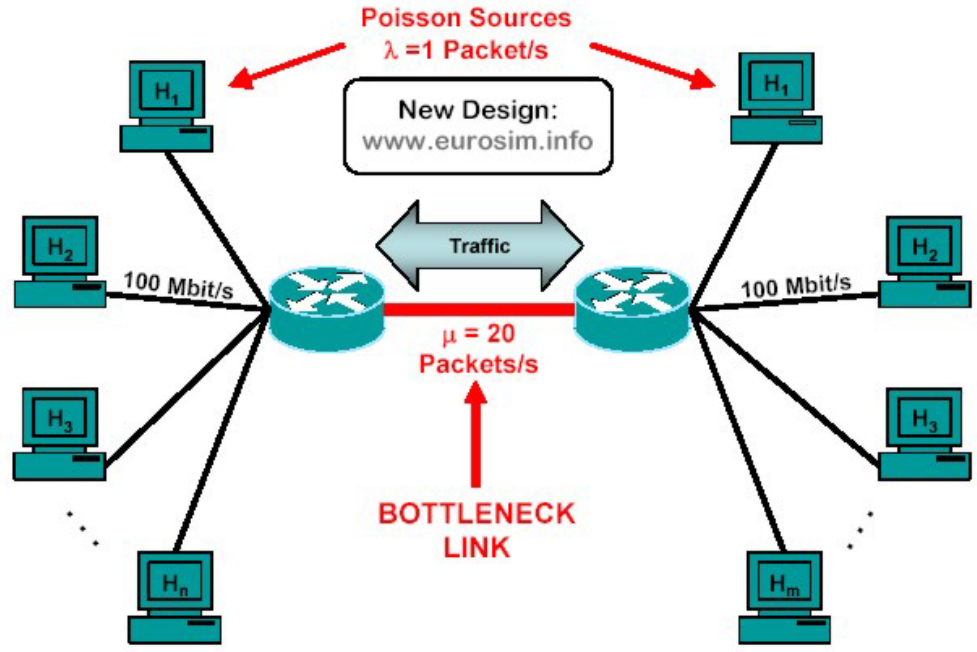
SIMULATION NEWS EUROPE

S N E

A European Forum on
Development in Modeling and Simulation



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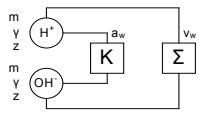
News Flash

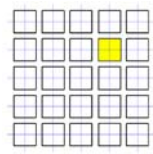
Discrete Event Software Evaluation
Comparison and Decisons Support for discrete Simulators
– *page 3*

Simulator A, or Simulator B, that is the question!



Flowsheet Toolbox for Chemical Processes
Analysis of flow models at different levels
– *page 14*

SIR-type Epidemic- C17
Definition of a New Comparison working wirh Cellular Automata
– *page 42*



C1, C8, C10, C12, C14, C15, 2 x C16 C17 **9 Comparison Solutions**
Comparisons of Modelling and Simulation Techniques and Tools – *page 45 - 53*

24 Book Reviews - *page 54 - 64*

Simulation Organisations: MATHMOD, Sim-Serv and Modelica
page XXI - XXIII

…….And Much More

Impressum

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Scope: Information on development in modelling and simulation, membership information for European simulation societies and for SCS Europe, comparisons on simulation techniques

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EDITORIAL

Dear readers,

This issue again continues the opening of SNE towards alternative modelling approaches and simulation- related areas. The new Comparison C17 "Spatial and Temporal Evolution of a SIR-Type Epidemic" is the second one, which does not address different simulation tools, but which addresses the comparison of different modelling approaches – in this case ODE modelling and modelling with cellular automata. We also can present solutions to Comparison C16 "Restaurant Business Dynamics" – the first Comparison with this new aim, showing very different approaches.

We will continue with Comparisons of this new kind, and we will complete the Comparisons by a more detailed model description and model derivation, introducing also into applications and backgrounds. These model descriptions will start in the next issue. Each comparison can then be used as self-containing part of a lecture on modelling and simulation, with model description and derivation, application area and background, comparison definition (i. e. specification of exercise or case study), various solutions, and various implemented models with sources.

The Technical Notes and Short Notes also reflect the fact, that nowadays modelling and simulation is met in very different areas, and that modelling and simulation is not only linked to ODE and DEVS modelling. Paul Schausberger from Vienna University of Technology introduces into flowsheet modelling in chemical engineering. Shabnam Tauböck from ARC Austrian Research Centres reports about modelling for points-of-sale for electronic toll devices resulting in a database-driven utilisation model and in an education. Björn Johansson from Chalmers University of Technology presents an interesting evaluation of approaches and tools for "Dynamic Rough Cut Analysis".

*Organisationally, we are separating the News Section more strictly from the Notes Section. The reviewed Notes Section guaranties the citation of **SNE** papers as scientific papers. The **News Section** can be found again at the end of the issue. In this issue not only contributions from the EUROSIM Societies can be found, but also information about modelling standardisation organisations (Modelica) and about simulation engineering agencies (Sim-Serv).*

*We thank all authors and members of the editorial boards for their co-operation. We ask to take care on the deadlines, so that each society can publish information and news in time; deadline for the next issue **SNE 43** (June 2005) is May 1st, 2005.*

Felix Breitenecker, editor-in-chief
Felix.Breitenecker@tuwien.ac.at

Table of Contents

Aims & Scope

The journal **SNE - S**imulation **N**ews **E**urope – is intended to inform about developments in modelling and simulation by technical notes, short notes, software notes and comparisons, and to report about news from European simulation societies and from International Simulation Societies and Groups.

SNE reports in the *News Section* on EUROSIM, EUROSIM societies, and on other International Simulation Societies and Simulation Groups.

SNE's *Notes Section* publishes technical notes (fully reviewed), short notes (reviewed), and software notes on general overviews or new developments, on new software and hardware, on new applications and methods. Furthermore **SNE** presents *Simulation Centres,* introduces *Simulationists* and reviews 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.

All contributions are selected and may be edited. For news publication, please contact a member of SNE's News Editorial Board (p. XX), for publication of technical notes, short notes, etc. please contact a member of SNE's General Editorial Board (p. 37) or the Editor-in-Chief.

TECHNICAL NOTES

Discrete Event Simulation software evaluation for "Dynamic Rough Cut Analysis"

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…evaluates discrete event simulation software (DES) wrt to dynamic rough cut analysis,

…presents the idea of dynamic rough cut analysis (DRCA) as a concept for a more efficient way of working with DES: quick modelling and simulation for daily work, for pre-studies, for stop-or-go decisions etc,.

…tests features and efficiency of Simul8, Witness, Extend, and Taylor ED for DRCA, and

refers to a reference model and to the multi attribute utility theory (MAUT) for evaluation.

Abstract

Many companies view simulation as a complex expert tool, and therefore do not use it as frequently as they could. The purpose of this paper is to asses what Discrete Event Simulation (DES) software is suitable for the modelling of Dynamic Rough Cut Analysis (DRCA). The paper presents an evaluation of different DES software suitability for DRCA. A reference model built in four different DES packages was evaluated according to the Multi Attribute Utility Theory (MAUT).

The software packages evaluated are Witness, Simul8, Extend, and Taylor ED. This evaluation can be used as a guide for choosing the proper simulation tool to speed up the decision process in the early stages of larger projects or for fast feedback in smaller projects to support decision-making. The need for speed during model building addresses the importance of an easy to use simulation tool since many simulation packages demand expert knowledge of the user in order to be fully utilised.

The focus of this study has been on the concept of "Dynamic Rough Cut Analysis", which means building DES models rapidly and efficiently. A consequence of speed in the building of a model is a rougher level of the system being modelled, although it gives enough detail to allow strategic decisions to be made. The results imply that Simul8, Extend, and Taylor ED are suitable softwares for conducting DRCA.

1. Introduction

Production development has undergone considerable changes during the past decade in terms of development times owing to the shorter lifecycles of today's products [1-4]. An increasing need of faster decisions has also extended in industry along with the ongoing revolution in production turnover [1-4]. Many industries are facing a higher level of product mix, an increasing need to reduce costs, and shortening the lead-time in development and in production processes. To be able to cut time spent in product and production development, there is a need of a tool that supports fast decisions.

According to a broad investigation by Eriksson [5], Discrete Event Simulation (DES) rates among the top three tools used in management science. Nevertheless, simulation has not been spread and exploited in an efficient manner. In many cases, engineers try to solve problems in other ways, thinking that simulation will only make the problem more complex and time consuming. Production engineers must master a wide range of skills, which makes it difficult for them to have expert knowledge of DES as well. This problem has been discussed in many articles and books, pointing out for example:

- A large simulation project can be a very tedious and time-consuming task [4].
- The complexity of simulation packages requires expertise [6].
- Simulation modelling and analysis can be time consuming and expensive [7].

These statements address the unspoken wish for simpler, faster and more effective ways of conducting simulation projects. To work efficiently with simulation, a framework such as the one presented by Klingstam [8] is necessary. This framework describes how, what and when to use DES in the different lifecycle phases. Although using a framework will facilitate work with DES, there are still situations when a quick estimate is needed in order to understand the importance of a problem, especially in early phases of a project when the decision is to be made as to whether a problem requires further investigation.

Using DES together with the concept Dynamic Rough Cut Analysis (DRCA) can speed up the decisions.

The main objective of this paper is to evaluate and recommend appropriate simulation packages for DRCA. The evaluation takes into consideration the most important criteria of DRCA modelling, such as tutorial, execution, output data visualisation, straightforward models, multi-faceted models, and editing possibilities. The evaluation of these criteria was made using MAUT and a reference model. In which four different simulation packages were evaluated: Extend, Witness, Simul8, and Taylor ED. The aim of this paper is also to describe these software packages with regard to the criteria evaluated. The recommendations are based on an evaluation in which 24 Master of Science students at Chalmers University of Technology have built a reference model in each of the four different softwares.

This TN is structured as follows: The next section describes DRCA theory and why it is important. We then outline the methodology used to evaluate the DRCA software. We follow this with a description of the evaluation of DRCA software packages, and then a description of the software packages evaluated is presented. In conclusion, we discuss the results and future research in this area.

2. Dynamic Rough Cut Analysis

The focus of this study has been on the concept of "Dynamic Rough Cut Analysis", which means building DES models rapidly and efficiently. DRCA is a concept for a more efficient way of working with DES as a decision tool in pre-study phases. Decisions must often be made on short notice, which requires swift work in the process. Ordinary simulation projects tend to be time consuming, taking weeks to many months. The goal of DRCA is to reduce the time spent in model building and experimentation to hours. This makes DES a powerful tool for engineers in their daily work, such as in pre-studies, stop-or-go decisions, and other similar situations. Due to the speed with which models are built, the quality will be very rough. This roughness will make the validation difficult and will in many cases not be accurate.

This way of separating the "tool" from the decision maker is unfortunate in terms of testing creative solutions. Engineers are bereaved of their intuitive ideas that may be possible to test with simulation software. Furthermore, the creative environment improves with the support of DES. The simulation software that engineers need is a tool that is quick and uncomplicated to operate, which make it possible to respond rapidly to ideas.

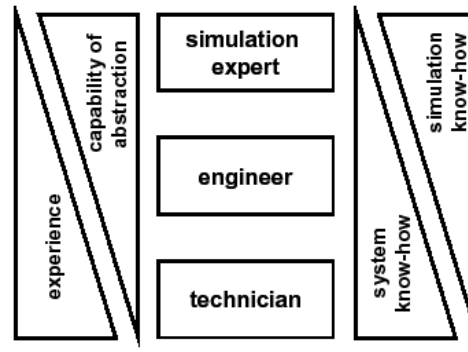

Figure 1: System knowledge versus simulation knowledge [9]

Since the tool will be only one of many in an engineer's daily work it should be very user-friendly and the model needs to be up and running without major start-up preparations each time a new analysis is made. A common answer to the question of why companies do not use DES in their daily work has been that it is considered an expert tool [5] that is time-consuming and expensive [4]. For this reason the simulation expert must work closely with engineers and technicians to make the know-how of a system and the simulation overlap each other [9].

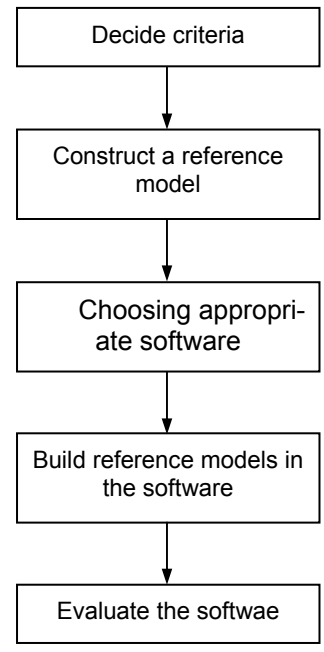

Figure 2: Methodology used in the evaluation of DRCA software.

3. Method and Procedure

The four DES softwares, Witness, Taylor ED, Simul8, and Extend, were evaluated in order to identify which of them is most suitable for conducting DRCA. The methodology used in the software evaluation consisted of the following steps, Figure 2.

3.1 Evaluation criteria

After considering some frameworks for simulation software evaluation [6, 10, 11], a decision was made to base the DRCA evaluation on the hierarchical framework for simulation software evaluation described by Nikoukaran [6]. This framework was modified to fit the evaluation of suitable software packages for DRCA according to Figure 3. The modifications are made considering the most important criteria for DRCA, all of which manage speed and quality in conducting the DRCA. The evaluated criteria used in the evaluation methodology are described in the following sub-sections.

Tutorial

The tutorial service in simulation software is of critical importance for initially learning the basics of the software very quickly. Questions asked to evaluate the tutorial are, for example:

- Is there an online tutorial?
- Are there any example models from which to learn?
- Does the package contain a beginner's guide?

Other features considered in this category are: Online documentation, multimedia examples, and help function.

Execution

The execution of a DES model is important in debugging the model in the verification phases and comparing it with reality in the validation phases of the model creation procedure [12].

This is primarily significant in terms of changeability and level of understanding during a "test run", but is also important when the model has been completed and an analysis is being made. Questions asked to evaluate the execution of models are, for example:

- Does the model have to be compiled before a run?
- Is it possible to make model changes during a run?
- Is there any way to control the execution speed?

Other features considered in this category are: Warm-up, multi-runs, random seeds, and confidence intervals.

Output data visualisation

The output data visualisation of the runs in DES software used for DRCA is of critical importance. This is why the model is built and it must be clearly presented and easily accessed for it to be useful. Questions asked to evaluate the output data visualisation are, for example:

- Is the output data easy to access and understand?
- Does the model clarify the ongoing events?
- Can the output data be visualized during a simulation run (graphs, numbers or bars)?

Other features considered in this category are: Gantt chart, histogram, animation and customised reports.

Straightforward models

Being able to build straightforward models fast is the most vital ability for conducting fast, efficient, and successful DRCA. This is the main objective of the DRCA, which also requires the model building in the software to be intuitive. This is a question of a user-friendly interface and of the architecture of the software. The aim in this category is to get the desired model up and running almost instantly without the use of a manual.

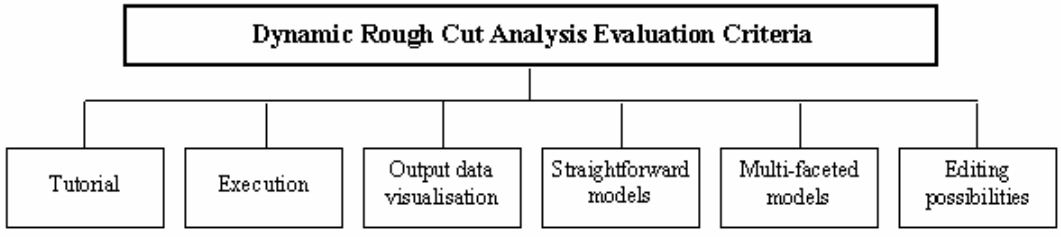

Figure 3: Criteria Groups of the Hierarchy used in the DRCA Evaluation [6]

Questions asked to evaluate the possibility of building straightforward models are, for example:

- Is the flow easy to define?
- Are the logical couplings automatically connected?

Other features considered in this category are: Model creation without manual, intuitive model building.

Multi-faceted models

Although multi-faceted models is not of critical importance in DRCA, it must still be considered mainly because of an uncomplicated task may need implementation of a multi-faceted model. This is required in the DES software to make it function in agreement with the desires of the user. Questions asked to evaluate the possibility of building multi-faceted models are, for example:

- Is it possible to create complex multi-level models?
- Is there any easy way to access the source code?
- Is it possible to merge models?

Other features considered in this category are: Conditional routing and hierarchic modelling.

Editing possibilities

Editing a model when using DRCA must be easy and functional without menus and pop-ups to learn and manage before locating the item to be edited. Functions such as cut, copy and paste are effective, timesaving and useful features that are desirable in DRCA software, while too many drill-down menus are not as desirable. Questions asked to evaluate editing possibilities are, for example:

- Is the cut and paste function easy to access?
- Is it possible to cut and paste between models?
- Does the software package contain modular functions in order to build models faster?

Other features considered in this category are: Drill-down menus, source-code editing, and autocorrecting features.

3.2 Evaluation software selection

Different DES software packages are suited for different customers, not only in terms of focus areas, such as logistics or manufacturing, but also in terms of different types of users, such as everyday users and one-shot project users.

A simulation package for DRCA modelling has to be in line with user needs, since the simulation-software will just be one part of users' daily work. These needs are translated into evaluation criteria that will, if fulfilled, ensure effective use of the tool.

This evaluation was made in four software packages suitable for DRCA, which is why software such as QUEST, Automod, Arena and the like did not qualify for the evaluation. These software packages tend to be suited for longer and more complex analyses, which make them too time consuming to be used for building DRCA models.

In section 4 Intuitive assessment of Dynamic rough-cut analysis software, we will describe the selected software used regarding the evaluation criteria.

3.3 Evaluation reference model

The reference model used in the evaluation is a straightforward model with one small complexity that is to maintain the order of the products after the parallel machines. This means that no overtaking is possible at the parallel section of the model, Figure 4. The circles in Figure 4 represent operations and the triangles represent buffers.

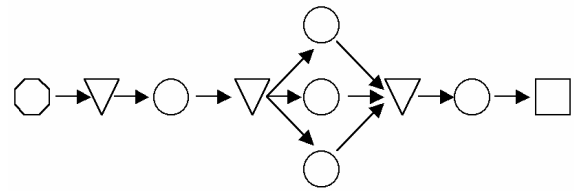

Figure 4: Reference model used in the DRCA evaluation

3.4 Executing the evaluation

24 Master of Science students made the practical portion of the reference model building as a part of a DES course given at Chalmers University of Technology during the spring of 2001. Each student built the reference model individually in each of the four software packages. The software was chosen in random order by each student. DES assistants supported the reference model building, but the main issue was for students to solve problems by using the online help. After the construction of the model in one of the pieces of software, a form was filled in with the different criteria in the section on evaluation criteria. The six criteria were given a score of 0, 2.5, 5.0, 7.5 or 10, depending on the impact the specific criteria have when conducting DRCA, see section 3.1 Evaluation criteria. These scores were then used to calculate the mean value for each criterion, which in turn was multiplied by the factor from the weighting of each criterion. The simulation software packages were evaluated using the Simple Multi-Attribute Rating Technique (SMART), which is a version of Multi Attribute Utility Theory (MAUT). The SMART technique is supported by a piece of software called Decision Plus, which is distributed by InfoHarvest inc. [18].

Decision Plus handles the data from the evaluated criteria and calculates the part ratings and the total rating for each DES software package. The evaluation criteria were weighted from zero to ten in comparison to the importance of each factor for the DRCA. The criteria are described in section 3.1:

- Tutorial 7,5
- Execution 2,5
- Output data visualization 7,5
- Straightforward models 10
- Multi-faceted models 2,5
- Editing possibilities 10

The logical connections between each part of the evaluation are shown in Figure 5, which is a screen-shot from Decision Plus.

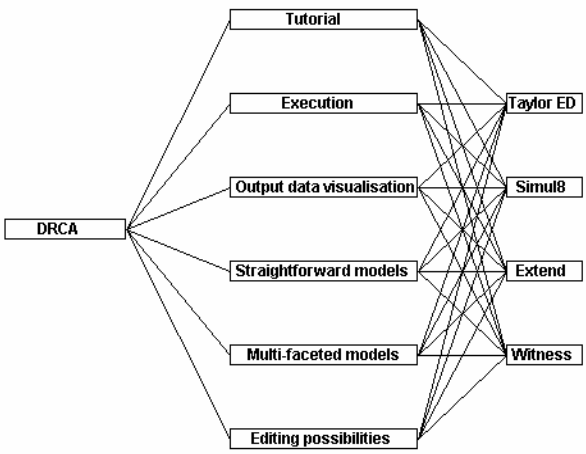

Figure 5: Snapshot form Decision Plus of the Evaluation Model based on SMART.

3.5 Evaluation results

This evaluation shows that the most suitable software for conducting DRCA, according to the test group, is Simul8, Figure 6, although Extend and Taylor ED also received high scores. Simul8 was clearly the best software for making straightforward models, which is an important issue in the DRCA concept. The most important result of this test is that it shows differences between the software packages and how easy they are to operate. The best software package in the different criteria in the evaluation is (from Fig. 6):

- Tutorial Simul8
- Execution Simul8
- Output data visualization Extend and Taylor ED
- Straightforward models Simul8
- Multi-faceted models Extend
- Editing possibilities Extend

Note that this evaluation of the software is made considering only the aspect of usability for DRCA - in other words, not taking heed of any other aspects in DES projects, such as projects in which the users are experienced or more time consuming projects. Figure 6 also clearly shows that the three software packages Simul8, Extend, and Taylor ED are better suited for use in DRCA projects. Although WITNESS is not as powerful for DRCA, it is very powerful in conducting longer and more complex DES projects.

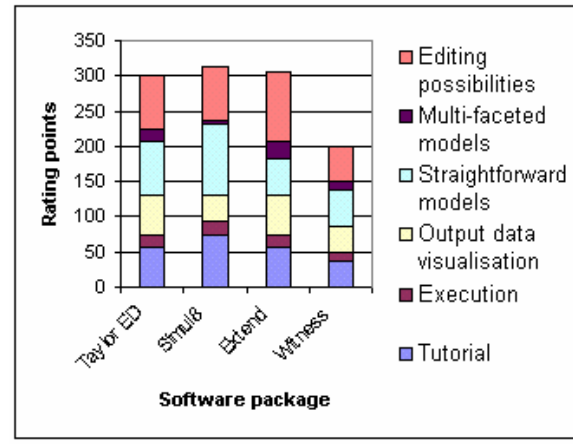

Figure 6: Evaluation results divided according to each criteria group for thr software packages

4. Intuitive Assessment of DRCA Software

This section provides some basic facts about the DRCA software evaluated in this paper. Note that the evaluation was made in software packages suitable for DRCA, which is why software such as QUEST, Automod, Arena and the like did not qualify for the evaluation. These software packages tend to be suited for longer and more complex analyses, which make them too time consuming to be used for building DRCA models.

4.1 Simul8

Simul8, developed by Visual Thinking [13], is often promoted as a package for Quick & Dirty analysis and is frequently used in educational sites.

The model-building concept in Simul8 is very simple to understand and easy to learn how to use. There are actually only five items that must be understood, and all of them work in a similar way. These items are:

- Work entry point (source)
- Work centre (station, server, machine etc.)
- Work exit point (sink)
- Resource (labour, tool)
- Storage area (e.g. queue in front of a station, etc.)

For a small extra fee, the user can get various add-ons, including cost analysis, model optimiser, and Gantt chart output. These add-ons are easy to understand and are integrated into the standard interface in Simul8 [13]. Simul8 is also compatible with VISIO. A"Simul8" button will appear in the main menu in VISIO if simul8 and VISIO are installed on the same computer. Clicking that button transforms a TQM flowchart to a Simul8 model (a "Storage" transforms to a "Storage Bin" in Simul8; Operation, Procedure or Transport are transformed to "Work Centres").

Tutorial

The documentation, which provides help for the user in Simul8, is extensive and consists of:

- On-line tutorial
- Searchable help engine
- Several useful examples
- Reusable models

Simul8 also has a newsletter and WebPages for fast support response on questions about add-ons and Simul8 in general. There is also an Internet café where the user can communicate with a forum of Simul8 experts. However, these resources need only be called upon if the documentation does not give the user good enough help.

Execution

The executions in Simul8 are handled interactively by dialogs. There is also a speed control with infinite levels that can be managed during a "run". The possibility of running experiments in batch runs is included, as well as a model optimiser in one of the add-ons.

Output data visualisation

The visualisation of output data from Simul8 can be viewed during the run in line graphs and histograms, as well as after the run in a previously defined output statistics file. Cost analysis and Gantt charts can also be obtained if the add-ons are installed.

Straightforward models

Building straightforward models in Simul8 is not difficult. It is very easy to create a system consisting of straight-line operations (even without a manual) and is up and running almost instantly.

Multi-faceted models

On the other hand, multi-faceted models are more difficult to obtain. In simul8, the Visual Basic program language supports complex control logic. The user does not have access to the source code, but hierarchic modelling is possible although it must be created carefully. Merging and modularity are possible by the use of "sub-models". Since all control logic is hidden, an overtake may be awkward in Simul8.

Editing possibilities

Copy and paste features are superb when using the Ctrl-key to duplicate a work centre, but are slow and sometimes messy if a complete model is selected. There is no possibility to copy and paste to a word processor.

Other assessments

It is easy to edit a Simul8 model, but there are some small annoying details, such as when the spell checker always wants the user to type in all names of resources with correct spellings. The spelling checker continues to show the comment "misspellings" until it is disabled. A problem is that, despite disabling the spelling checker, this action is only temporary and is enabled again each time Simul8 is launched.

4.2 WITNESS

The WITNESS software was developed during the 1970s and is now distributed by the Lanner Group [14]. The package used today has a mature user base, which probably suffers from the "innovator's dilemma" [15]. WITNESS was previously, and probably still is, the market leader, although only in number of the models produced.

The cost of a WITNESS licence is about ten times more than it costs to purchase Extend or Simul8. The support is also somewhat more expensive in the case of WITNESS, approximately as much as for a new licence for the other software packages. On the other hand, WITNESS is one of the most used, most reliable and best known among the DES software. The WITNESS simulation package is not primary developed for use in DRCA, but it is one of the best-suited software among the older ones for use in this kind of modelling.

The model-building concepts in WITNESS consist of building blocks similar to those of Simul8 except for the source and sink blocks. A source block is simulated with either an item (part) initiating and feeding itself into the model or by the use of a workstation that pulls out an item from "world" and then pushes it into the model. A "sink" is simulated with a workstation pushing out an item to "ship".

The model-building concept in Witness is generally "define", "display" and "detail". The model-building process starts by defining elements (work stations, resources and buffers), then displaying the elements on the screen. Finally, the control logic is implemented, detail. This process is simplified with a "library" called "Designer Elements". With clicking and positioning, the elements are placed on the display. The easiest control logic, concerning routing, is accessed by push buttons in the menu.

To add a complete new activity/element in WITNESS, the process must be repeated (define, display, detail) for the "new" element. It is possible to clone an element by changing its quantity.

WITNESS can communicate with excel sheets to treat input and output data. WITNESS is also compatible with VISIO-like software called Mood, and it is possible to create a "Flowchart" background directly in the WITNESS software.

Tutorial

Since there is a high yearly fee for support for the WITNESS software package, it also comes with good support. The online support is limited to some example models and tutorials but, on the other hand, the support function consists of an Internet café as well as standard email support, which are both well developed.

Execution

The executions in WITNESS are handled interactively by dialogs. It also has a speed control with infinite levels that can be managed during a "run". The possibility to run experiments in batch runs are included, as well as a feature for model optimisation.

Output data visualisation

The most preferable output data visualisation is made in Excel from the WITNESS software package, mainly owing to the good compatibility between these pieces of software. The output data from WITNESS can be visualized during the run in line graphs and histograms, and after the run in the output statistics files.

Straightforward models

Since the WITNESS software package is old, many add-on features have been developed during the years, such as prepared output and input data fields. However, this also complicates model building; even if the model is simple and straightforward, quite a bit of effort must be put into understanding the software before the user can build quickly and efficiently. The model must be filled with data to be able to run, which also makes the model building more difficult.

Multi-faceted models

On the other hand, when it comes to multi-faceted models, WITNESS has its strengths. Hard coding in prearranged menus supports complex control logic, and hierarchic modelling is possible by using different layers.

Editing possibilities

Ctrl+C/Ctrl+V do not function; instead, a "clone" button must be used. It is not possible to position the elements in WITNESS by selecting and using the arrow keys.

All control logic (e.g. element routing) must be coded. Some assistance is placed under the "prompt" button but for the most part, it must be coded.

Other assessments

As with Simul8, there are some small annoying details in WITNESS as well. The "space" character is not allowed in WITNESS names. When an object's name is hidden behind a window (if you are in the detail/machine/action phase), it is not possible to move the window. The delete button is not operational; instead, a button in the menu must be used.

4.3 Extend

A former rocket drop simulation engineer at NASA, Bob Diamond, is the founder of Imagine That Inc. [16], which is the developer of the Extend software package. Extend is promoted as a package for simulation in general, and the user-friendly interface gives the user a good start in learning Extend in a short time. It might be the market leader in terms of number of licences sold, but probably not in quantity of models created, where WITNESS leads the market.

The method for creating a model in Extend is very similar to the method used in Simul8 except that Simul8 uses only five types of items (source, queue, station, labour and sink) to handle the load while Extend has about 200 types of items. The 20 libraries construct the model-building concept in Extend, each with 15 different building blocks. Each library is identified with a name. For example, the animated output data blocks are positioned in the "plotter" library and math functions in the "generic" library.

The integration between Extend and Excel and the like is controlled with spreadsheet links, which exist in several ways, either by a functional block (send and receive) or by text files. There is no direct connection between Extend and programs similar to VISIO. However, the copy & paste function works very well, which at least gives a "Flowchart" background in Extend.

Tutorial

The documentation in Extend to help the user during model building and simulation of the experiments is extensive and contains the following:

- Searchable help engine
- Printout tutorial
- Numerous useful examples
- Reusable models

The support function in Extend consists of an Internet café and regular email support activities. The support is included in the purchase of Extend, as are some add-ons dealing with manufacturing and business process re-engineering. These add-ons are easy to understand and are integrated into the standard interface in Extend.

Execution

It is possible to adjust the model input parameters during a run in Extend, which gives the user good help in debugging the model to be able to verify and validate it. In addition to this, the interactive dialog boxes and the speed control (approximately five levels) are both very easy to access.

Extend gives the user the opportunity to make batch runs when the model is ready to be used for experiments. The optimizer, which is included in the manufacturing add-on, gives the user help with the tuning of the model to find a good solution to the stated problem.

Output data visualisation

The output data visualization in the Extend simulation package can be viewed in many forms during the run, such as in line graphs, histograms and numerous shapes of the variables. The output can also be stored during the run to be viewed in excel or text files when the simulations are complete.

Straightforward models

A system consisting of a straight line of operations is easy to create, even without the manual, and it is up and running almost instantly.

Multi-faceted models

This flora of items for controlling the flow of loads in the model adds strength in terms of multi-faceted models but also slows down the knowledge ramp-up in the software for the user.

A language called Visual Logic supports the complex control logic. The Visual Logic commands are accessed by pointing and clicking, in which all instructions and conditions are found below in “drill down” menus.

Editing possibilities

The copy and paste features between models, including between the Extend models and the “Office Package”, are effective (Ctrl+C/Ctrl+V). While editing an element (for example a cycle time in a machine), the adjustment is confirmed immediately when it is typed in.

Other assessments

In Extend, it is not necessary to close an edited window before opening another one or to see what is behind the window. Hence, there is no”OK” click, which eliminates the positioning of different windows.

4.4 Taylor ED

Taylor ED is a newly developed software package from Flexsim Software Products [17]. The precursor to Taylor ED was Taylor II, but the developers have made the new version from scratch [17].

Despite this, there are many similarities between the two software packages, such as the user view and the architecture of the software. Taylor ED’s price is about half of that of WITNESS and five times more than the other two (Simul8 and Extend).

The integration of Taylor ED with other software is handled by a DDE link, which distributes the information to and from Excel, for example, or other software for data structure management. This DDE link makes it possible for Taylor ED to use different database formats, such as SQL or XML. This is continuous and connections can take place either before or after the simulation is made.

The model-building concept in Taylor ED is the same as the developer used in Taylor II. This concept is different from the other software. In Taylor ED, everything is an atom (product, machine, the model itself, the software application), as compared to Simul8, which consists of five building blocks, and Extend, which consists of over 100 building blocks. Flow connections between the atoms in Taylor ED are determined through channels, which is the same thing as links in the other software packages.

Tutorial

The documentation for Taylor ED consists of:

- On-line tutorial
- Searchable help
- Several useful examples

In case there is not enough help to solve the problem, Flexsim also has email support combined with another feature, an Internet exchange place where models and functions are emphasized. The user has to pay an hourly fee to obtain personal online support from Flexsim.

Execution

The execution in Taylor ED is made without compilation; this enables the code to be changed by the user or by the system while executing. Note that: product behaviour, machine locations and flow can change interactively because no compilation is needed, which is a useful feature.

Output data visualisation

The output data visualisation is good in Taylor ED. The user has many options to choose from when selecting the way in which output data are analyzed, such as line graphs, built-in histograms and customisable graphs.

There is also an extensive built-in report system that the user can easily access. This report can also be exported and viewed in the viewer of the user’s choice. The different display settings for visualization while the model is running are also optional.

The possibility to view the animation in virtual reality through OpenGL graphics is supported but is hardly needed in DRCA.

Straightforward models

The model building in Taylor ED is simple and user-friendly. It is easy to build a straightforward model and the models are up and running immediately.

Multi-faceted models

On the other hand, in building complex, multi-faceted models, the user must use programming. The language built into Taylor ED is 4Dscript. The 4Dscript can be used to increase the predefined logic. It can also be used to build different product and machine logics and appearances, which is a powerful feature.

Editing possibilities

The feature for copying and pasting models and logic between models is well developed.

Other assessments

When building the model in Taylor ED, the user is shown a 2Dlayout. During the simulation runs, however, there is an option that allows a choice between 2D, 3D or VR layout.

5. Discussion and Conclusions

The evaluation results show a clear line between complex software packages, which according to this evaluation, can be classified as expert tools (WITNESS). And more DRCA-friendly ones (Simul8, Extend, Taylor ED), where analyses can be made quickly in order to obtain help in deciding whether ideas for improvements are worth implementing, or further investigation is needed.

Different DES software packages are suited for different customers, not only in terms of focus areas, such as logistics or manufacturing, but also in terms of different types of users, such as everyday users or one-shot project users. The conclusion is that a company may need several different DES software packages for their various different needs and that this will speed up the analysis and the decision making process.

The number of decisions that must be made is growing day by day due to the global competition among industries [1-4]. Making the right decision is of vital importance for survival on the market. This evaluation can serve as a guide for one critical successful factor.

Mainly to be used as decision help in early phases of production development. Discrete Event Simulation has for many years been a tool that provides the user with needed support in complex and economically hazardous projects [4, 19].

Although methods for proper simulation analysis have been developed during the last decades, the use of DES has tended to be expert-oriented [5]. This evaluation of DES software appropriate for conducting DRCA analysis shows the importance of choosing the right tool for non-experts.

This evaluation shows that DRCA software can serve as link to use DES in a more efficient way in everyday work.

An efficient approach toward using this tool in projects would be to let engineers use it to support their ideas in early phases. Engineers today work with a large number of different methods and tools for solving production related problems, and DES ought to be one of them.

According to this evaluation, and other studies in this field [3-5, 20, and 21], there is a great need for a simulation package that offers greater completeness in all aspects. As Mabrouk said at the panel discussion “Simulation in the Future” [22]: “I have a dream….”. He continued to name all the positive factors needed for a successful simulation project such as: Perfect input data, easy to interpret output easy, models that can be built in a second, software without bugs, and free software packages. While this is not yet the case today, this evaluation shows efforts in the direction Mabrouk mentioned with respect to time spent on simulating a system.

The DES software of today tends to be developed for an everyday use that normally focuses on larger companies with simulation experts. DES software also tends to grow in complexity with each new release as a result of users’ needs of new functions, which makes the programs increasingly expert-associated. This negatively affects new users who must develop knowledge in the software, since the level that must be achieved before being able to use the software fully gets is continually being raised. It is also important for the developer of the software not to make excessively great changes in the interface. If this is done, not even experienced users will recognize the software interface in new releases.

The evaluation described in this paper was made by students for whom this was their first contact with DES software packages, and it reflects their points of view concerning how well the program fit the concept of DRCA. This also means that the evaluation was made with the intention to help engineers who have previously not used DRCA at all to employ DRCA technology.

Even though the students were unaffected and had no previous experience in the field of DES, similar study may show different results, but not likely completely different.

Another important topic is to address the issue of working with DES as a method to meet the new needs companies are facing today.

The results of the evaluation point out certain positive features included in the more user-friendly software packages for DRCA (Simul8, Extend and Taylor ED):

- The price of simpler software is less.
- The time needed to conduct a DRCA project is shorter.
- No expert knowledge in DES is required.

On the other hand, there are also some distinct disadvantages:

- The software features are limited.
- Data interpretation can be difficult for the inexperienced user.
- Other software might be needed to conduct longer and more complex projects.

Due to the high speed in which models are being built in DRCA projects, the quality will be very rough. In cases where the consequences of the decision have a critical impact on investments, a more extensive DES project must be conducted to clarify results and ideas. In this case, it is advisable to contact a DES expert.

Author Biography

BJÖRN JOHANSSON was born in Gothenburg, Sweden, 1975. He attended Chalmers University of Technology at Mechanical Engineering, where he obtained his M.S. degree in Production Engineering in 2000, and his Licentiate Degree in 2002. He is now working as a PhD student in the field of Discrete Event Simulation and Productivity Improvements in Manufacturing Systems at the Department of Product and Production Development, Chalmers University of Technology, Sweden.

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A Toolbox for the Chemical Engineer: Flowsheet Models of Fluegas Cleaning Topics

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… introduces into conceptual formulation of a process-simulation: property level, unit operation level, and process level
… sketches flowsheet models for property level, unit operation level, and process level,
… presents the implementation of these flowsheet models in a software for steady-state flowsheet simulation,
… and shows as application fluegas cleaning topics.

Abstract

A commercial software for steady-state flowsheet simulation on base of user-defined models is applied to gain insight to the fluegas cleaning process and to provide a tool for designing these complex systems: firstly, a tool for supporting the basic engineering by enabling fast and transparent comparison of different process-schemes is sought for. Secondly, a sub-system within these processes - the unit operation of SO_2 absorption (scrubbing) - is investigated for its efficiency and output properties, which is decisive for the water and resource balances of the whole process. Thirdly, a further sub-system - the phase equilibria within the scrubber – is analyzed, determining the gypsum solubility in mixed electrolyte solutions.

This conceptual formulation corresponds to the structure of a process-simulation in general: the property level describes the substances and their physical properties, the unit operation level delivers the apparatus performance, the process level depicts the overall mass and heat balances. The outcome are flowsheet models for each level: the question for gypsum solubility leads to a new concept of depicting aqueous electrolyte solutions. The information gained on this level is transferred to the unit operation level, where idealized reactor models give quantitative data on the absorption unit. The result on process level is a highly flexible flowsheet tool evaluated in industrial practice, for balancing different fluegas cleaning schemes. The simulation of three processes for emission reduction after waste incineration and the comparison of its performance serves for demonstration.

The results from the methodological point of view are the applicability and the limitations of the software for future topics and new ideas for modeling and simulation strategies in the field of chemical engineering in general.

Introduction

The simulation method as a virtual experiment by means of mathematical models gains more and more importance in research and application of chemical processes. The specific field of process-simulation aims to support the development, design, implementation, operation and optimization of these processes, defined as the arrangement of several chemical and physical unit operations. The processes addressed here are the measures for fluegas cleaning to meet the legal emission limits after incinerating coal, biomass and waste. A mathematical model, that enables simulations answering to the tasks listed above, needs to comprise three main levels; according to this structure, three separate models have been developed:

- the process level, comprising the sequences of unit operations and their connections and delivering the total mass and heat balances
- the apparatus level, describing a single apparatus and its performance by means of mass and heat transfer formulations
- the property level, describing the substance systems and their physical properties, e.g. phase equilibria, equations of state, …

Generally spoken, there are three groups of software tools applied for process simulation: the first group are user-defined codes on base of programming languages (Fortran, C/C++). Here, hardly any basic equipment for modeling and designing the user-interfaces is available, some commercial ‘plug-ins’ containing property data - e.g. Chemkin [1] - can be used. The second group are environments like Matlab and spreadsheet-software, which offer a default range of features for solution, visualization, etc. - the latter predominate in industrial practice. The third group are ‘high-end’ simulation environments mostly originating from oil processing industry - e.g. ASPENplus and ChemCAD.

These tools offer a wide range of basic equipment for modeling (apparatus models, substance models including property data) and simulation (user interfaces, …) and mostly use a sequential-modular approach.

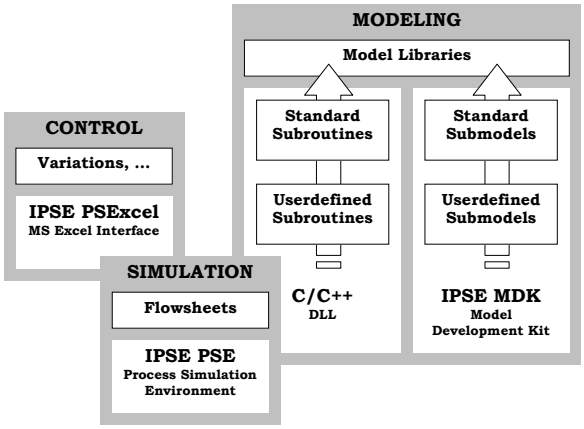

Fig. 1 The modeling and simulation toolbox

The toolbox used here, Fig.1, is based on the commercial software tool IPSEpro and can be classified between group two and three [2]: the main part is IPSE PSE, a steady-state flowsheet simulation engine, which uses an equation-oriented approach (Newton method). The modeling section comprises IPSE MDK, where the models within a flowsheet are designed on base of an object-convention (Unit-Connection-Global). Additionally, external functions can be implemented as Dynamic Link Libraries. For conducting variations or other simulation agendas, IPSE PSExcel - a MS Excel interface – is provided.

1. Property level

The first step when describing a chemical process is modelling the relevant substances and their physical properties. As the streams of interest mostly consist of mixtures, models of different complexity appear: in the simplest case, the mixture is described by an array of mass-, mole- or volume fractions and its physical properties are calculated by linear combinations of the single fraction property. In the most complex case, phase equilibria (gaseous-liquid-solid) occur.

This case is addressed here to answer the question for gypsum (CaSO4.2H2O) solubility in a SO2 scrubbing unit. To solve a system of coupled equilibria within aqueous electrolyte solutions, the following SOLUTER model was developed. The equilibrium condition is derived from the change of the Gibbs free energy within an open system, resulting into the 'Law of Mass Action', e.g. [3]:

$$K^*(T) = \prod_i (a_i)^{\nu_i} \qquad \text{Eq. 1}$$

These equation in logarithmized form and the condition of electro-neutrality for the exemplary water equilibrium (auto-dissociation) H2O ↔ H+ + OH- read as follows:

$$\begin{aligned} \log K = {} & 1 \cdot (\log m + \log \gamma)_{H^+} \\ & + 1 \cdot (\log m + \log \gamma)_{OH^-} \\ & - 1 \cdot \log a_w \end{aligned} \qquad \text{Eq. 2}$$

$$0 = (m \cdot z)_{H^+} + (m \cdot z)_{OH^-} \qquad \text{Eq. 3}$$

The corresponding flowsheet model for simultaneous solution of these equations takes the following shape:

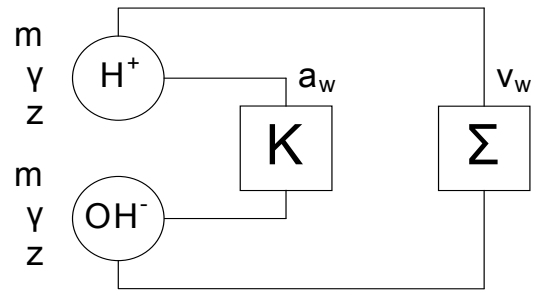

Fig. 2: Model of the water equilibrium

The activity coefficients for the ions and the activity of water are calculated externally according to the Pitzer ACM [4]: the basic equation is a series expansion describing the free excess enthalpy, comparable to the 'Virial-Equation-of-State'.

Here, any interaction between the species in the solution is described by interaction parameters, which are determined from empirical sources for any species pair and triplet. The equilibrium constant results from chemical potentials of the single components, which is also conducted externally [3].

This way, complex equilibrium systems can be depicted and balanced in a flowsheet-like manner. This model has been used to determine gypsum solubility in an aqueous solution. This data is necessary to describe the gypsum balance on process level, as will be shown later:

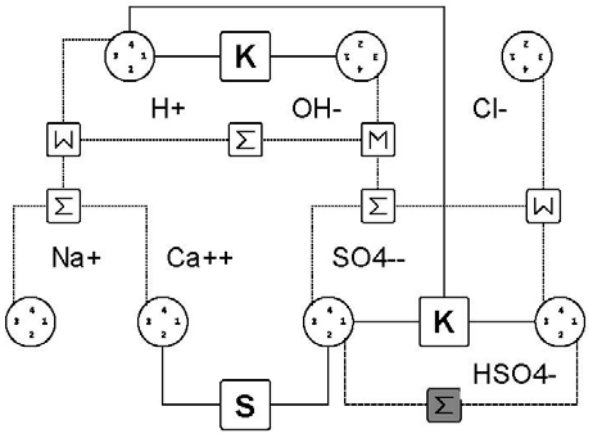

Fig. 3: SOLUTER flowsheet of the NaCl-$CaSO_4$.2H_2O-H_2O equilibrium system

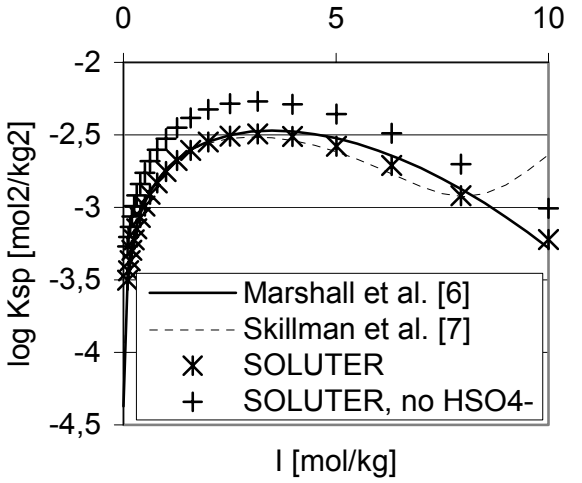

Fig. 4: Comparison of SOLUTER results for the gypsum solubility in the system NaCl-$CaSO_4$.2H_2O-H_2O with data from literature

Fig. 4 shows a comparison of SOLUTER results with less detailed models from literature. This comparison was used to validate the SOLUTER model and to choose the appropriate model for the process level.

The 'SOLUTER, no HSO4-' data reveal the sensitivity of the Pitzer ACM, as neglecting the HSO4- ion causes a considerable deviation of the solubility product despite its low concentration.

2. Apparatus level

The property level, the studies on phase equilibria, delivers the behaviour of a liquid volume of arbitrary magnitude in contact with a solid and/or a gaseous phase. At apparatus level, this behaviour is combined with reactor models, thus with flow rates to predict the apparatus performance.

The apparatus of interest, the spray tower for SO2 absorption into aqueous solution of calcium hydroxide, is widely spread in industry. Nevertheless, the explanation of the single mechanisms and the total apparatus performance by basic principles of physics and chemistry still is a challenging task.

Against this background, the spray section of a spray tower is simplified by means of the following model to identify single mechanisms and dependencies: a SOLUTER flowsheet describes the equilibrium distribution of SO2 and HCl in the fluegas and in the solvent:

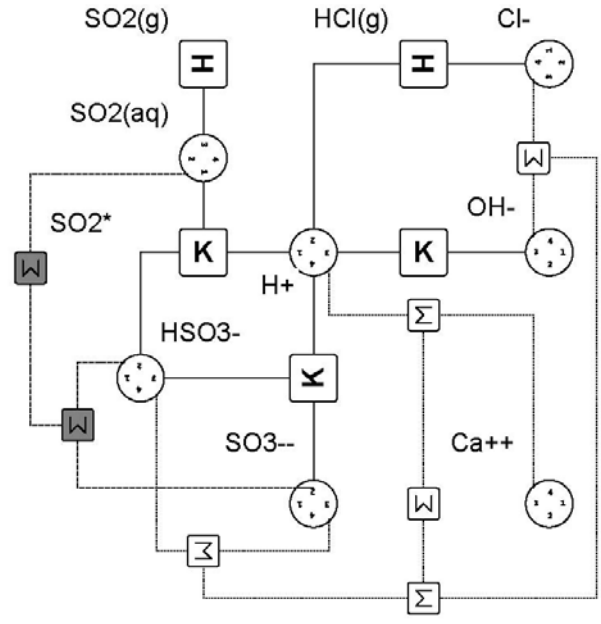

Fig. 5: SOLUTER 'flowsheet' for computing the simplified spray section model

An ideal stirred tank reactor model and the corresponding balance equations are implemented using the PSE feature 'free equations':

MATLAB
MATLAB ist eine intuitive Sprache und eine Oberfläche für technische Berechnungen. Es besteht aus einem mathematischen Kern und modernen Grafik-Werkzeugen für technische Berechnungen, Datenanalyse, Visualisierung sowie für die Entwicklung von Algorithmen und Anwendungen.

Simulink
Simulink ist eine Entwicklungsplattform für den Entwurf, die realitätsgetreue Simulation und Analyse von dynamischen, Systemen und Prototypen. Simulink bietet eine mit Block-Diagrammen operierende, grafische Programmierumgebung zur Modellierung von Systemen, die auf MATLABs mathematischer Kernfunktionalität aufbaut.

Stateflow
Stateflow ist eine grafische Simulationsumgebung zur Modellierung von Zustandsautomaten für den Entwurf ereignisgesteuerter Systeme. Als Add-on zu Simulink bietet Stateflow eine elegante Lösung zur Entwicklung von Steuer- oder Protokoll-Logiken.

Toolboxen
Toolboxen sind Sammlungen hoch optimierter, anwendungsspezifischer Funktionen, die MATLAB erweitern. Sie unterstützen Anwendungen, wie die Signal- und Bildverarbeitung, den Entwurf von Regelungs-Systemen, Optimierungen, finanztechnische Anwendungen, neuronale Netze und vieles mehr.

Blocksets
Blocksets sind Bibliotheken anwendungsspezifischer Simulink-Blöcke für unterschiedlichste Anwendungsgebiete, z.B. zum Entwurf von Steuerungen und Kommunikationssystemen, für die digitale Signalverarbeitung, für die Entwicklung von Festkomma-Algorithmen u.a.

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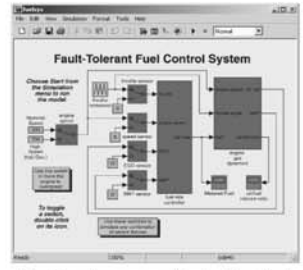

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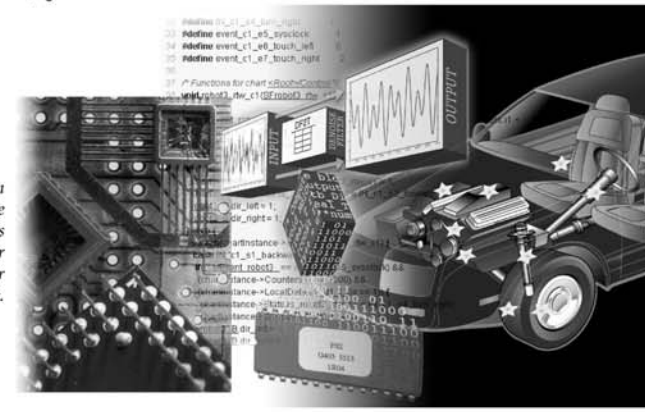

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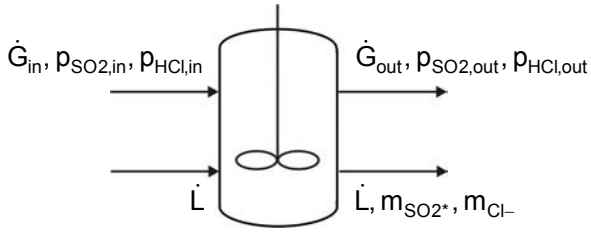

Fig. 6: Spray section modeled as an ideal stirred tank reactor

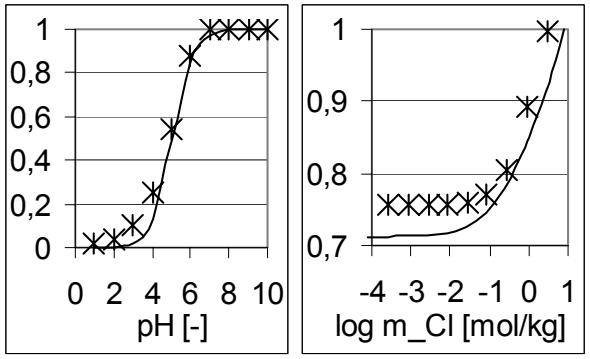

Fig. 7: Comparison of the calculated SO2 removal depending on the pH value of the solvent and the chloride content, *** … theoretic model, --- … empirical model [7]

By means of this theoretical model, the key figure of SO2 removal depending on the most important operation parameters has been investigated. The mean for comparison is a fully empirical model, which was derived from measurements by regression [7]. In spite of the vast simplifications within the theoretic model, the usage of a single stirred tank reactor instead of the appropriate counter-current reactor cascade, two major dependencies can be predicted: as shown in Fig. 7, the dependency of the SO2 removal on the pH of the solvent and the chloride content in the system can be reproduced nearly quantitative.

When it comes to simulating the influences of the SO2 load on the fluegas or the ratio of gaseous and liquid phase, the theoretical model fails.

For predicting the dependencies on all relevant operating parameters within this complex system, more detailed reactor models have to be applied, which are hardly solvable using the equation-oriented approach. On process level, these circumstances lead to the necessity of prescribing the SO2 removal using knowledge of practical feasible values.

3. Process level

Finally, on process level, a new software tool has been developed to improve the basic process engineering in industrial practice. The development comprises the modelling of the current fluegas cleaning technologies for coal and biomass combustion up to the most complex task of emission control after waste incineration [8]. In parallel to the modelling procedure, the tool and the single models have been tested and evaluated by real plant data from industrial practice.

To enable future simulations of total power plants, the models implemented are based on a commercial IPSEpro model library, which allows the thermodynamic design of power cycles. Thus, the first task of the modeling procedure is the identification of the chemical substances relevant to fluegas processing and its classification in terms of global objects. These objects are then combined to yield the composition models for the objective streams (Fig. 8).

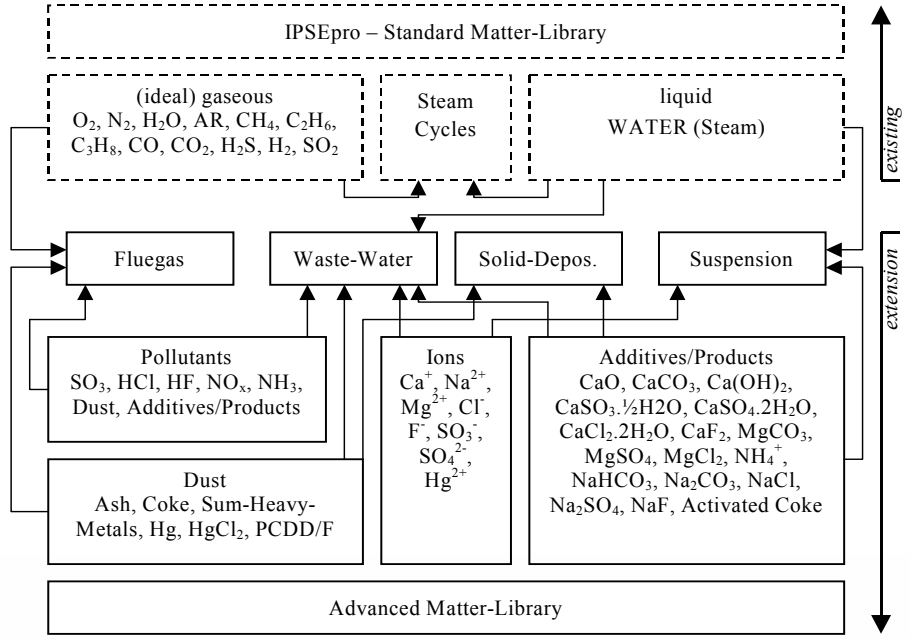

Fig. 8: The substance library

This classification essentially simplifies balancing: if the composition of a global object, a group of substances, does not alter when passing an apparatus, no balance equations for the constituents are necessary.

For demonstration of the software tool, a comparison of three fluegas cleaning processes after incineration of two different types of waste (FG A/FG B) has been conducted [9]:

- [Dry]-Process
- [Wet]-Process, no waste water
- [Wet WW]-Process, waste water

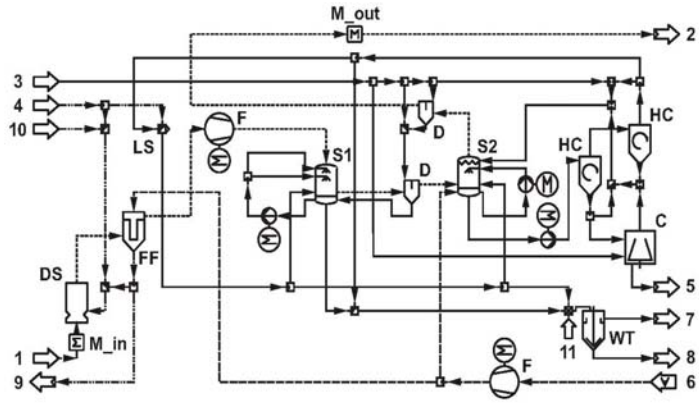

Fig.11: IPSEpro flowsheet [Wet WW]-Process

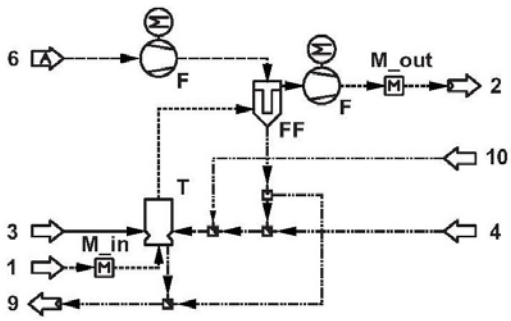

Fig. 9: IPSEpro flowsheet [Dry]-Process

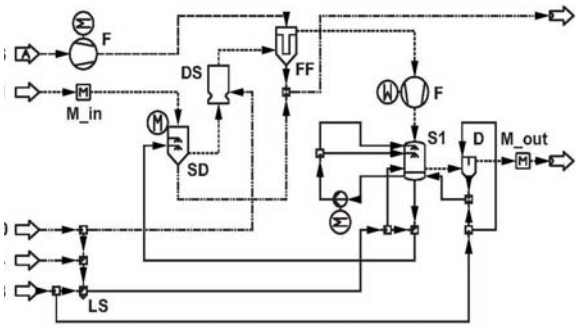

Fig. 10: IPSEpro flowsheet [Wet]-Process

The process flowsheets are setup to meet the emission limits according to 17. BimSchV – German regulation concerning incineration plants for waste and similar combustible matter (BGBl. I 2000 p.632).

Fig. 12 shows exemplary results from balancing the resources and residues for the three processes compared. The numbers are based on combustion of 16.5 t/h domestic waste or a corresponding raw gas volume flux of 100000 m^3_{STP}/h:

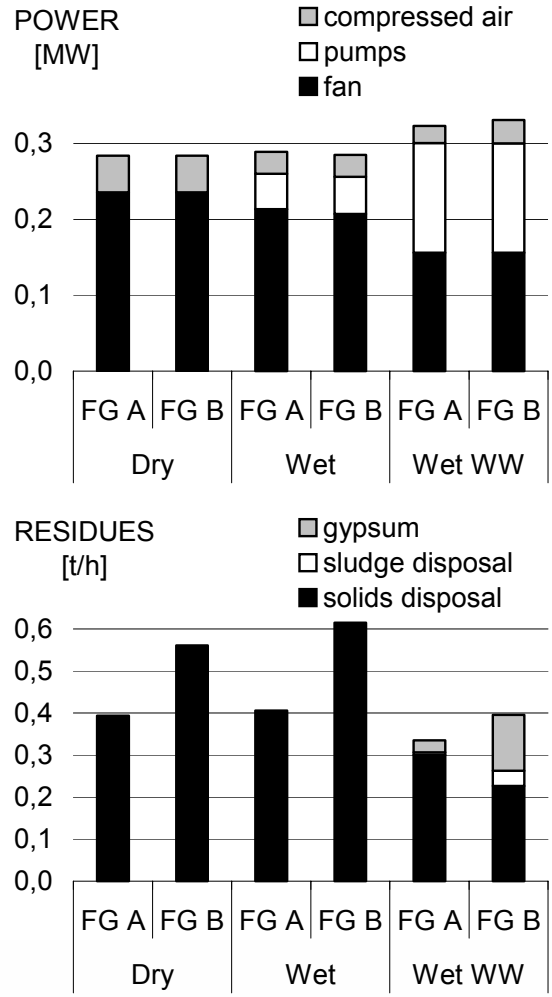

Fig.12: Power consumption and residues of the three processes

The [Dry]-Process shows the highest fan power, for the main apparatus (T) is a fluidised bed reactor producing high pressure losses. The [Wet WW]-Process in comparison consumes high pump power for pumping around the solvent in the scrubbers. In any case, the primary residue is solid waste for disposal, whereas the [Wet WW]-Process yields saleable gypsum.

These exemplary data show the tool's capacity for selecting and designing an optimum process in ecological and economical respect.

Conclusion

In general, the tool-box applied here offers extensive possibilities to model and simulate systems, where the object-structure 'unit-connection-global' is applicable (and reasonable of course) and which can be mathematically described by algebraic equation systems.

These possibilities also comprise the user-interface, thus the transparency and the control of the simulation and the features for handling and post-processing the results. The outsourcing of most general sub-models on basis of the external functions seems very reasonable, since dynamic link library functions are accepted by a great range of other applications (Matlab, VBA, …).

Referring to solution of the equation systems, some measure for under-relaxation will be helpful to provide even better convergence.

Acknowledgement

This work was co-funded by Austrian Energy and Environment GmbH. Furthermore, the authors want to acknowledge the contribution of Erhard Perz at Simtech Simulation Technology and Felix Breitenecker at Vienna University of Technology.

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Nomenclature

Variables

K*	common equilibrium constant
K	chemical equilibrium
S	solid-liquid equilibrium
H	gas-liquid equilibrium
Σ	electro-neutrality
Ksp	(ionic) solubility product
T	absolute temperature [K]
p	partial pressure [bar]
a	activity [mol/kg]
m	molality [mol/kg]
z	charge
I	ionic strength [mol/kg]
v	stoichiometric coefficient
γ	activity coefficient
G, L	gaseous, liquid flux [kg/s]

Indices

i	species
w	water

Abbreviations

PSE	Process Simulation Environment
MDK	Model Development Kit
ACM	Activity Coefficient Model

A Simulation Study of the Utilisation of Points-of-Sale along Motorways

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…. reports about development of a DEVS model for utilisation of special Points-of-Sale along motorways,
… describes the implementation of two models in the simulation system Taylor-ED,
… presents a database generated model for utilisation analysis of all Points-of-Sale,
… and presents a model with animation for teaching purposes emphasising on complex routing strategies

Abstract

This simulation analyses the utilisation of Points-of-Sale along mororways. The one aim was a basic study for teaching purposes, another aim was to check if certain criteria with respect to selling and buying certain products (toll account devices) can be fulfilled. Here, the main problem was that modelling the whole traffic system was far too complex to be done within the given time limit: a combination of a traffic flow model with service models for the about 150 points-of-sale (also lack on data). So instead a microscopic model was developed, including all possible variations a point-of-sale could offer.

There were two results of this study: a simulation model for teaching purposes, with complex routing and control strategies, an a specialised simulation environment, which allows to model and analyse any given Point-of-Sale according to the given specifications from a database.

1. Introduction

The first aim of the simulation was to develop a simulation to check if certain criteria concerning about 140 Points-of-Sale situated along the Austrian motorway were fulfilled.

The main focus concerning the results was the duration of a purchase of a certain accessory for trucks. The specification of these Points-of-Sale demands that at least 98 percent of all these purchases have to occur within the time limit of ten minutes.

The second aim was to develop a model for teaching purposes, similar to the four-machine model. The advantage is, that modelled process can be met at any gas station along the Austria motorways.

There are two different kinds of Points-of-Sale to be considered, that may also occur combined:

- Gas stations and roadhouses where following points need to be taken into consideration: regular traffic, opening hours, staff resources, number of cashes
- Vending Machines: they may be additionally installed. They offer the same services in a large variety of languages, a fact that will be an advantage for non German speaking customers. Following points need to be taken into consideration:
  - they are in use 24 hours a day,
  - traffic caused by other actions then buying the product
  - down times

In principle it is assumed that the processing time for vending machines will be longer than for cashes. Queues in front of cashes will depend on all kinds of traffic while those in front of the vending machines will only be influenced by the traffic specific for this product. The process of purchasing the product consists of:

- A: The way from vehicle to Point-of-Sale
- B: Waiting time; to model the behaviour of the customer concerning the decision which waiting queue he should enter, two different strategies are established:
  - The customer chooses the shortest queue.
  - The customer chooses the queue according to a distribution.
- C: Processing time
- D: The way from Point-of-Sale to vehicle
- E: Installation of the purchased product

2. Model Components

A Point-of-Sale may be a roadhouse, a gas station or a shop selling this specific product. All components that might occur are defined and used to form the different scenarios.

The layout shown in Figure 1 for example, shows a Point-of-Sale consisting of five parking spaces for trucks, one cash and two vending machines.

Access Road

If the dimensioning of the parking spaces is not sufficient a queue will form here. It is assumed that overtaking is not possible. The decision where a vehicle leaving the access road will go to is based on:

- whether vehicle is a truck or not
- whether the vehicle is going to fuel
- whether the needed resources are available

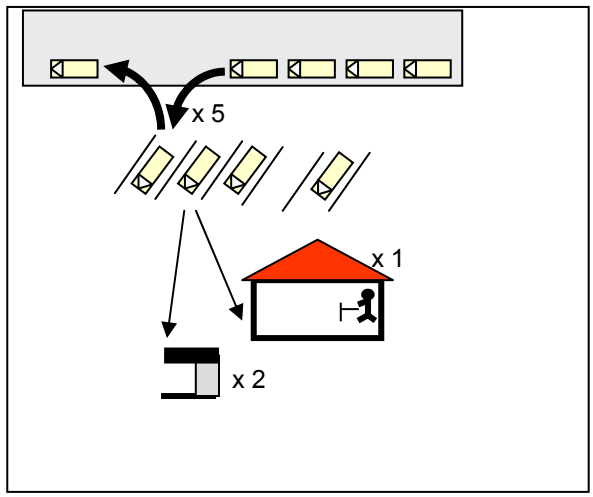

Figure 1: Layout of a Point-of-Sale

Parking Spaces.

Parking spaces for trucks and other vehicles are strictly separated. It is not possible for a truck to use a parking space for cars and vice versa. For the results only the utilization of the parking spaces for trucks are of relevance, characterised by:

- Number of parking spaces for trucks and for cars
- Distances from selling point
- Capacity of queue in front

Petrol Pumps.

Similar to the parking spaces there are different petrol pumps: for trucks, for cars or a combination of both. The number of these pumps may be set individually for each Point-of-Sale. Parameters are:

- Number of petrol pumps of each kind
- Distance from selling point
- Capacity of queue in front

In Principle, the pump with the shortest waiting queue is chosen.The time needed for fuelling depends on the vehicle and the kind of pump used:

- Car at petrol pump for cars
- Truck at petrol pump for trucks
- Car at petrol pump for both
- Truck at petrol pump for both

Selling Points.

Basically there are two different kinds of selling points: manned and unmanned. More precisely the product may be sold either in shops or vending machines. Some Points-of-Sale may offer both possibilities. Additionally the manned selling points may have three different kinds of cashes:

- Cashes specifically set up to handle all transactions regarding this product. No other transactions can be done there.
- Regular cashes – no transactions regarding the product can be handled there.
- Combined cashes: all kinds of transactions can be handled there.

This entails that customers that wish not only to buy the specific product have to either use the combined cash or line up twice. The decision which cash to use depends on the length of the queue in front, where the combined cash - if needed - is favoured up to double length.

Model Implementation

As there is no interaction between the Points-of-Sale it seemed sufficient to developed a microscopic model, representing a single Point-of-Sale.

The model had to be developed completely generic to offer the highest flexibility possible. Each component is variable and may be individually parameterised. So it is possible to use this simulation for any given Point-of-Sale, enabling an analysis of those that are known to be critical.

Input Parameter

For all inter arrival times as well as handling times distribution functions are used. Due to the fact, that the system modelled did not exist at that time it was not possible to use real data for input parameters. The decision for certain distribution functions was solely based on expert knowledge [1], [2], [3].

Flow of Traffic

Due to the rather complex flow of traffic it is divided in several input streams:

- Regular Traffic
- Traffic generated by customers buying the specific product.
- Traffic generated by customers needing any kind of support for the specific product.

It has also to be taken into consideration, that the flow of traffic is also dependent on the time of day. At night there will be surely less traffic than during the day, especially during lunchtime a high number of customers is expected at roadhouses.

To account for this the day is divided in different time zones, whereas for each of them a different input distribution may be defined. The number of input streams and as the number of time zones is arbitrary.

Handling Times

The handling times at cashes and vending machines depend on the kind of customer to be served.

Opening Hours

Manned selling points have opening hours, individually for each cash, so the availability of staff during the day can be taken into consideration as well.

Down Times

Vending machines may have down times, either at fixed times or at random.

Timeframe

By default a time frame of 24 hours is simulated, it may be extended to any length. It was assumed, that if the time limit is not exceeded during days with peak traffic, it will not be exceeded during normal days.

Initial State

Starting the simulation all components are reset and therefore zeroed, meaning that no elements are within the system and all queues are empty. To avoid starting the simulation with such an 'empty' system a lead time of arbitrary length is implemented.

4. Simulation Scenarios

To ensure a high flexibility the simulation implemented in Enterprise Dynamics is completely controlled by the data stored in an ACCESS database. Depending on this data the model structure is formed, the single components are connected /parameterised.

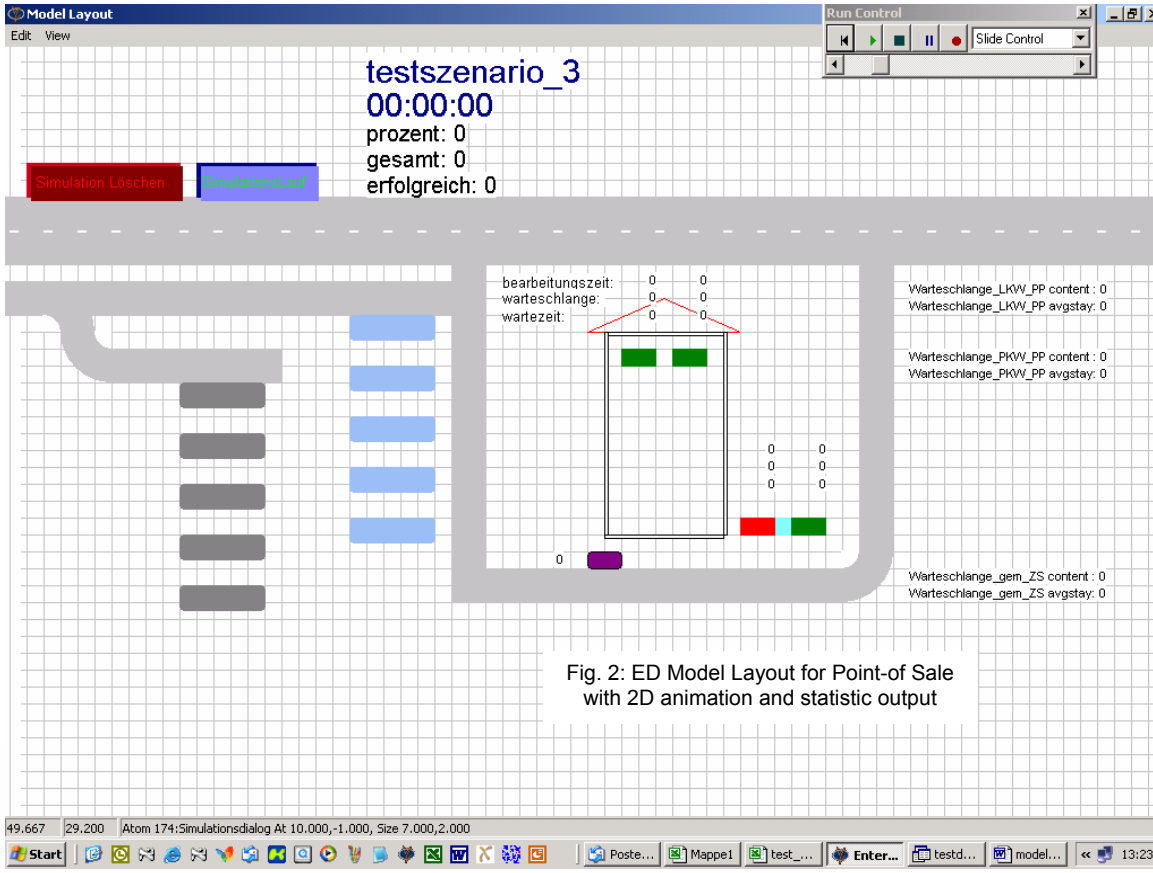

Fig. 2: ED Model Layout for Point-of Sale with 2D animation and statistic output

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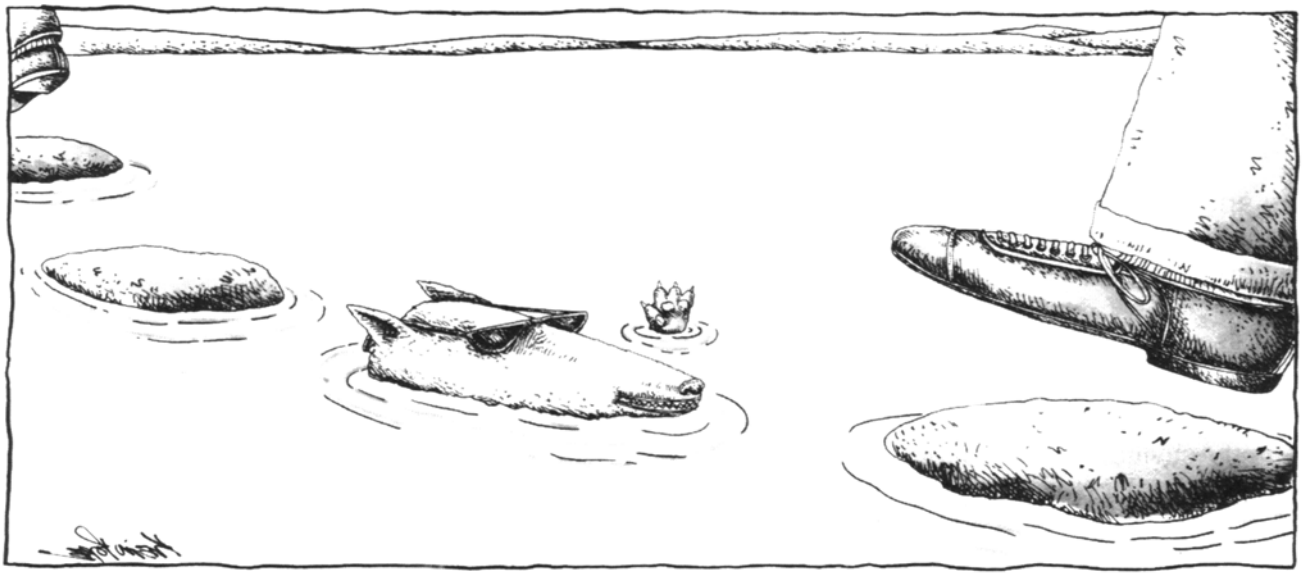

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The database contains all needed specifications for each Point-of-Sale: the number of input streams as well as their parameters, handling times, the number of parking spaces, petrol pumps, cashes, vending machines, the length of queues, opening hours etc.

A list containing all of the scenarios stored in the database enables the user to choose which ones to simulate. A function implemented in Enterprise Dynamics allows simulating several of these Points-of-Sale consecutively, exporting the result data back to the database before starting the next simulation.

Here, the outcome is no longer a simulation, but a highly specialised simulator, that is able to generate any Point-of-Sale consisting of the specified components, it only has to be defined in the database. Using it to simulate places where one could not be sure if they would be able to deal with the additional customers allowed a better assessment of the future situation, as well as an easy way to evaluate the effect of changes. Using this special simulator, it could be proven in advance, that the duration starting from exiting the vehicle until re-entering and installing the purchased product will not exceed ten minutes in more than 98 percent.

On the other hand, the basic model is used for teaching purposes: variable model structures, complex routing, queue priorities, etc.

Animation

The animation of the simulation was done in 2D (see Figure 2). The Animation should offer a graphical overview, enabling the user to watch certain components during the simulation run. Certain parameters are dynamically displayed to present the current state of the system:

- Percentage of successful purchases (done in less than 10 minutes)
- Average waiting times in queues
- Length of queues
- Average handling times
- Utilisation: cashes, vending machines, pumps

Additionally a simplified 3D Animation was implemented (see Figure 3).

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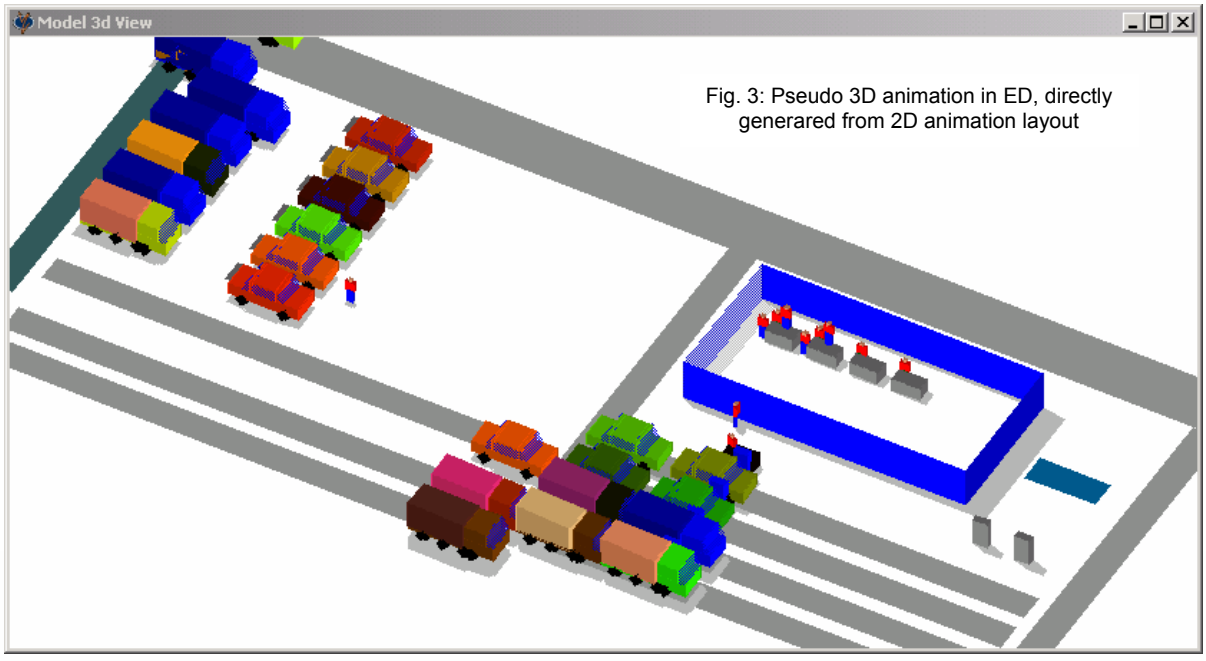

Fig. 3: Pseudo 3D animation in ED, directly generared from 2D animation layout

SHORT NOTES

Experience with a Real-time Control System for a Test Stand using a MATLAB/Simulink R14 Toolbox xPC Target

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… reports about the rebuilding of a test stand by a CANopen bus,

… and about the experiences using the MATLAB xPC Target within this test stand,

… sketches the implementation of the CANopen bus into the system using MATLAB Stateflow,

… and summarises advantages and benefits of this interface axtension for xPC Target.

Starting point

Due to the rebuilding of a test stand at the Institute for Engineering Design and Logistics Engineering, the steering concept also has to be altered and adapted for a larger number of analogue and digital inputs and outputs (Table 1).

	Output	Input
Servo actuator	6	6
Force measurement	0	10
Displacement measurement	0	2 (min)

Table 1: Number of inputs and outputs

The chosen concept has to be arbitrarily expandable, as the number of controlled servo actuators and force measurements will vary during the project. The plant should also be operated outside a real-time environment. The object of this exercise is to determine the solution with the best cost/performance ratio.

Expandability requirements could be met with a CANopen bus. CANopen is basically an extension [1] of the CAN (Controller Area Network) data bus concept. It provides the bus with such features as synchronous or asynchronous operation, initialisation of different nodes of the bus, or error tracking of nodes.

This type of bus was chosen because frequencies to be controlled are not expected to be high. Cost effectiveness requirements were met with the xPC Target toolbox; this enables the user to create a real-time environment on an older desktop PC.

Functionality of xPC Target

Fig.1 shows how a real-time environment, subsequently referred to as Target, can be created. It also shows in a symbolic way how the data bus is located within the whole process. Firstly a real-time operating system is created within Matlab on a desktop PC (host). This operating system is saved onto a disc, from which the target PC is booted. The operating system will establish a connection with the host PC via TCP/IP or via a serial connection.

As the real-time operating system is completely stand-alone, it is not connected to another operating system. It is also running on autonomous hardware, so it is possible to meet hard real-time requirements.

A Simulink model can be created, driver blocks from xPC Target can be inserted. The resulting model is then compiled with the Real Time Workshop (RTW) onto the target PC. After completion of compilation, an object will be created in the Matlab workspace with which parameters of the model running in the real-time environment can be tuned and signals obtained from this model. xPC Target is capable of working in multitasking mode parallel to communication with the CAN hardware, addressing an RS232 interface of the target PC.

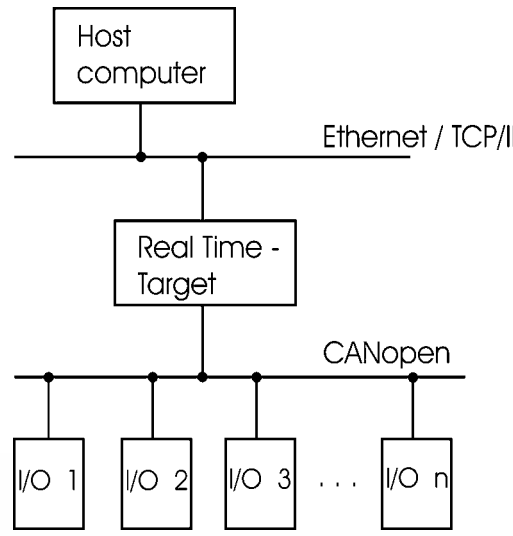

Figure.1: Hardware layers when using xPC Target

Toolboxes used

Since xPC Target does not support a CANopen interface, the CANopen functionality has to be added to the system with a scheduler; this was realised in Stateflow [2].

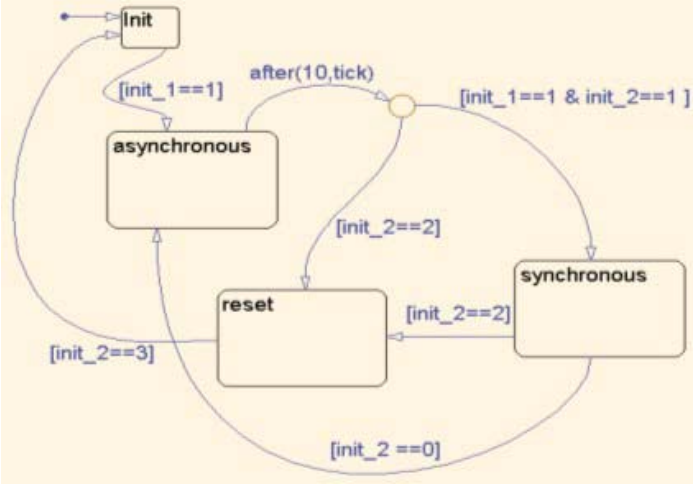

Figure 2: Scheduler for CANopen

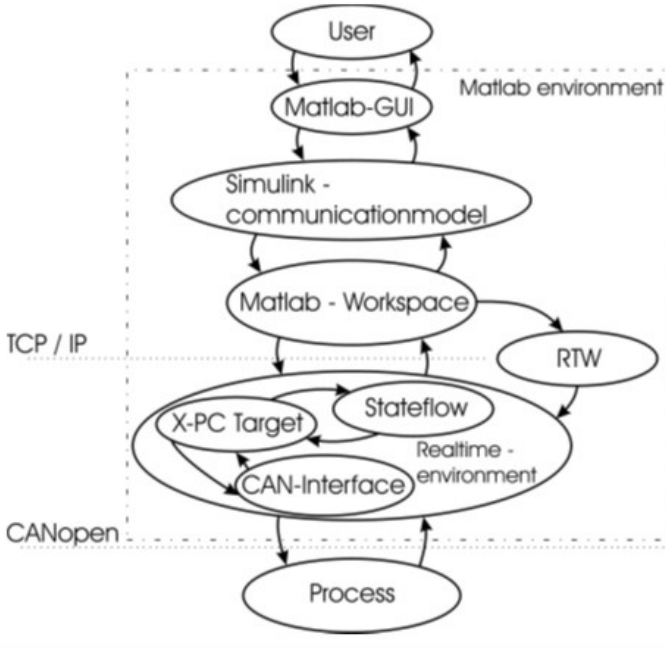

Figure 3: Interaction of toolboxes used

The basic functionality of this scheduler is shown in Figure 2. All states relating to switching from synchronous to asynchronous operation were subsumed to one state.

The use of a data scheduler is especially advisable for higher dynamic models, as state flow models are compiled in a C-close code which works performance-optimised.

A Matlab graphical user interface (GUI) was programmed for interaction with a user. This GUI interacts with a Simulink communication model which provides interface blocks to the xPC object in the workspace, so parameters can be tuned using a GUI, and signals can be logged and stored.

In this GUI it is also possible to archive various measurements for subsequent post-processing. Development of means of signal analysis programming is in hand.

The interaction of the Matlab toolboxes used can be seen in Fig. 3. To avoid programming Matlab GUIs, it is also possible to program a GUI in Visual Basic, the target object is then connected to the GUI via a COM interface [3].

Summary

Using the Matlab/Simulink program package, an open software architecture can be created in which the number of inputs and outputs can be varied according to given circumstances. The plant in question can be controlled in a real-time environment and the user is able to tune process parameters and obtain signals online interactively. Since older desktop

PCs can be used as real-time hardware platforms, the user is able to realise a real time environment which obeys hard real-time requirements in a cost-effective manner.

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Small PC-Network Simulation – Performane Case Study

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Wiedner Hauptstrasse 8-10, A-1040 Vienna

… discusses the performance of a small PC- network model simulation in a special network simulator and in a general purpose DEVS simulator,

… sketches DEVS approach and classical queuing system approach for the network,

…and compares theortical results and results of the simulation systems ns2 and AnyLogic

Introduction

For the last several decades, queuing theory has produced a broad range of analytical descriptions for many different types of queues. The most simple of those models refers to the famous M/M/1 queue, meaning that packet arrivals and packet service represent a Poisson process (the first two letters in the Kendall notation), and that there is only one server processing the individual packets (represented by the last letter, "1"). However, in practice more complicated models are often of interest, like e.g., the M/G/1/K queue. In this queue, the packet arrivals still represent a Poisson process, but in contrast to the M/M/1 case, the packet service times may basically assume any distribution [Kleinrock]. In general, for complex queuing systems (like e.g., for many M/G/1/K queues) explicit queuing statistics often cannot be derived, which severely hampers their analysis. Therefore, the investigation of such systems is a typical example of problems which are ideally suited for simulations, as it is often too difficult or too costly to set up an experimental environment.

Small PC Network Model

In this Small PC-Network, the packet loss probability at the output queue of a link between two remote sites which host a number of network users (see Figure 1) is investigated. At each site, each user transmits data at the rate λ = 1 packet/s towards a user at the other remote site. The inter-arrival time of sent packets is exponentially distributed, i.e., each user generates Poisson traffic. Further we assume that the size of all packets is equal, such that the service time (i.e., the time it takes to transmit the packets on the link) is constant.

In the simulations, the link speed (i.e., the packet send rate) is set to μ = 20 packets/s. In the Kendall notation such a system is described as M/D/1/K, where D stands for 'deterministic' (note that M/D/1/K is of type M/G/1/K).

Three sets of simulation results were produced, which correspond to three different numbers of users attempting to transmit packets across the bottleneck link (see Table 1). For each set of simulations the queue size in varied in the range of 5 to 200 packets in order to investigate its impact on packet loss statistics.

	Simulation Set 1	Simulation Set 2	Simulation Set 3
Link Capacity	20 packets / s	20 packets / s	20 packets / s
Number of Users	18	20	22
Link Utilization	0.9	1	1.1

Table 1: Parameters of the Performed Simulations

Performance evaluation

For performance evaluation of this model, two different simulators were tested: the Network Simulator **(ns-2)**, which is a text interface open source simulator developed at the University of Berkley [2 - Web], and the simulator Anylogic which has been developed at the University of St. Petersburg.

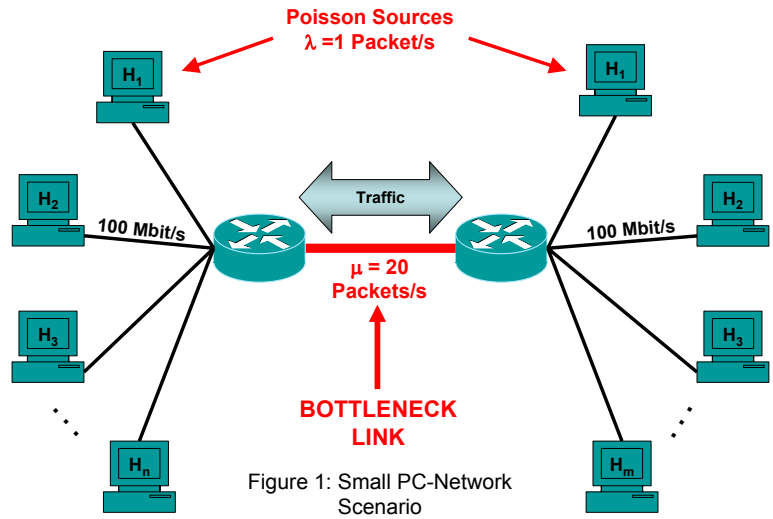

Figure 1: Small PC-Network Scenario

The Network Simulator is primarily used for carrying out performance evaluations of current and future Internet algorithms and protocols. As it has been developed in an open source process, there exists a huge library of network modules, such that it is possible to simulate many different networks at great level of detail.

AnyLogic is a Java-based general purpose simulation system, with a very comfortable user interface. AnyLogic offers for modelling as well discrete as well as continuous elements. State charts support discrete and hybrid modelling, and also agent-based modelling is supported. In the graphical user interface, libraries are available for application-oriented modelling: continuous signal graphs like Simulink, process flow modelling, etc. Classical statistical output features are completed by a 2D-animation, which can be also translated into a Java applet.

Implementation of the Small PC-Network in Network Simulator (ns-2)

The following code lines show main parts of the textual model and of the run commands. **(ns-2)** offers a very powerful library of network components, which allows to code very efficient and compact models. But it takes long time to become familiar with the library and with the call procedures.

```
#Create two router nodes
set n0 [$ns node]
set n1 [$ns node]

#Create links between the nodes
#Capacity of 80 kbit/s and packet size of
#500 bytes correspond to a link capacity of 20
packets/s
$ns duplex-link $n0 $n1 80kb 100ms DropTail
$ns queue-limit $n0 $n1 5
$ns queue-limit $n1 $n0 5

#Initialize queue monitors ……..
#Create Null agents and attach to routers
set null0 [new Agent/Null]
$ns attach-agent $n1 $null0 ……..

#Create the users attached to the first node
for {set m 1} {$m < 21} {incr m} {
      set udp($m) [new Agent/UDP]
      $ns attach-agent $n0 $udp($m)
      set onoff($m) [new Traffic/Expoo]
      $onoff($m) set packetSize_ 500
      $onoff($m) set idle_time_ 1
      $onoff($m) set burst_time_ 0
      $onoff($m) set rate_ 500000000
      $onoff($m) attach-agent $udp($m)
      $ns at 1 "$onoff($m) start"
      $ns connect $udp($m) $null0
}
#Create the users attached to the second node
for {set n 1} {$n < 21} {incr n} {
      set udp($n) [new Agent/UDP]
      $ns attach-agent $n1 $udp($n)
      set onoff($n) [new Traffic/Expoo]
      $onoff($n) set packetSize_ 500
      ……
      $onoff($n) set idle_time_ 1
      $onoff($n) set burst_time_ 0
      $onoff($n) set rate_ 500000000
      $onoff($n) attach-agent $udp($n)
      $ns at 1 "$onoff($n) start"
      $ns connect $udp($n) $null1
}
#Call the finish procedure after 1,000,000
#seconds of simulation time (plus 1 second warm-
up time)
$ns at 1000001.0 "finish"
#Run the simulation
```

Implementation of the Small PC-Network in Anylogic

The Small PC-Network model in Anylogic was designed using the Enterprise Library. Only the four simple classes `Source`, `Delay`, `Queue`, and `Sink` have to be used. Additionally a new class `HostNode` is defined, modelling PC (Host) and link to router.

Figure 3 illustrates the graphical implementation with connections between the different class elements. There are 18 to 22 `HostNodes` that feed the `RouterQueue` with data packets. The `HostNode` model itself is a self generated class. Changing the distribution function of all the hosts is very easy because only the `HostNode` model has to be changed. Figure 2 shows the new class that consists of a `Source` and a `Delay` function. The `Delay` is used to model the `Host` to `Router` link. Four this simple model this delay can be set to a minimum value and therefore it can be neglected.

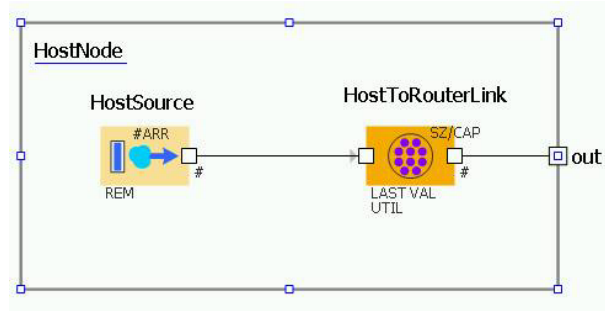

Figure 3: `HostNode` model

In principle, the model can be also generated dynamically: a parameter could instantiate arbitray numbers of hostnodes and links to the router automatically – and also change during simulation. For simplicity and better readability for beginners (students) a “static” implementation was chosen.

The queue size of the router can be varied between 1 and 200 via a slider in the animation. If the queue is full all new arriving data packets will be directed to a `LostPackets` sink until space is again available in the queue. The lost data packets can be counted for further statistics.

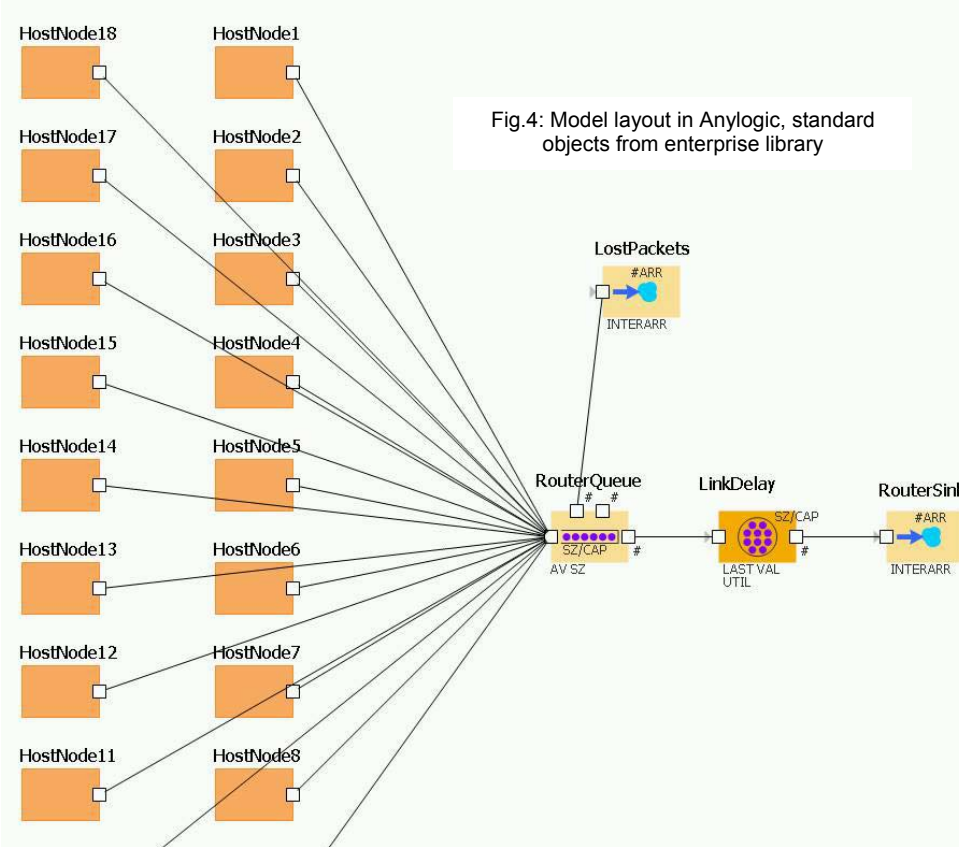

Fig.4: Model layout in Anylogic, standard objects from enterprise library

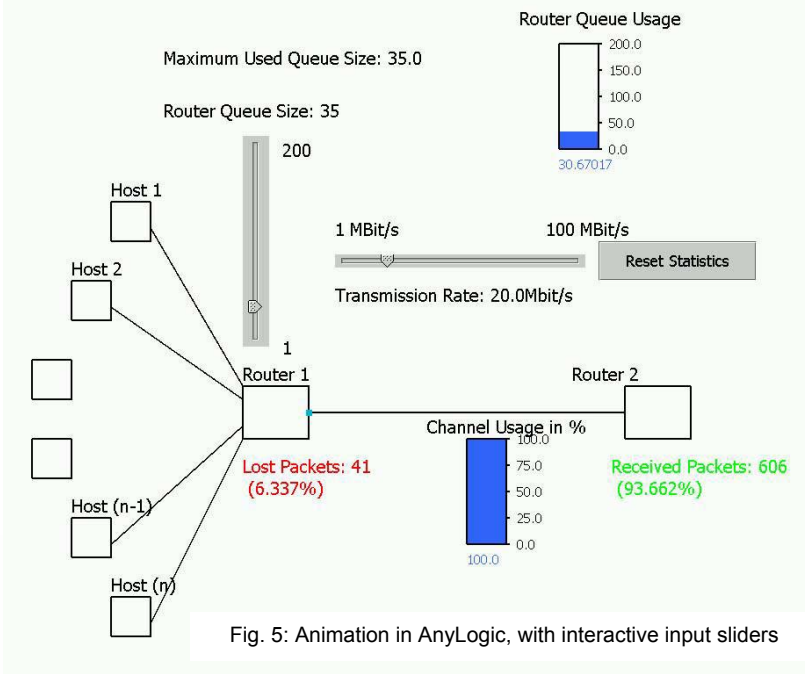

Fig. 5: Animation in AnyLogic, with interactive input sliders

The redirection of the packets in the queue full case is implemented with the preemption function of the AnyLogic queue modelIn this Small PC-Network the link capacity between two routers was fixed to 20 packets per second. In the AnyLogic implementation the capacity can be varied via a slider between 1 and 100 packets per second, with the default value set to 20.

The capacity of the link has been implemented as a simple Delay model. The delay time in its own can be calculated with the formula (1/packets per second). For example the link capacity of 20 packets per second will result in a delay of 50 ms for one packet. The second router that receives the packets is implemented as a sink for counting the packets. The implementation has only been run for one link direction, but due to symmetry the results would be identical for the opposite direction as well.

Figure 4 shows the animation picture of the implemented model. The animation delivers the following statistic calculations of the Small PC-Network model:

- Mean link usage between the two router (Channel Usage in %)

- Received packets at the second router in % and as absolute number (Received Packets)
- Lost packets at the first router in % and as an absolute number (Lost Packets)
- Maximum used queue size during simulation run. This value will only be interesting if the number of lost packets is zero. (Maximum Used Queue Size)
- Mean router queue usage during the simulation run as absolute number (Router Queue Usage)

If a new simulation run is started, the user has to reset all the statistics after the warm up period of the model. This can be executed via ResetStatistics button in the animation. The models can be downloaded from the ARGESIM website.

Simulation Results and Conclusions

Figure 5 displays our simulations results. It is most important to first note that the results obtained from two different simulators are relatively close, which boosts confidence in their correctness. The closeness of the results is also surprising if we take the simulation times into consideration – in ns-2, we have simulated for 1,000,000 seconds of simulations time, whereas in Anylogic, due to its lower performance, we could only afford a simulation time of around 1,000 seconds. The three curves for each simulator (90, 100, and 110% link utilization) display packet loss probability (Y-axis) as a function of queue size (X-axis).

Vocational Adjustment -Simulation Effort

The period of vocational adjustment for Network Simulator (ns-2) is about 2 or 3 months. Even with experience in simulation in a Linux environment it will take about a month to be well prepared for an implementation of a new model. Only 2 or 3 weeks will be necessary to understand the basic concept of AnyLogic. The graphical user interface supports the simulation of simple models and animations of them in short time.

Further information about Network Simulator and AnyLogic will be available at the web:

http://www.isi.edu/nsnam/ns/

http://www.xjtek.com/.

The models presented are used for teaching in simulation classes and may be downloaded from the ARGESIM website. The main intention is to compare classical statistic models with simulation and to compare results.

Comparing the duration of one simulation run in AnyLogic and ns-2 on a Pentium 3 with 1 GHz gives:

- Simulation of 1 thousand seconds in Anylogic with graphical user interface lasts about 12 minutes.
- Simulation of 1 million seconds in Network Simulatior (ns-2) without graphical user interface lasts about 4 minutes.

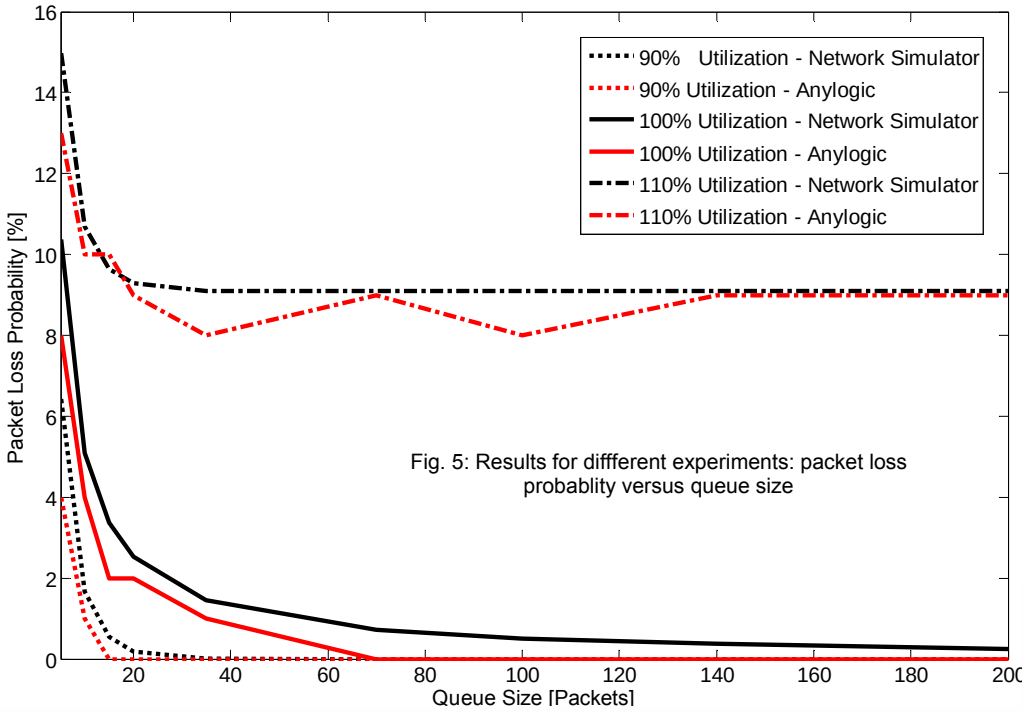

Fig. 5: Results for diffferent experiments: packet loss probablity versus queue size

Of course it is very hard to compare these two simulators because especially ns-2 is a specific tool for network simulation problems. Under this aspect it is very amazing to get so close results.

References

[Kleinrock]*L. Kleinrock:* Queueing Systems I. John Wiley & Sons, 1975.

Bond Graph Modeling, Simulation and Control Software

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Chelan, WA 98816, USA

…. gives an overview and reviews on bondgraph software

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Furthermore, all links to the software presented and to developers, developer groups etc. also van be found at this web site.

ENPORT

ENPORT, From RosenCode Associates, Inc., is the first bond graph modeling and simulation software written in the early seventies by R.C.Rosenberg. This software did not request causalities to be specified, and it transformed the topological input description into a branch admittance matrix which could then be solved. Consequently, ENPORT is able to handle structurally singular problems.

The current version of the code, ENPORT-7 offers an alphanumerical topological input language and a menu-driven graphical input. ENPORT-7 runs on various mainframe computers, but a slightly reduced version, ENPORT/PC, exists for IBM PC's and compatibles.

Review: There are a lot of sentimental values attached with this product. It takes a very high position in the heart of bond graphers. This software was instrumental in growth of bond graph theory and applications.

The new release Model Builder (MB) supports hierarchical model structuring by defining subsystem Components that can contain other Components; and it has display properties, such as an icon, that can be used in a graphical modeling environment.

It structures equations for solution with MATLAB®. User-Defined Model Types (UDMTs), which are generalized model definition based on multiport templates that can be specialized for a particular purpose, are the latest improvements to this product.

The MDI (Multiple document interface) architecture make it a suitable editing and development environment. However, the product is not available in a commercial scale and doesn't confirm to cutting-edge software development practices.

ARCHER

ARCHER is a product of The "Laboratoire d'Automatique et d'Informatique Industrielle de Lille" (L.A.I.L.) at the "Ecole Centrale de Lille". The bond graph group (BG-group) of LAIL is a research structure devoted to the development and application of the bond graph theory to create physically consistent modeling of a wide class of engineering and life-sciences systems.

The BG-Group has developed the modeling software (ARCHER) allowing a structured and graphical development of engineering models.

This group has also developed advanced methods for fault diagnosis and structural analysis using bond graphs.

Review: The software is written in VB and C++, is object oriented and structured. It is yet not commercially available. The software allows determination of structural controllability, observability and invertibily of linear models. It is a high quality academic work based on the research at the "Ecole Centrale de Lille" catering mostly to automatic control theory. The user interface lacks modern features. Numerical simulation and control systems analysis are not within the scope of this product.

CAMP-G
The Universal Bond Graph Preprocessor for Modelling and Simulation of Mechatronics Systems.

CAMP-G is a software package that helps engineers and scientists design Mechatronics and Dynamic Systems using as input physical models described by the method of Bond Graphs. Mechanical, Electrical, Hydraulic, Thermal and Control Systems can be modeled together using computer graphics, CAMP-G is a model generating tool that interfaces with Languages such as MATLAB / SIMULINK, ACSL and others to perform computer simulations of physical and control systems.

Review: A Preprocessor, based on a good GUI, doesn't support object based modeling. Equations derived are neither completely reduced nor sorted properly. Heavily depends on external software to perform post-processing. In the post-processing domain, relation to the base bond graph model is lost amidst mathematical abstractions.

20-sim
Twente Sim the simulation package from the University of Twente.

20-sim is a modeling and simulation program that runs under Windows. It is an advanced modeling and simulation package for dynamic systems that supports iconic diagrams, bond graphs, block diagrams, equation models or any combination of these. With it you can simulate the behavior of dynamic systems, such as electrical, mechanical and hydraulic systems or any combination of these. The latest release is MATLAB enabled and allows interaction with SIMULINK.

Review: The product is a time-tested modeling tool evolved after the famous TutSim software. The sub-model facilities are big bonus. It supports hierarchical modeling, but sticks to a out-dated PDMT (Pre-Defined Model Type) object implementation. Doesn't require external compilers or any other post-processing software. Control systems analysis module is present only in form of simulation and some basic frequency domain charts.

The object property and equation description language does'nt confirm to any current day programming languages like Pascal, Fortran, C, or C++. Overall, it is a good product recommended for modeling of small to medium sized systems. The graphics and hard copy output quality is poor. Use of non-standard menu and toolbar systems, difficult to access library windows and SDI (Single document interface) architecture make overall model creation very tedious.

PASION 32

A object-oriented simulation tool for discrete, continuous and combined models. It supports ODE, signal-flow graphs, bond graphs, queuing models and animation. It is a low-cost simulation software for discrete event and continuous system simulation, queuing models, bond graphs, signal flow graphs, animation in 3D scenarios, training and more. The Bond Graph model is created on the screen using a menu-driven easy-to-use graphical editor BONDW. No causalities are needed. BGS can verify the user causalities or impose its own causalities on the user model. Non-linear dependencies can be used describing source nodes or special user-defined non-linear graphs. BGSW (Bond Graph Simulator) generates a set of differential equations for a given model.

These equations are used to automatically generate the corresponding PASION code. It then invokes the solver module DIFEQ for simulation.

Review: A product from Stanislaw Raczynski, who is an editor of open directory project on scientific simulation software, this product lives up to reputations of its author. It is an object-oriented, Pascal-related simulation language.

The language has a clear process/event structure. It's translator generates Pascal source code that can be run using a Pascal compiler. The software computes transient process simulation as well as frequency response (Bode and Nyquist plots) are provided. State events, Discrete and continuous objects can run concurrently. Various frequently used processes are available in library form. Also includes a Post Mortem analyzer for stochastic (discrete and continuous) models.

The Complex System Simulator (CSS) is very useful for combined systems, permits model coupling. Sub models of different types (queuing, continuous, etc.) can run concurrently in the same simulation program. Hierarchical model building features are not very advanced in bond graph domain. The GUI features are rather rudimentary. Recommended for classroom and tutorial purpose use by students and researchers.

BondLab
Bond Graph laboratory from K.U. Leuven

BondLab is a design environment which has the aim to facilitate and optimize the design cycle of mechahytronic products. BondLab is developed as a platform independent MATLAB toolbox. It integrates seamlessly the behavioral modeling with other tasks in a mechahytronic design cycle. It has an easy to use model entry graphical interface and a unified treatment of both linear and nonlinear models.

Several smooth transitions between the behavioral and causal model descriptions are available ((non)linear parametric ODE description in MATLAB m function format, Transfer Function (symbolic and numerical), (non)linear State Space (symbolic and numerical), parametric Simulink2® .mdl block diagram format). Contains direct simulation, visualization and animation facilities.

Review: The GUI confirms to standard software practices. The editing tools are ergonomically placed. It is based on a SDI (single document interface) architecture in Win 32, which makes model building a bit difficult.

A bond graph animation support is available. Overall, this product can be rated as an average software.

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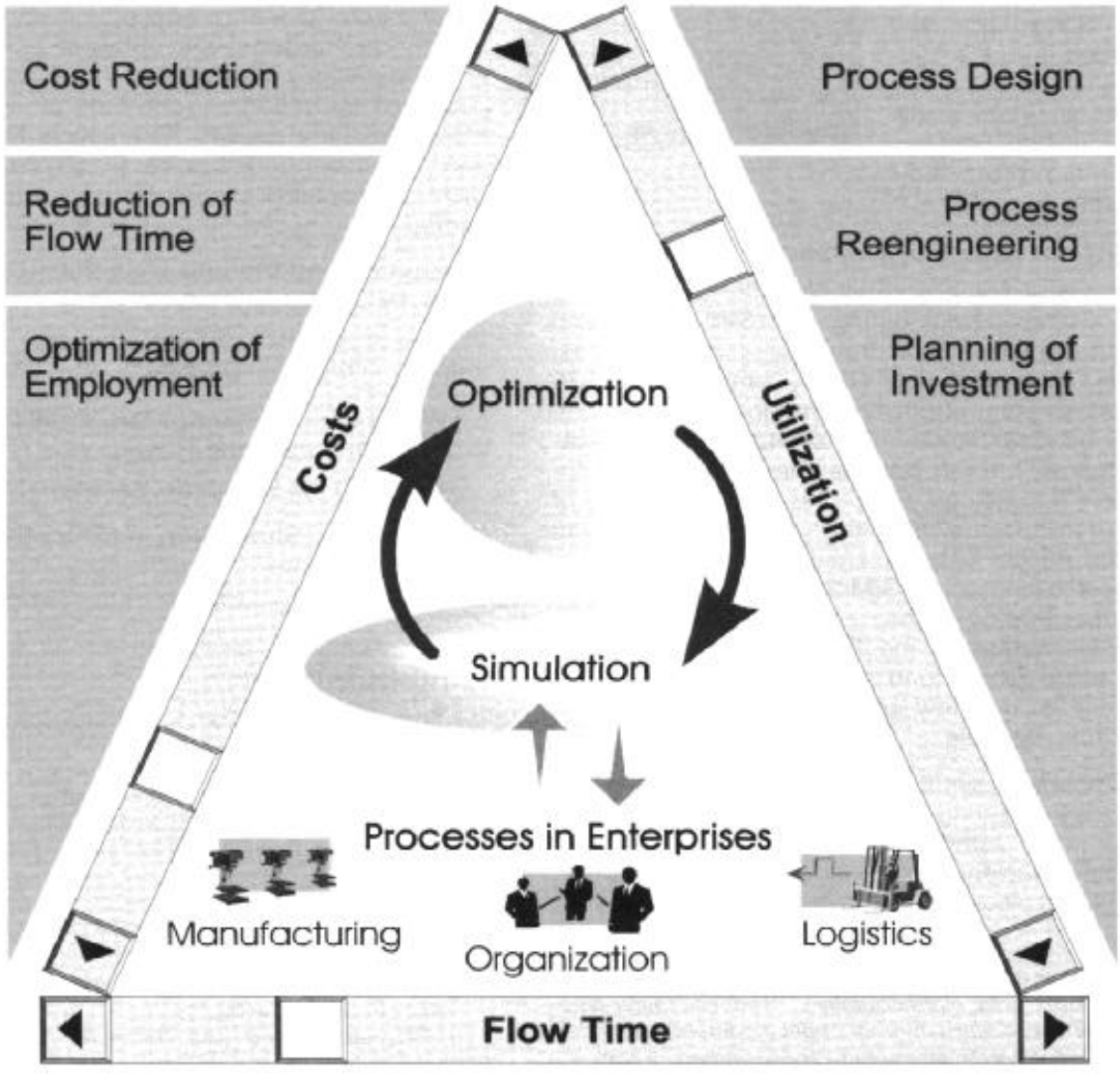

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CAMBAS
Computer Aided Model Building Automation System

In this automated modeling software using BGs from U. Michigan, system components are represented by icons called templates, which have a fixed number of ports by which they can be interconnected. Expandable (variable complexity) bond graph models are used to represent the detailed model contained in each component template. CAMBAS allows the design engineer to simply select and arrange the icons (templates) containing the expandable model to build a 'word bond graph like' representation that matches the configuration of the system to be modeled (designed). CAMBAS then automatically deduces the Proper Model (global system bond graph) by searching through the component templates based on the eigenvalue structure of the system. The software includes four major components, namely, bond graph processor, system synthesizer, equation generator, and eigenvalue solver. The parameters (mass, stiffness, damping, diameter, etc.) of each component are entered using the Parameters tool. The bond graph of any component can be displayed by the Expand tool.

Review: CAMBAS is developed using the C programming language and the OSF/Motif graphics commands for RISC workstations. This software facilitates the development of proper models (simplest model with physically meaningful parameters and variables) using a two-level, Template-Based Modeling Approach. The proper model is detected when all the system eigenvalues within a user specified frequency range of interest are found. An additional accuracy criteria, which requires all of the critical system eigenvalue to converge to a user specified tolerance, can also be used. This product aims at generating proper models during the early stages of the design, shortening the design cycle and boosting the dynamic performance. Applicable to only linear systems, simulation and control analysis (besides eigenvalue inspection) are out of its scope. It is a freeware available from Automotive Research Center, University of Michigan.

Dymola
BG modeling software from Dynasim AB

Dymola provides an object oriented modeling using Modelica language. Dymola allows for graphical model composition from library models, continuous/discrete simulation and 3D animation. Bond graph methodology can be used. Model details are given by ordinary differential and algebraic equations, also in a matrix form. Dymola converts the differential-algebraic system of equations symbolically to state-space form if possible.

Graph-theoretical algorithms are used to determine which variable to solve for in each equation and to find minimal systems of equations (optionally using tearing) that have to be solved simultaneously (algebraic loops). The equations are then, if possible, solved symbolically. Linear systems of equations can be solved symbolically or numerically. Dymola also supports instantaneous and discontinuous equations. Ready to use model libraries are available in many engineering domains.

Review: Handles large, complex multi-domain models, faster modeling by graphical model composition, symbolic pre-processing, allows user defined model components, 3D Animation and real-time simulation. Huge library modules make it an ideal platform for easy and quick model creation. Uses object oriented modeling language Modelica to support hierarchical structuring, reuse and evolution of large and complex models independent from the application domain. Acausal sub-model creation based on differential and algebraic equations gives flexibility of implementation. Learning Modelica language seems to be the only hitch. There are no major provisions for advanced frequency domain and control system analysis. It is rated a very high as a modeling language, but fails to impress in its bond graph processing capabilities.

Java Applet for BGs

This internet version of the program, developed by U. Miskolc, can be run as Applet with a Java compatible browser Models cannot be saved. Only the example models are available to load. The Application version supports local file operations and requires Java compatible OS, Java Developers Kit or Microsoft Command-line Loader for Java. Static data for parameters can be assigned through a properties dialog. Simulation results are displayed for selected variables.

Review: A small implementation, that is good for modeling and solving very small and linear tutorial problems using basic bond graph elements. The Internet version is a good learning tool.

HybrSim
Hybrid Systems Simulation from DLR

HYBRSIM is an implementation of a hybrid (mixed continuous/discrete behavior) bond graph modeling and simulation. It embodies a set of physical principles that govern discontinuous changes in physical system models which violate the continuity of power constraint. It is an experimental modeling and simulation environment to establish a formal framework and serves as a precursor to an object-oriented implementation as part of the Modelica modeling language.

This software was designed using IBM VisualAge for Java. It consists of a model editor and two toolboxes, one for bond graph elements and one for block diagram elements. The simulator has an animation facility to study the power distribution over time.

Review: Hybrid bond graphs extend traditional bond graphs by an ideal switching element, the controlled junction. Simulation is based on graph propagation. No explicit system of equations is derived. It supports only ideal bond graph elements and a few block-diagram components for analysis of small linear systems. The software is still in development stage. Free java source code can be downloaded.

Modelica -Object-Oriented Physical System Modeling Language

This is a language designed for multi domain modeling developed by the Modelica Association, a non-profit organization with seat in Linköping, Sweden. Modelica is An object-oriented modeling and simulation tool, influenced by many of the ideas from OMOLA.

Modelica is a freely available, object-oriented language for modeling of large, complex, and heterogeneous physical systems. It is suited for multi-domain modeling, for example, mechatronic models in robotics, automotive and aerospace applications involving mechanical, electrical, hydraulic and control subsystems, process oriented applications and generation and distribution of electric power.

Models in Modelica are mathematically described by differential, algebraic and discrete equations. Modelica is designed such that available, specialized algorithms can be utilized to enable efficient handling of large models having more than hundred thousand equations. Modelica is suited and used for hardware-in-the-loop simulations and for embedded control systems.

Review: The simulation and graphical editing interface of many software products like DYMOLA generate and use Modelica code. A release of Modelica language Version 1.4 was on December 15, 2000 by the Modelica Association.

Modelica can be used for mixed continuous and discrete models (Hybrid models) as well as for Discrete Event and Discrete Time Models. It can deal with conditional equations with causality changes and generally adopts to a formal acausal (non-causal) modeling scheme at the front-end. It is suitable for modeling of large systems using hierarchical modeling scheme embeded as reusable sub-model classes. The lack of proper GUI drivers and difficulty in linking with other high-level programming languages like C and C++ code are a few short-comings.

MS1
BG modeling software from Lorenz Simulation

MS1 is a modeling workbench developed in partnership with EDF (Electricité de France), which allows free combination of Bond Graph, Block Diagram and Equations for enhanced flexibility in model development. MS1 is an interactive environment for modeling, simulation and analysis of nonlinear systems.

Models can be introduced in Bond Graph, Block Diagram or directly as equations. MS1 performs a symbolic manipulation of the model (using a powerful causality analysis engine) and generates the corresponding simulation code. Calculation is done by commercialy available solvers like Esacap, MATLAB and ACSL. MS1 also permits topological analyses of the model (looking for causal loops and paths between variables). Downloadable Trial version of MS1 version 5 is available for evaluation.

Review: MS1 provides ways to call subroutines in C and Fortran. Hierarchical description is allowed using top-down and bottom-up approaches. The user interface (GUI) is outdated, has no scroll bars in the model viewing window (large models are clipped) and the overall design and ergonomics is awfully unprofessional. It fails to impress as a reliable, modern modeling and simulation package.

MTT
Bond Graph based Model Transformation Tools

MTT (Model Transformation Tools) comprises a set of tools for modeling dynamic physical systems using the bond-graph methodology and transforming these models into representations suitable for analysis, control and simulation. These tools use, and generate m files for, GNU Octave. It allows incorporation of bicausal bond graphs and hierarchical bond graphs. MTT handles hybrid modeling of systems using two new elements, namely, a switched I component(ISW) and a switched C component(CSW).

Review: MTT has been developed by Peter Gawthrop at the University of Glasgow. It is a non-commercial research tool. Besides command line and batch mode input, a simple menu driven interface is also available. GNU Octave is a freely redistributable high-level language software, primarily intended for numerical computations and is mostly compatible with MATLAB. It provides a convenient command line interface for solving linear and nonlinear problems.

Bond graph tool box for Mathematica

A product of Virtual Dynamics in collaboration with Wolfram Research, this toolbox features a complete embedding of graphical bond graph in the Mathematica symbolic environment and notebook interface.

Allows field elements and non-linear constitutive relations. It uses a portable notation of models to exchange bond graphs between users.

Review: As demonstrated at ICBGM'01, the attempt is note-worthy. However, it still is in a developmental stage and doesn't include any hierarchical modeling philosophy. Till review, the tool box did only support basic bond graph elements and junction structures. Recommended for tutorial use in modeling of very small simple systems.

SYMBOLS 2000
SYstem Modeling in BOndgraph Language and Simulation

SYMBOLS-2000 is an object oriented hierarchical hybrid modeling, simulation and control analysis software. It allows users to create models using bond graph, block-diagram and equation models. Large number of advanced sub-models called Capsules are available for different engineering and modeling domains. It automatically derives completely reduced system equations. Differential causalities and algebraic loops are solved out using its powerful symbolic solution engine.

Non-linearities and user code can be integrated in single editing IDE. It creates high-level C language code and allows any external code embedding. The simulator module has both online and post-display facilities. Event handlers and online event notification and variation of parameters are key features of this advanced simulator. It has a well-developed controls module, that automatically transforms state-space modules from BG or block diagram models and converts them to analog or digital transfer functions. Most control charts and high-level control analysis can be performed.

Review : This software uses a contemporary GUI with great outlook. Its symbolic and numeric solution capabilities are very advanced. The iconic modeling facility allows system-morphic model layout. The event handlers are a great bonus. It also has many post-processing facilities over the simulated result. This software requires pre-installed Microsoft Developer Studio (version 5.0 or above).

The direct C++ compilation allows easy integration of external code. The controls module incorporates advanced state space, analog, digital routines for various conversions, filters, feedback systems. The controls module handles matrices, transfer functions, quadruples and numeric data equally. This software is recommended for use in research and industrial modeling of large systems.

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SIMULATIONISTS - PERSONALITIES

This SNE corner – introduced in December 2000 in SNE 29 - follows three aims: to introduce young simulationists or simulationist of the rising generation, resp., to introduce simulationists serving in a simulation society, and to report about awards and personal events of well-known simulationists.

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Björn Johansson recently became Scientific Assistant (Senior Research Assistant) at the Chair of Manufacturing Systems (Head: Prof. Anders Kinnander), Chalmers Technical University, Gothenburg.

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

The MSc studies in production engineering at Chalmers brought me an early contact to simulation enthusiasts. The first contact with Discrete Event Simulation (DES) was made in the software Plant Design from Prosolvia. The software was during development, which means that there were plenty of bug-fixing included in this PhD course. After having some small titbits of DES I got caught up into it and decided to make my master thesis in this field. Volvo Car Corporation did have an opening on a half year project consisting in building the main assembly plant in Torslanda. The model was created in the software QUEST from Dassault Systems. At the time for the project (During 1999) the plant capacity was about 35 cars per hour. By using the model we could find bottlenecks and solutions to improve them, resulting in a model output of about 57 cars per hour. Now (2004) all our recommended changes are implemented and the factory is producing around 60 cars per hour.

The MSc thesis did put me on the track for dissemination knowledge of DES and dig deeper into the pitfalls and problems that arises with this technology when trying to gain from the benefits. I started my path towards PhD in Production Engineering. My first large project was entitled “Productivity Development in Manufacturing Systems”.

This project was conducted by five PhD students, one each from Swedish mail service, Flextronics, SKF AB, Royal Institute of Technology, and Chalmers University of Technology. The project was scheduled for three years and we did many studies on how to improve productivity development in Swedish manufacturing companies. As of my part most were majoring in Discrete Event Simulation as a tool for productivity improvements. During this project I had the honour to start up the DES course for MSc students at Chalmers. The first year 10 students were taking the course, second year 26 students, third year 41 students, and the fourth year 70 students. This upcoming class (Starts in January 2005) currently has 120 students registered for the course.

During the five years as a researcher at Chalmers University of Technology my role in the organisation has been quite interesting and varying. I have been conducting research as any other PhD student and published one Licentiate thesis, 13 articles in journals and well renowned conferences, and additionally about 10 internal reports. I have also been writing applications of research funding for both national (SSF, VINNOVA, NUTEK) and international (6th Framework, IST and NMP). I have been employed as lecturer for additional teaching (not only DES) in various production engineering courses at MSc level. I have been supervisor for about 40 MSc students while they did conduct their final diploma thesis, most of them in the field of DES.

Furthermore I did start up a company during 2003, which is active in the field of production engineering, with the mail focus activities in DES. This new company is currently forming a branch office for Production Modeling Corporation in Europe.

Current research activities are focusing on DES of autonomous modular manufacturing systems. The main considered issue is dealing with: How can modularity help the (re)configuration of manufacturing systems in terms of lead-times, DES support, knowledge level demands, and in the end sustainable productivity development. My recent publication “Using Autonomous Modular Material Handling Equipment for Manufacturing Flexibility” published at the Wintersimulation conference, December 2004, shows the first indication of potentials and more articles are in the pipeline dealing with and clarifying these issues.

The Future is unknown, but my intentions are clear, production will always remain important and DES support is powerful when utilised with respect and knowledge. That is why my career will continue to focus on DES and productivity for a wiser future. Research and education for future welfare!

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ARGESIM COMPARISONS

Comparisons of Modelling and Simulation Techniques and Tools

www.argesim.org

ARGESIM started started in 1990 the series *Comparison of Simulation Software* in the journal Simulation News Europe (**SNE**)

These software comparisons developed towards benchmarks not only for simulation tools but also for modelling tools and for modelling techniques and modelling approaches.

For instance, the new comparisons **C16 Restaurant Business Dynamics** and **C17 Simulation of SIR-type Epidemic** address also non-classical modelling techniques, like agent-based simulation and cellular automata; they can be analyed by various software systems, not only by simulation systems.

SNE		Comparisons																	
	Sum	C1	C2	C3	C4	C5	C6	C7	CP1	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17
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	13	2	-	-	1	2	-	3	-	-	-	1	-	-	2	1	Def/1		
37	11	-	1	-	-	1	-	2	-	-		2	-	-	2	2	1		
38/39	14	1	2	1	1	1	3	-	1	-	-	1	1	-	1	-	1		
40	9	-	1	2	-	1	1	-	-	-	-	-	1	-	-	1	1	Def/1	
41/42	9	1								1		1		1		1	1	2	Def/1
Total	272	37	33	25	13	15	14	40	12	6	15	20	9	16	6	6	5	3	1
	Sum	C1	C2	C3	C4	C5	C6	C7	CP1	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17

The solutions allow comparisons of different modelling approaches, of features of simulators, of development of simulators, etc. Furthermore, the solutions – many of them with source codes – may be used as examples in simulation courses, etc.

Development of the Comparisons

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. For 2005, the data-based driven evaluation and classification is planned within the new ARGESIM web server, with access from the EUROSIM web server.

The principle idea of the comparison is a mixture of a general simple comparison 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 implementations as well as features of modelling and experimentation within simulators, also with respect to application area, are compared.

The comparisons started in 1990, and since that time there have taken place new developments in software and algorithms.

Consequently also the comparisons developed further on, from *comparisons of simulation software* to *comparisons of modelling and simulation techniques and tools*. This development is based on following facts:

- Nowadays different modelling approaches are offered by simulators.
- The paradigm of Classes and Objects has changed software engineering dramatically. Also in modelling and simulation OO approaches give better insight into structures.
- Hybrid approaches become more and more important; and as simulators offer environments with complex features, hybrid approaches can now be set up easily.
- Symbolic computation is an alternative to analysis in the time domain. Nowadays symbolic computation systems can analyse also nonlinear systems and can handle complex semi-numerical tasks.
- Up to now missing are approaches to the discrete comparisons by means of statistical tools - in combination with symbolic computation.
- Alternative modelling techniques, like cellular automata and agent-based systems become more and more of importance
- Furthermore, many simulators have been developed continuously. So it makes sense to solve a comparison from time to time with the new version of a specific simulator, to show the advances and new features of the system.

We also are working on a classification and evaluation of the solutions. Key words should characterise a specific solution: method or approach used generally modelling technique, methods used in the tasks. This evaluation will be part of the new ARGESIM web server, which will offer parts of SNE as electronically journal, together with news at the EUROSIM web server.

Comparisons as Education Tool

The comparisons are a valuable source for exercises or demos in simulation education. As the comparisons tend towards modelling approaches, they can be used not only in simulation software classes, but also in more or less general classes on modelling and simulation.

In order to make a comparison a self-contained part of a lecture, each comparison will be accompanied by a model description and model derivation, introducing also into applications and backgrounds. These model descriptions will start in 2005, including also the previous comparisons. Each comparison can now be used as self-containing part of a lecture on modelling and simulation, with:

- Model description and derivation (download)
- Application area and background (download)
- Comparison definition (download)
- Various solutions (printed, download)
- Various implemented models (sources, download)

Comparison Definitions

Up to now 18 comparisons were defined. The following list shortly introduces the comparisons and sketches special problems (SP), which could be observed for a special comparison. Clearly, some defined tasks seem to be simple, but they prove tricky, so that they must cause "problems" in implementation.

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

SP: loops with logarithmic increments, correct double – logarithmic plots, steady state calculation

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

SP: complex control strategies, analytical considerations before modelling very helpful, optimisation avoidable

C3 Generalised Class-E Amplifier, **SNE 2** (7/91), simulation of electronic circuits, table functions, eigenvalue analysis, and complex experiments.

SP: use of same model for analytical and numerical analysis, up to now accuracy, table function evaluation vs. piecewise functions

C4 Dining Philosophers I, **SNE 3** (11/91), general comparison, involving not only simulation but also analysis e.g. by Petri nets and, etc.

SP: network analysis for deadlocks, simultaneous events, results difficult to compare

C5 Two State Model, SNE **4** (3/92), checks high- accuracy features and state event handling.

SP: analytical approach possible, but ill-conditioned; fully discrete approach possible, accuracy of 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.

SP: no strict separation of entities and resources, complex routing and priority problems

C7 Constrained Pendulum, **SNE 7** (3/93), checks features for hybrid modelling, comparison of models, state events, boundary value problems.

SP: choice of states, different levels of hybrid approaches,

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.

SP: results not encouraging wrt parallelisation, very often direct programming necessary

C8 Canal-and-Lock System, **SNE 16** (3/96), discrete system, checks features for complex logic control, validation and variance reduction.

SP: complex logic control, analytical considerations necessary; support for advanced statistical analysis (variance reduction methods) often missing

C9 Fuzzy Control of a Two Tank System, **SNE 17**, (7/96), asks for approaches and for implementations of modules for fuzzy control.

SP: support for fuzzy control, two-dimensional calculations for control surface, pure discrete approach possible

C10 Dining Philosophers II, **SNE 18** (11/96), reviews discrete simulators with respect to concurrent access to resources and with deadlocks.

SP: discrete random variables, simultaneous events, deadlock recognition

C11 SCARA Robot, **SNE 22** (3/98), deals with implicit and hybrid systems with state events.

SP: implicit model, different approaches for collision event and action

C12 Collision of Spheres, **SNE 27**, November 1999, allows numerical or analytical analysis as well as continuous or discrete approaches

SP: broad variety of approaches (numerical - continuous, numerical – discrete, numerical – analytical, analytical – symbolic), collision limit

C13 Crane Crab with Embedded Control, **SNE 31** (3/01), revised **SNE 35/36** (11/02) checks techniques and features for embedded digital control with sensors and with DAE-systems

SP: implicit model, discrete control coupled with sensor diagnosis, complex experiments

C14 Supply Chain, **SNE 32/33** (11/2001), **SNE 34** (7/2002) addresses discrete simulators - features for supply chain systems (messages, strategies)

SP: distinction between material flow and order flow, distance-dependent control strategies

C15 Clearance Identification, **SNE 35/36** (11/02), checks identification features (based on measured data) and influences of noise

SP: identification algorithms, short-term input functions (Dirac-like), support of statistics

C16 Restaurant Business Dynamics, **SNE 40** (05/04), addresses agent-based simulation as well DEVS approach and classical programming

SP: renaissance of activity scanning, coordination of run samples, optimisation

C17 SIR-type Epidemic, **SNE 41/42** (12/04), analyses temporal and spatial behaviour of the process by cellular automata models

SP: features for cellular automata in simulation systems

Solutions

We invite all readers to participate in these comparisons. Please, simulate the model(s) with any tool of your choice and send in a solution. A solution should consist of:

- a short description of the simulator,
- description of modelling technique,
- model description,
- results of the three tasks,
- and additionally we ask for model sources

The printed solution should fit into one page of **SNE** – templates are found at our web page. Solutions sent in are reviewed.

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Temporal and Spatial Evolution of a SIR-type Epidemic – ARGESIM Comparison C17 - Definition

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The aim of this comparison is to numerically solve the classical Kermack McKendrick epidemic-model, given through a system of ordinary differential equations, and furthermore to develop a cellular automaton model whose properties represent the ones governed by the continuous model. Since for this purpose, lattice gas cellular automata (LGCA) seem to be well suited, different LGCA should be implemented, the results compared and arising differences interpreted and discussed.

The used software is not of primary interest as the concentration should be put on the comparison of completely different approaches to simulate the same process. Under certain assumptions analogy will have to be shown and advantages of one or the other approach emphasized.

General Description:

W. O. Kermack and A. G. McKendrick proposed in 1926 a simple SIR model for epidemic spread based upon a system of nonlinear ordinary equations. The abbreviation SIR stands for susceptible – infected – recovered and it deals with an epidemiological model to investigate the theoretical number of people infected with a contagious illness in a closed population over time.

As to simplify the model, several assumptions have been made. The first one considers the population size which has to be constant over the observed period of time.

This means that no in- or outflow (e.g. births or deaths) takes place. Besides that, incubation time of the infectious agent is zero and the duration of infectivity is the same as the length of the disease.

Taking into account all this information, the following system arises:

$$\begin{aligned}\frac{\partial S(t)}{\partial t} &= -r \cdot S(t) \cdot I(t) \\ \frac{\partial I(t)}{\partial t} &= r \cdot S(t) \cdot I(t) - a \cdot I(t) \\ \frac{\partial R(t)}{\partial t} &= a \cdot I(t)\end{aligned} \qquad (1)$$

Here r is the infection rate, a the recovery rate, $S(t)$ the number of susceptible individuals, $I(t)$ the number of infected individuals and $R(t)$ the number of recovered individuals, at time t respectively.

Purpose of this comparison is not just solving this task with conventional methods but also to implement a cellular automaton model to obtain a solution for the problem. Therefore, a lattice gas cellular automaton (LGCA) should be considered to describe the epidemic. For those not being familiar with cellular automata in general and with LGCA in particular, a brief outline should explain the main properties.

Cellular automata are based upon a discretisation of space and time. Each cell can hold a finite number of states and the temporal evolution of the automaton is governed by transition rules which act locally and simultaneously on the cells. The transition rules can either be deterministic or probabilistic. Locality is introduced by a neighbourhood-function which defines the cells being determinant for updating the cell state (see Figure 1).

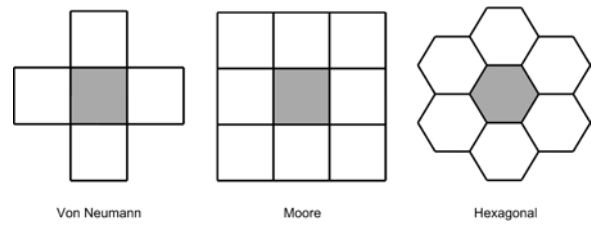


Figure 1: Graphical representation of different neighbourhood-functions in 2-dimensional cellular automata

Figure 2 shows a configuration of the probably best known example of a 2-dimensional cellular automaton, the Game of Life. Cells can hold two different states and Moore-neighbourhood (eight surrounding neighbours) is chosen as neighbourhood-function. The transition rules are purely deterministic but will not be presented here in detail.

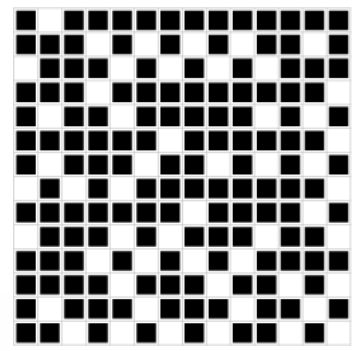


Figure 2: Game of Life; 2-dimensional CA with two different states for each cell (black, white)

As we are studying epidemic spread, a LGCA has been chosen, allowing for the simulation of diffusion processes. LGCA are two-dimensional cellular automata with particles moving from cell to cell during each time-step of the automaton. Therefore, the definition of different states for the cells becomes obsolete, rather each particle can hold different states (in our case this will be susceptible, infected or recovered). Neighbourhood now refers to all particles in one cell and not to the surrounding cells. Since LGCA descend from fluid dynamics, basic physical quantities like mass and momentum are conserved. Evolution (the motion of the particles) consists of propagation and collision.

We have to distinguish between the **HPP** (Hardy, de Pazzis, Pomeau - 1973) and the **FHP** (Frisch, Hasslacher, Pomeau - 1986) model. The first one is composed of a **square lattice** which contains no more than **four particles** per cell. Each particle is determinate by its lattice-vector which connects the cells to its four nearest neighbours and defines the direction the particle moves on. It is not possible that one cell contains two particles moving along the same direction. If and only if two particles collide when entering one cell from opposite directions, each particle changes direction by 90°. Usually the orientation of the deflection will be predefined but it may also be chosen randomly for each collision. Discussion of this feature will be content of a later task.

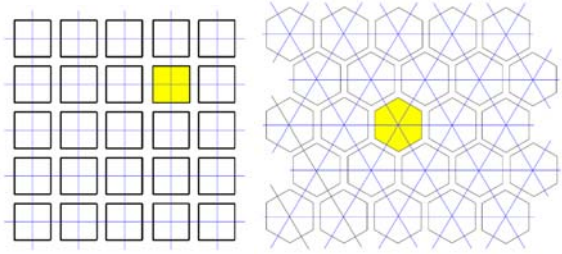
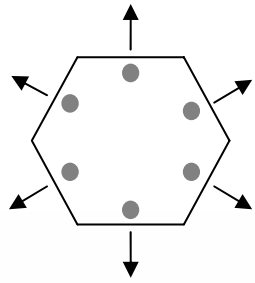


Figure 2: HPP and FHP lattice-gas cellular automaton; the lines represent the directions of the lattice-vectors connecting the cells with its neighbours; particles are not represented

The FHP model consists of **hexagonal** structure containing a maximum of **six particles** per cell again being defined by its lattice-vectors connecting the cell to its six nearest neighbours. Collision rules are more elaborated in that case; we chose the simplest ones, also called **FHP-I collision rules**.



A two-particle head-on collision redirects the particles by changing the direction of their lattice vector by 60° randomly clockwise or counter clockwise but equally for the two particles. A three-particle head-on collision again changes the direction equally by 60° either clockwise or counter clockwise but remaining the same for all collisions of this type. For further readings we recommend [2].

We now identify each particle of the automaton with one individual, which can either be susceptible, infected or recovered. Let N be the total number of nodes (cells) in the lattice and S_k the number of susceptible individuals in the entire lattice at time k. Then the probability of one susceptible individual to become infected in a single time step ($k \rightarrow k+1$) is

$$1-(1-r)^{\frac{I_k}{N}} \qquad (2)$$

and hence the expected number of susceptible individuals who become infected is

$$S_k \cdot \left(1-(1-r)^{\frac{I_k}{N}}\right). \qquad (3)$$

The expected number of individuals who recover in a single time step is

$$a \cdot I_k. \qquad (4)$$

For a well stirred population equations (2), (3) and (4) yield to:

$$S_{k+1} = S_k \cdot (1-r)^{\frac{I_k}{N}}$$

$$I_{k+1} = I_k + S_k \cdot \left(1-(1-r)^{\frac{I_k}{N}}\right) - a \cdot I_k$$

$$R_{k+1} = R_k + a \cdot I_k$$

The following considerations may give a relation to a system of difference equations. Taylor expansion for small r

$$(1-r)^{\frac{I_k}{N}} = 1 - \frac{r \cdot I_k}{N} + \frac{I_k \cdot (I_k - N) \cdot r^2}{2 \cdot N^2} + \cdots$$

keeping only the first two terms and defining

$$\rho_S(k) = \frac{S_k}{N}, \ldots \qquad \text{yields to}$$

$$\begin{aligned} \rho_S(k+1) &= \rho_S(k) - r \cdot \rho_S(k) \cdot \rho_I(k) \\ \rho_I(k+1) &= \rho_I(k) + r \cdot \rho_S(k) \cdot \rho_I(k) - a \cdot \rho_I(k) \\ \rho_R(k+1) &= \rho_R(k) + a \cdot \rho_I(k) \end{aligned} \qquad (5)$$

This system of difference equations (5) is of equal structure as the previously given system of differential equations (1).

Task a – CA and ODE Simulations

Find the solution for the problem by solving the system of ODEs (1) using the initial values and parameters given in Table 1.

$S(t=0) = S_0$	16000
$I(t=0) = I_0$	100
$R(t=0) = R_0$	0
Infection rate r	$0.6 \cdot 10^4$
Recovery rate a	0.2

Table 1: initial values and parameters for task a

Following this data, implement a FHP LGCA with a domain size of 100×100 (and therefore 10^4 hexagons), an infection rate of $r = 0.6$ (in accordance to the parameter value for the previous task divided by the number of hexagons) and periodic boundary conditions to remodel the system and compare the obtained results. To prescribe an initial configuration, uniformly distribute the individuals of type S and I.

Oppose the results for the FHP model to a HPP model and discuss the differences. Furthermore change the properties of the HPP model regarding the direction of the deflection of particles to obtain random motion (not only depending on the initial configuration) and compare the results to the former ones.

Task b – Vaccination Strategies in CAs

Use the properties of the FHP model of the previous task and implement different strategies for vaccination of susceptible individuals in LGCA. A group of 4000 susceptible individuals should be vaccinated. Therefore, assume having the infected individuals grouped together in one half of the domain and vaccinate a part of the rest of the population. Experiment with different policies for vaccination and oppose the results. In particular, implement vaccination in the whole domain, vaccination in the part of the domain containing the infected individuals (epidemic area) and vaccination of individuals being located at the borders of the epidemic area. Once again solve the continuous model, wherein a vaccination process can easily be described by setting $R_0 = 4000$ but note that spatial inhomogenities can not be represented in this approach.

Task c – ODE vs. CA Solutions

Until now, spatial grouping of infected individuals can be observed which will consequently change the results of the simulation in comparison with the continuous approach.

Change the FHP LGCA to avoid spatial inhomogenities of different groups of individuals. For these purpose, ensure perfectly uniform distributions for all three groups of populations ($S(t)$, $I(t)$, $R(t)$) by randomly rearranging all individuals in every time step of the automaton. The fact that this assumption destroys basic principles of LGCA is not decisive for our studies.

Use parameter values given in Table 2 for these simulations.

$S(t=0) = S_0$	40000
$I(t=0) = I_0$	1000
$R(t=0) = R_0$	0
Infection rate r	$0.3 \cdot 10^4$
Recovery rate a	0.2

Table 2: initial values and parameters for task c

Show that for these parameter values the obtained results for the continuous and the LGCA approach are not only of equal qualitative behaviour but also lead to fairly similar quantitative values. Explain the slight differences concerning the speed of epidemic spread by comparing the data with the solution of the difference equation (5).

Experiments with lower values of S_0 and interpret the growing discrepancies.

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A directly Programmed Implementation of ARGESIM Comparisons C17 "SIR-type Epidemic" using MATLAB

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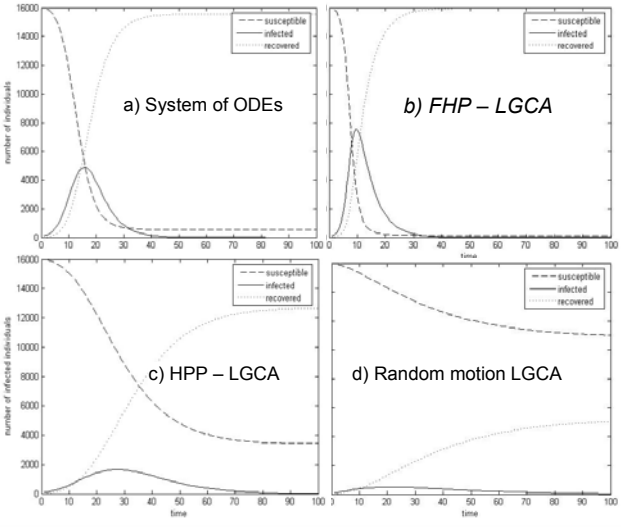
Simulator. MATLAB is a high-level technical computing language and interactive environment for algorithm development, data visualization, data analysis, and numerical computation.

Model. The numerical solution of the given system of ODEs is not a problem for modern computer algebra systems or numerical libraries for other high-level programming languages. To implement the LGCA, a straight-forward approach has been chosen. Simple matrices contain the single cells whereas one cell is represented through 6 elements in the matrix for the FHP model and 4 elements for the HPP model respectively. Therefore, every element of the matrix `lgm(i,j)` can hold 4 different states: 0 if there is no particle at the corresponding position in the cell, 1 for susceptible, 2 for infected and 3 for recovered individuals. Propagation and Collision rules must be implemented once for a cell of the LGCA and hence for 6 (or 4) elements of the corresponding matrix, always being aware of periodic boundary conditions.

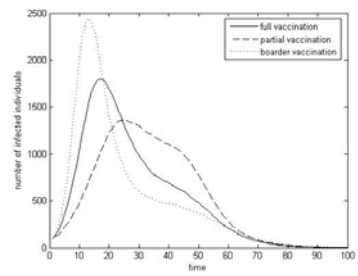
Task a - CA and ODE Simulations. To solve the given system of ODEs in MATLAB, an explicit Runge-Kutta formula of order (4,5) has been applied.

```
g = inline('[- 0.6/10000*y(1)*y(2);
0.6/10000*y(1)*y(2) - 0.2*y(2); 0.2*y(2)]',
't', 'y');
[ts,ys] = ode45(g,[1,150],[16000; 100; 0]);
plot(ts,ys)
```

The results are of similar qualitative nature but differ quantitatively for the different approaches:

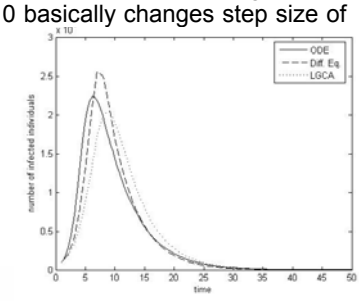


The reason for this is the fact that infected individuals form spatial groupings in the LGCA and thus slow down the speed of the epidemic. When using the same parameters of infection rate r and recovery rate a, one must be aware that epidemic spread is much slower in the HPP model. Infection occurs within one cell of the automaton and so the infection-probability is much lower as no more than 4 individuals can "meet" in one cell. When we introduce total random motion in a HPP-LGCA, the speed of the epidemic slows down even more since nearly no mixture of individuals takes place.



Task b – Vaccination Strategies in CAs. Different vaccination strategies can easily be introduced in the LGCA model by defining vaccination areas and initially setting a particle state of 3 for the number of individuals to be vaccinated. Vaccinating individuals at the borders of the epidemic area leads to a rapid outbreak in the epidemic area but as infected individuals initially remain isolated, the duration of the epidemic is shorter compared to other strategies. Homogeneous vaccination in the whole domain can only partially slow down epidemic spread whereas specific vaccination in the epidemic area slows down the infection process but due to diffusion of infected individuals can not stop the epidemic from spreading all over the domain.

Task c - ODE vs. CA Solutions. Changing the parameter values and initial conditions to the given values and avoiding inhomogenities by rearranging all individuals after every time step of the automaton results in fairly similar behaviour for the system of ODEs, the difference equations and the FHP-LGCA. The slight differences arise due to a relatively big step size of 1 for the discrete approaches. Dividing the parameters *a* and *r* by 10 basically changes step size of the according explicit Euler method and thus leads to even better concordance. The number of infected individuals remains lower in the LGCA because the solution of the difference equations serves as upper bound for the automaton.



C17 Classification: Directly Programmed Appr.
Simulator: MATLAB 6.5

A fully Numerical Approach to ARGESIM Comparison "C1 Lithium-Cluster Dynamics" with Dymola

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Simulator. Dymola, Dynamic Modeling Laboratory, is a simulation environment built for modelling various kinds of physical objects. It uses an object oriented approach for modelling of large, complex and heterogeneous physical systems. A graphical editor and a specific language (Modelica) allow the user to construct models composed of mechanical, electrical and hydraulic subsystems out of predefined models.

Model. Because of the simplicity of the present model there is no need for graphic modelling, therefore a pure textual approach at Modelica level was taken:

```
model C1
… declaration of parameters and variables …
  equation
  der(r)=-dr*r + kr*m*f;
  der(m)=dr*r - dm*m + kf*f^2 - kr*m*f;
  der(f)=dr*r+2*dm*m-kr*m*f-2*kf*f^2-lf*f+p;
end C1;
```

Task a - Comparing ODE Solvers. The System is a highly stiff one. Among the more than 10 ODE solvers five solvers worked efficiently. Two are based on the LSODE Solvers, two on the DASSL code, and the fifth is a generalized RK – method.

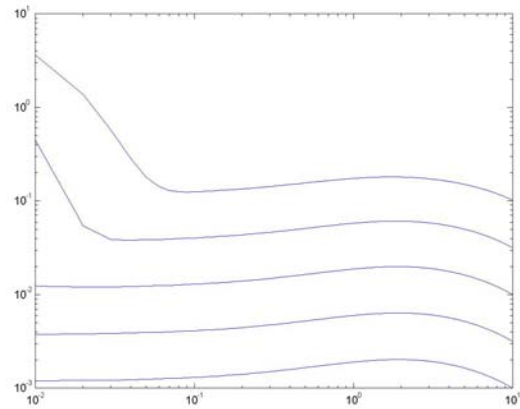
For this task, a relative accuracy of 10^{-6} was set, of the five algorithms used the DASSL-algorithm (DAE solver of Petzold of order 1-5) was the fastest, further results given in the next table. A classical RK4 - algorithm takes about 1.5 s, but one has to choose the stepsize very carefully.

LSODE2	0,36s
LSODARr	0,36s
GRK4T	0,578s
DASSL	0,343s
ODASSL	0,344s

Task b - Parameter Variation: A variation of the parameter l_f from 100 to 10000 in logarithmic steps is to be documented for the function f in a double-logarithmic plot.

Dymola offers now a script language, where such parameter variations could be done, but up to not very comfortable. In this solution the parameter variation was done 'manually', performing different runs with precalculated values of l_f . As Dymola's environment does not support directly logarithmic plots, the resulting time courses of f were exported to MATLAB (supported directly in Dymola).

The following figure shows the MATLAB plot, with 1000 evenly distributed output points for each graph, with $l_f = 10^{(3+i)/2}$, i = 1, …, 5.



Task c: Calculation of steady states: A direct approach is, to simulate in the time domain until the derivatives become zero or almost zero. The model has to be extended by the following lines:

```
when der(r) <= 1e-10 and der(m) <= 1e-10 and
der(f) <= 1e-10 then
       a = r;    b = m;    c = f;
```

Additionally the simulation horizon has to be set large enough. The results are surprisingly exact: a = b = c = 0 without bombardment p(t) and a = 1000, b = 10, c = 10 for a constant bombardment of p = 10000.

Another (relatively new) feature of Dymola is the possibility, that simulation runs can start in steady states. This is implemented in an initial statement by means of an algebraic equation for the derivatives:

```
initial equation der(r) = 0;   der(m) = 0;
der(f) = 0;
```

Dymola solves this equation iteratively with respect to the states, giving accurate results as given above.

C1 Classification: Fully Numerical Approach

Simulator: Dymola 5.1

A DEVS – Solution to ARGESIM Comparison C8 "The Canal-and-Lock System" with CSIM

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Simulator. CSIM (Mesquite Software) is a process-oriented, general-purpose simulation toolkit, which supports the development of process-oriented, discrete-event simulation models, by using the standard programming languages C and C++. Because of the nature of compiled C and C++ programs and CSIM's dynamic memory allocation, developed models are compact and efficient.

Model. We have described the model textually by writing the corresponding C++ code. In order to model barges we have defined the class *Barge*. The methods of the class Barge, *proceedEastbound()* and *proceedWestbound()*, define the movement of the barge in the eastbound and westbound directions resp.

Task a – Control Logic Modelling. The behaviour of the barges during the movement through the system is modelled using CSIM *processes*. In a CSIM model a *process* represents an active entity. Furthermore, we have used CSIM *processes* to model the generation of the eastbound and westbound barges.

The control logic is constructed by using CSIM *events* and a set of integer counters. *Events* are used for the synchronization of CSIM processes, which in our model represent barges. When a *barge* is generated, based on the state of the system, either proceeds through the system or enters the *queue* and waits for the occurrence of a specific event. We have used the class facility, which is provided by CSIM, to model resources of the canal-and-lock system. The *west canal*, the *lock*, and the *east canal* are modelled as instances of the class *facility*.

The instances of the CSIM class *table* are used to collect explicit statistics on barge transition times. CSIM supports the automatic calculation of the *confidence intervals* (CI) for the mean of data stored in the table. The automatic calculation of commonly used confidence intervals (90%, 95%, and 98%) is enabled by invoking the method *confidence()* of the class *table* immediately after the table instance is created. Note that a minimum number of observations, which is determined by CSIM at run time, is required in order to automatically compute confidence intervals.

CSIM offers an interesting feature for controlling the length of the simulation run based on confidence intervals.

CSIM monitors the confidence interval during the simulation run, and when the desired accuracy is reached automatically terminates the simulation. Please note that this feature is not needed for solution of this *particular comparison*, but we consider that in general it may be a useful feature.

Task b – Model Validation with Deterministic Data. The deterministic model validation was a challenging and interesting task, because of the occurrence of multiple events at the same simulation time. Our model was valid for all specified datasets.

Task c – Variance Reduction Experiments. Table 1 shows the mean barge transition times for Activities 1, 2, and 3. The use of the Antithetic Random Variates (ARV) has not resulted in a significant change of the confidence intervals (CI).

Activities 1 and 2 90% CI [minutes]	Activity 3 (ARV) 90% CI [minutes]	CI Change [%]
497.58 +/- 31.66	454.67 +/- 34.46	-8.84
507.06 +/- 32.79	504.18 +/- 30.26	7.72
474.82 +/- 28.53	509.15 +/- 29.44	-3.19

Table 1. Mean barge transit times.

Table 2 shows the difference in mean transit times between the case in which maximally 5 barges and the case in which 6 barges are allowed to move in one direction before the movement direction is changed by the system control. The use of the Common Random Numbers (CRN) reduced significantly the confidence intervals (about 90%).

Activities 4 and 5 90% CI [minutes]	Activity 6 (CRN) 90% CI [minutes]	CI Change [%]
23.18 +/- 78.88	55.90 +/- 8.71	88.96
-0.85 +/- 73.99	54.32 +/- 7.42	89.98
98.89 +/- 79.58	50.80 +/- 6.82	91.42

Table 2. Difference between 5-barge and 6-barge mean transit times.

Based on results in the first column of the Table 2 it can not be inferred about the acceptance of the null hypotheses that the mean transit time for 5 barges is less than for 6 barges maximum, because it contains positive and negative values. However, CRN results in the second column show clearly that for 6 barges the mean transit time is decreased. Therefore, the null hypotheses can be rejected.

C8 Classification: Object-Oriented Simulation
Simulator: CSIM 18.3 for Linux

An Event-Oriented Approach to ARGESIM Comparison C10 "Dining Philosophers II" with Taylor ED

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Simulator. The simulator Taylor Enterprise Dynamics is an object-oriented software application used to model, simulate, visualize and control processes. It provides all the benefits and disadvantages of a windows application.

Everything in Taylor ED is an atom. These atoms are hierarchically structured, one main Atom containing all others. Each atom has four dimensions: location and time.

The user surface is graphic oriented – creating a model is easily done with dragging the model elements from the library tree into the Model Layout Window. Behind the graphic surface the 4d script is hidden; it allows the user to add or remove functionality to atoms as he wishes. Therefore a high level of flexibility is provided.

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.

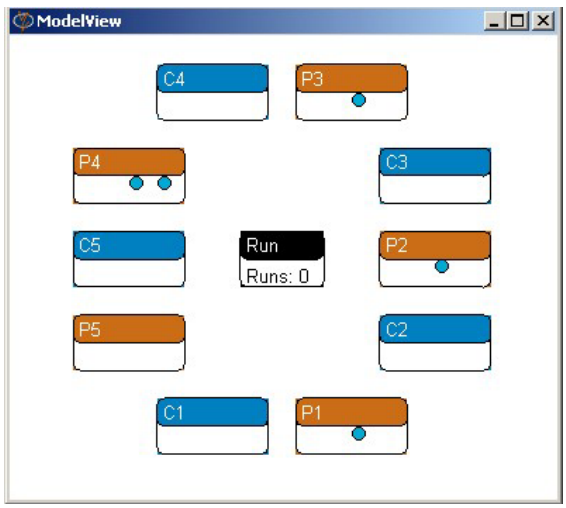


Figure 1: Model View in Taylor

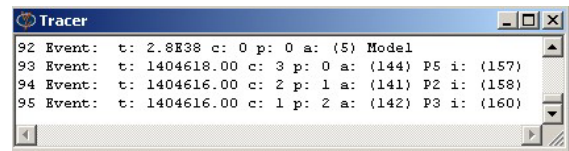
Time for thinking and eating follows a discrete uniform distribution in the interval (1,10).

The chopsticks are Product atoms to be processed. They are stored in own atoms until being requested again. These atoms and the philosopher atoms are Base class atoms. Their functionality is programmed with the 4d script code.

Task a: Single simulation run. Average times (+/- standard deviation) of thinking, waiting and eating periods; rate of chopstick utilisation are given in the following table, produced by Taylor ED's statistical output features:

philosophers	thinking time	eating time	waiting time	chopstick	utilisation
P1	5.49+/-2.87	5.51+/-2.87	11.44+/-8.05	C1	91.95 %
P2	5.50+/-2.87	5.51+/-2.87	11.44+/-8.05	C2	92.01 %
P3	5.49+/-2.87	5.49+/-2.87	11.44+/-8.07	C3	91.98 %
P4	5.51+/-2.87	5.49+/-2.87	11.44+/-8.07	C4	91.92 %
P5	5.49+/-2.87	5.49+/-2.87	11.45+/-8.07	C5	91.94 %
all	5.50+/-2.87	5.50+/-2.87	11.44+/-8.06	all	91.96 %

Task b - Simultaneous access. In a simultaneous access situation the philosopher sitting on the right gets the chopstick first and the philosopher to his left must wait. In the simulation this was realized with the capability to prioritise an event in the event list. In the following a snapshot from Taylor ED's event list (in trace modus). As default, in case of simultaneous events, Taylor ED processes that event first, which belongs to first defined block atom.



Task c - Deadlock detection. Taylor ED does not recognise a deadlock for what it is – the simulation continues until no more events are listed. So a time overflow occurs, simulation does not stop. To prevent this overflow, a query is made each time a philosopher seizes his left chopstick: if a global variable containing the number of philosophers holding a chopstick is equal to five the simulation run is stopped. In the following the so-called 4D-script code (Taylor ED's) programming language) for the deadlock prevention.

```
If(label([send],last(c))=1,
do(inc(dead),
{deadlock}
if(dead=5,stop)))
```

The minimum and maximum termination time evaluated on 50 simulation runs is 32259 s or 14354390 s.

C10 Classification: DEVS Approach

Simulator: Taylor ED 6

A directly Programmed Solution to ARGESIM Comparison 12 "Collision of Spheres using Octave

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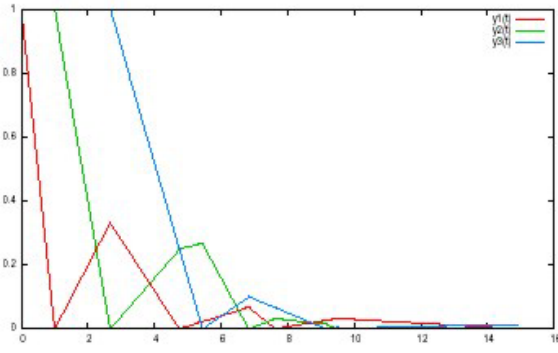
Simulator. Octave is a freely available and redistributable software (http://www.octave.org). It is primarily intended for numerical computations, using a language that is mostly compatible with MATLAB.

Model. The system of differential equations (4) is directly solvable. Therefore an event-discrete approach has been chosen. Determining the point in time of the next collision is done using a simple loop:

```
function [time,num] = next_coll(distance, speed)
t = 1000000;
num = 0;
for i = 1:3
     if speed(i) < 0
         new_t = distance(i) / abs(speed(i));
         if new_t <= t
              num = i;
         end
         t = min(t, new_t);
     end
end
```

Task a1 - Simulation in the time domain. The function `collision_run` takes as parameters the collision coefficient `e`, diameter `d`, initial distance `a` and initial speed v_0. It repeatedly runs next_coll until the termination criterion is met and returns arrays representing the points in time of the collisions and the corresponding absolute distances. The speed between the collisions is linear, so a simple plot gives the result (fig.1).



Task a2 - Final values for the velocities. For `e=1` the final velocities are [0 0 0 1]. The quasi plastic case was found for `e=0.176`, when the maximum of the absolute relative velocities falls below 10^{-9}.

Task b1/b2 – Variation restitution coefficient . Variation from 0.17 to 1 with stepsize 10^{-2} gives fig.2 showing the number of collisions, as well as fig.3 showing the final velocities as a function of `e`.

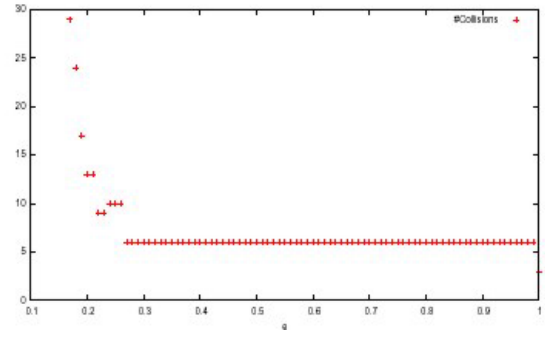


Fig. 2: Number of collisions versus restitution coefficient

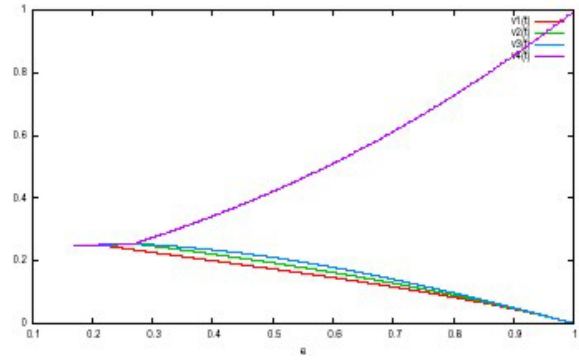


Fig. 3Final velocities of the four spheres versus restitution coefficient

Task c1 - Boundary value problem. This task has been implemented searching for a zero point of the function $v_4 - v_0/2$ using Regula Falsi. It was found for `e=0.5874` using an accuracy of 10^{-6}.

Task c2 - Normal distributed restitution coefficient. The built-in function normal_rnd was used to generate a sample of 2000 values with mean value 0.5 and standard deviation 0,05. The resulting distribution of v_4 is shown in fig.4.

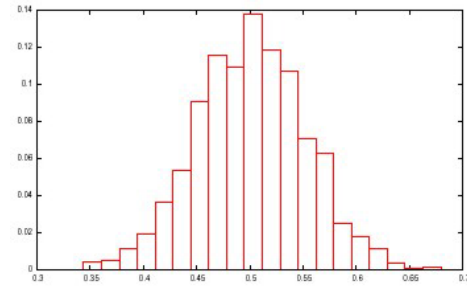


Fig. 4 Histogram of distribution

C12 Classification: Programmed Event Approach

Simulator: Octave Rel. 2004

Mixed Analytical / DEVS Approach to ARGESIM Comparison C14 "Supply Chain Management" using Xpress-MP and AnyLogic

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Programs. Xpress-MP MP is the standard LP Solver of Dash Optimization (www.dashoptimization.com). AnyLogic (www.xjtek.com) is a general-purpose simulator for discrete but also for continuous and hybrid application. The modelling technology of AnyLogic is based on Java so that building simulation models using AnyLogic should be easy for experienced programmers.

Model. Based on the Comparison 14 we want to demonstrate a possible connection between a discrete-event simulation and exact optimization. We developed a LP model which is aligned with the definition of the simulation model described in Comparison 14. Some parameters of the original definition have been changed slightly in order to apply optimization and to meet the requirements of the LP model.

We assumed a time horizon of 10 days (240 hours). Within our model factories 1 and 3 supply products 1 to 6, and factories 2 and 4 supply products 7 to 12. The amounts of products supplied at each factory have been generated randomly according to the definition of Comparison 14. Furthermore, we included inventory costs at the factories and the transportation costs are linearly depending on the number of products ordered.

The objective function consists of the inventory costs at the factories, the inventory costs of the distributors and the transportation costs between factories and distributors. To prohibit a solution where no product is delivered at all, the objective function of the optimization model is augmented by penalty costs, occurring if an order of one of the wholesalers is not fulfilled.

Without taken into account any stochastics, the goal of this experiment was to find the optimal solution for the whole network. Both the factories and the distributors are provided with an initial inventory level for each product. The inventory level costs are calculated based on the inventory level in the periods before ordering. The constraints of the LP model ensure that the products are sent through valid routes. Furthermore, the objective function is subject to several inventory balance and flow equations. The model was implemented in XPress-MP.

We also considered the possibility to develop a binary model minimizing the ordering costs, in order to have an exact representation of the assumptions given in the definition of Comparison 14. Due to the complexity of this problem (about 480 binary decision variables), the effort needed to optimize this model exceeded a reasonable amount of time.

Furthermore, we took the solution of the Comparison 14 provided by Michael Gyimesi and Johannes Kropf (SNE, Issues 35/36, December 2002, p.85) and adapted it according to the changes assumed for the LP model. The inventory costs for the factories and for the distributors have been assumed to be nonlinear. The distributors order the products following an ordering plan, which is at first determined in the optimization model using linearised cost functions. After a simulation run, the average inventory costs at each factory and at each distributor are computed and in turn are used for the next optimization run. We performed three iterations of this ping-pong game until the simulation model provided the same average inventory costs as in the previous round.

Results: For one of the test instances we assumed piecewise linear cost functions. Three iterations of the ping-pong game had to be performed, until the simulation model provided the same average inventory costs as in the previous round. Table 1 shows the changes of the inventory costs at factories (F) and at distributors (D) during the experiment.

	F1/F2/F3/F4	D1/D2/D3/D4
1st run	1,5/1,5/1,5/1,5	2,5/2,5/2,5/2,5
2nd run	3,44/3,29/3,23/3,19	1,0/1,03/1,02/1,01
3rd run	3,39/3,11/3,04/2,92	1,04/1,04/1,06/1,04

Table 1: Change of linearised inventory costs

We tested also other scenarios with logarithmic and piecewise constant cost functions. In the logarithmic case three iterations were necessary to get the same results for the simulation and the optimization model, whereas in the case of piecewise constant cost functions we got trapped in a cycle. Although we can gain convergence in the first and second example, we do not know if we are trapped in a local minimum or if we have found the global optimum. Especially if we consider more complex networks with different types of nonlinearities, it will be very difficult to find some general conditions under which we can guarantee convergence and to find an optimal solution.

C14 Classification: Mixed Analytical / DEVS Appr.
Simulator: Xpress-MP Rel. 2003, AnyLogic 5.1

A directly Programmed Solution to ARGESIM Comparison C15 'Clearance Identification" with Java and JMSL Numerical Library

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Simulator: Java 5 is an object oriented platform independent programming language. JMSL is a numeric library for Java which is little object oriented but favours static methods. JMSL is a successor of IMSL which is a numerical library for FORTRAN and is written 100% in Java.

Model: The model was implemented in an object oriented manner. The class `CompartmentModel` represents the model, the class `Compartment` a compartment and the class `Connection` the flux from one Compartment into another.

```
CompartmentModel model=new CompartmentModel();
Compartment Vc=new Compartment("central",0);
Compartment Vp=new Compartment("peripheral",0);
model.add(Vc);
model.add(Vp);
Connection k1i=new Connection(null,Vc);
Connection ko1=new Connection(Vc,null,0.0041);
Connection k21=new Connection(Vc,Vp,0.0498);
Connection k12=new Connection(Vp,Vc,0.0585);
model.setVolume(7.1);
```

This allows extracting the ODE model with `model.getLinearODE()` and can be solved by the static methods of the JMSL library.

Task a: Simulation of the System. The ODEs are solved by the `OdeRungeKutta` class of JMSL. It implements Runge-Kutta-Verner fifth-order and sixth-order method. The plots where create with JMSL chart package

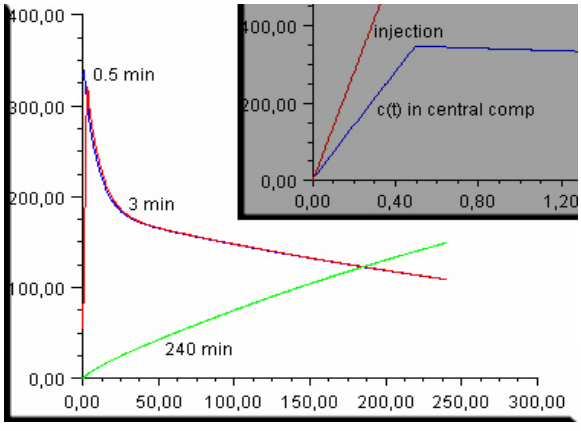

Fig. 1: Concentrations for different injections

Different injection times result in different concentrations in the central compartment (Fig. 1). The difference between the concentration of the injection and the real concentration in the central compartment can investigated in the grey plot (Fig. 1). After 0.5 min the injection stops and the concentration starts to decrease. The calculated values one minute after injection for t1=0.5, t2=3 and t3=240 are 2342.46 (t=1.5), 2208.84 (t=4) and 1060.4 (t=240).

Task b: Parameter Identification. The identification is done with a modified Levenberg-Marquardt method which is implemented in JMSL. The class is called `BoundedLeastSquares`. To make sure the numerical function is evaluated at exactly the same points the experimental data is measured, the Runge-Kutta solver has to integrate between the given times.

```
for (int i=0; i<times.length-1; i++) {
  solver.solve(times[i],times[i+1],y);
  f[i+1]=fehler(y);
}
```

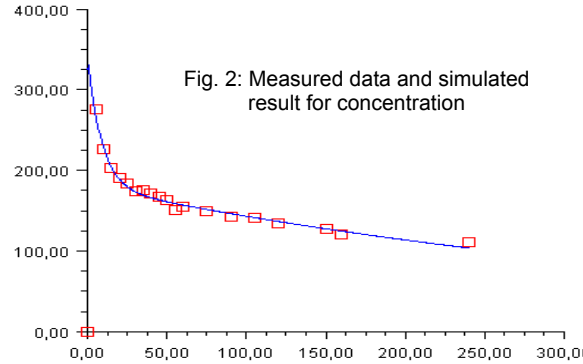

Fig. 2: Measured data and simulated result for concentration

Results of the identification are shown in Figure 2, the identified parameters are given in the next table:

k_{01}	k_{21}	k_{12}	V_1	Max	Clear.	Res
.0043	.0501	.0599	7.28	330	31.34	288

Task c - Error Estimation. The data are disturbed using `Random.nextNormalAR()` from JMSL, an acceptance/rejection algorithm to compute standard normal distribution. Mean and standard deviation of 1000 samples are given in the next table:

	k_{01}	k_{21}	k_{12}	V_1
mean	.0042	.0506	.0595	7.297
sd	2.1E-7	.000105	.000057	.1484

C15 Classification: Programmed Numerical Appr.

Simulator: Java 5, JIMSL

An OO - Approach to ARGESIM Comparison C16 'Restaurant Business Dynamics' with JAVA

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Simulator. Java is a widely used and platform independent programming language. A big advantage is the vast amount of freely available packages. For the realization of the graphical representation the package ptplot 5.3, provided by the UC Berkeley, was used.

Model. Due to the fact that the given problem is not time-critical, which means that the orders of people having dinner or of opening and closing restaurants are not decisive, there is no need for elaborated event-handling. Therefore, a straightforward object-oriented approach was used for the simulation.

In accordance to the definition it is obvious to define two different classes for restaurants and persons:

Restaurants: For each instance of the restaurant class the weekly revenue is accumulated and at the end of every week the profit is calculated by subtracting the taxes and the running costs. Afterwards, the policy for deciding to open a new restaurant or to close the inspected one is applied (either a new instance is generated or an existing is deleted).

Persons: Each instance contains information considering the position and the next dining date. Although there is neither spatial movement nor change in the population number, a separate class was developed for a possible extension of the model.

The algorithm for the update at a restaurant visit shows efficient but hard-to-read Java code:

```
public void visitRestaurant(double[] darrXYp){
  Vector vPossibilities = new Vector();
  for (int i = 0; i < vRestaurants.size(); i++) {
  double[] darrXYr = ((Restaurant)(vRestaurants
    .elementAt(i))).getXY();
  double dDist = Math.sqrt(Math.pow((darrXYr[0] -
  darrXYp[0]), 2) +
  Math.pow((darrXYr[1] - darrXYp[1]), 2));
      if (dDist < iRange) {
        vPossibilities.add(new Integer(i));}
```

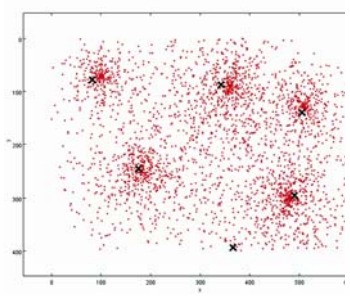

Figure 1: Spatial distribution of restaurants

Task a - Time Domain Analysis: Because of the influence of stochastic opening and closing decisions, multiple (e.g. 50) simulation runs have to be performed to get a meaningful result. Nevertheless, single simulation runs have been performed for different time periods resulting in a value of 6 restaurants after 1, 7 after 5 and 6 after 10 years.

Results at the end of the fifth year for a simulation over 50 runs are shown in the table. Fig. 2 shows the temporal evolution of restaurants and one can easily see that the number of restaurants remains at a level between 5 and 6 after a warm-up period of about half a year.

Mean	6.06
Min	4
Max	9
Variance	2.02
Deviation	1.42

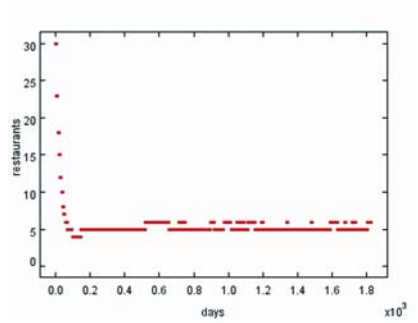

Figure 2: Total number of restaurants (5 years, 50 simulation runs)

Task b - Tax Income Maximisation. To maximise the tax income we have simply varied the tax rate with a step width of 1%. A reasonable maximum in the interval [30, 45] can be noticed with a steep decrease following due to the fact that higher tax rates would not allow economical survival of restaurants. A maximum overall tax income of 90911.55 after simulation over 2 years with reduced step width (0.1%) in the given interval corresponds to a tax rate of 37.8%.

Task c - Restaurants' Revenue Analysis. Once again, variation of the parameter of interest has led to maximal revenue for new restaurants. Figure 2 shows the dependence of the weekly revenue of the parameter *k*. A maximal value (714.67) has been achieved at a value of $k = 1.0$.

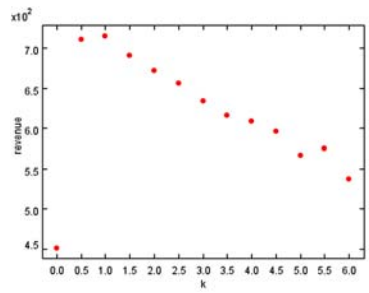

Figure 3 – Average weekly revenue of new restaurants

C16 Classification: Object Orient., Programmed
Simulator: Java 2.0

An Activity-Sanning Approach to ARGESIM Comparison C16 "Restaurant Business Dynamics" in MATLAB

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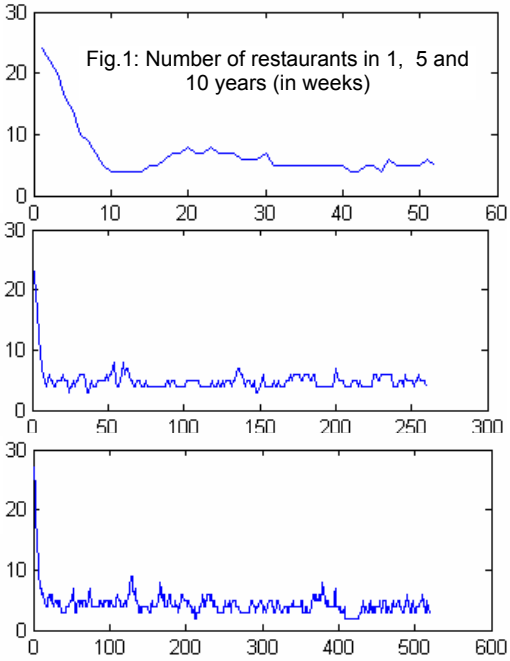
Simulator: MATLAB one of the most powerful numerical tools at the time. Although its capabilities are further enhanced by the Simulink modelling and simulation toolbox, those functions were not used.

Task a - Modelling & Simulation of the System. As MATLAB is no discrete event simulator, the time honoured approach of activity scanning had to be used, made much easier by the fact that the behaviour of people as well as restaurants was based on the fixed time steps of days and weeks. Also the complex randomness of the problem - restaurants can open at arbitrary points on the grid and close down as well – can be managed by standard features of MATLAB.

As size of MATLAB arrays can vary, arrays can be used as a list to store data about the restaurants. The algorithm for the update loop shows efficient but hard-to-read MATLAB code (results in Figure1):

```
For i=1:365*5; …. ; For j=1:3000
 Reach=sort ((restaurants (: 1)-people (j, 1)).
^2+
   (Restaurants (: 2)-people (j, 2)). ^2)-100;
   For k=1: length (restaurants (: 1))
   If reach (k) <0 count=count+1; end;
   Count=ceil (rand (1)*count);
   For k=1: length (restaurants (: 1))
    If reach (k) <0 count=count-1;
    If count==0 money (k) =money (k) +1; end;
```



The other sub-task, simulating the model 50 times and computing statistical data was easily done by adding an outer loop for the repeated modelling and a variable to store the statistical data. Calculation of the mean value (4.48 Restaurants) and the variance (2.25) again are basic MATLAB features.

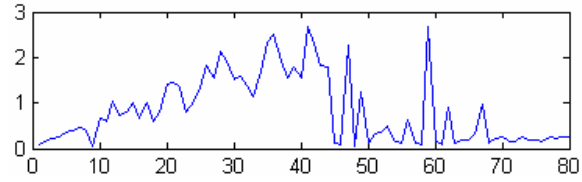


Fig 2: Tax income vs. Tax rate

Task b – Tax Income Maximisation. Figure 2 shows a variation of tax level between one and eighty percent of the income after the running costs (scaled at 10^5). The statistical data gathered at task a, together with the simulation for ten years, shows us that at 20 percent then number of restaurants oscillates between 3 and seven restaurant once the start up phase has ended. When the tax rate is increased, tax income rises up to a certain point where the maximum is gathered. Then restaurants in less populated areas are unable to survive any more, so tax income drops as there are less restaurants. But those restaurants now attract more people, so the tax rate can be raised again. Figure 3 shows the average of the maximum number of restaurants which can reach the profit threshold at certain tax rates. This also is an explanation for the drastical drop in tax income at the really high rates: Here, restaurants can no longer survive in the smaller cities, and therefore the people there do not contribute to the pool of possible guest any more.

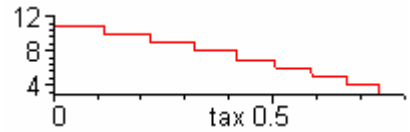


Fig. 3: Restaurants above profit threshold vs. taxrate

Task c - Restaurants' Revenue Analysis. The restaurant density parameter is used to determine how much other restaurants in the area are considered when choosing the spot for a new restaurant. Also achieved with simple loops and arrays to carry the data, the average lifetime of a restaurant in days and its variance do not differ much significantly.

Value	1	2	3	4	5	6
Mean	48.3	45.6	47.3	42.1	46.5	43.9
StdDev	53.1	52.1	54	44.5	59.7	48

C16 Classification: Activity Orient., Programmed
Simulator: MATLAB 6.5

BOOK REVIEWS

Applied Laplace Transforms and z-Transforms for Scientists and Engineers

A Computational Approach using a *Mathematica* Package

Urs Graf, Birkhäuser Verlag 2004; ISBN 3-7643-2427-9

Are you using *Mathematica* for solving problems involving Laplace transform and/or z-transform? Then this book might be ideal for you. The author presents his *Mathematica* package `LaplaceAndzTransforms` which is readily available on the CD that comes with the book. The package can be helpful in a variety of different fields, as shown by a large number of examples for applications throughout the whole book.

A basic knowledge of *Mathematica* as well as of calculus, in particular of integration theory and of differential equations, is assumed, whereas the basics of Laplace transform and z-transform are explained in the first two chapters which make up nearly one fourth of the book. These two chapters are merely a short introduction to the subject, and make no reference to *Mathematica* at all.

The *Mathematica* package mentioned above is finally introduced in the next two chapters which parallel the first two, but this time concentrating on the appropriate *Mathematica* commands. Later on, several subjects generally considered to be on a higher level are introduced both in theory, as well as in connection with the appropriate package commands (e.g. the complex inversion formula, asymptotics of inverse Laplace transforms, the advanced z-transform, and the numerical computation of an inverse Laplace transform).

About one third of the book is finally entirely devoted to several applications of the Laplace transform and the z-transform, and a large number of *Mathematica* commands are presented for solving problems in the fields of automatic control, electricity, control engineering, thermodynamics, and mechanics.

To sum up, this book (along with the presented *Mathematica* package) can be quite helpful for solving problems involving Laplace transforms or z-transforms with *Mathematica*: Beginners get a comprehensible introduction to that topic, along with the appropriate *Mathematica* commands. More advanced readers will probably appreciate the large variety of useful *Mathematica* commands that can save a lot of rather tedious work when applying the Laplace transform or the z-transform to more sophisticated problems.

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

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Modelling and Analysis of Computer Systems (in German) – a Tutorial.

Modellbildung und Analyse von Rechensystemen - Ein Tutorium

Dieter Zöbel, Elisabeth Balcerak; vdf, Hochschul-Verlag an der ETH, 1999; ISBN 3-7281-2692-6

Waiting in queues commonly is perceived as unpleasant. Also in technical systems there are states of waiting, which delays processes and causes costs. Just think about the waiting at the counter in the supermarket and the slow transfer from data in the internet. The involved users and provider of technical systems often wonder about:

- How can the waiting-times occur?
- Is there a possibility to shorten waiting-times?
- What effects the raising of the number of servers?
- How to run service-systems optimal?

Queuing theory as a mathematical theory delivers starting for solutions. The book introduces step by step, mathematical complete and comprehensive into theory its practical application. Lots of examples out of life as well as from computer and networking show the proceeding on modelling and analysis of performance. There are also some exercises to check the personal learning-progress. Enclosed example-solutions allow the comparison with the own experiments.

This book is written for students of informatics, economic-informatics, traffic and telecommunications as well as for practicing.

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

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A Handbook of Real Variables

With Applications to Differential Equations and Fourier Analysis

Steven G. Krantz, Birkhäuser Verlag 2004, ISBN 0-8176-4329-X

This book gives on no more than 200 pages an overview of real analysis of one variable. All basic concepts are mentioned, as for example series, set theory, differentiation and integration.

So this book can give an overview for beginners as well as be a manual for users, who have to look up some basics.

Not only the basics are shown, topics as differential equations and Fourier analysis also are treated in this book. These chapters form the applications – part, giving for example the solution of the wave – equation.

Called "Advanced Topics", topology and metric spaces form the most theoretical part of the book.

Very useful are a detailed glossary and a comprehensive index. The list of symbols is ordered by chapters and contains formulas as Stirlings formula or Hadamards formula.

But the mathematician won't be satisfied with this book. For nearly all theorems, the proofs are omitted. Instead of a proof, you will find an illustrating example and figures.

Another victim of the shortness of the book are problem sections, which usually follow after the chapters in basic analysis books. So it is not very useful to be read in combination with (or even instead of) a lecture in analysis for students.

We can recommend Krantz's book as a guide for beginners and engineers, easy and quickly to read, with many figures and explanations in plain text. The examples given really help understanding the newly learned concepts.

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

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Large-Scale Atmosphere-Ocean Dynamics

I – Analytical methods and numerical models

II – Geometric methods and models

J. Norbury, I. Roulstone; Advances in Simulation, Cambridge University Press 2002

These two volumes provide an account of the mathematics and numerical modelling used for weather forecasting, climate change simulations, dynamical meteorology and oceanography. Although boundary conditions and physical properties are not the same in water and air, both elements can be described through similar models. They are modelled by the Navier-Stokes based equations of fluid mechanics together with classical thermodynamics.

The first volume is axed on the analytical and numerical resolutions of simplified models. The first chapter presents the mathematics of fluid dynamics and thermodynamics, on which the models for ocean and atmosphere are based, that is the basics equations such as mass continuity or Newton's second law. Then the most important approximations which lead to the asymptotical models are introduced.

In each of the next chapters a mathematical or physical simplification that is pertinent for the ocean and/ or the atmosphere modelisation is presented, such as extended-geostrophic Euler-Poincaré models, rearrangements of functions with applications to meteorology and ideal fluid flow, or statistical methods in atmospheric dynamics. In each case an analytical method to the resolution is proposed or a numerical model and its application on computer are presented, sometimes both.

The second volume deals with geometric constraint. The key idea is to make approximations to the Lagrangian without disturbing the symmetry properties of the functional. In this way the derivatives have to be calculated no more independent but with conservation of the inner properties of the system. This way of thinking is based on the Hamilton's principle and leads to other approximations.

First this principle is described. Then different simplifications, useful for the numerical matter, are exposed. Some concrete applications of this principle are also described, such as the transformation theory in mechanics or plan weakly nonlinear internal gravity waves.

The two volumes provide therefore a complete view of the methods in large-scale atmosphere and ocean dynamics. Different methods and approximations are presented.

It is always thought as a way to understand them, even if one gets in touch with them here for the first time, and a to be able to applied them, either through an analytical method or a numerical way. Because of the enormous complexity of the equations it is necessary in both cases to use drastic simplifications, which are described in detail with or without considering the geometrical constraints.

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

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Queuing Modelling Of Supply Chain in Intelligent Production

Oleg Zaikin; Printing & Publishing Lab, Technical University of Szezeein, 2002; ISBN 83-87362-43-3

The author begins by introducing the general mathematical model of a supply chain to achieve intelligent production. Examples are given to support this model.

He then presents some of the fundamental queuing systems. Again, he supports this method by giving examples used to work with computer networks. This chapter tackles the queuing systems by introducing the stochastic flow processes and Markov chains. The M/M/x and M/G/1 systems are discussed in brief.

Another chapter is on queuing networks, which is too often neglected in many queuing books. A special emphasis is given on the workflow modelling, covering the combination of optimisation and simulation.

Over the entire book has done a good job particularly on the queuing modelling and would be recommended to those who want a first glimpse on queuing theory.

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

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Data Locality Optimizations for Iterative Numerical Algorithms and Cellular Automata on Hierarchical Memory Architectures

Markus Kowarschik; Advances in Simulation, SCS & ASIM 2004; ISBN 3-936150-39-7

This work is intended to be a contribution to the field of research on high performance scientific computing. On the whole, this thesis focuses on architecture-driven performance optimisations for numerically intensive codes. In particular, it addresses the following areas:

- Memory hierarchy optimisations for numerical intensive codes
- Architecture-oriented development of efficient numerical algorithms
- Performance analysis and memory hierarchy profiling
- Development of flexible and efficient numerical software

After an introduction to the relevant hardware-specifications and the two classes of algorithms used (iterative solution methods for large sparse systems of linear equations and cellular automata), a variety of approaches to enhance the locality exhibited by the data layouts and the data access patterns are discussed by application to these algorithms, and the results are presented.

One Chapter focuses on the design of inherently cache-aware multigrid algorithms for the numerical solution of partial differential equations. A description of the patch-adaptive multigrid algorithm is given and experimental numerical results are presented.

At least there is an overview of selected related topics, including an introduction to the cache optimized multigrid library DiMEPACK.

This thesis could be helpful for performance-tuning of numerical applications under consideration of the new multilevel hardware architecture.

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

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The Problem of Integrable Discretization: Hamiltonian Approach

Yuri B. Suris; Basel, Berlin, Boston: Birkhäuser, 2003; ISBN 3-7643-6995-7, 1092 pages.

The book explores the theory of discrete integrable systems, with an emphasis on the following general problem: how to discretise one or several of independent variables in a given integrable system of differential equations, maintaining the integrability property?

This question (related in spirit to such a modern branch of numerical analysis as geometric integration) is treated in the book as an immanent part of the theory of integrable systems, also commonly termed as the theory of solions.

Among several possible approaches to this theory, the Hamiltonian one is chosen as the guiding principle. A self-contained exposition of the Hamiltonian (r-matrix, or "Leningrad") approach to integrable systems is given, culminating in the formulation of a general recipe for integrable discretisation of r-matrix hierarchies.

After that, a detailed systemic study is carried out for the majority of known discrete integrable systems which can be considered as discretisation of integrable ordinary differential or differential-difference (lattice) continuous integrable systems as well.

The list of systems treated in the book includes, among others: Toda and Volterra lattices along with their numerous generalizations (relativistic, multi-field, Lie-algebraic, etc.), Ablowitz-Ladik hierarchy, peakons of the Camassa-Holm equation, Garnier and Neumann systems with their various relatives, many-body systems of the Calogero-Moser and Ruijsenaars-Schneider type, various integrable cases of the rigid body dynamics. Most of the results are only available from recent journal publications, many of them are new.

Thus, the book is a kind of encyclopaedia on discrete integrable systems. It unifies the features of a research monograph and a handbook. It is supplied with an extensive bibliography and detailed bibliographic remarks at the end of each chapter.

Largely self-contained, it will be accessible to graduate and post-graduate students as well as to researchers in the area of integrable dynamical systems. Also those involved in real numerical calculations or modelling with integrable systems will find it very helpful.

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

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Modeling, Simulation, and Optimization of Integrated Circuits

Proc. Conference Mathematisches Forschungsinstitut, Oberwolfach, Nov. 25-Dec. 1, 2001

Name ?? EDS; Birkhäuser, 2003. 360 pages, ISBN 3-7643-2192-X

In November 2001 the Mathematical Research Centre at Oberwolfach, Germany, hosted the third Conference on Mathematical Models and Numerical Simulation in Electronic Industry. It brought together researchers in mathematics, electrical engineering and scientists working in industry.

As a contrast to the two preceding conferences, which concentrated more on device and process simulation, in this conference two new topics were introduced. On the one hand Co-Simulation (i.e., the coupling of different simulation tools with strongly varying time scales and electromagnetic effects) and on the other hand the introduction of concepts, which are of potential interest for Chip design.

The contributions by the participants to this volume try to bridge the gap between basic and applied mathematics, research in electrical engineering and the needs of industry. They can be classified into the following topics:

- Device Simulation and Applications
- Circuit Simulation and DAE's
- Coupling of Devices and Circuits
- Circuits with Stochastic Sources
- Advanced Mathematical Tools.

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

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The Modelling of Human Behaviour

B. Schmidt; Advances in Simulation, SCS & ASIM 2000; ISBN 1-56555-211-3

This work gives a description and applications of the PECS multi-purpose reference model (PECS stands for Physical conditions Emotional state Cognitive Capabilities Social Status) which is a tool to simulate human behaviour.

To allow a better understanding for the common reader there is given a brief introduction about agents, models and modelling in general.

The author justifies why he may claim that it is possible to model human behaviour and provide a summary of modules of which the complex human behaviour can be co-ordinated.

These are reactive behaviour (instinctive behaviour, learned behaviour, drive controlled behaviour, emotionally controlled behaviour) and deliberate behaviour (constructive behaviour, reflective behaviour).

Later the author describes the PECS reference model (these state variables must be taken always into account: physical state variable, emotional state variable, cognitive state variable, social state variable) and illustrates how one might build models with that tool i.e.

The Adam model. A single agent exists on a grid environment with food and danger cells. The physical component contains energy management (+ with food, - with movement and danger), the emotional one is his fear of danger, the emotional one manages the agents fears and the cognitive one is building the map containing location of food and danger.

Adams behaviour is chosen by taking into account the motives and states of the agent.

The Learning Group model. It also uses the social status component. Here the agents are students that have the choice to study alone or in a few groups. They can choose the group to learn with and will make their decision dependent on their own ability to learn and their will to make social contact. The balance between their motives will drive the dynamics of the model.

A short preview how to model role play of children is also available.

All in all this book gives an - also for the mathematical inexperienced but interested reader – easy understandable, brief introduction how to use the PECS specification with illustrating applications.

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

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Applications of Software Agent Technology in the Health Care Domain

Moreno, Antonio; Nealon, John L. (Editors), Whitestein Series in Software Agent Technologies, Birkhäuser Verlag, Basel – Boston – Berlin, 2003, ISBN 3-7643-2662-X

The book is published within the scope of the Whitestein series, which reports new developments in agent-based software technologies and agent-oriented software engineering methodologies, with particular emphasis on applications in various scientific and industrial areas. It contains a collection of papers that provides an overview of how software agent technology is being applied in diverse problems in health care, ranging from community care to management of organ transplants. It also provides an introductory survey that highlights the main issues to be taken into account when deploying agents in the health care area.

Beside the introductory article written by the editors which cover the most fields of application within health care, the other contributions focus on some different application areas e.g. decision support systems, wound care documentation, deployment of agent based healthcare applications.

As the original articles are not meant to be read together and information about the interconnection of contributions in respect of content is missing, the book gives the feeling of a proceedings volume. It is worth to have a look at the table of contents to check if there are single articles of interest before you think about buying the book.

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

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Principles of Object-Oriented Modeling and Simulation with Modelica 2.1

Peter Fritzson, John Wiley & Sons Inc 2004, ISBN 0471471631

Modelica is a freely available, object-oriented, component based language for modelling of large, complex, and heterogeneous physical systems. The language unifies and generalizes previous object-oriented modelling languages and models in Modelica are mathematically described by differential, algebraic and discrete equations.

The book by Peter Fritzson gives an introduction to the latest modelling and simulation techniques as well as an up to date and comprehensive overview of object-oriented component-based modelling in a number of application areas. In addition the book provides a tutorial and reference for the latest version of Modelica complete with a comprehensive overview of application model libraries from many domains. So it can be seen as a combination of a textbook for teaching modelling and simulation, a textbook and reference for modelling and programming using Modelica and an application guide in physical modelling in different application areas.

The book starts with an introduction to modelling and simulation and continues with a quick tour of Modelica. Then the reader can decide if he wants to go into details of the Modelica language, learn more about object-oriented modelling or take an application oriented course. Each chapter of these introductory courses offers a balanced mix of introduction, intermediate to expert knowledge as well as exercises and encourages the reader to take further steps. An introduction to mathematical equation representation, a description of some Modelica libraries, Modelica environments and a more technical Modelica language reference complete the book.

Beside the textbook chapters, the book covers plenty of modelling knowledge for advanced simulationists even for experts in environments which are not strictly object-oriented. In particular the comprehensive modelling examples from a wide range of application areas are recommended for modelling experts who are interested not only in continuous but also discrete and hybrid modelling. Although the origin of Modelica comes from physical and continuous modelling, it is interesting to watch the development of Modelica into a comprehensive modelling language which provides rich structure to build pure discrete and hybrid models too - e.g. with Petri nets or finite state automata.

Altogether the book impresses as a well written and comprehensive lecture book as well as a reference guide in object-oriented modelling techniques and their applications.

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

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Nonlinear Equations: Methods, Models and Applications

Progress in Nonlinear Differential Equations and Their Applications, Volume 54

D. Lupo, C. D. Pagani, B.Ruf (ed.); Birkhäuser, Basel, 2003; ISBN 3-7643-0398-0, 267 pages

This volume contains research articles from the field of Nonlinear Differential Equations which result from the "Workshop on Nonlinear Analysis and Applications" held in Bergamo on July 9 to 13, 2001. The main purpose of the conference was to provide a forum to the discussion of recent work and modern trends in various fields of Nonlinear Analysis.

The classical topics of Nonlinear Analysis such as Calculus of Variations, Variational Inequalities, Critical point Theory and their use in various aspects of the study of elliptic differential equations and systems, equations of Hamilton-Jacobi, Schrödinger and Navier-Stokes, and free boundary problems were considered. Moreover, various models were focused upon: travelling waves in supported beams and plates, vortex condensation in electroweak theory, information theory, non-geometrical optics, and Dirac-Fock models for heavy atoms.

This volume contains the contributions of 17 of the 50 invited speakers. As the book deals with a very special topic, it is only interesting for experts on this field. In conclusion, the final aim of this book is to provide, by a sequel of examples a view of the state of art of some significant attempts in the above directions and to indicate research perspectives in the field.

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

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Technological Concepts and Mathematical Models in the Evolution of Modern Engineering Systems

Mario Lucertinti, Ana Millan Gasca and Fernando Nicolo (Eds.); Birkhaeuser, 2004; ISBN 3-7643-6940-X

This book is an offspring of an interdisciplinary research project named 'The evolution of events, concepts and models in engineering systems'. This was supported by the UNESO Regional Office for Science and Technology and happened during the years 2001 and 2002.

It explains the interaction between mathematical models of engineering systems and technological concepts. In doing so this text not only focuses on theoretical issues but also on historical topics.

The first part of this book is dedicated to the historical aspects and starts with a fascinating essay about the role of mathematics until the pre-industrial era. It contains a lot of references to interesting historical events like the removal of the Vatican obelisk in 1586.

Another treatise is mainly about the figure of Balthazar van der Pol because of his importance to mathematical modelling. He talked as one of the first about the idea of mathematical analogy which is typical for mathematical modelling.

The second part of this interesting book centres on several developments in the design of engineering systems during the 20th century. For example Stuart Bennett analyses the evolution of control engineering which was also influenced by the evolution of mathematical instruments.

In summary, this book is meant for people who are either interested in mathematics and history or in economics and management science. It provides an insight into the not so obvious influence of technological concepts on contemporary life and culture.

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

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An Introduction to Linear and Nonlinear Finite Element Analysis

Prem K. Kythe and Dongming Wei

Birkhaeuser Boston, 2004; ISBN 0-8176-4308-7

This book represents an approach to finite element analysis which focuses on interdisciplinary applications unlike a lot of other texts which place emphasis on a particular field like mechanical engineering. This is due to the evolution of this book out of a lecture for students from the engineering, physics and mathematics departments.

This lecture consists of two parts which are both presented in this book. The first part is described from chapter 1 to chapter 7. For example chapter 1 focuses on Galerkin and Rayleigh-Ritz weighted residual methods which lays the foundation for Galerkin finite element method.

Starting with chapter 5 two-dimensional problems are treated and special emphasis is placed on the development of linear three-node triangular elements.

The underlying mathematics for this part is restricted to basic techniques like the Gauss-Jordan elimination method, chain rule for differentiation and Newton's method for solving nonlinear systems of algebraic equations.

The second part consists of chapter 8 to chapter 13 which needs a deeper mathematical background. Especially advanced techniques for solving discrete algebraic systems are needed.

Besides of that advanced topics of finite element analysis are treated like plane elasticity problems in chapter 11 and vibration analysis in chapter 13.

Recapitulating one can say that this book gives a very thorough introduction to finite element analysis and deals with diverse applications like non-Newtonian fluid flows or continuum mechanics.

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

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Hierarchical Device Simulation

The Monte-Carlo Perspective

Ch. Jungemann, B. Meinerzhagen, Springer Wien New York, ISBN 3-2111-01361-X, 254 p.

From the preface: "This book tries to describe the state of art of the Monte-Carlo semiconductor device modelling…".The text summarize the effort of the authors and their research group to develop a modelling system for technology computer aided design applications (TCAD), where the classical models and the Mote-Carlo model should coexists in most benefiting manner.

The opera begins with a very useful notation table (especially for who is not an expert in this field), followed from a physical introduction to the semi classical Boltzmann Transport Equation (BTE) that describes the particles motion on a position-dependent band structure calculated with the non-local empirical pseudo potential method and scattering rates determined by Fermi's Golden Rule. It is then introduced, the Theory of the Monte-Carlo Method (MC) and the MC solver for the BTE is determined.

In the fourth chapter in introduced the Scattering Mechanism, and as a result is shown that with small approximation it is possible to obtain the SiGe transition rates by linear interpolation of the silicon and germanium cases. Chapter 5 explain how to include in a MC model the Full-Band of a structure creating a K-space (KS). In Chap.6 the Real Space (RS) is discretised with a tensor-product grid in order to find a self-consistently solution for the BTE with the Poisson equation for the electric field, in the end is also implemented a method for the enhancement of rare events such as impact ionization.

The following chapter explores in detail the momentum-based hydrodynamic model (HD) and since the drift-diffusion model is a straight forward approximation of the HD, its derivation is less described. The 8th chapter gives the mathematical tools to derive the relative stochastic error of a quantity evaluated by stationary MC simulation, showing that it is proportional to its variance, in latest part of the chapter is shown also how to estimate in-advance the CPU time of MC simulations.

In the last chapter the transport model are applied to the simulation of three different types of devices to assess the accuracy either by comparison to each other or experimental data.

The book is really focused on a specific field it is therefore suggested a good knowledge of the arguments, also because the reader is not driven through each step but phenomenas are just analyzed and not explained. Other info on www.springer.at

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

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Modern Developments in Multivariate Approximation

5th International-Conference, Witten-Bommerholz (Germany), September 2002

W. Haussmann Kurt J. M. Reimer, J. Stoeckler (Eds.); ISBN 3-7643-2195-4, 319 p.

This book is a collection of articles from the main topics and talks kept at the Fifth International Conference on Multivariate Approximation that took place from the 22nd to the 27th September 2002 in the guesthouse of the University of Dortmund.

The main topics treated, from the 49 participants coming from 10 different countries, were:

- Applications of multivariance approximation in finance
- Approximation and stable reconstruction of images, data reduction
- Multivariate splines for Lagrange interpolation and quasi-interpolation
- Radial basis functions
- Spherical point sets
- Applications of adaptive wavelet methods
- Blending functions and cubature formulae
- Singularities of harmonic functions

All the themes are covered in eighteen peer-reviewed articles. Being the audience just mathematicians the book appears as an academic text in which it is hard to go through without guidance. I would therefore suggest it just to who knows already the subjects and wants to upgrade is knowledge about a specific field.

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

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Simulation in Environmental and Earth Sciences

Workshop Osnabrueck 2003; Jochen Wittmann, Dimitris K. Maretis (Ed.), Shaker Publishing Company 2003, ISBN 3-8322-1635-9

This conference paper covers technical aspects of simulation as well as social and political aspects.

Environmental simulation develops, and one can examine how the use of renewable resources can be modelled in terms of costs or of effectivity. Agent-based simulation is used to build a model of a forest and to give a general formulation of the investigation of abstract ecosystems in structured environments. While handling the dynamics of the sewage distribution in rivers and the air circulation in a barn, the problems of environmental modelling could be seen, like the expensive registration of measured data, the construction of three-dimensional models, the visualization or the handling of the results from a legal point of view.

Programming, especially object-oriented, is very important because it makes simulation more effective when complex and highly refined problems are simulated. The concept of object-orientation is implemented in two ways, on the one hand to use an object-oriented database to solve simulation problems, on the other hand to put an object-oriented extension over a conventional database in order to achieve maximal adaptability to the needs of the user.

The structure of the book made a good impression: The preface is extensive, but concentrates on the essential part, while it arouses interest in studying the single articles in detail. These are well structured, and one can decide after short lecture of the abstract if the topic is worth to go into it. The layout of the book is very pleasing – which is achieved by using the professional typesetting software Latex – and has good quality pictures and diagrams in it.

All in all it is an interesting book, covering various themes concerning environmental simulation in overview as well as in detail.

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

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Stochastic Modeling of Microstructures

K. Sobczyk and D. J. Kirkner; Modeling and Simulation in Science, Engineering and Technology; Birkhäuser, 2001, ISBN 0 8176 4233 1

The book presents the language of random field theory and the principles of stochastic geometry in order to give the systematic and concise knowledge necessary for modelling real random heterogeneous media. The book is ideal for a general scientific audience needing an in-depth guide to current ideas, methods and models for the stochastic modelling of microstructures.

It is an essential reference for practitioners, researchers and professionals in material modelling, mechanical engineering, materials science, chemical, civil, environmental engineering and applied mathematics with following features:

- First comprehensive introduction to the comparatively new field of stochastic modelling of material microstructures
- Presentation of basic tools required from the diverse subjects of random field theory, stochastic geometry and spatial statistics
- Provides background concepts from probability theory and stochastic processes are provided
- Applications from various fields are discussed, including stochastic wave propagation and the mechanics of porous media flow
- Clear and integrated exposition guides the reader from the basics through problems of contemporary interest

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

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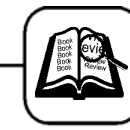
Virtual Instruments in Applications - Virtuell Instrumente in der Praxis

Begleitband Kongress VIP 2003, R. Jamal, H. Jaschinski (Eds), Hüthing, 2003; ISBN 3-7785-21-3

A better title for the proceedings of a congress for measurement and test engineering as well as automation would have been '101 things a boy can do with LabView'. Almost no information about the congress itself is in the book, but a little research reveals that it is organized by National Instruments Germany.



An evaluation copy of 'NI Vision Builder for Automated Inspection' is shipped with the book. Recommended for everyone looking for a broad but unbiased overview of LabViews capabilities.

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

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IT-Days 2003 - Informatiktage 2003

Fachwissenschaftlicher Informatik-Kongress im Neuen Kloster Bad Schussenried, Konradin (2004) ISBN 3-920560-21-3

The Informatiktage (Ger. IT-days) are a special congress initiated by the German Gesellschaft für Informatik (Ger.: society for information technology), as only the main and keynote speakers are graduates. These graduates have to be recommend by a member of the Gesellschaft at their university before they can apply. As the location suggests – monastery in the middle of nowhere near the Swiss border – the Informatiktage are more a conclave then a congress, allowing young scientist to practice for real conferences as well as to get feedback.

Except the main and keynote lectures, all works are about unfinished projects – therefore the book is more suited for those who want an overview about the work of German IT-scientist, as the presented diploma thesis reflect the work of the respective departments.

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

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Gnomes in the Fog

The Reception of Brouwer's Intuitionism in the 1920s, Dennis E. Hesseling, Birkhäuser (2003) ISBN 3-7643-6536-6

This book is a historical study about the founding of the school of mathematical thought introduced by the Dutch mathematician Luitzen Egbertus Jan. Brouwer, (1881–1966), the reactions of the scientific community at this time.

In contrast with mathematical Platonism, which holds that mathematical concepts exist independent of any human realization of them, intuitionism holds that only those mathematical concepts that can be demonstrated, or constructed, following a finite number of steps are legitimate.

The book provides the reader with solid but somehow unstructured overviews on intuitionism itself as well as the debates about it, from the first publications in 1907 to Kolomogrov's and Gödel's work to formalise intuitionism.

Alas, the author's Ph. D in mathematics has dire consequences in his book. Although it is possible to use LaTex for typesetting books on lighter subjects, it is too easy to get carried away. The reader gets way to distracted by different emphasises. Citing other documents in the original language also gets tiresome when the cited passages are quite long and their translations are only footnotes, sometimes not even on the same page. This, together with inconsistencies in the use of original language and translations, makes the book nearly unreadable. A book only suited for those most keen on the subject of intuitionism – and for no one else.

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

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Introduction to Rare Event Simulation

Springer Series in Statistics; J. A. Bucklew, New York 2004, ISBN 0-387-20078-9

The author starts with an introduction to random number generators, stochastic models (Gaussian and Markov Processes) as well as in two basic concepts of the large deviation theory: Cramér's Theorem and the Gärtner-Ellis Theorem. Target of the lecture is to simulate rare events that are the result of large deviation events in order to calculate their probabilities or at least a good estimator.

The principle method to attack the rare event simulation problem is a variance reduction technique from simulation theory known as importance sampling. First the importance sampling is watched very generally. To test whether a family of simulation distributions is a good choice it has to be efficient. Such efficient estimators are developed for example for Gaussian systems.

To handle more general systems the author takes a look at the class of universal simulation distributions. Further he computes estimators for level crossing, queuing systems, blind simulations and more.

The book contains plenty of short examples, which shall show the connection to realistic problems. Before long theoretical parts are always notes that justify the following. This and the good structure enable the reader to keep an overview over the not so easy topic. Generally the author tries to keep the requirement concerning the mathematical knowledge of the reader at a minimum. Nevertheless basic knowledge of statistics and probabilistic theory is necessary.

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

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Nonlinear Hyperbolic Equations, Spectral Theory, and Wavelet Transformations

Advances in PDEs; S. Albeverio, M. Demuth, E. Schrohe, B. Schulze (Eds.); Birkhäuser, 2003; 437 pages; ISBN 3-7643-2168-7

This book is the seventh volume of "Advances in Partial Differential Equations", a series originating from the work of the equal named research group at the University of Potsdam. This volume focuses on recent developments in non-linear and hyperbolic equations. In the first contribution, the singularities of the solutions of several classes of non-linear partial differential equations are investigated. Applications concern the Monge-Ampere equation, quasi-linear systems arising in fluid mechanics as well as integro-differential equations for media with memory.

A second contribution deals with spectral theory of semi-bounded self-adjoint operators. Here, upper and lower bounds for the bottom eigenvalue as well as an upper bound of the second eigenvalue are proven.

Another part of the book is dedicated to the Gabor transformation and the wavelet transformation, which are two distinguished tools in signal processing with a wide range of applications.

Several papers complete the present volume; they are concerned with subjects as diverse as the Weyl-Hörmander calculus for manifolds, singular fibration, and index theory.

This very sophisticated and theoretical collection of articles concerning the theory of nonlinear hyperbolic differential equations in particular, gives an overview of the state of the art of this topic at a very high level.

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

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A Natural Introduction to Probability Theory

Ronald Meester , Birkhäuser (2003) ISBN 3-7643-2188-1

Like many authors before, Ronald Meesler wants to introduce interested people to the huge field of probability theory. It has been done before and it will be done again, but at least he adds a few interesting details.

Basically the book is divided into two big parts, the first one about finite and discrete probabilities starting with the definition of experiments and advancing up to the central Limit Theorem.

The Second part deals with non-discrete and infinite probabilities and events including Poisson processes and leading to the law of large numbers.

Most notable, the reader does not need any knowledge of measure theory. Being proficient in basic calculus – about year one for technical studies – is sufficient. The drawback is that the more technical proofs tend to get cumbersome – therefore this book can be recommended for everyone working in a technical discipline, who needs probability theory but is not very interested in it.

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

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EUROSIM SOCIETIES

EUROSIM
Federation of European Simulation Societies

www.eurosim.info

General Information

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

EUROSIM Board

EUROSIM is governed by a board consisting of one representative of each member society, president and past president. The President is proposed by the society organizing the next EUROSIM Congress. Secretary and Treasurer are elected between the members of the Board. Representatives for the official EUROSIM publications (journals SIMPRA and SNE) are also invited to the EUROSIM Board Meetings.

At the **EUROSIM'04** Congress the EUROSIM Board appointed new officers for a three years period: B. Zupančič (president), P. Fritzson (secretary), F. Breitenecker (treasurer+SNE), Y. Hamam (past president), J. Halin (SIMPRA), F. Maceri (Savastano award).

EUROSIM Official Publications: SIMPRA and SNE

SNE

EUROSIM societies are offered to distribute to their members the journal **Simulation News Europe** (**SNE**) as official membership newsletter. SNE is a membership newsletter (with information from the societies) as well as a "technical" journal with reviewed contributions. (Technical Notes, ARGESIM Comparisons, Short Notes etc.).

SNE's *Notes Section* publishes technical notes (fully reviewed), short notes (reviewed), and software notes on general overviews or new developments, on new software and hardware, on new applications and methods, and book reviews on recent books in modelling and simulation and in related areas. Furthermore **SNE** presents *Simulation Centres,* introduces *Simulationists* and reviews 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.

SNE reports in the *News Section* about EUROSIM, EUROSIM societies, SCS Europe and about other International Simulation Societies and Simulation Groups. Furthermore, basic information on EUROSIM societies is "mirrored" at the new designed EUROSIM website. More information at www.argesim.org

SIMPRA

Members of EUROSIM societies can subscribe the official EUROSIM scientific journal **Simulation Modelling Practice and Theory** (**SIMPRA**) at a significantly reduced price. Information about recent issues and special issues may be found in this SNE issue elsewhere. More information is available at WWW: ees.elsevier.com/simpat/

Savastano award

Prof. Savastano was the first EUROSIM president. He died suddenly in February 1990. After his death the EUROSIM Board decided to install The Savastano Award, to be granted every three years during EUROSIM Congress.

Conferences - EUROSIM Congress

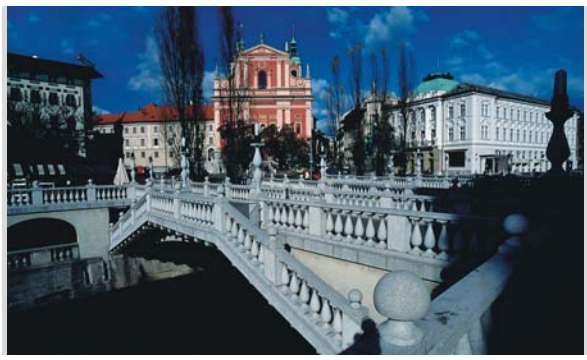
EUROSIM societies organise national and international conferences and workshops, with the common trademark *EUROSIM Conference.* For details please refer to the announcements of the societies.

The EUROSIM Congress is arranged every three years by a member society of EUROSIM. **EUROSIM'04**, the 5th EUROSIM congress, took place in Noisy-le-Grand, near Paris, France in Sept. 2004.

6th EUROSIM Congress

Sept. 10-14, 2007, Ljubljana, Slovenia

www.eurosim2007.org



The next congress, **EUROSIM'07**, the 6th EUROSIM Congress, will take place in September 2004 in Ljubljana, Slovenia.

The Congress will be organised by the Slovenian Society for Modelling and Simulation SLOSIM with support of ASIM and other simulation societies.

Detailed information about **EUROSIM'07**, is available at the web: www.eurosim2007.org

For personal information about EUROSIM and about the congress EUROSIM 2007, please contact the EUROSIM president, Mr. B. Zupančič.

EUROSIM contact

Information about EUROSIM and EUROSIM societies may be found at EUROSIM's WWW Server: www.euroim.info.

Personal information can be obtained from the EUROSIM officers, see section **"New EUROSIM officers"**.

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New EUROSIM officers

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Ph.D. in electrical engineering from University of Ljubljana, Slovenia, full professor from 2000, major research interests: modelling, simulation and control, the president of the Slovene Society for Modelling and Simulation 1994-2002, member of the EUROSIM Board from 1995, vice Dean at the Faculty of Electrical Engineering 1999-2003, currently head of the Laboratory for Modelling, Simulation and Control, author of 175 conference papers and 30 papers in scientific journals, co-author of one international book from the area of modelling and simulation.

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Peter Fritzson is a professor and Director of the Programming Environment Laboratory (PELAB) at the department of Computer and Information Science, Linkoeping University, Sweden. He currently holds the positions of President of MathCore Engineering AB; chairman of the Scandinavian Simulation Society and vice chairman of the Modelica Association, an organisation he helped to establish. Peter Fritzson has published ten books and over hundred scientific papers.

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Felix Breitenecker got a PhD in Applied Mathematics at Vienna University of Technology. After work as research assistant (with habilitation) and guest professor at University Glasgow, Clausthal-Zellerfeld and Hamburg he became Professor at Vienna University of Technology. There he deals with modelling and simulation in research and education in an interdisciplinary area. He has been active in ASIM, the German simulation society for more than 20 years, being ASIM president since 1999. From 1992 to 1999 he held the position of EUROSIM President or Past President, resp. He is head of ARGESIM, a working group providing infrastructure for ASIM, EUROSIM and other simulation activities. He has published three books and more than 200 scientific publications.

Prof. Yskander Hamam
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Ph.D. from the University of Manchester, Institute of Science and Technology (1972), HDR: Habilitation à Dirigar des Recherches (HDR), Université des Sciences et Technologies de LILLE, 1998, Professor Adjunto at the Universitade Federal do Rio de Janeiro (1972-1973), Assistant Professor at the American University of Beirut (1973 - 1976), since 1978 teaching and research at Groupe ESIEE, France, several positions: head of department and dean of Faculty, major research interests: optimization, optimal control, mathematical modelling, parallel and distributed systems.

Report 5th EUROSIM Congress

The Congress took place in Noisy-le-Grand, near Paris, France, on September 6-10, 2004.

EUROSIM 2004: The speech of the President Y. Hamam during the congress dinner

Participants from CSSS – Czech and Slovak Simulation Society - at EUROSIM 2004

More than 180 people participated and 167 papers were presented in two parallel sessions. The presentations were organised into 15 main sessions and 9 special sessions. These sessions covered the wide ranging field of modelling and simulation and covered both basic subjects and applications. The presentations were from industry as well as from academia. The selected papers will be published in the SIMPRA journal.

Savastano award 2004. In 2004 the recipient of the award was Dr. Giuseppe Vairo from Italy, for the best paper published in the SIMPRA Journal during the period 2001-2003. The title of the paper was: A numerical model for wind loads simulation on long-span bridges (SIMPRA, Volume 11, Issues 5-6, 15 August 2003, Pages 315-351).

Recipient of the Savastano award: Dr. Giuseppe Vairo

Yskandar Hamam, Chairman of the Congress
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Report from the Executive Board Meeting – Ljubljana, November 20, 2004

This was the first meeting of the new EUROSIM Executive Board after its appointment in Paris in September 2004 during the 5th EUROSIM Congress.

Before EUROSIM Executive Board Meeting in Ljubljana

The basic directions for future work were discussed. The president presented a brief overview of the important decisions made at Board meetings since 1995. Most of the time was then devoted to a discussion about some necessary changes to internal rules. The changes will be proposed for acceptance during the next EUROSIM Board meeting. The new Savastano award document will be prepared. The societies must nominate new/old representatives and deputies to the EUROSIM Board. It was decided that the introduction of new EUROSIM web pages is one of the most urgent requirements. They will be prepared by ARGESIM, based on the concept of an on line-content management system. The societies will be able to add information, mailing lists, address lists, etc., themselves. It was also decided that the 26th EUROSIM Board meeting will take place on March 6, 2005, in Hamburg, before the Modelica Conference.

Borut Zupančič, EUROSIM president
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Snapshot from the new EUROSIM web page

Letter from the New President

Dear colleagues from the modelling and simulation community

It is a great pleasure for me to write to you as the new president of EUROSIM. I like to think that the decision of the EUROSIM Board represents recognition of the activities of the Slovenian society for simulation and modelling: SLOSIM.

In my triennial period I do not promise to make any dramatic changes, but I will do my best to emphasize and to further develop, again and again, the idea of modelling and simulation through EUROSIM. We all must be aware of the fact that modelling and simulation is, in spite of being a very traditional discipline, still attractive, modern, and with a wide range of applications and research possibilities. Modelling and simulation are closely connected with many of the most sophisticated and modern disciplines. Examples include emulation, when one computer simulates another; computer games, which are based on models; artificial intelligence, which models various aspects of human behaviour; robots which attempt to simulate human movements; expert systems, which emulate a human being through a design and implementation process; virtual reality, which is again based on dynamical models, control systems, where modelling and simulation is again very important in a design as well as in an implementation phase, etc.

My other efforts will be devoted to the organisational aspects of EUROSIM, which should have the level of importance that corresponds to its name: Federation of European Simulation Societies. This is a big umbrella organisation that includes 10 full members and 3 observer members. I believe we can strengthen this organisation, and perhaps even enlarge it.

We must also recognise that the organization of the EUROSIM Congress is an important activity for each president. The EUROSIM Congress must be the number-one event for the modelling and simulation community in Europe because this is the congress of the federation and because this is the triennial event. So SLOSIM, with the support of the other simulation societies (I must express special thanks here to Felix Breitenecker, president of ASIM, who has already initialised some cooperation activities) will do its best to organise the next congress, from scientific to social. So you are kindly invited to participate at the event, which will be the next 6th EUROSIM Congress in Slovenia in September 2007. Slovenia is a small, yet beautiful country, a new member of EU, and a country with a tremendous amount to offer the visitor.

Finally on behalf of the new EUROSIM Board and all the EUROSIM societies I would like to thank prof. Yskandar Hamam and all the members of EUROSIM Board for their past efforts. They have done a lot of good work, which must be continued by the new board. I would also like to thank everybody who was active in the organization of the 5th EUROSIM Congress in Paris.

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ASIM - Buchreihen / ASIM Book Series

ASIM - Buchreihen / ASIM Book Series

Reihe Fortschritte in der Simulationstechnik / Series Frontiers in Simulation – with SCS

kürzlich erschienen / recently appeared:

- R. Hohmann (Hrsg.): Proc. 17. Symp. Simulationstechnik, Magdeburg, 2003
- Dj. Tavangarian (Hrsg): Proc. 16. Symp. Simulationstechnik, Rostock, 2002
- W. Borutzki: Bondgraphen – Eine Methodologie zur Modellierung multidisziplinärer dynamischer Systeme;
- H: Szczerbicka, T. Uthmann (Hrsg.): Modellierung, Simulation und Künstliche Intelligenz
- S. Wenzel (Hrsg.): Referenzmodelle für die Simulation in Produktion und Logistik
- I. Bausch-Gall (Hrsg.): Simulation technischer Systeme – Stand und Entwicklungen

Schwerpunkte / Topics:

- Statusberichte über Simulation in den ASIM Fachgruppen / Status Reports
- Allgemeine Monographien / General Monographs
- Proceedings der ASIM Tagungen / Proceedings of Conferences

Reihe Fortschrittsberichte Simulation / Series Advances in Simulation – with ARGESIM / SCS

kürzlich erschienen / recently appeared:

- 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
- Th. Fent: Applications of Learning Classifier Systems for Simulating Learning Organizations
- H. Ecker: Suppression of Self-excited Vibrations in Mechanical Systems by Parametric Stiffness Excitation
- K. Kleemayr: Modellierung von Schnee und Lawinen

Schwerpunkte / Topics:

- Spezielle Monographien (Dissertationen, ...) / Special Monographs (PhD-thesis, ...)
- Erweiterte Berichte der ASIM Fachgruppentreffen / Workshop Proceedings
- Handbücher für Simulationssprachen, Berichtband / User Guides, Reports

Preis / Price: EUR 20.- (ASIM-Mitglieder EUR 15.-) + Versandkosten

Bestellung, Information, Informationen für Autoren / Info, Orders:

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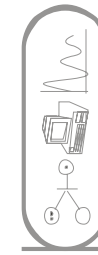
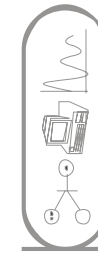
ARGESIM REPORT



ARGESIM REPORT



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 30 institutional or industrial members.

From the ASIM Board

At an ASIM board meeting in 2003 decisions about the structure of the ASIM working groups, about the promotion plans and about the future plans for publications were done, details see later. Furthermore, it was decided to redesign totally the ASIM web pages, with interactive features for the members, driven by a content management system.

At the last board meeting in Bonn (December 2004) the new structure for the working groups was presented, and an advanced versions of the new ASIM web page was presented. Also discussions about the publication structure took place: in principle, more publications for the members (less printed info, more www and download publications).

ASIM Publications

ASIM is publishing (co-publishing) **ASIM-Nachrichten** and **SNE** (Simulation News Europe). Both journals are regularly published and sent to all ASIM members (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“

In these series the Proceedings of the annual ASIM conferences, status reports of the working groups, and PhD theses are published.

As the “SCS European Publishing House” had to stop operating because of financial problems in the SCS European office, ASIM will continue the cooperation with the legal successor “European Publishing House”, founded as “Verein” by Rainer Rimane.

Change of publication structure. Based on the results of a questionnaire to the members, the board discussed and decided some changes for the publications:

- ASIM-Nachrichten will appear as electronically newsletter.
- **SNE** should be extended. News and general information will be put as (German or English) addendum in SNE’s news section.
- ASIM will publish **Special Issues SNE**. Each year one ASIM working Group will prepare a special issue dealing with “Status, Developments and Trends” in its area.
- The ASIM web pages will be redesigned totally, offering special areas for members, interactive information, mailing lists, download of workshop proceedings, etc, based on a content management system.

New ASIM Webpage

At present the new ASIM webpage is tested. The webpage is driven by content management system (TYPO3). The member data base is included into the web, with interactive change for members and query and newsletter distribution for the Working Groups.

The members’ area will offer Proceedings of ASIM Workshops, SNE archive, material for education, etc. Detailed information can be found at the leaflet (printed ASIM-Kurznachrichten) distributed with this SNE.

ASIM Working Groups

Working Group Structure. The reorganisation of the Working Groups is now finished. The new structure was approved by the GI board in December 2004. ASIM consists now of 5 working groups (Fachgruppen):

- Working Group **GMMS**
  Methods in Modelling and Simulation
  The working group “Simulation and KI” has become part of the working group “Methods of Modelling and Simulation”

- Working Group **SUGMBB**
  Simulation in Environmental Systems and in Medicine, Biology and Biophysics
  The new working group is a fusion of the previous working groups "Simulation in Environmental Systems" and "Simulation in Medicine, Biology, and Biophysics"
- Working Group **STS**
  Simulation of Technical Systems
  As before
- Working Group **SPL**
  Simulation in Production and Logistics
  As before, later with working party SBW
- Working Group **SVS**
  Simulation of Traffic Systems
  As before
- Working Party ***SBW***
  Simulation in OR
  will first strongly co-operate with the working group SPL (to become later part of SPL)

Working Group Activities

The ASIM Working Group **"Methods of Modeling and Simulation"** met on March, 2 - 3, 2004 at University Siegen. The workshop, organised by W. Wiechert, concentrated on the topic „Spatially Distributed Systems and Simulation-Based Optimisation". Proceedings can be downloaded from the ASIM server. Together with the Working Group **„Simulation of Technical Systems"** the 2nd ASIM Wismar Workshop on *Modelling, Control and Simulation in Automotive*, September 16 – 17, 2004, Wismar, was prepared (report below). The working group is now preparing the

ASIM GMMS Workshop 2005
Review of Modelling Methods and Approaches
Univ. Wuppertal, March 9 – 11, 2005

The workshop offers a review of various modelling techniques and modelling approaches, in order to get better insight into developments and trends in more or less distinct simulation areas. Mainly overview lectures of modelling and simulation specialists will introduce into their area and will report about trends and developments.

Additionally, a poster session offers opportunity for diploma or PhD students to present their work. More information at www.math.uni-wuppertal.de/org/Num/conferences/asim.html

The ASIM working group **"Simulation in Environmental Systems"** – now **"Simulation in Environmental Systems and Medicine, Biology and biophysics"** co-operates since many years with other working groups of GI in the area of environmental simulation.

The working group is preparing the

Annual Workshop
Simulation in Environmental Systems
March 16 – 18, Dresden, Germany

The workshop will inform about status and trends in modelling and simulation of environmental systems. Specialities of these workshops are discussion groups, where new ideas are born and investigated. More info at www.ioer.de/SUG/.

The working group **„Simulation of Technical Systems"** met 2004 in Ingolstadt, for a workshop "Simulation of Technical Systems", on March 9 – 10, 2004. The collected contributions can be downloaded from the ASIM server. The group was also co-organising the 2nd ASIM WISMAR Workshop on *Modelling, Control and Simulation in Automotive*, September 16 – 17, 2004, Wismar (report see below.

The working group is preparing the workshop

Simulation Methods and Test Methods for Software in Automotive Systems
Technical Univ. Berlin, March 1 -2, 2004

The workshop will deal with simulation and test of software systems in automotive from design to implementation, emphasising on:

- Clarity of the design process
- Model-based development
- Language standards (VHDL-AMS, Modelica)
- Simulation in electronics
- Model test
- Validation (experiment vs. simulation)

More info at swt.cs.tu-berlin.de/asim-sts-05/

The working group **"Simulation in Production and Logistics"** (SPL) organised in October 2004 the very successful bi-annual conference **11th Conference *"Simulation in Production and Logistics"*** (report below). The working group is preparing a one – day meeting, details will be sent via email:

ASIM SPL Meeting
View to other Simulation Areas
IPK Berlin, April 6, 2005

The Working Group **"Simulation of Traffic Systems"** has decided to combine their annual meetings with the SIMVIS conference in Magedburg. Next working group meeting is scheduled (more info at www.simvis.org):

ASIM SVS Workshop
Traffic Simulation
Magdeburg, March 4, 2005

A further meeting is planned for October 2005, together with other working groups within the BVL Jahrestagung.

ASIM Conferences

ASIM's Conference Structure.

ASIM organises the annual ASIM Conference, the ASIM Working Groups organise annual workshops (up to 100 participants) and bi-annual conferences (more than 100 participants. ASIM cooperates in organising the three-annual EUROSIM Congress, and ASIM and SCS Europe will continue the co-operation for the ESM and ESS conferences.

A special co-operation was established with the annual conference series SIMVIS – Simulation and Visualisation in Magdeburg (March) and with the three-annual conference series MATHOD - Mathematical Modelling in Vienna (February).

The development of the ASIM conferences is as follows. While previously the Annual ASIM Conference was the main event covering also all applications, now also the workshops and conferences of the working groups are main events dealing with a certain application area. Especially the bi-annual conferences "Simulation in Production and Logistics" and the annual workshops of the working group "Simulation of Technical Systems" attract almost as many people as the Annual ASIM conference.

The Annual conference seems to become a simulationists' family meeting, with a majority from university participants. Consequently the conference will open to English contributions and English-speaking sessions. The conference is also intended for diploma and PhD students to present their first scientific results.

As consequence, ASIM members are offered two main events a year, an "ASIM simulation family meeting", and an application conference.

In 2004, no Annual ASIM Conference took place, because of the EUROSIM congress. The annual conference ASIM 2005 will take place in Erlangen – organised by R. Rimane (details below). The conference ASIM'06 is planed to be held in Hannover, and in 2007, SLOSIM, the Slovenian Simulation Society will organise the EUROSIM Congress; ASIM will not only co-sponsor, but also co-organise this event.

Report Conference "Simulation in Production and Logistics 2004"

Welcome in Berlin to Europe's greatest conference dedicated to "Simulation in Production and Logistics"!

This sentence has proven to be true: The conference (October 4 – 5, 2004, Berlin) has been an outstanding success.

- at least this was the comment which we received from everybody at the end of the conference. We would like to thank all the contributors and especially express our gratitude to the programme committee for the excellent work.

The ***9th ASIM Dedicated Conference on Simulation in Production und Logistics*** is the regular Conference of the "Fachgruppe 4.5.6 Simulation in Produktion und Logistik" within the Association Simulation in German speaking countries ("Arbeitsgemeinschaft Simulation im deutschsprachigen Raum", ASIM). It is a biannual conference, and it is on the way to become a "European Winter Simulation Congress"

The conference was organised at the Fraunhofer Institute for Production Systems and Design Technology - IPK (Director: Prof. Dr.-Ing. Kai Mertins), Conference Chair was Markus Rabe, Conference Assistant was Grit Kümmele. Markus Rabe, Sigrid Wenzel (head of the ASIM working group "Simulation in Production and Logistics), and Felix Breitenecker (head of ASIM) could welcome nearly 270 participants.

The organisers have organised a very interesting main lecture, bridging from virtual reality in simulation to virtual reality in movies:

Brave new Worlds of Moving Images
by Rolf Giessen.

Gradually, initially guided by experts and computer scientists, then with an erupting force, as if someone had opened Pandora's Box, digital techniques, especially animation and simulation, have entered the world of moving images, of film and t.v. Not only environment is copied and simulated. Artificial avatars already stroll through a network of synthetic images. A completely synthetic universe of images is in the making. How will we deal with an interactive future? Will we use it to support imagination and creativity in order to (poetically inspired) aim at the stars?

Rolf Giesen (* 1953) took his doctor's degree at Freie Universitaet Berlin in 1979 with a thesis on "Fantastic Cinema". Since then he has written numerous books ("Artificial Worlds" 2000, "Encyclopedia of Special Effects" 2001, and an English-language "Nazi Propaganda Films: History and Filmography" 2003). He is a curator at Filmmuseum Berlin and writes screenplays for animated feature films. Giesen is Professor at German Film School for digital production and member of Visual Effects Society Los Angeles. www.filmmuseum-berlin.de

Two other invited lectures gave an overview about new developments and trends:

- *Simulation in Business Economics*
  Klaus Böhnlein, Universität Würzburg, Germany
- Distributed Simulation in Industry:
  Status and Perspectives
  Simon Taylor, Brunel University, United Kingdom

The conference covered a broad area. In the following some interesting sections are listed:

Supply Chains
- Approaches to Modelling and Control of Supply Chains and Networks - A Situation Analysis
- Agent-Based Simulation for Supply Network Planning.
- Simulative Analysis of the Effects of Stochastic Traffic Systems on Logistic Processes
- Simulation Based Production Planning and Control - A Field Study.

Interoperability and Distributed Simulation
- Managing Time and Consistency in Distributed, Interactive Real-Time Applications Using the Example of a Virtual Training Environment.
- Interaction-Mechanisms for a Cooperative Simulation of Material Flow Systems.
- Coupling Architecture for a .NET-Based Multi-Agent-System and a Discrete Event-Based Simulator. Zimmermann, Jens, Technische Universität Ilmenau

New Applications of Simulation
- Computer Simulation in Construction Management - State of the Art, Innovative Application Fields
- Reserach into Developing a Training Tool Federate in the Manufacturing Systems Domain
- Planning Support by Simulation
- Application of the Eurobios Agent-Based Modelling Framework: Joint Simulation of Production and Logistics to Support Plant Selection for a Multi-Site Corrugated Box Company

Simulation in Japan

The conference could also attract participants from Japanese industry and universities. Their contributions were scheduled in a special session to get overviews about the simulation trends in Japan:

- Lean Business Process Reengineering Methodology for Overseas Production Preparation
- Dynamic Management Architecture for Production Systems Based on Parts and Packets Unification
- Decision Making and Bifurcation Under Opposite Alternatives
- Simulation in the Semiconductor Industry - Japan
- Simulation Studies of the Shifting-Bottleneck Heuristic for Scheduling Semiconductor Manufacturing Facilities
- Using Simulation as Test Tool in Semiconductor Industries Manufacturing Simulation Researches in Japan
- Distributed Virtual Factory under E-Business Environment
- A Study on Efficient Digital Engineering - Combination between Real Factory and Virtual Factory

Further sections were:

- Planning and Control, Logistics
- AnyLogic Tutorial
- Simulation in Daily Enterprise Business
- Quality in Simulation, Digital Factory
- Methods and Modelling for Simulation
- Workshop: Manufacturing Execution Systems
- Workshop: Emulation
- ISSOP User Group Meeting
- Forecast in Complex Projects
- Sim-Serv: Support for Simulation Users

Exhibition. The exhibition could gather many developers and vendors of discrete simulation tools and simulation consultants:

- ARC Seibersdorf research GmbH , AnyLogic, Enterprise Dynamics
- DELMIA GmbH; QUEST, IGRIP
- DUALIS IT Solution GmbH; ISSOP, SPEEDSIM, GANTTPLAN
- Dürr Automotion GmbH Systemtechnik / Simulation
- Fraunhofer-Institut für Materialfluss und Logistik (IML)
- Fraunhofer-Institut für Produktionsanlagen und Konstruktionstechnik (IPK)
- Incontrol Enterprise Dynamics GmbH; Enterprise Dynamics
- Profount Corporation, SupplyChainBus(™)
- Rockwell Software, ARENA
- SimPlan AG
- SimulationsDienstleistungsZentrum GmbH
- Tecnomatix, eM-Plant
- Universität Duisburg, Institut für Produkt Engineering, Transportsysteme und –logistic

Social Programme. Last, but not least, the social programme also was part of the success: an Evening event including show and buffet in the "Kalkscheune" .

Proceedings. The Proceedings of the conference are available: Kai Mertins, Markus Rabe (Eds.): **Experiences from the Future** Stuttgart: Fraunhofer IRB-Verlag, 2004. ISBN 3-8167-6640-4 zgl. 11. ASIM-Fachtagung Simulation in Produktion und Logistik, Berlin, 2004 zgl. ASIM-Mitteilung Nr. AMB 91.

M. Rabe, Markus.Rabe@ipk.fhg.de

Report ASIM STS / GMMS Workshop Wismar, Sept. 2004

The 2nd ASIM Workshop “Modeling, control and simulation in automotive and process automation” with emphasis on Modeling, control and diagnostics of combustion engine processes took place in Wismar, September 16 – 17, 2004.

The workshop was organised by: Hochschule Wismar, Univ. Rostock, IAV GmbH Gifhorn, and by the ASIM working Groups “Simulation of Technical Systems” and “Methods in Modelling and Simulation”.

Objective targets of the workshop, An essential target of the workshop was the exchange of experience between developers and users regarding different problems of modelling, control and diagnostics of combustion engine processes. For this reason the event was organized together by representatives of the university and industry, again.

The contributions pointed out current questions of control of modern combustion engines, present new approaches and methods for solutions or deliver experience reports regarding different control and diagnostics concepts. Since the developing heavily depend on the availability and quality of suitable models, also aspects of modelling and simulation of engine processes were regarded in the contributions.

A big potential for improving engine controls is in introduction of engine management systems based on the capturing of process values like cylinder pressure or engine moment. The possibilities and problems of the according measurement methods and the effects to the engine management were discussed.

The contributions could be grouped into five main sessions:

- Modeling and simulation of combustion engine processes
- Control approaches, modern engine management
- Diagnostics methods, applicable in automobiles
- Sensors and measuring methods for capturing control relevant values
- Methods and tools for function development and calibration

Some of the contributions were written and presented in English, amongst them:

-
- An Investigation of Neural Networks in Fault Diagnosis of an Automotive Engine Air Path
- Fibre-Optical Monitoring of Exhaust Emissions from Road Vehicles
- Neural Network Modelling and Predictive Control of an IC Engine
- Active Set Method Approach for Real Time Model Predictive Engine Control

At a rustically dinner at the Brauhaus, the organisers C. Deatcu, P. Dünow, S. Pawletta, T. Pawletta, C. Kadow, R. Fink (Hochschule Wismar), B. Lampe, W. Drewelow (Universität Rostock), M. Schultalbers, T. Jeinsch (IAV GmbH Gifhorn), and A. Wohnhaas (ASIM FG Simulation Technischer Systeme) could thank the almost 80 participants for coming.

Th. Pawletta, pawel@mb.hs-wismar.de

ASIM at EUROSIM'04

ASIM working groups have organised special sessions at the EUROSIM Congress:

- Alternative Methods in Modelling and Simulation
- Education in Simulation
- Modeling and Simulation - all problems solved !??
- Simulation and Optimisation

In these sessions thirty contributions were presented. Together with other contribution from ASIM members, about 30% of the EUROSIM'04 contributions were reached.

ASIM was also present in the ARGESIM booth, where SNE and ASIM publications were on display. There also information material for the EUROSIM'07 Congress in Ljubljana could be presented (see picture).

SLOSIM team (R. Karba, B. Zupancic) and ASIM/ARGESIM team (K. & F. Breitenecker, J. Kropf. F. Judex, S. Tauböck, C. Rainbacher, Th. Löscher) at EUROSIM'04

Announcement ASIM'05

ASIM 2005

18th Symposium Simulation Technique

Friedrich-Alexander University in Erlangen

Sept. 12 – 15, 2005; Erlangen, Germany

www10.informatik.uni-erlangen.de/asim2005

The goal of the 18th Symposium on Simulation Techniques is the exchange of information and experience between experts from industry, science, and education. It will provide a stimulating environment for the development of new ideas and for the identification of new applications and trends in the field

ASIM 2005 offers:

- Invited talks on new developments and trends
- Presentations and posters on all topics of modelling and simulation
- Workshops on current topics
- Exhibition of hardware and software for simulation
- Tutorials on new methods
- User group meetings on software tools

We invite Scientists, Developers and Users in the field of simulation techniques and those who are interested in Modelling and simulation methods, hardware and software, simulation tools, and any kind of applications

Deadlines: Abstract submission May 15, 2005, Notification of acceptance June 16, 2005; Final paper submission August 15, 2005

ASIM – STS Workshop
Simulation Methods and Test Methods for Software in Automotive Systems
March 1 – 3, 2005; Berlin, Germany
swt.cs.tu-berlin.de/asim-sts-05/

SIMVIS 2005
16th Conference "Simulation and Visualisation"
March 3 – 4, 2005; Magdeburg, Germany

ASIM – SVS Workshop
Traffic Simulation
March 4, Magdeburg, Germany
www.simvis.org simvis/tagung2005/meetings.htm

ASIM – GMMS Workshop
Review of Modelling Methods and Approaches
March 8 – 10, 2005; Univ. Wuppertal, Germany
www.math.uni-wuppertal.de/org/Num/conferences/asim.html

ASIM – SVS Workshop
Traffic Simulation
March 4, Magdeburg; Germany
www.simvis.org simvis/tagung2005/meetings.htm

ASIM – SPL Meeting
View to other Simulation Areas
April 6, 2005; Berlin, Germany
www.asim-gi.org

ASIM – SUGMBB Workshop
Simulation in Environmental Systems
March 16 – 18, 2005; Dresden, Germany
www.ioer.de/SUG/

ASIM 2005
18th Symposium Simulation Technique
Friedrich-Alexander University in Erlangen
Sept. 12 – 15, 2005; Erlangen, Germany
www10.informatik.uni-erlangen.de/asim2005

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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 Event

The 1st International Workshop NETSS "New Trends in System Simulation" took place on the 25th and 26th of February in Krnov, Czech Republic. Some 22 participants from Czech and Slovak republics attended the conference.

The 38th International Conference on "Modelling and Simulation of Systems" (MOSIS'2004) that took place on the 19th to 22nd of April 2004 in Roznov pod Radhostem, Czech Republic, was organised by the Department of Computer Science FEEI VŠB – Technical University Ostrava and Faculty of Information Technology, University of Technology Brno and sponsored by CSSS, ASU EUROSIM and SCS. The Conference was connected with conference ISM'2004 - of Information System Implementation and Modelling. Some 75 participants from Czech republic, Slovakia, and Poland attended the conference. The CSSS boar meeting took place during conference.

The XXVI International Colloquium on "Advanced Simulation of Systems" (ASIS 2004) took place on the 22nd to 24th September 2004 in St. Hostin, Czech Republic. Colloquium was organised by the Department of Computer Science FEEI VŠB – Technical University Ostrava and Faculty of Information Technology, University of Technology Brno. The chairman of the international program committee was Dr. Ing. Jan Štefan. Colloquium was connected with the 10 anniversary of Ing. Milan Kotva, first president of CSSS death. S. Some 44 participants from Czech republic, Slovakia and Poland attended the workshop.

The 6th International Scientific Conference on "Electronic Computers and Informatics'2004" (ECI'2004) took place on September 22-24, 2004, in Herlany Slovak Republic.

Conference was organised by the Department of Computer and Informatics– Technical University Košice under the auspices of the Slovak Society for Applied Cybernetics and Informatics (SSAKI). Interesting topics: Formal Foundations of Programmable Systems and Information Technologies, Architecture of Computer Systems and Networks, Computer Graphics and VR systems. One of the topics was concentrating on Modelling and Simulation of the Systems. Some 82 participants from Czech republic, Slovakia, Cyprus, Ukraine, Poland and Romania attended the workshop The general chair of the conference was prof. Jelšina, Technical university of Košice.

Coming Events

NETSS 2005

2nd International workshop NETSS
"New Trends in System Simulation
February 23 – 24, Krnov, Czech republic

The 2nd International workshop NETSS "New Trends in System Simulation will take place in Krnov, Czech republic on 23-24 of February 2005. For more information – jan.stefan@marq.cz.

MOSIS'2005

39th International Conference on
"Modelling and Simulation of Systems
April 18-21, 2005
Hradec nad Moravici, Czech republic

The 39th International Conference on "Modelling and Simulation of Systems" (MOSIS'2005) will take place on April 18-21, 2005, in Hradec nad Moravici, Czech Republic. The Conference will be connected with workshop ISM'2005 - Information System Implementation and Modelling. The chairman of the international program committee is Dr. Ing. Jan Stefan. For more information – jan.stefan@marq.cz.

12th International Symposium
„Railways on the edge of third millennium"
May 25 – 27, 2005
Zilina, Slovak republic

The 12th International Symposium „Railways on the edge of third millennium – On the way towards the European Railway – Harmonisation and ITS" (Zel '2005) will take place on May 25-27, 2005 in Zilina, Slovak republic. One of the interesting points in topic is „Simulation of Railways Stations". The chairman of the international program committee is Prof. Ing. L. Skyva, FRI-KTK, University of Zilina.

ASIS'2005

27th International Workshop
„Advanced of Simulation Systems"

September 21 – 23, 2004
St. Hostin, Czech republic

The 27th International Workshop „Advanced of Simulation Systems" (ASIS'2005) will take place in the Moravian town St. Hostin, Czech republic on September 21-23, 2005. The chairman of the international organising committee is Dr. Ing. Jan Stefan.

MOSMIC'2005

5th International Workshop "Modelling and Simulation in Management Informatics and Control"

October 11-13, 2005
Zilina, Slovak republic

The 5th International Workshop "Modelling and Simulation in Management Informatics and Control" (MOSMIC'2003) will take place on October 11-13, 2005 in Zilina, Slovak republic, 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. The CSSS boar meeting will take place during workshop.

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AES Spanish Simulation Society

Spanish Simulation Society

No news received.

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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 consists of the following members: A.W. Heemink (TU Delft), Chairman, L. Dekker, Vice-Chairman , W. Smit (E&E Consultants, Inc.), Secretary and Treasurer, Th.L. van Stijn (Royal Dutch Meteorological Institute/KNMI).

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.

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

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CROSSIM - Croatian Society for Simulation Modelling

General Information

CROSSIM (The Croatian Society for Simulation Modelling) was founded in 1992 and became a full member of EUROSIM in 1997.

The Society is run by Executive Board consisted of five members including president and vice-president elected by the General Assembly of the Society that meets once a year. Actual president is prof. Jadranka Bozikov from Zagreb and vice-president is prof. Vesna Dusak from Varazdin. Other members of Executive Board are prof. Vesna Bosilj-Vuksic, prof. Vlatko Ceric and prof. Tarzan Legovic.

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Activities

The Society co-operates with University of Zagreb Computing Centre in the organization of the international conference *Information Technology Interfaces* (*ITI*) that traditionally has a strong section on modelling, simulation and optimisation and in publishing of 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.

The Society is organizing simulation seminars and workshops and members are encouraged to present their ongoing work in order to discuss the problems and exchange the experience.

At the 5th EUROSIM Congress that was held last September in Paris (Marne la Vallée) there were eight contributions from Croatia authored by authors coming from Zagreb, Split and Osijek.

Coming Events

ITI 2005

27th Conference Information Technology Interfaces, June 20-23, 2005

Cavtat near Dubrovnik

The 27th Conference *Information Technology Interfaces ITI 2005* will be held on June 20-23, 2005 in Cavtat near Dubrovnik.

The Conference will be held under the auspices of the Croatian Ministry of Science, Education and Sports and University of Zagreb and CROSSIM is one of co-operating institutions. ITI seeks papers that will promote the communication and interaction among academic, engineering and business communities. It will include a special session *High performance computing, networking and grids* and twelve other sessions including the session *Modelling, Simulation and Optimization*. After presentation at the Conference a selection of papers will be recommended for publishing in the following journals: *Journal of Computing and Information Technology* (*CIT*), IMACS Journal of Mathematics and Computers in Simulation, INFORMATICA. The deadline for submission of camera-ready full papers or poster abstracts is February 1, 2005.

Besides contributed papers and posters the Conference will include invited lectures, panel discussions, tutorials, workshops, teleconferencing session and best student competition/award as well as hardware and software presentations and book exhibitions. BIOSTAT 2005, the meeting of researchers in Biometrics/Statistics will be held as a part of the Conference followed by School of Biometrics that will be held on June 23-24, 2005.

The Conference will take place at the luxurious five stars hotel *Croatia* in Cavtat. The official Conference language is English.

All the information including call for papers and posters for ITI 2005 can be found at iti.srce.hr or obtained from

ITI Conference Secretariat
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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).

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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).

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Francosim Organised in September 2004 the Fifth Eurosim Congress in Modelling and Simulation. More than 180 persons attended the congress and 167 papers were presented (a report is given in the EUROSIM section).

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French speaking activities

Report Conference MOSIM 2004

The **MOSIM Conference** is now an essential place for French-speaking researchers in Computer Science and Operations Research working on various aspects of modeling and simulation.

MOSIM is now an established forum which offers the opportunity of sharing the last theoretical advances in these fields, and which is aimed at theorists and practitioners that are concerned with the development of simulation, operations research, decision support, analysis, design and optimization of industrial and logistic systems.

Thanks to the quality of the preceding editions, which were held in Rouen (1997), in Annecy (1999), in Troyes (2001) and in Toulouse (2003), the MOSIM conference has now a very high scientific reputation. Several international journals are associated the conference and articles of the conference are selected for special issues and regular issues. The Steering Committee and the Scientific Committee did their best to ensure that the 2004 edition of MOSIM continues this tradition and contributes to the reinforcement of the prestige of the conference.

Indeed, **184 articles were submitted**, coming from about ten different countries. The scientific committee has selected **131 articles that have been published in the Proceedings** (after being duly evaluated by two referees). The selected articles were organized in **42 sessions** over three days. Moreover, well-know researchers gave **4 invited conferences**. MOSIM'04 thus showed that the MOSIM conference is well established and that it meets an actual need from the scientific community. The conference was sponsored by several international and national scientific organizations (SCS, EURO, ESRA, ROADEF, SOGESCI-B.V.W.B., ImDR-SdF, GDR MACS), local communities (Région Pays de la Loire, Nantes Métropole), industrials (SEGULA, Rockwell Software), the IRCCYN, the Ecole des Mines de Nantes, the University of Nantes and AIP PRIMECA.

About 200 people participated to MOSIM'04, including approximately 70 students. MOSIM'04 enables participants, in the nice surroundings of the Ecole des Mines de Nantes, to perform an interesting and fruitful work, to establish new contacts and to develop new ideas and collaborations. It is important to note that very few presentations have been cancelled. It is during the conference dinner, which proceeded in a very good atmosphere, that were announced the attribution of the price for young researchers to two Ph.D. students and the next edition of the MOSIM conference in Rabat, in Morocco, through a collaboration between the EMI (Ecole Mohammedia d'Ingénieurs) and the ENIM (Ecole Nationale de l'Industrie Minérale).

It is necessary to thank the entire Steering Committee for their important work and their continuous effort, as well as the Ph.D. students of the SLP and ACSED teams of the IRCCyN that agreed to give a big help during the three days of the conference. Moreover, MOSIM' 04 would not have been possible without the agreement of the directions of the Ecole des Mines de Nantes and the IRCCyN, and without the assistance and support of the various services of the Ecole des Mines de Nantes.

Lastly, it is also necessary to thank the organizers of the invited sessions, the referees who did an excellent work and all the participants of MOSIM' 04for their contribution to the success of this scientific meeting. More info: mosim04@emn.fr, www.emn.fr/mosim04/

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Alexandre Dolgui, Chairman of Scientific Committee, Dolgui@emse.fr

MOSIM '06

Modelling and Simulation Conference, April 2006
Rabat, Marocco

The next edition of the MOSIM conference will be organized in Rabat in Morocco (April 2006) by two engineering schools: the EMI (Ecole Mohammedia d'Ingénieurs) and the ENIM (Ecole Nationale de l'Industrie Minérale).

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 264 members. The Board consisting of the following persons directs the affairs of the PSCS: Andrzej Tylikowski (President), Leon Bobrowski and Andrzej Chudzikiewicz (Vice Presidents), Zenon Sosnowski (Secretary), Kazimierz Furmanik (Treasurer), Roman Bogacz, Jaroslaw Rybicki, Andrzej Grzyb (Members)

Activities

The main activities of the Polish Society for Computer Simulation are annual conferences known as „PSCS Workshops on Simulation in Research and Development": Mielno (1994), Warszawa (1995), Wigry (1996), Jelenia Gora (1997, 1998), Bialystok & Bialowieza (1999), Zakopane – Koscielisko (2000), Gdansk-Sobieszwo (2001), Osiekik/ Koszalina (2002)., and Zakopane (2003).

The annual PSCS Workshop on Simulation in Research and Development took place on September 1-4, 2004 in Bialystok&Augustow, Poland. The 75 papers of the workshop covered the following areas: simulation in mechanical engineering, simulation in mathematical problems, artificial intelligence and simulation, simulation in transportation, neural nets and simulation, simulation in automation and control, and simulation tools.

Publications. Proceedings of the 10th PSCS Workshop on „Simulation in Research and Development", A. Tylikowski and A.Grzyb (Eds.), Krakow, 2004, (in Polish). The price is 30,- PLN.

Coming Events

12th PSCS Workshop
„Simulation in Research and Development "
September, 2005

Prof. A. Chudzikiewicz will organize the 12th PSCS Workshop on „Simulation in Research and Development" in September 2005. More info via email:: ach@it.pw.edu.pl

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ISCS - Italian Society for Computer Simulation

www.iscs.it

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: Ing. Mario Savastano (Chairman), Prof. Franco Maceri (Vice Chairman), Dr. Paola Provenzano (Secretary), Prof. Pasquale Arpaia (Treasurer).

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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 research, development, application and education of simulation in Hungary and also contributing to the exchange of information between the Hungarian simulation community and the simulation communities abroad. HSS deals with the organization of lectures, exhibitions, demonstrations, and conferences.

Activities. At the Department of Information and Knowledge Management at the Faculty of Economic and Social Sciences of the Budapest University of Technology and Economics classes "Simulation and Modeling 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 of simulation mainly in the fields of traffic, economic and interdisciplinary problems.

In the town of Gyor at the Szechenyi Istvan University simulation is also taught. Here the class "Simulation Methodology and Applications" is studied by undergraduate students of informatics, electrical and traffic engineering. Lately a new specialization called "Informatics in Economy" was started, with simulation as a basic subject.

Conferences. We have participated at EUROSIM and SCS conferences and presented our simulation results. Professor András Jávor, chairman of HSS has been invited to organize a track on Education at the Summer Computer Simulation Conference in San Jose, USA. Professor András Jávor – as member of the Board of Directors of EUROSIM – beyond having participated and giving presentation at the EUROSIM Congress in Paris, also participated at the board meeting and in the election of the next president and preparation of the next congress.

Our members have been and are successfully participating in national and EU simulation projects.

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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.

Another important objective of ROMSIM is organization of national scientific events in the field of modelling and simulation and participation at international conferences. In April 1999 ROMSIM has been accepted as an observer member of EUROSIM.

Past Events

ROMSIM has developed in the last time a lot of activities in both scientific and information field, as for instance: organization of scientific conferences and seminaries in modelling and simulation of systems, information of ROMSIM members on international conferences also.

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. Some ROMSIM members developed activities in the frame of 15th IFAC World Congress, Barcelona, Spain 2002; several members of ROMSIM presented 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. A member of TOMSIM has participated at MATHMOD Conference 2003 organised at TU Vienna.

At the demand of Prof. Yskandar Hamam, Past EUROSIM President, a ROMSIM member was proposed for international programme committee of BioMedSim03 conference. An important contribution was given by some ROMSIM members to the scientific organization of the Eurosim Congress 2004 in Paris. Five papers have been presented by six authors, in different field of modelling and simulation of systems, Expert Systems for simulation and control and applications.

Present and Coming Events

Some ROMSIM members have sent papers to Organizing Committee of the IFAC World Congress to be hold in Prague, Czech Republic, in July 2005.

ROMSIM is involved in organization of the periodic scientific seminary titled Image Processing and Imagistic; 15 to 20 specialists attend the reunion of the seminary.

An other important activity is the publishing of books in the field of modelling and simulation. Such a book is Modelling of High Complexity Systems with Applications, by dr. Florin Stanciulescu, published by WIT Press of Wessex Institute of Technology, UK. A presentation of the book can be found on the site of the WIT Press and an Advanced Information Leaflet can be obtained from WIT Press or from the author.

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SLOSIM

Slovenian Society for Simulation and Modelling

msc.fe.uni-lj.si/SLOSIM

General Information

SLOSIM (Slovenian Society for Simulation and Modelling) was established in 1994 and became the full member of EUROSIM in 1996. Currently it has 76 members from both Slovenian universities, institutes, and industry. It promotes modelling and simulation approach to problem solving in industrial as well as in academic environments by establishing communication and cooperation among the corresponding teams.

News

In the last period the following activities can be itemised:

- on the meeting of the EUROSIM boards in September (on the EUROSIM 04congress in Paris) prof. dr. Borut Zupančič was elected for the president of EUROSIM till the next EUROSIM congress (2007 in Ljubljana),
- the liflet with preliminary information about the EUROSIM 07 congress was prepared and shared among EUROSIM 04 congress participants,
- the SLOSIM members also participated with contributions in the programme of EUROSIM 04 congress,
- as usually, SLOSIM organised a section on slovene conference ERK 04 from the areas of modelling and simulation,
- as decided on the board meeting in April, SLOSIM organized the presentation about the role of modelling ad simulation in the weather forecast on the Environmental Agency of Slovenia,
- SLOSIM organized a tour to world known Postojna cave and dinner (Figure 1) for the members of EUROSIM executive board, which had meeting in November at the Faculty of Electrical Engineering, University of Ljubljana

Figure 1 EUROSIM executive board meeting dinner in Ljubljana

- in November, also general assembly of SLOSIM was held at the Faculty of Electrical Engineering in Ljubljana, where the reports about the previous two years period and future plans were presented by the president and treasurer,
- finally, the tenth anniversary of SLOSIM establishment was celebrated with a small snack.

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SIMS - Scandinavian Simulation Society

www.scansims.org

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

Sims Structure

SIMS is organised as federation of regional societies. There are FinSim (Finnish Simulation Forum), MoSis (Society for Modelling and Simulation in Sweden), DKSIM (Dansk Simuleringsforening) and NFA (Norsk Forening for Automatisering).

Membership, SIMS Board

- Peter Fritzson, chairman
- Erik Dahlquist, Brian Elmegaard, Anne Elster, Kaj Juslin, Esko Juuso, Bernt Lie, Kim Sörensen
- Vadim Engelson is SIMS coordinator for practical matters.

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: www.scansims.org

Past Events

The **45th SIMS conference** was held at Technical University of Denmark in Lungby, Denmark in September 23-24, 2004. The conference was organised by Technical University of Denmark, Copenhagen University and Aalborg University. More than 100 participants attended the conference. The programme consisted of 52 papers and 4 keynote presentations. Main topics were process industry and manufacturing processes, process optimisation and diagnostics, energy systems, numerical methods, mechanical and electrical systems, rigid and soft body simulation and modelling and simulation tools.

The annual meeting of SIMS was held during the conference. A change of the bylaws to include Iceland was approved in the meeting.

The First Sim-Serv Conference, a meeting of a EU-COST action E36 and a course on Object-Oriented Modeling and Simulation with Modelica were organized in connection to the SIMS 2004 conference. The proceedings of the conference are available as a pdf file on the web page of the Scandinavian Simulation Society. See www.scansims.org for details.

The **Danish Simulation Day** on Ship Training Simulators was organized by DKSIM. 20-25 participants attended the meeting.

Future Events

46th SIMS Conference

September 2005
Trondheim, Norway

The **46th Scandinavian Conference on Simulation and Modeling**, will be organized at NTNU in Trondheim, Norway, September 2005. Further information is available from www.scansims.org

4th Modelica International Conference

March 7 – 8, 2005, Hamburg, Germany

The International Modelica Conference is organized each one-and-half year. Location of Modelica'2005 is Technical University of Hamburg-Harburg, Germany. Local organizer is Prof. Schmitz. Further information is available from www.modelica.org

Seminar on Benefits of Simulation in Process Industry

April 2005, a cruising on the Baltic Sea between Helsinki and Stockholm

The Finnish Simulation Forum (FinSim) will organise a seminar on Benefits of Simulation in Process Industry on the Baltic Sea between Helsinki and Stockholm. The special emphasis on process automation. Further information will become available in www.scansims.org

SIMS Contact Address, Information

Updated SIMS web page: www.scansims.org

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UKSim United Kingdom Simulation Society

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

General Information

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

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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Activities

The UK Simulation Society held its annual meeting in conjunction with the UK Simulation 2004 conference (Oxford, St. Catherine's College, March 29-31). As agreed during the meeting, another UK Simulation conference will be held in 2005 maintaining Oxford as a conference location. The details of the conference organization were discussed during a second meeting of the society held on the 7th of July at Glamorgan University, Cardiff, in conjunction with a UK Simulation research workshop. As a result of this second meeting the conference venue was agreed to be one of the older colleges in Oxford, St. John's college, and the conference dates were decided to be April 6-8.

The society is significantly involved in the organization of SCS-Europe European Simulation Multiconference (SCS-ESM) series. The chairman of the society, Professor David Al-Dabass, is in fact the director of this conference series and several members of the UK Simulation board participate in conference and track chairing duties for the upcoming ESM 2005 to be held in Riga, Latvia, on June 1-4.

Three special issues of the International Journal of Simulation; Systems, Science & Technology (IJSSST) have been published in 2004. Two of them, including selected papers from the latest UK Simulation conference, are the June issue on "Modelling & Simulation of Complex Systems", and the September issue on "Applied Modelling and Simulation", guest editor for both issues being Dr Alessandra Orsoni, Kingston University, London, UK. A third issue on "Grid Performance and Dependability" was published in December, guest editor Dr Nigel Thomas, School of Computing Science, University of Newcastle upon Tyne, UK, and a January 2005 issue on "Advances in Analytical and Stochastic Modelling", guest editor Professor Khalid Al-Begain, School of Computing, University of Glamorgan, Pontypridd, Wales, UK. All issues are available online. An example issue may be found at:

http://ducati.doc.ntu.ac.uk/uksim/journal/Vol-5/No-3&4/cover.htm

The society would like to encourage individuals and university libraries to subscribe to the journal. The cost of one full year subscription is £297 for individuals, and £495 for university libraries and institutions. Details are available on the website, or send a cheque or credit card details to Professor David Al-Dabass, Editor-in-Chief, IJSSST, School of Computing & Informatics, Nottingham Tent University, Nottingham, NG1 4BU.

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SNE REPORTS EDITORIAL BOARD

www.argesim.org/sne/

SNE (Simulation News Europe) is the official membership journal of EUROSIM and sent to most members of the EUROSIM Societies as part of the membership benefits. Furthermore **SNE** is distributed to the members of SCS Europe, and to User Groups and for promotional purposes via **ARGESIM**.

SNE is registered with ISSN 1015-8685, continuing the ISSN 0929-2268.

If you have any information you want to see published, please contact the corresponding member of the editorial board (society news, conference announcements, conference reports, events, etc.).

EUROSIM

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INTERNATIONAL SOCIETIES AND RESEARCH GROUPS

MATHMOD Conference Series

www.mathmod.at

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

The conference series is run by the Inst. f. Analysis and Scientific Computing (I. Troch) of Vienna University of Technology, in close Co-operation with ARGESIM (F. Breitenecker).

5th MATHMOD Vienna
5th Vienna International Conference on Mathematical Modelling
February 8 – 10, 2006; Vienna, AUSTRIA

The scope of the conference covers theoretic and applied aspects of the various types of mathematical i.e. formal modelling for systems of dynamic nature (deterministic, stochastic, continuous, discrete or hybrid, etc.). The conference will also deal with alternative modelling methods (e.g. cellular automata) and modelling for / in scientific computing.

The topics to be discussed will include e.g.

- modelling theory, processes and methods for model formulation, identification, development, reduction and validation
- automation of modelling and software aids for modeling, computer modelling
- qualitative modelling including fuzzy and iterative approaches to modelling
- modular modelling and interdisciplinary modelling
- learning networks / uncertainties in modelling
- methodologies for model validation
- fitting mathematical models to real processes
- relationship between the modelling approach and problem solutions
- comparison of methods for modelling, model reduction and model validation
- applications in the field of engineering systems and in natural sciences
- applications in other fields (such as environmental systems, biotechnology, etc.)
- case studies of comparisons for ideas or methods
- education in modelling
- modelling aspects in scientific computing

The **Scientific Programme** will consist of Invited Lectures, Regular Sessions, Organised Sessions, Poster Sessions, and Student Sessions. The Invited Lectures will deal with Models for Nonlinear Control, Continuous and Discrete Multidimensional Systems, Modelling of Structured Systems, Model Reduction and Undermodeling, and Scientific Computing.

Social Programme will include Welcome Party, Heurigen Evening, and Reception. Program for Accompanying Persons will include the Social Programme and Guided Tours in Vienna.

Deadlines

Submission Review Abstract	Sept.30, 2005
Notification of Authors	Nov. 7, 2005
Full Paper and Proc. Abstract	Dec. 15, 2005

Date and Place

Vienna University of Technology
Freihaus Building
Wiedner Hauptstrasse 8-10, A-1040 Vienna
February 8 -10, 2006 – All Sessions
February 7, 2006 - Workshops and Tutorials

For more information please visit the conference website www.mathmod.at or contact the conference chair: Prof. Dr. Inge Troch, Vienna University of Technology, Wiedner Hauptstrasse 8-10, A-1040 Vienna info@mathmod.at; Phone: +43-1-58801-10116, -10117, FAX: +43-1-58801-10199

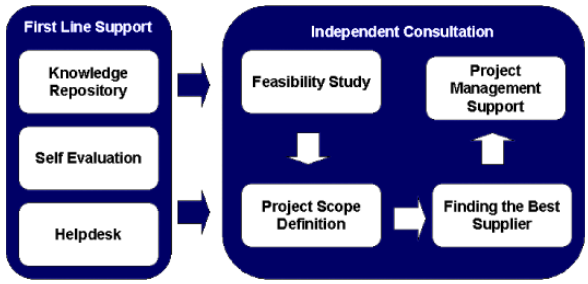
SIM-SERV - the Virtual Simulation Institute

www.sim-serv.com

The Virtual Simulation Institute **Sim-Serv** focuses on product- and production-oriented simulation. It provides practical support to researchers and developers, to those offering tools and services on a commercial basis as well as to industrial users.

Objectives of SIM-SERV

It is widely accepted that simulation – in spite of its obvious power and benefits – is not widely used in industry, clearly not as wide as it should be. The estimated potential for savings and improvement in European industry, which could be achieved by proper use of simulation, is enormous. The main objective of Sim-Serv is therefore to help turn potential into real benefits. To this end, Sim-Serv builds up a **central entry point** for those seeking information, guidance and support. Newcomers find general information, case studies about successful applications (with an emphasis on the business dimension), a data base of papers and articles about all aspects of simulation, links to experts as well as a help desk ready to answer any questions regarding the use of simulation.



SIM-SERV offers several services that help manufacturers to improve production by using new technologies that are based on simulation. SIM-SERV helps manufacturers to identify the areas where applying simulation has highest impact and shortest payback time. SIM-SERV provides independent consultation from the beginning of the project until the successful delivery. Together with the customer SIM-SERV defines the project scope and oversees the development and supply to ensure that delivery is in full.

A network of experts is available for specific questions which cannot all be answered by the help desk staff themselves. In addition, industrial users find **independent consultation and advice** about the possibilities of applying simulation technology to their business, the expected cost and benefits.

An in-depth analysis of the problem leads to a recommendation of suitable solutions and suppliers who are able to deliver them.

On the other hand, the supply side consists of numerous small or even micro-enterprises offering in many cases highly specialised tools and solutions. Many of them are recently born spring-offs from research institutes.

Working Groups. Sim-Serv wishes all interested people welcome to participate and contribute to the working groups. The purpose of the working groups is to increase collaboration between organizations working in simulation field and European industry.

The working groups should aim at development of common RTD projects, better interoperability of software and implementation and take-up of simulation technology by industry. Sim-Serv has started working groups listed below. To read the details and join click on the group name below.

- MOTTO Modular Design of Simulation Tools
- ODF Open Digital Factory
- SIM-PLAST Simulation Accuracy for Plastics and Rubber Production
- SAAT Simulation Assisted Automation Testing
- Quantitative Benefits of Simulation
- Enhancing Service Concepts for Simulation Project Delivery
- Roadmap of Simulation in Process Industries
- Business and Enterprise Modelling
- Roadmap of Simulation in Manufacturing and Logistics
- Simulation of Traffic and Transportation Systems
- Human-centred Modelling and Simulation

Sim-Serv is constantly looking for new interesting working group topics and enthusiastic people who would like to run a group.

Sim-Serv closely co-operates with other virtual institutes, mainly with the virtual institute for advanced manufacturing technologies ADMAN (www.max-serv-com). These two institutes seem to complement each other in a most natural way.

Information

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Modelica Association

www.modelica.org

The Modelica Association is a non-profit, non-governmental organization with the aim of developing and promoting the Modelica modeling language for modelling, simulation and programming of physical and technical systems and processes. The Modelica Association owns and administrates incorporeal rights related to Modelica, including but not limited to trademarks, the Modelica Language Specification, Modelica Standard Libraries, etc., which should be generally available for the promotion of industrial development and research.

Modelica is governed by a boad: Martin Otter (Chairman), DLR Oberpfaffenhofen; Germany; Peter Fritzson (Vice Chairman), Linköping University, Sweden; Hilding Elmqvist (Treasurer), Dynasim AB, Lund, Sweden; Michael Tiller (Secretary), Ford Motor Company, Dearborn, U.S.A.

Modelica History. There have been several attempts to define object-oriented languages for physical modeling. However, the ability to reuse and exchange models relies on a standardized format. It was thus important to bring this expertise together to unify concepts and notations. The Modelica design effort was initiated by Hilding Elmqvist, Dynasim AB, and started in September 1996 within an action of the ESPRIT project "Simulation in Europe Basic Research Working Group (SiE-WG)". The Modelica language has been designed by the developers of the object-oriented modeling languages Allan, Dymola, NMF, ObjectMath, Omola, SIDOPS+, Smile and a number of modeling practitioners in different domains. After 19 three-day meetings, during a 3-year period, version 1.3 of the language specification was finished in December 1999. This was the first version used in actual applications. In December 2000 an update of the language, version 1.4, has been published.

Development Groups. The core design of the Modelica language is finished since Dec. 2000. The further development has been reorganized into the following three development groups: Modelica Advanced Development Group (Peter Fritzson), Modelica Language Specification Group (Hans Olsson), Modelica Library Group (Martin Otter):

Modelica Tools. In order that the Modelica modeling language can be used to solve actual problems, a modeling and simulation environment is needed

- to conveniently define a Modelica model with a graphical user interface (composition diagram/schematic editor) such that the result of the graphical editing is a (internal) textual description of the model in Modelica format
- to translate the defined Modelica model into a form which can be efficiently simulated in an appropriate simulation environment. This requires sophisticated symbolic transformation techniques.
- to simulate the translated model with standard numerical integration methods.

Dymola and MathModelica are commercial tools. **Dymola** from Dynasim has a Modelica translator which is able to perform all necessary symbolic transformations for large systems (> 100 000 equations) as well as for real time applications. A graphical editor for model editing and browsing, as well as a simulation environment are included. Convenient interfaces to Matlab and the popular block diagram simulator SIMULINK exist.

MathModelica from MathCore Engineering provides a Modelica simulation environment which is closely integrated into Mathematica and Microsoft Visio. The tight integration with Mathematica also makes it possible to perform complex analysis tasks, advanced scripting, and other technical computations on models and simulation results. MathModelica has a graphical editor for model editing and browsing (extension of the Microsoft Visio diagramming tool).

The **Open Source Modelica** is a new project at Linköping University. The goal of the project is to create complete Modelica modeling, compilation and simulation environment based on free software distributed in source code form intended for research purposes.

Free Modelica Editors. Modelica models are usually graphically constructed. However, since Modelica is basically a textual description it is also possible to utilize a text editor to edit Modelica models. The **Free Modelica Editor** has been developed by Falko Jens Wagner (Windows), and **Modelica mode for Emacs** , by Rüdiger Franke.

Conferences. Modelica conferences are held every 18 months. The location of **Modelica'2005** is Technical University of Hamburg-Harburg, Germany. Local organizer: Prof. Schmitz.

Modelica 2005

4th International Modelica Conference

March 7 – 8, 2005; Hamburg, Germany

Information: www.modelica.org

INDUSTRY NEWS

Simulator MODEN

The laboratory of simulating was established on the bases of Ltd. Energovent. The team of the laboratory consists of the designers and developers of the program "MODEN". The first version of the program was designed a few years ago, in 1994-1995th. The majority of the developers of the first version work very successfully in the USA. It was the desire to bring to life all recently appeared ides that inspired us to design a new version MODEN.

The program MODEN is a unique simulating program. With its help one can design and calculate different power systems and processes in dynamics:

- The program allows modeling of different power systems, from systems of large enterprises up to thermal-moist processes.
- The program allows modeling of hydraulic and power processes in the systems of heat supply and heating.
- 3-D modeling of temperature fields.

Laboratory of Simulating
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energovent@open.minsk.by
www.energovent.com/english/

Scientific Computers: Maple Global Optimisation Toolbox

The goal of global optimization is to find the absolute best answer for models that have a number of possible solutions. Features of the Global Optimization Toolbox are:

- Incorporates the following solver modules for nonlinear optimization problems:
  - Branch-and-bound global search
  - Global adaptive random search
  - Multi-start based global random search
  - Global solution further refined by local search
- models with thousands of variables & constraints.
- Solvers take advantage of Maple arbitrary precision capabilities in their calculations
- Supports arbitrary objective and constraint functions, including of special functions
- Built-in model visualization capabilities

Scientific Computers GmbH
Friedlandstrasse 18, D-52064 Aachen
Tel + 49 (0241) 40008 - 0, Fax – 13
info@scientific.de, www.scientific.de

MathWorks: 64-bit Support - MDB Conference in Munich

MDB Conference Munich. The MathWorks organizes the International Model-based Design (MBD) Conference 2005 Munich, Germany, June 8 – 9. The conference is dedicated to the application of the MATLAB+Simulink tool chain Contributions to the following topics will be presented:

- Control Design, Simulation, Code Generation
- Certification, Rapid Prototyping, Video processing
- Aerospace, Communication, Semiconductor
- Industrial Equipment or Medical applications
- Sharing models, Verification and Validation
- Multi domain modelling
- Wireless communications

Information at MATLAB web site or directly from Dr. Hans-Martin Ritt, Tel.: +49-241-47075-47, Fax: +49-241-47075-12, martin.ritt@mathworks.de

64-bit Support under Linux. MATLAB and Simulink support now support AMD64 und Intel EM64/ processors under Linux. This support enables MATLAB users to take advantage of the efficiency of 64-bit processors, for instance in hanlding very big datasets, or for fast numerics. Furthermore, there is no more memory limit of 4GB. This MATLAB implementation is the fastet testes up to now.

The Mathworks GmbH
Friedlandstr. 18, D- 52064 Aachen
Tel +49 -241-47075-0, Fax – 12
info@mathworks.de, www.mathworks.de

Enterprise Dynamics Training Courses

Enterprise Dynamics offers training courses, either in Incontrols's Training Center in Maarssen, or directly at the costumer's location:

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The Netherlands
Tel +31-346-552500, Fax - 552451
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Introducing Maple **9.5**

command the brilliance of a thousand mathematicians

Maple 8 ist aus der gemeinsamen Begeisterung einer der dynamischsten und leidenschaftlichsten Gemeinden in der Computerwelt entstanden. Seit über 20 Jahren haben Anwender aus der ganzen Welt ihren Beitrag dazu geleistet, das Maple-System von einem ursprünglich hoch spezialisierten Forschungsprojekt in eine der führenden Kräfte im Bereich der Computeranwendungen für Technik und Unterricht umzugestalten.

Evolution Maple 8 bietet eine Vielzahl von neuen mathematischen Funktionen und Verbesserungen wie z.B. neue Pakete für Analysis 1 und für Scientific Constants, numerische Löser von Randwert-problemen bei PDEs, Code-Generierung und Java-Konnektivität, Rechtschreibprüfung, bessere Kontrolle über die Worksheet-Displays und vieles mehr.

Revolution Maple 8 beinhaltet Maplets, eine innovative Neuerung im Bereich mathematischer Software. Maplets erlauben es Ihnen, auf einfache Weise individuelle grafische Benutzeroberflächen für Maple zu entwickeln, ohne dabei umständliches Programmieren in Kauf nehmen zu müssen.

Für weitere Informationen wenden
Sie sich bitte an maple@scientific.de
oder rufen Sie uns an (0241) 40008-0

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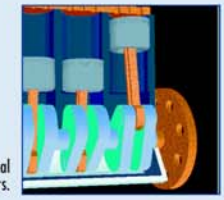

Simulate mechanical systems and controllers.

New—MATLAB 6.5 extends the desktop and lab

- JIT-Accelerator technology for fast execution
- Deployment to Excel, COM, and C/C++
- Connection to instruments via TCP/IP, UDP, and to new data acquisition boards
- Statistical methods and curve fitting tools

New—Simulink 5 extends simulation and embedded systems

- Modeling for wireless, mechanical, and power systems
- Intrinsic fixed-point
- Rapid control prototyping with new xPC TargetBox™ hardware
- Next generation of automatic production code
- Targeting for microcontrollers, DSPs, and FPGAs

Model, generate, and verify embedded code.

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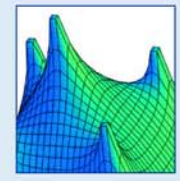

Speed up code performance.

The MathWorks