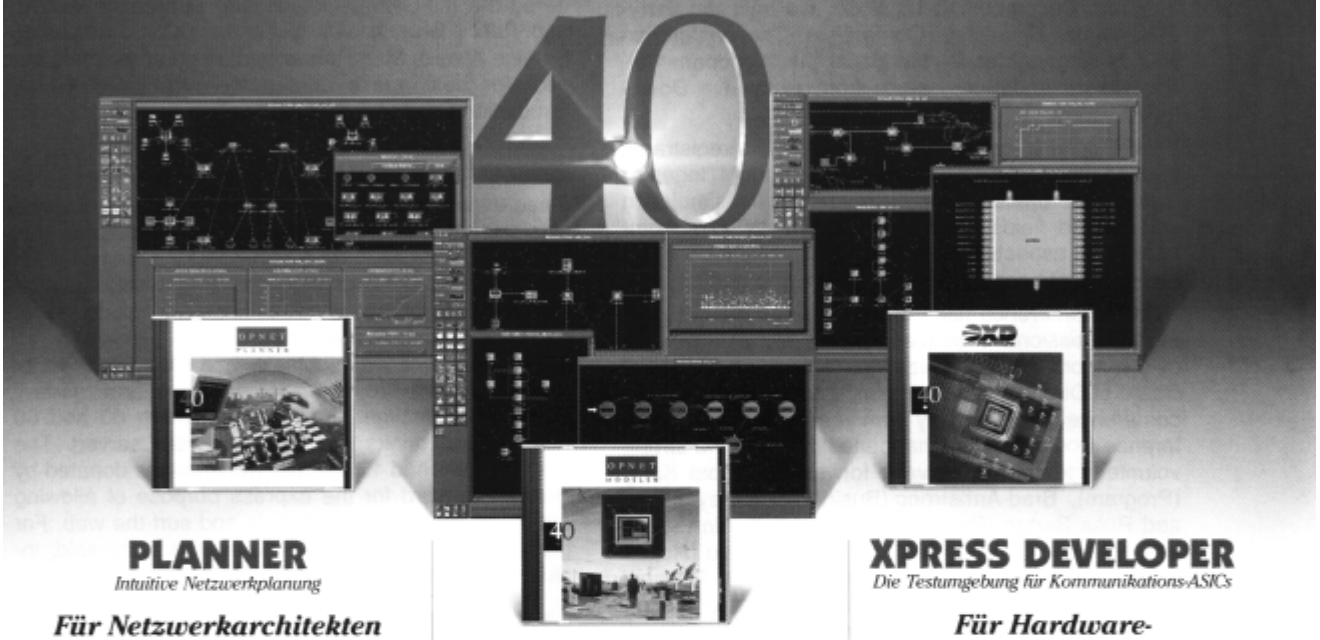

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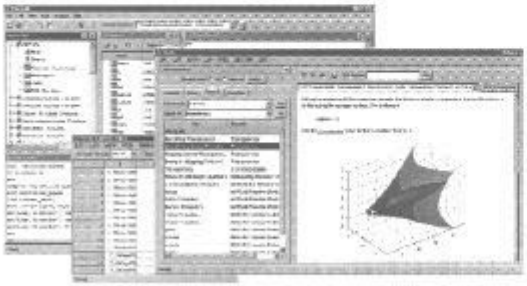

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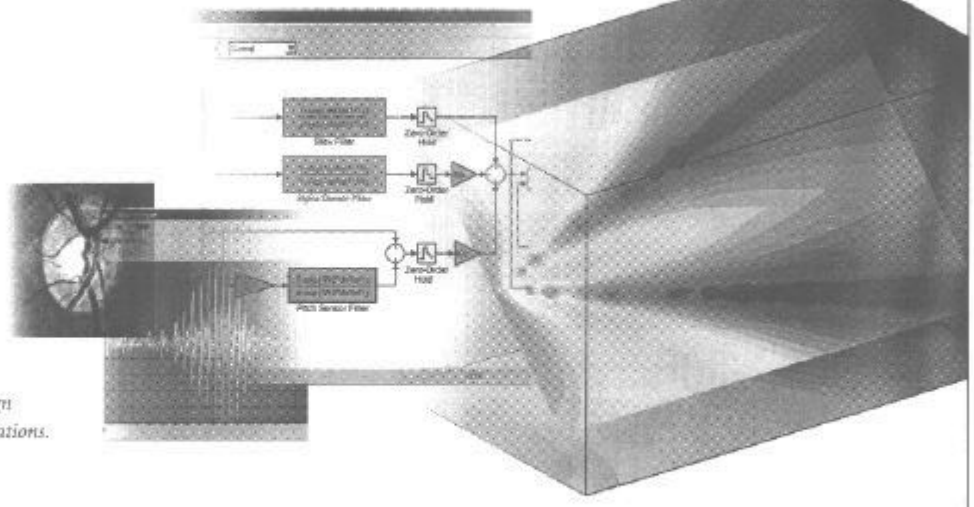

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