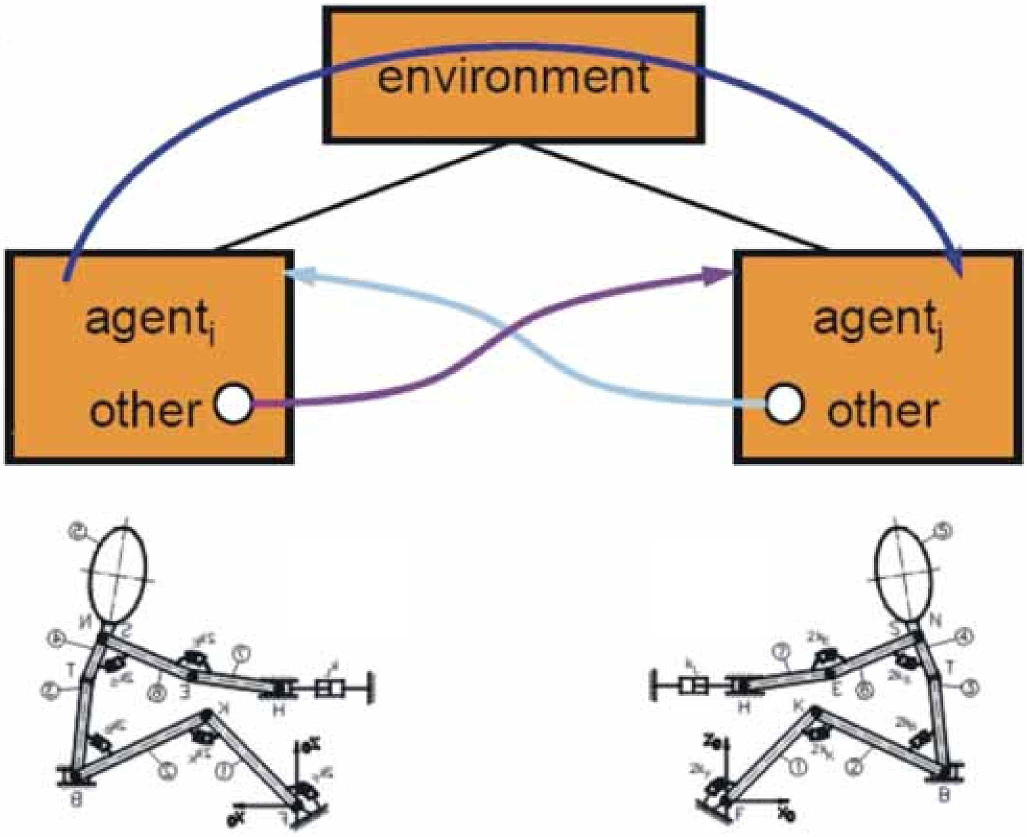
SIMULATION NEWS EUROPE

SNE

A European Forum on
Development in Modeling and Simulation



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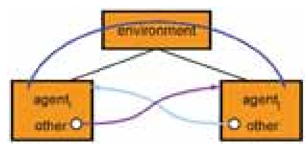

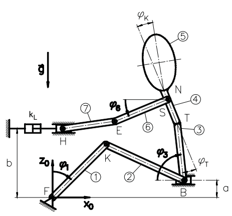

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$$\sum_i \frac{1}{D^k(cell, rest_i)}$$

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.......And Much More

Impressum
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EDITORIAL

Dear readers,

In this issue we continue our new strategy for SNE: we open the contents towards new alternative approaches, we extend the Comparisons on Simulation Tools to Comparisons on Simulation Methods, and we will inform also about "other" societies and user groups, and we consequently change the structure of SNE a little.

This issue introduces Agent-based Modelling and Simulation as an alternative approach: Franziska Klügl and co-workers from University Würzburg, Germany, compare in a technical note the agent-based approach with classical methods like Petri nets and queuing networks.

Furthermore, we have set up a new comparison, C16 - Restaurant Business Dynamics. This comparison can be either tackled by agent-based modelling and simulation, or by standard tools because of a relatively simple time advance. We expect a broad range of solutions from high-level object oriented simulation systems with dynamics structures via classical discrete-event simulators to numerical and also statistical (!) environments.

We also are glad to present a technical note by M. Kuchler and M. Gföhler (Vienna Univ. of Technology) on modelling and simulation of the direct and the inverse problem for the human movement on a rowing ergometer. Modelling and simulation of direct and inverse problems is also a new challenging task.

A short contribution introduces CISM, the International Centre for Mechanical Sciences, where a lot of modelling and simulation is done.

*Organisationally, we are separating the News Section more strictly from the Notes Section. The **News Section** can be found now at the end of the issue. The Notes Section consists of Technical Notes (fully reviewed by the Editorial Board), of Short Notes (reviewed by the Editorial Board), of Software Notes (reviewed by the Publisher), and of **ARGESIM Comparison Solutions** (reviewed by the Authors of the Comparisons). That guaranties the citation of **SNE** papers as scientific papers.*

*We are glad to publish also new solutions to the ARGESIM Comparison, interesting Short Notes, and we thank the authors of Book Reviews for their support. We hope, you enjoy this issue, and I thank all authors and members of the editorial boards for their cooperation. We are now in time with publication of SNE, the deadline for the next issue **SNE 41/42** (November 2004) is October 1st, 2004.*

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

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EUROSIM Federation of European Simulation Societies II
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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 events from International Simulation Societies and Simulation Groups all over the world.

SNE is the also the official membership journal of EUROSIM and SCS Europe.

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

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.

mSNE's special series *Comparison of Modelling and Simulation Technique and Tools* (**ARGESIM Comparisons**) gives a comprehensive overview on developments in application and implementation.

Parts of **SNE** can be also found on the web, e.g. an archive and an evaluation of the Comparisons: www.argesim.org

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. 40) or the Editor-in-Chief.

TECHNICAL NOTES

Multi-Agent Modelling in Comparison to Standard Modelling

Franziska Klügl, Christoph Oechslein, Frank Puppe, Anna Dornhaus
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….introduces multi-agent simulation, a rather new modelling and simulation method

…. discusses advantages of the multi-agent approach versus complexity

… compares the multi-agent approach with Petri net approach and queing network approach based on the bee recruitment model,

…. and summarizes properties for a system that advise the use of a multi-agent simulation

Abstract

Modeling and simulating complex natural systems is a demanding task. With multi-agent simulation a rather new modeling and simulation method is available that is based on a set of interacting autonomous agents. However, dealing with a multi-agent simulation is very effortful due to multi-level behaviour, increased amount of parameters, etc. Thus a modeler has to be sure about the advantages that he gains when applying this paradigm. This question is addressed based on an example of a bee recruitment model. Different attempts to represent that model as a Petri-Net, a Queuing Network or a multi-agent model show the different properties of these frameworks. In the conclusion aspects of a system that is best simulated by multi-agent simulation are summed up.

Motivation

The best way of analyzing multi-agent systems that exhibit emergent phenomena or generate unforeseen patterns of spatial aggregation or global behavior, consists of modeling and simulating them. This kind of complex adaptive systems are characterized by locally interacting entities that produce a pattern or a behavior that is observable on a global scale, but not directly deducible from local behavior [1].. Examples can be found in an ant colony as an adaptive superorganism, a traffic jam that is moving backwards or other complex societal models.

Multi-agent simulation seems to promote a natural form of modeling, as active entities in the original are also interpreted as actors in the model [2].

The origins of this way of conceptualizing a model lie in Distributed Artificial Intelligence that deals with the theory, construction and application of multi-agent systems, i.e. systems that consist of several interacting intelligent entities [3,4]. Main characteristics of "agents" are their autonomy, their ability for flexible action in reaction to perceived environment conditionns and their pro-activeness depending on motivations generated from their internal states.

Developing, designing and finally implementing a multi-agent simulation is not trivial. There are several reasons for the complexity of multi-agent models: concurrent processes have to be organized, the levels of modelling and observation are twofold, agent behavior can build on lots of parameters with unforeseeable effects on the global level, etc. From an engineering point of view, the situation is even worse, as neither an unified formal framework for multi-agent models nor a widely accepted methodology for developing multi-agent simulations exist.

A few formal frameworks for agent-based simulation were suggested, e.g. AgedDEVS [5] that focuses on the internal model of agents and their representations of social relationships for facilitating the formulation of variable structure models. Another example is PECS [6] that seems to be more like agent architecture, as it focuses on the different components an agent should be contain. A more recent approach combines a framework for reactive planning with DEVS models [7]. This mirrors the current situation in Distributed Artificial Intelligence with a variety of mainly logical frameworks for specifying multi-agent systems – e.g. ConcurrentMetatem, that is based on temporal logic [8] or AgentSpeak(L) [9] as an operational BDI (Belief Desire Intention) Logic. The component oriented framework DESIRE [10] is used not only for specifying agent-based systems, but also for simulations. Recent developments favour less formal approaches based on UML extentions for specifying multi-agent systems like AgentUML [11]. Oechslein et al. developed an UML extension for behaviour-oriented multi-agent simulations [12]. A special role play formal frameworks for specifiying coordination, like COOL [13] which are state machine based or based on Coloured Petri Nets.

Thus, without any help from an accepted, generally applicable formalism – a modeler has to deal with complexity of multi-agent simulations rather on his own. This especially concerns verification and validation issues in addition to the problematic aspects mentioned above. Although multi-agent simulation offers an attractive way of dealing with modelling natural multi-agent systems, one must carefully think about whether this instrument is really necessary and whythere is no "simpler" method for modeling and simulating the system. This even leads to the basic question, about the advantages of multi-agent simulation?

In the following we want to tackle the question about the potential of multi-agent simulation based on comparing different standard methods for concurrent processes applied to an interesting model. After introducing our test scenario, different modeling attempts as a Petri-net or a queuing network model are given. This is followed by a version as multi-agent model. The contribution concludes with a summary of characteristics of systems where multi-agent simulation is well suited.

Test Scenario

The test problem we are using here was originally delt with in an interdisciplinary project about particular questions in social insect superorganisms. The basic question that ought to be answered by the example model is the following: how the nectar input of a bee hive is influenced by a recruitment strategy. The hypothesis concerned the influence of distribution and variability of resources, which formed the main input variables to the model. We tackeld two different scenarios – with and without recruitment combined with the communication of the position of the newly discovered resource.

The output of the model is measured by the nectar input of the different colonies. Details can be found in [14,15]. The model that we used for this comparative study is a preliminary version of it. However, it is sufficient as it exhibits all interesting features. The detailed concepts of the model are given in figure 1.

The behavior of an individual bee can be described in the following way: A bee normally waits inside of the hive. In some individually perceived situation (lack of energy, etc) it becomes a scout and starts to fly according to some random search until it finds a resource patch or abanondons its search. When a successful scout returns to the hive, it decides on its further behavior: First whether to recruit other bees for foraging bees at the newly discovered resources by dancing, whether to return to discovered resource itself continuing as a forager or alternatively to stay in the hive and wait again.

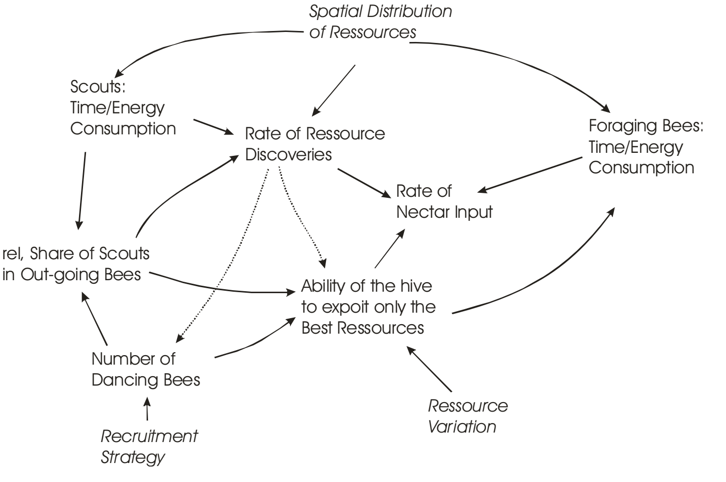

Figure 1: Informal representation of the relations between different (individual and global) variables of the test scenario

This decision is based on the quality and amount of the nectar in the newly discovered resource in comparison to the quality and level of nectar in the hive storage. Also the number of potentially recruited bees is depending on the evaluation of the nectar source, as the scout who dances, may decide to do this more or less intensively.

This is only a small part of the model, but it exhibits some interesting features, that illustrate its complexity.

- Conditional behavior based on internal attributes of an agent and on external perceptions, like the energy level inside of the hive or the position of the memorized resource that the bee returns to.
- Variable interaction partners. Executing the recruitment behavior, it is not predefined, which bees and how many are going to forage at the resource. The interaction between recruiting bee and the waiting bees in the hive cannot be fixed.
- Heterogeneous space as the main input factor.
- Decisions on further behavior based on Evaluations of some non purely local property (energy storage in the hive).

Although the recruitment scenario does not require dealing with variable structures in the sense of a variable number of bees, this type of insect behavior is a rather typical application example for multi-agent simulation. There are many other simulations dealing with (pheromone) recruitment of ants. Also, task allocations models in combinations with different mechanisms for specialization are prominent examples for applying multi-agent simulation. However, all these models of agents as insects focus just on the behavior of rather simple interacting agents.

The situation becomes much more complex when dealing with social systems consisting of humans. These models cannot concentrate on pure – externally observable – behavior, but also have to incorporate sophisticated internal models of the agents – representing social relationships, individual desires or intelligent generation of behavior, which lead to structural problems in validation. Thus, the simpler behavior-oriented multi-agent simulation seems to a justified starting point for a study about alternatives.

Standard Methods for Modelling Concurrent Processes

Queuing Networks

Queuing Networks form an established formalism for performance analysis in production systems. Anderson [16] has already successfully applied this framework to the simulation of task portioning and its regulation between foraging and storing bees in a very simple scenario. Also, the scenario presented here can be interpreted as performance analysis under different interaction and environmental conditions.

Queuing networks are directed graphs. There are two different types of nodes, servers with or without a queue. Jobs are wandering along the network. The servers represent resources that the jobs have to be processed by. If the server is busy, the job has to wait in the queue in front of that resource. Every queue may have its special queuing discipline.

Connections between the different elements are either deterministic (without branching) or probabilistic (branching or merging).

Figure 2 shows a possible representation of the test scenario as a Queuing Net with the following properties:

- Waiting inside of the hive seems to be a problematic state, as the termination of this waiting state cannot be associated with a resource, but the internal state of a job. However jobs usually possess no internal structure.
- Returning to the same resource can be modeled with N different loops that deterministically lead one bee-job back to one particular resource. This makes the network rather complex, but allows representing spatial differences, like the travel time between hive and resource.
- The decision whether to recruit or not is depending on non-local information, but on some quasi-global value of energy state of the hive.
- Recruitment requires specifying at least two bee-jobs in particular activities, i.e. being processed by two servers in a synchronized way.

Petri Net

Petri nets have been accepted as a powerful formal speci-fication tool for a variety of systems including concurrent, distributed, asynchronous, parallel, deterministic and non-deterministic ones. It is mainly used for dealing with performability issues in systems with concurrent processes with local behavior.

Thus it seems to be providing an ideal framework for modeling a multi-agent system (see also [17]). According its basic definition, the core of a Petri net structure consists of a finite set of places and a finite set of transitions.

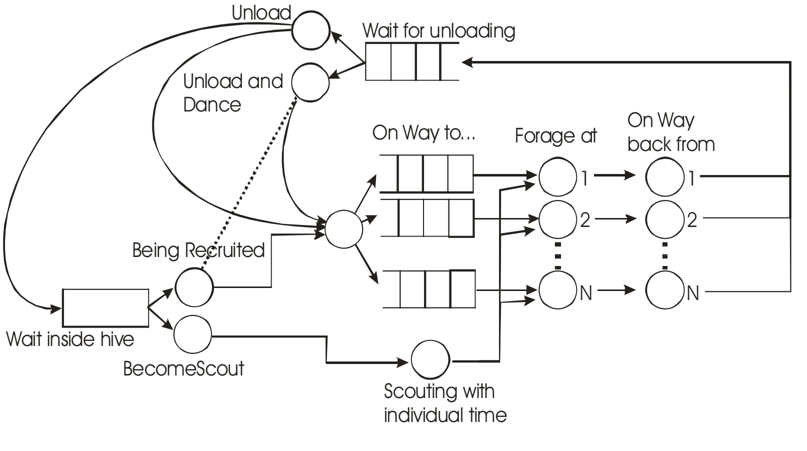

Figure 2: Attempt of formulating the model as a queuing network.
The dotted line tries to represent that the servers "dancing" and “being recruited" are depending. The box “wait inside hive” represents a waiting state the end of which end is not determined by a resource

Places can hold tokens (one or more tokens with or without colors).

The colors of the token represent its internal state and allow formulating behavior in reaction to this internal state. Between a place element and a transition element there are arcs, characterizing the flow of tokens.

Transitions may take time or may describe deterministic or stochastic events. In a colored Petri-net a transition or event may change the color that means it may change the internal state of the token.

In figure 3 an attempt for formulating the model using a Petri-net is depicted.

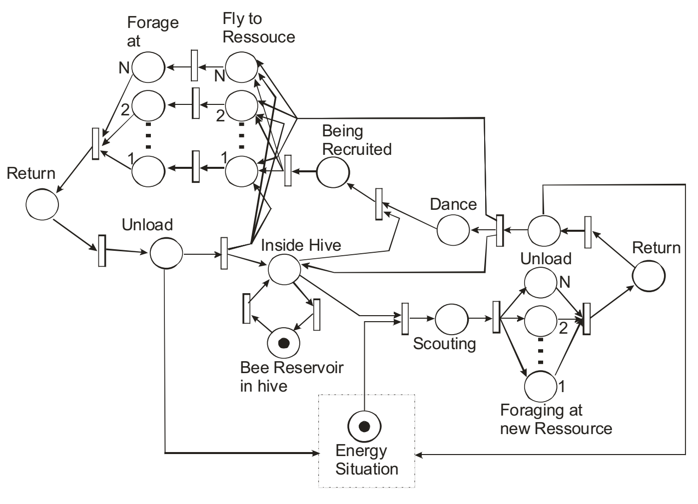

Figure 3: Attempt of formulating the model as a Petri-Net

The process of bee behavior with bees as tokens is modeled rather elegantly. The comparison to the quasi global value of energy level inside of the nest could not be represented in a satisfying way: the dotted box and lines just indicate this feature. As colored tokens may store the information about which resource was visited separated loops for the different resources are not necessary, but if the number of resources is changed, a different net has to be tested. Time delays – according to the duration of the flight to a resource – can be expressed in a timed Petri-net, when the transitions can only fire after the token has resided in the preceding places.

However, there are a few problems. In some situations it is necessary, that a transition fires when just one preceding place carries a token, resulting in just one succeeding place with a token (e.g. scouting → foraging at a new resource). Additionally it is not clear, how to integrate multiple recruitments, that characterize the situation when more than one bee is caused to fly to this resource, excited by a excellent new resource. The modeled feed-back loop - more bees are flying to a good resource than to a worse one – is therefore restricted to the effects of abandoning worse food sources.

Other Modelling Paradigms

A major problem of Petri-nets and Queuing networks is the total lack of mechanisms for representing inhomogeneous space. Flying times and the rate of discovering new resources based on more or less random movement can only be expressed in a very abstract way by stochastic terms.

The consequence is that either at every decision point involving abstracted space a probabilistic factor is used, or a fix amount of resources are distributed with predefined flying times, etc. A variable environment that is a central part of the original research effort could not be expressed except by changing the structure of the networks.

Cellular Automata, on the other side, can be seen as purely space based representations. However, one of the main properties of a Cellular Automaton is that uniform rules with purely local effects are associated with every cell. That means the rules for every cell are the same and just govern the behavior of this cell in relation to its neighborhood. An agent that is located on a cell can be represented by a certain state of this cell. However, the consequence is that even agent movement can only be expressed in rather complex way, as a rule can not change the state of more than one cell concurrently. Individual behavior of the agents also has to be integrated into that one uniform rule set. Therefore, Cellular Automata are seldom used for simulating multi-agent systems themselves, but are a popular mean for representing an environment, like in [18].

Multi-Agent Model

As the next step we present a simplified version of the model we actually used in the recruitment simulation project. The specification of a multi-agent model consists of several parts, the most important one is the description the agents with their sensors, effectors, interal states and decision making. Other parts relate to environmental aspects, agent relations and interactions [19]. The latter are often the most difficut part due to synchronization problems. In the following we just present the specification of the behaviour, i.e. the decision making, of the agent class. We developed a completely visual modelling and simulation environment that is able to directly interpret this specification-like representation for generating an executable multi-agent simulation. This environment is called SeSAm and is available via www.simsesam.de.

For the bee communication model the description of the decision making results in a behavior description. That means, that the bee agents are not defined using true reasoning capabilities but their behavior is explicitly described. Figure 4 shows the behavior of a bee agent in an enhanced UML activity diagram. This diagram specifies not only the different activities of one agent, but also the relations to the environment based on explicit interaction description [12]. The configuration of the complete model contains an additional description of the parametrized spatial environment and its dynamics.

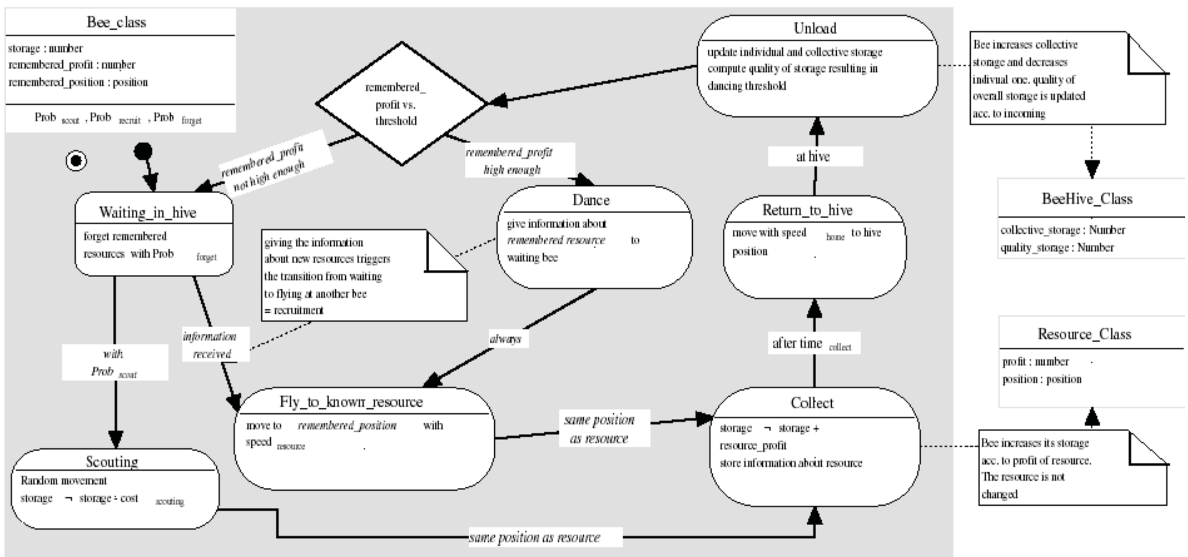

Figure 4: Bee behavior in a multi-agent version of the model (enhanced UML-activity graph

This kind of representation is very powerful. However, it lacks the formal conciseness of Petri-net or Queuing networks. Primarily, this representation is just a means for communication and does not resemble a precise and complete model.

The graph depicted in figure 4 is not directly comparable to the models given in figure 2 or 3, as in the latter the information in the formal figures is sufficient to simulate the model without ambiguity. The price for it is the aggregated and abstracted information that it contains.

Discussion and Conclusion

Based on the attempts to represent the same model in different frameworks one may propose some properties for a modeled system that advise the use of a multi-agent simulation.

- A multi-agent simulation is well suited, when feedback loops in the agent behavior are important, but the conditional behavior they are based on is not purely locally determined. The means, the decision making of the simulated entity is not only based on its local surroundings but must relate to more or less global properties or values.
- The formulation of flexible agent behavior has advantages to network structures with fixed connections, when feedback loops are not fixed. This is the case when the affected entities or even their number is not predefinable, or the existence of the feedback loop itself is depending on additional factors.
- When inhomogeneous space is relevant, then abstractions using stochastic terms for flight times, etc. might not always be sufficient to reproduce the effects of space onto different behavioral patterns, or at least make a valid representation of behavior unnec-essarily complex compared to an multi-agent model. The problem with traditional approaches seems to be still more sophisticated, when the configuration of the relevant spatial patterns is undergoing dynamic changes.
- When flexible conditional or adaptive individual behavior has to be formulated, then it could be easier to concentrate on the behavior of an agent than to describe a network that is passed through by a token, even if it carries an internal structure.
- Adaptivity of behavior was not a central point in this study, but is also an important feature that is rather directly representable in an agent-based model, whereas it causes problems in other modeling frameworks.
- When interactions with flexible individual participants have to be represented, then it might be hard to specify them using either uniform entities or predefined sequences of processes. When it is not irrelevant who the interaction partner of a particular agent is, or the agent may flexibly decide not to interact at all, then a focus on the agent, its behavior and reasoning is advisable. This is one of the most important advantages of multi-agent simulation. It consists in its ability to deal with unfixed interaction participants.

- Multi-agent models facilitate the simulation of variable agent numbers and variable structures at all. When an agent has to be erased or a new agent enters the scenario, it may start interacting with the other agents without complex re-configurations of the system.

As mentioned above, multi-agent simulation currently has a lot of drawbacks. The efford for a valid simulation behavior causes an immense effort on justification, modeling and simulation – for at least two levels of observation, for large parameter spaces, etc. The lack of a formal framework makes the unambiguous presentation of a model a rather hard task. Thus, there some properties of the original system that on the other hand make the method of multi-agent simulation not advisable, although it seems to become a rather popular method.

- If it is not clear, what parts of the system can be identified as agents, then multi-agent simulation is not apt. Components with simple non-autonomous behavior or systems with fixed direct connections between components can be tackled with traditional methods.
- If the considered space has a large extension or the agent numbers are huge, then an abstraction of homogeneous space and homogeneous societies may still be satisfying due to averaging effects. A macro simulation approaches might be sufficient. One has to regard that a simulation of millions of agents takes very much time, especially compared to the computations necessary for simulating a set of differential equations.
- If a formal analysis of the model without simulating is necessary, e.g. for detecting deadlocks, etc., then a modeling method resulting in an exact and explicit model is necessary. Such a modeling method does not yet exist for multi-agent models. This restriction might change as there is a lot of ongoing work about formal specification aiming at tools for software specification and verification.

As a conclusion one might state that multi-agent simulation is not a new modeling paradigm that solves every problem of the established ones. But it has many advantages, so that its application in particular domains that deal with real-life multi-agent systems, e.g. biology or sociology is very promising. However, formal frameworks and methods for actually designing and simulating a multi-agent model are somehow immature, therefore theorists and practitioners in multi-agent simulation can learn a lot from established modeling techniques.

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Mechanical Modeling and Simulation of the Human Movement on a Rowing Ergometer

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…. deals with the development of a biomechanical model of the human body,

…. develops a mechanical concept to model the behavior of a rowing ergometer which works with a ventilator,

…. solves the inverse problem to calculate the muscle forces that appear during the human movement on a rowing ergometer,

…. and solves the direct dynamic problem taking the muscle dynamics into account

Abstract

The work at issue deals with the development of a biomechanical model to simulate the human movement on a rowing ergometer. This model is subsequently used to solve the inverse and the direct dynamic problem.

The developed rigid-body model represents a planar 8-link kinematic chain. The links are connected by idealized joints. A resistance mechanism of the ergometer working with a ventilator was assumed for the simulations. The considered muscles develop moments at the idealized joints which move the rigid-body model. The applied biomechanical muscle-tendon model consists of several spring-elements and one contractile element.

For solving the inverse problem the model was used to calculate the courses of the muscle forces during a predetermined human motion on a rowing ergometer. The joints are spanned by more muscles than there are degrees of freedom. This results in underdetermined systems of equations with more unknown muscle forces than equations. In order to solve this task an optimization criterion was minimized under the consideration of corresponding constraints. The calculated courses of muscle forces essentially agree with electromyographic measurements reported in the literature.

Solving the direct dynamic problem the neural excitations of the considered muscles were predetermined to simulate the human movement on a rowing ergometer.

The motion of the mechanical model was calculated by using the neural excitations, the biomechanical muscle-tendon model, the joint geometries and the equations of motion.

Introduction

In the past several researchers studied the biomechanical aspects of ergometer rowing. Hawkins [1] constructed a dry-land rowing system which provides immediate feedback on the rowers joint kinematics, pulling force and pulling power throughout a rowing stroke. Torres-Moreno et al. [2] measured joint excursion, handle velocity and applied handle force of several subjects on an instrumented rowing ergometer. Pudlo et al. [3] described the external efforts at the contact points of the rower and the environment. Macfarlane et al. [4] developed a portable data-acquisition system to measure the stroke-by-stroke power output and the force at the feet during simulated ergometer rowing. Rodriguez et al. [5] used electromyography to study muscle activity in the upper and lower extremities and in the torso during the rowing stroke on a rowing ergometer. Peltonen et al. [6] measured among other things electromyographic signals of several muscles during ergometer rowing.

The objective of this project was to establish a biomechanical model to simulate the human movement on a rowing ergometer.

Models of the Extremities

The human body is modeled as a rigid-body system. In order to establish such a model the inertial properties of the human segments must be determined. For this purpose the mathematical model of the human body from Hanavan [7] was used.

The segments of the body are represented by rigid bodies of simple geometric shape with uniform density. The dimensions and inertial properties of the model are calculated using 25 anthropometric dimensions. Here the anthropometric data of a body with a height of 1.8 m and a mass of 80 kg was used.

The upper extremity is modeled by a planar system of two rigid bars representing the upper and the lower arm (Fig. 1). The shoulder joint S, the elbow joint E and the hand joint H are each replaced by frictionless hinge joints with one degree of freedom.

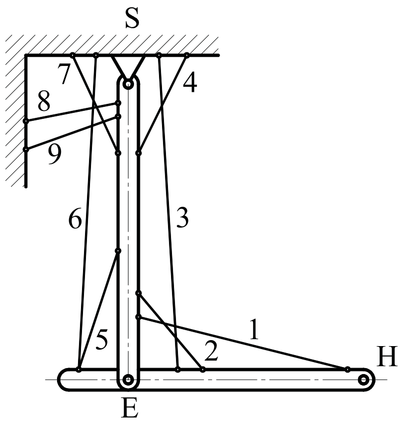

Figure 1: Model of the upper extremity with Brachioradialis (1), Brachialis (2), Biceps (3), Deltoideus anterior (4), Triceps group (5), Triceps caput longum (6), Deltoideus posterior (7), Teres group (8), Latissimus dorsi (9), hand joint H, elbow joint E and shoulder joint S.

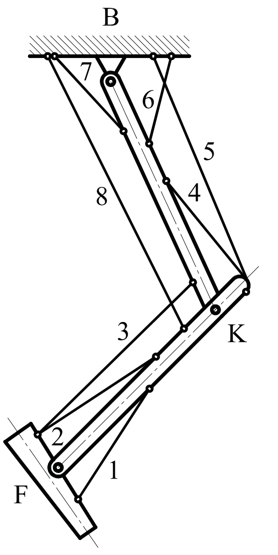

Figure 2: Model of the lower extremity with Tibialis anterior (1), Soleus (2), Gastrocnemius (3), Vastii (4), Rectus femoris (5), Iliopsoas (6), Glutaeus maximus (7), Hamstrings (8), hip joint B, knee joint K and foot joint F.

In the model of the upper extremity the following muscles are considered: Brachioradialis, Brachialis, Biceps caput longum, Biceps caput breve, Deltoideus pars clavicularis, Triceps caput mediale, Triceps caput laterale, Triceps caput longum, Deltoideus pars spinalis, Teres major, Teres minor, Latissimus dorsi pars vertebralis, Latissimus dorsi pars iliaca and Latissimus dorsi pars costalis.

In order to keep the number of the considered muscles at a comprehensible magnitude muscles with the same function and similar muscle parameters are combined into groups. The Biceps caput longum and the Biceps caput breve form a group named Biceps. The Triceps caput mediale and the Triceps caput laterale are also combined in a group. At the shoulder the Teres major and the Teres minor unite to the Teres group. Finally the Pars vertebralis, the Pars iliaca and the Pars costalis are merged to form the Latissimus dorsi group.

Data on the moment arms of the considered muscles was mainly taken from [8], [9] and [10]. Muscle parameters were mainly taken from [11] and [12]. The used physiological cross sectional areas represent average values from available sources. The parameters of the muscle groups were calculated from weighted averages with the corresponding parameters of the combined muscles.

The lower extremity is modeled by a planar system of two rigid bars, representing the thigh and the lower leg, and a rigid foot element (Fig. 2). The hip joint B, the knee joint K and the foot joint F are each replaced by frictionless hinge joints with one degree of freedom.

In the model of the lower extremity the following muscles are considered: Tibialis anterior, Soleus, Gastrocnemius caput mediale, Gastrocnemius caput laterale, Vastus intermedialis, Vastus medialis, Vastus lateralis, Rectus femoris, Iliactus, Psoas, Glutaeus maximus, Biceps femoris caput longum, Semimembranosus and Semitendinosus. The Gastrocnemius caput mediale and the Gastrocnemius caput laterale form a muscle group named Gastrocnemius. The Vastus intermedialis, the Vastus medialis and the Vastus lateralis are combined in a group called Vastii. In the hip joint the Iliactus and the Psoas are merged to form the Iliopsoas group. Finally the Biceps femoris caput longum, the Semimembranosus and the Semitendinosus unite to the Hamstrings group.

Data on the moment arms of the considered muscles was taken from [13]. The muscle parameters were taken from [13] and [14]. The used physiological cross sectional areas are taken from [13] and [15]. The parameters of the muscle groups were calculated from weighted averages with the corresponding parameters of the combined muscles.

Muscle-Tendon Model

The considered muscles develop moments at the idealized joints which move the mechanical model. The muscle-tendon model is based on [16], [17] and [18]. This model consists of a muscle model in series with a tendon element SE and a rigid beam representing the aponeurosis of the muscle (Fig. 3). The muscle model itself consists of a contractile element KE, a series elastic element SEE and a parallel elastic element PEE.

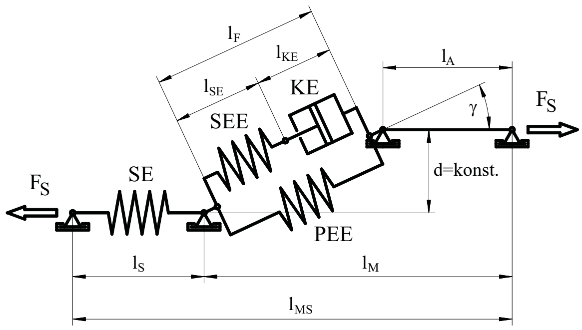

Figure 3: Muscle-tendon model with contractile element KE, series elastic element SEE, parallel elastic element PEE, tendon element SE, tendon force F_S, muscle fiber length l_F, length of the series elastic element l_{SE}, length of the contractile element l_{KE}, tendon length l_S, muscle length l_M, length of the muscle-tendon unit l_{MS}, aponeurosis length l_A, muscle thickness d and pennation angle γ.

The contractile mechanism of a muscle is modeled by a Hill-type contractile element KE which represents the muscle's force-length and force-velocity properties. The series elastic element SEE mainly represents the behavior of closed cross bridges between myosin and actin filaments. The behavior of the passive tissues inside and outside of the muscle is modeled by a parallel elastic element PEE. The behavior of the tendon element SE is determined by a dimensionless force-strain curve [19]. The most important assumptions that were made for the whole muscle-tendon model are that all the sarcomeres are homogeneous, all muscle fibers are parallel and insert under the same pennation angle γ into the tendon, the thickness of the muscle d stays constant, the aponeurosis is rigid and effects of fatigue are neglected. All these assumptions together allow the derivation of a first order differential equation for the tendon force F_S:

$$\frac{dF_S}{dt} = f\left(F_S, l_{MS}, v_{MS}, \alpha\right)$$

In this equation v_{MS} represents the shortening velocity of the muscle-tendon unit which is the first derivative of the muscle-tendon length l_{MS} with respect to time. The correlation between the activation function α, which describes the fraction of troponin that is bound to calcium ions, and an idealized neural input is modeled by a system of two first order differential equations [11]. These idealized neural inputs are here described by rectangular impulses, the heights represent the activation niveaus.

Mechanics of rowing ergometers

In principle a rowing ergometer consists of a frame which carries all the functional units of the ergometer. The experimentee is sitting on a sliding seat. The feet are positioned on a footplate where they are fastened by means of straps. The handle is connected to the resistance mechanism of the ergometer via a rope or a chain. This mechanism causes the force at the handle which the experimentee has to overcome during the drive phase (Fig. 4).

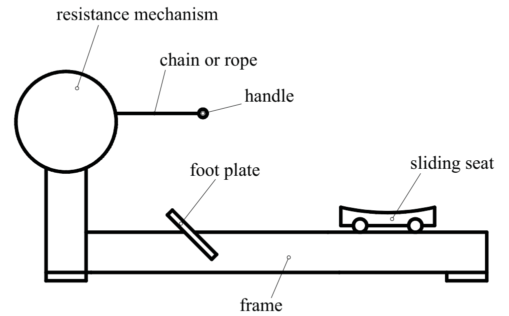

Figure 4: Schematic design of a rowing ergometer.

For the simulations a resistance mechanism of the ergometer is assumed that works with a ventilator. The behavior of this mechanism is modeled as shown in the model diagram (Fig. 5).

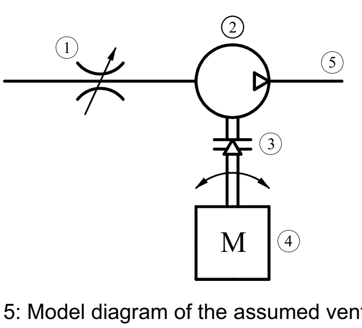

Figure 5: Model diagram of the assumed ventilator resistance mechanism with throttle valve (1), ventilator (2), clutch (3), drive unit (4) and pipeline (5).

The ventilator (2) is driven by the drive unit (4) and delivers air through the frictionless pipeline (5). All flow resistances are considered in the throttle valve (1). The ventilator (2) and the drive unit (4) are connected by a shaft and a clutch (3). The drive is managed by the experimentee via the handle.

The behavior of the ventilator is modeled by Euler's principal equation for flow machinery [20]. Furthermore, the air flow is assumed to enter the rotor momentum-free and to exit the rotor radially. All the friction losses are assumed to appear in the throttle valve and are set proportional to the square of the corresponding flow velocity

From the mechanical point of view all parts of the resistance mechanism are mod eled as rigid and massless. The handle is assumed to move only horizontally and is fixed to a gear rack which is in contact with a gear wheel. This wheel is connected to the ventilator by the shaft and the clutch. Under these assumptions the following equation can be derived for the handle force in the drive phase:

$$L = k_L \cdot v_H^2$$

In this equation v_H represents the horizontal handle velocity and k_L a mechanism dependent parameter. This parameter depends on the density of the air, the diameter and the resistance number of the throttle valve, the outlet diameter of the ventilator and the pitch circle of the model gearing. In the recovery phase the clutch is open and the force at the handle is zero. The behavior of the modeled ventilator resistance mechanism can consequently be represented by a nonlinear damping element.

Mechanical Model

The mechanical rigid-body model of the whole experimentee-ergometer system represents a planar 8-link kinematic chain (Fig. 6). The model consists of the lower leg segment (1), the upper leg segment (2), the lower torso segment (3), the upper torso segment (4), the head segment (5), the upper arm segment (6), the lower arm segment (7), the frame, the link-block guide in the hip joint B, the link-block guide in the hand joint H and a nonlinear and massless damping element to model the behavior of the ventilator resistance mechanism. The connection of the lower torso segment (3) and the upper torso segment (4) at the contact point T is assumed to be rigid. The upper torso segment (4) is bent forward by the torso angle φ_T against the lower torso segment (3). The connection between the upper torso segment (4) and the head segment (5) at the neck N is also assumed to be rigid. The head segment (5) is bent backwards by the head angle φ_K against the upper torso segment (4). The torso and the head are modeled as one rigid element. The models of the upper and the lower extremities are mounted on the torso-head element at the shoulder joint S and at the hip joint B. The mechanical model comprises seven frictionless hinge joints and 2 frictionless sliding joints with one degree of freedom each. The used inertial reference frame x_0-z_0 has its origin in the foot joint F.

The mechanical model has three degrees of freedom. The angle φ_1 between the z_0 axis of the inertial reference frame and the lower foot segment (1), the angle φ_3 between a horizontal line and the lower torso segment (3) and the angle φ_6 between a horizontal line and the upper arm segment (6) are chosen as degrees of freedom. The link-block guides in the hip joint B and the hand joint H are assumed to be massless. The foot joint is fixed in the inertial reference frame x_0-z_0. The height b of the hand joint H over the foot joint F and the height a of the hip joint B over the foot joint F are assumed to be constant.

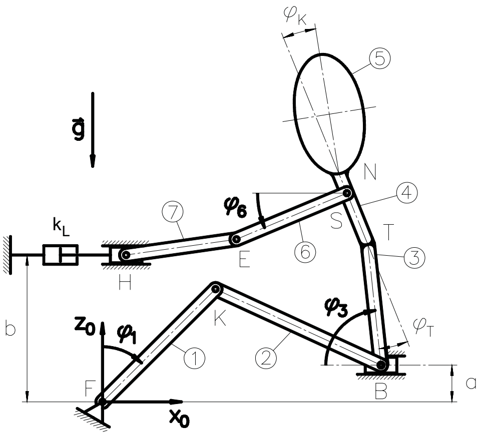

Figure 6: Mechanical model with the lower leg segment (1), the upper leg segment (2), the lower torso segment (3), the upper torso segment (4), the head segement (5), the upper arm segment (6), the lower arm segment (7), the foot joint F, the knee joint K, the hip joint B, the contact point between the lower torso segment and the upper torso segment T, the neck N, the shoulder joint S, the elbow joint E, the hand joint H, the damping element k_L to model the behavior of the ventilator resistance mechanism, the height b of the hand joint H over the foot joint F, the height a of the hip joint B over the foot joint F, the foot angle φ_1, the hip angle φ_3, the torso angle φ_T, the head angle φ_K, the arm angle φ_6 and the inertial reference frame x_0-z_0.

The equations of motion were derived using the Newton-Euler equations. The kinematics of the system are restricted by constraint equations.

Passive Joint Moments

Every biological joint is spanned by passive structures like for instance ligaments, joint capsules and passive muscle components. These structures develop moments at the joints which can be divided into elastic components and damping components [21, 22, 23]. In this study the elastic portion has been neglected. The damping components were considered by linear damping elements in the foot joint F, the knee joint K, the hip joint B, the shoulder joint S and the elbow joint E of the mechanical model (Fig. 7).

For the damping elements of the lower extremity the damping coefficients reported by [22] have been used. For the damping elements of the upper extremity appropriate damping coefficients have been estimated.

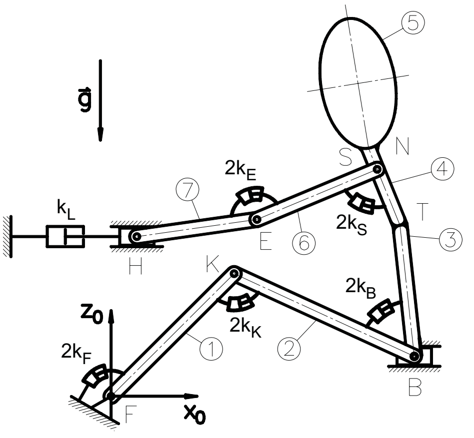

Figure 7: Mechanical model with passive foot damping element $2 \cdot k_F$, passive knee damping element $2 \cdot k_K$, passive hip damping element $2 \cdot k_B$, passive shoulder damping element $2 \cdot k_S$ and passive elbow damping element $2 \cdot k_E$.

Inverse Problem

Within the framework of the inverse problem the developed mechanical model is used to calculate the courses of the muscle forces during the human movement on a rowing ergometer. In order to reach this objective the inverse problem is split up into two subproblems: the determination of the joint moments and the calculation of the muscle forces. [22, 24].

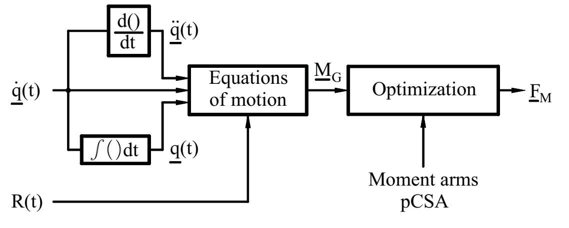

Figure 8: Process of solving the inverse problem with vector of generalized coordinates $\underline{q}(t)$, seat force R(t), vector of joint moments $\underline{M}_G$, physiological cross sectional areas pCSA and vector of muscle forces $\underline{F}_M$.

In order to calculate the joint moments the movement of the mechanical model must be predetermined. The mechanical model has three degrees of freedom (foot angle φ_1, hip angle φ_3, arm angle φ_6, Fig. 6) which are contained in the vector of generalized coordinates $\underline{q}(t)$. In this study the movement is predetermined by means of the first derivatives of the three degrees of freedom with respect to time (Fig. 8). For the formulation of these angular velocities importance was attached to the fact that the resulting courses of the segment angles are realistic. For the simulations a duration of the movement cycle, which consits of a drive phase and a recovery phase, of 2 seconds is assumed.

The reversal position should appear after 0.85 seconds. In order to calculate all the joint moments another quantity is necessary. For this purpose the seat force R(t) between the seat and its guideway was also predetermined. The formulation of the seat force R(t) was developed based on the measurements reported by [3]. The angular velocities and the seat force are described using polynomials.

All the considered joints are crossed by more muscles than there are degrees of freedom thus producing underdetermined systems of equations with more unknown muscle forces than equations. This so called distribution problem was solved by using mathematical optimization (Sequential Quadratic Programming) and the physiologically related cost function proposed in [25]:

$$U = \sum_{i=1}^{m} \left(\frac{F_i}{pCSA_i} \right)^n \rightarrow Minimum$$

In this criterion m is the number of muscles crossing the joint, F_i is the tensile muscle force and $pCSA_i$ is the physiological cross sectional area. Here the value of 2 was selected for the exponent n.

Furthermore there are constraints to be obeyed in the optimization process. First, neglecting the influence of ligaments and contact forces, the calculated joint moment $\underline{M}$ in each of the considered joints must represent the sum of the moments developed by the k muscles crossing the corresponding joint. The moment produced at one specific joint can be computed using the muscles moment arms $\underline{r}_j$ and forces $\underline{F}_j$:

$$\underline{M} = \sum_{j=1}^{k} \left(\underline{r}_j \times \underline{F}_j \right)$$

Secondly all the muscle forces F_j must be positive because muscles are only able to develop tensile forces. Additionally all muscle forces shall be smaller than the corresponding tetanic muscle forces F_j^{tet} at each instant of time. This constraint can be expressed by the following equation:

$$0 \leq F_j \leq F_j^{tet}$$

The Triceps caput longum (Fig. 9) develops a relatively high force in the drive phase to move the upper arm to the torso against the resistance at the handle. In addition this muscle prevents the elbow joint, where the muscle moment arms are smaller than at the shoulder joint, from too high flexion. The Triceps caput longum reaches the highest force value of all the considered muscles in the model of the upper extremity with a maximum of 893 N which occurs after 0.32 s.

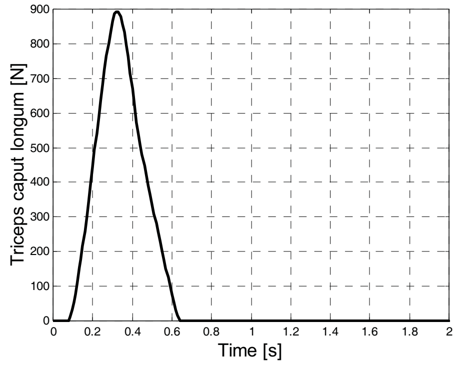

Figure 9: Force of the Triceps caput longum.

The Vastii develop a considerable force (Fig. 10) at the beginning of the drive phase which leads to the extension of the knee joint. This muscle group reaches the highest peak force of 4945 N of all considered muscles in the lower extremity model in the drive phase at 0.3 s. At the end of the movement cycle the Vastii are again active and decelerate the flexing movement of the knee joint.

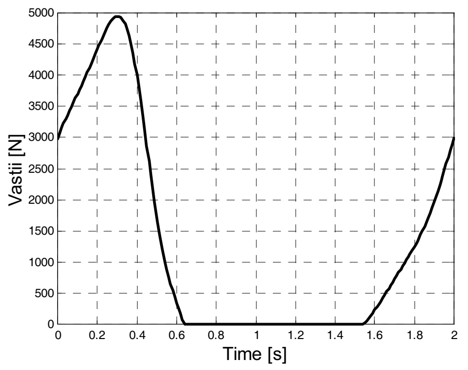

Figure 10: Force of the Vastii.

Direct Dynamic Problem

Within the framework of the direct dynamic problem the human movement on a rowing ergometer was simulated using idealized neural inputs of the considered muscles. In order to reach this objective the dynamic behavior of the muscles must be considered. For this purpose the mechanical model is combined with the muscle-tendon model.

For the simulations the duration of one movement cycle, which consists of drive and recovery phase, is assumed to be 2 seconds like in the solution of the inverse problem.

The three degrees of freedom of the mechanical model (foot angle φ_1, hip angle φ_3, arm angle φ_6, Fig. 6) are contained in the vector of generalized coordinates $\underline{q}(t)$. The idealized neural excitations of the considered muscles are included in the excitation vector $\underline{e}(t)$ (Fig. 11) and represent rectangular impulses between beginning and end of the neural excitation. The height of these impulses can be associated with the activation niveau which reaches the value of 1 if the muscle is fully activated.

If a muscle is active at the beginning and the end of the movement cycle the neural excitation is described using two rectangular impulses. If the muscle activation niveau jumps from one niveau to another a resulting neural excitation is constructed by summing up two rectangular impulses. All idealized neural excitations consist of maximal two impulses.

The mathematical formulation of the excitation vector $\underline{e}(t)$ was established using the solutions of the inverse problem and measured electromyographic data from literature [5, 6]. In the simulation parameters were adopted. During this process it was tried to reach the reversal position after the same time interval as defined in the framework of the solution of the inverse problem.

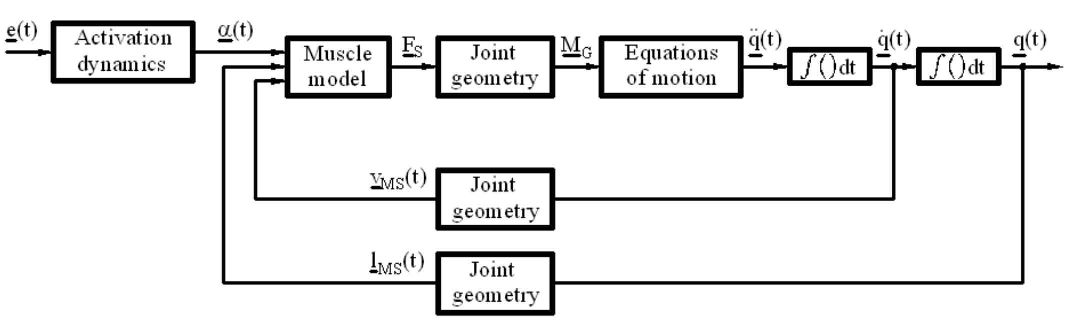

Figure 11: Process of solving the direct dynamic problem with the excitation vector $\underline{e}(t)$, the activation vector $\underline{\alpha}(t)$, the tendon force vector $\underline{F}_S$, the joint moment vector $\underline{M}_G$, the vector of generalized coordinates $\underline{q}(t)$, the vector of velocities of the muscle tendon units $\underline{v}_{MS}$ and the vector of lengths of the muscle tendon units $\underline{l}_{MS}$.

With the relationships of the activation dynamics the excitation vector $\underline{e}(t)$ can be used to calculate the activation vector $\underline{\alpha}(t)$ (Fig. 11).

This vector contains the activation status of all considered muscles. In the next step the tendon force vector $\underline{F}_S$ is computed using the activation vector $\underline{\alpha}(t)$, the length vector $\underline{l}_{MS}$ of the considered muscle tendon units, the velocity vector $\underline{v}_{MS}$ of the considered muscle-tendon units and the muscle-tendon model. The lengths and the velocities of the muscle-tendon units can be calculated with the corresponding moment arms in connection with the vector of generalized coordinates $\underline{q}(t)$ and its first derivative with respect to time.

Once the tendon forces $\underline{F}_S$ of the considered muscles are known the vector of the joint moments $\underline{M}_G$ can be computed using the modeled joint geometries. Inserting the joint moments into the equations of motion and integrating twice delivers the movement of the mechanical model.

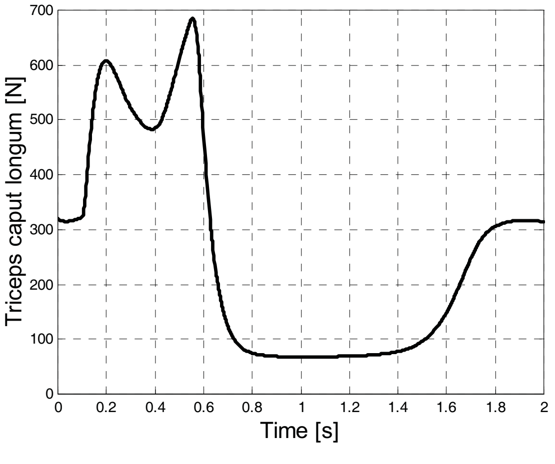

Figure 12: Force of the Triceps caput longum.

The Triceps caput longum (Fig. 12) is neurally excited to 73 % of the maximum activation between 0.1 s and 0.54 s and reaches the highest force value of all considered muscles in the upper extremity model. In the drive phase, where the maximum tendon force of 685 N appears after 0.553 s, this muscle moves the upper arm to the torso against the force at the handle generated by the ventilator resistance mechanism.

This muscle at the same time causes an extension of the elbow joint which is more or less compensated at the end of the drive phase by the flexors of the elbow joint in order to enable the handle to move towards the torso.

The muscle contraction is very high in the middle of the drive phase which leads to the local force minimum after about 0.4 s. The length conditions are relatively unfavourable except in the middle of the movement cycle where they are almost optimal.

At the beginning of the drive phase and the end of the recovery phase the parallel elastic element is stretched bejond its rest length. This fact leads at the end of the movement cycle to a deceleration of the upper arms movement into its starting position and an extension of the elbow joint.

The Vastii are the most important extensors of the knee joint (Fig. 13) and reach the highest force values of all the considered muscles in the model of the lower extremity. This muscle group is neurally excited to 69.8 % of the maximum activation between 0 s and 0.54 s and extends the knee joint in the drive phase. The length conditions are optimal at the end of the drive phase and the beginning of the recovery phase.

The force maximum of 4369 N is reached after 0.431 s. At the beginning and at the end of the movement cycle the parallel elastic element is stretched and thus causes the tendon force to rise. At the end of the recovery phase this increased tendon force causes the flexing movement of the knee joint to decelerate.

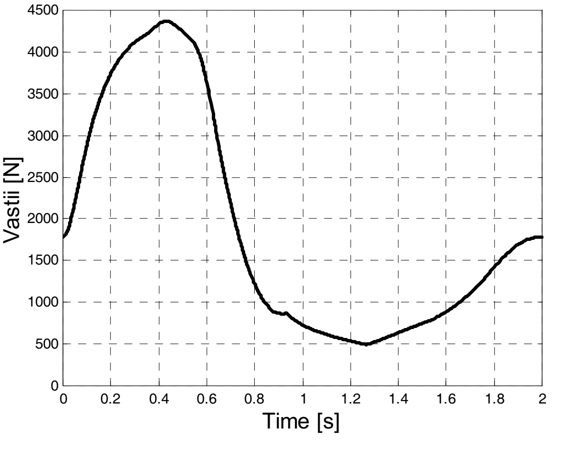

Figure 13: Force of the Vastii.

Conclusions

This paper describes the development of a biomechanical model which was established to simulate the human movement on a rowing ergometer and the assumptions which were made in the modeling process. The muscle forces that were calculated solving the inverse problem show good accordance with measured muscle activations.

The solution of the direct dynamic problem leads to a compareable movement of the mechanical model [26].

In the next step the construction of a test rig is planned to perform a validation of the model. Furthermore this model is in the mediate future intended to be used to enable paraplegic patients to move on a rowing ergomter with the help of functional electrical stimulation.

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SHORT NOTES

Efficient Modelling, Simulation and Optimisation of Mechatronical Components with Mathematica

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…. sketches the application of Computer Algebra Systems (CAEs) for mechatronic components
…. shows a Mathematica case study for the optimisation of a pressure-dependent valve,
… and underlines the benefits of the semi-analytical (semi-symbolical) approach in comparison with pure numerical approaches

Introduction

The constant rising pressure for innovations and shorter development cycles leads to an increasing use of mechatronical components. With the development of mechatronical components new simulation methods are demanded due to the close connection of different technical disciplines. The computer algebra simulation represents a method, in order to develop mechatronical components efficiently.

How does the simulation with Mathematica look?

In order to understand, how the simulation with computer algebra is optimally used, the internal structure of a mechatronical system is to be clarified.

The close connection of most different technical disciplines is the base of the internal structure. For the simulation with CALS the following proceeding results

1. The base of the entire process is the mathematical model which contains the substantial components of the physical system.
   The model is ideally compared with measurements or a detailed FEM/ MKS simulation for a parameter set. This verifies the model is sufficiently close to reality.
2. Based on the mathematical model an automated parameter variation with automatic analyses of sensitivity and the extraction of the characteristics of the system is done.
3. Based on the insights by the parameter variations an automatic optimization is computed. The optimum depends on the practical constraints of the system.

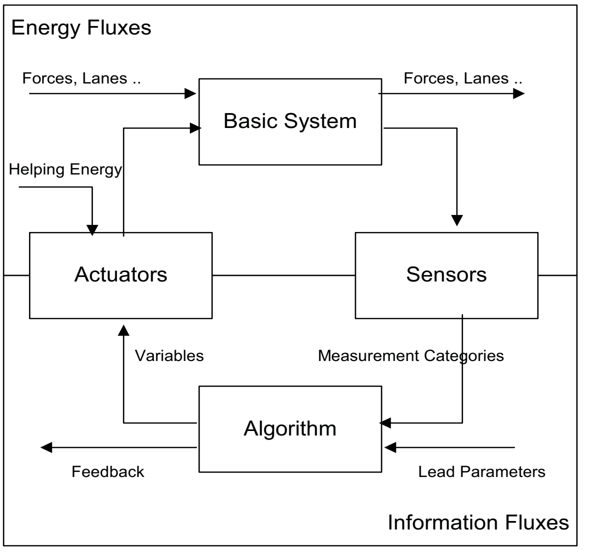

Fig.1: Internal structure of a mechatronical system

Optimization of a pressure-dependent valve

A pressure-dependent valve is linked up by a spring and separates two volumes. Increasing the pressure inside the volume opens the valve. Thus liquid or gas between the two volumes flows adjusts the pressure and closes the valve. How does the preloading of the spring and the spring stiffness influence the system time and the total volume through the vent?

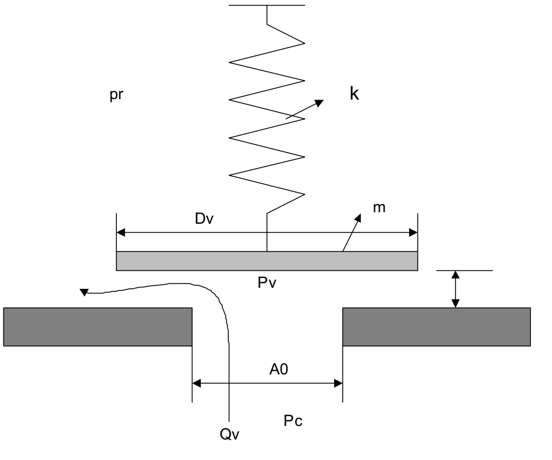

Fig.3: Sketch of the vent system

Definition of the differential equation of the movement of the vent

$$mx''(t) = F_m - F_{pre} + A_v \cdot \Delta p_v - k \cdot x(t) - c_1 \cdot x'(t)$$

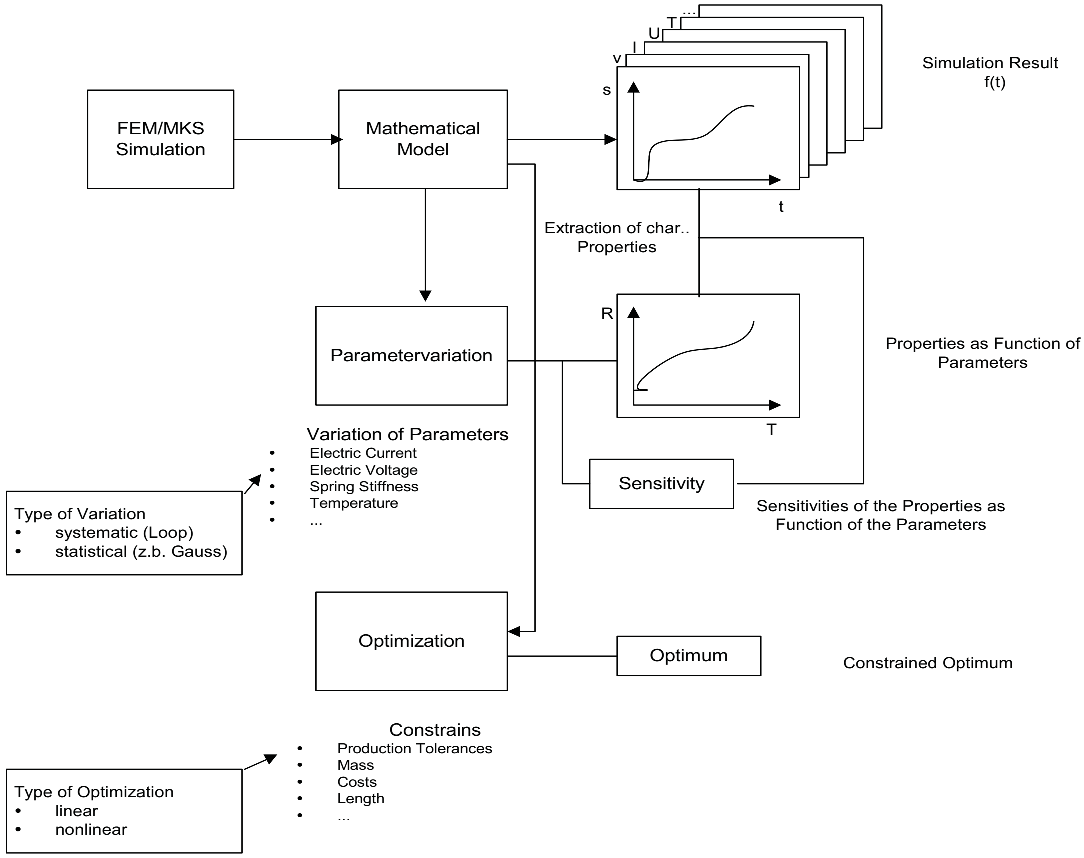

Fig.2: Typical simulation process with CALS

Definition of the Pressure in the volume

$$P_r'(t) = \frac{Q_v}{V \cdot \alpha}$$

with the following definitions

A_v Ventarea

Δp_v Pressure difference

m Mass of the vent

k Stiffness of the spring

c_1 Damping constant

F_m Force caused by the flow of the fluid

Q_v Volumeflow

V Volume

α Compressibility

Inserting all this and the equations for the movement and the pressure results in the following two equations

$$m \cdot x''(t) =$$

$$= \frac{1}{4}\pi \left(\frac{P_c \pi^2 D_0^4 + D_v^2 \pi^2 P_r(t) \cdot x^2(t)}{\frac{\pi^2 D_0^4}{4} + D_v^2 \pi^2 \cdot x^2(t)} - P_r(t) \right) \cdot D_v^2 +$$

$$+ \frac{2 C_d^2 D_0^2 \pi \left(P_c - P_r(t)\right) \cdot x^2(t) \cdot D_v^2}{D_0^4 + 4 D_v^2 \cdot x^2(t)} -$$

$$- F_{pre} - k \cdot x(t) - c_1 \cdot x'(t)$$

$$P_r'(t) = \frac{C_d D_v \pi \cdot x(t) \sqrt{\frac{D_0^4 \left(P_c - P_r(t)\right)}{D_0^4 + 4 D_v^2 \cdot x^2(t)}}}{\sqrt{2} \cdot V \cdot \alpha}$$

All symbolic calculation is performed By Mathematica, as well as the following numerical evaluations.

Numerical Results

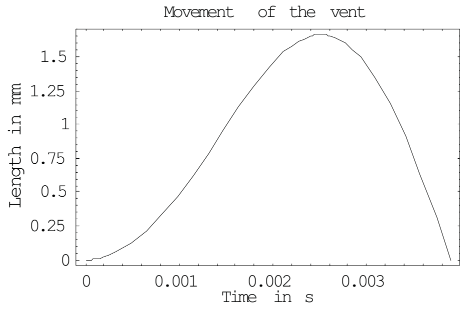

Fig.4: Movement of the vent

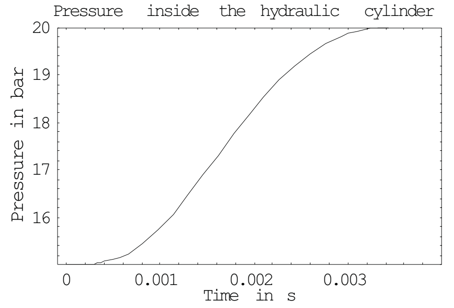

Fig.5: Pressure in the volume

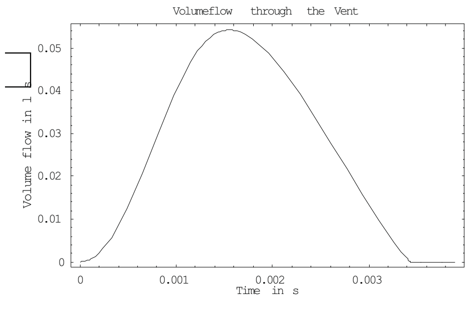

Fig.6: Volumeflow as function of time

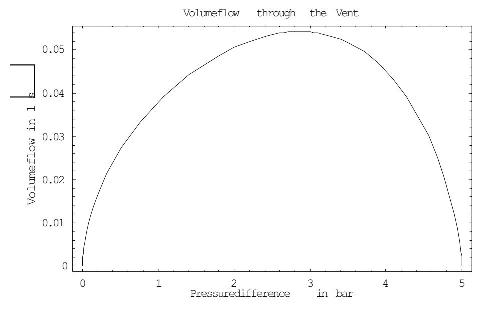

Fig.7: Volumeflow as function of pressure difference

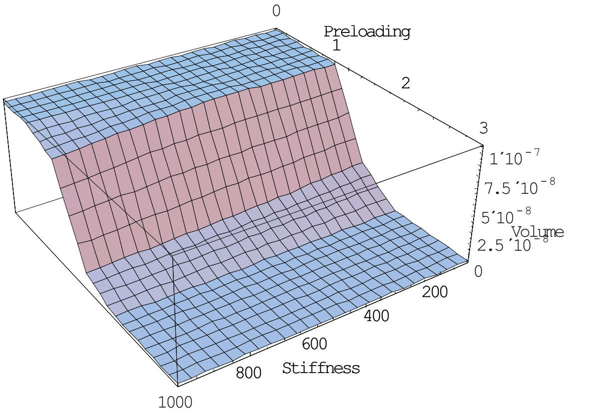

Fig.8: Total Volume through the vent as function of preloading and stiffness

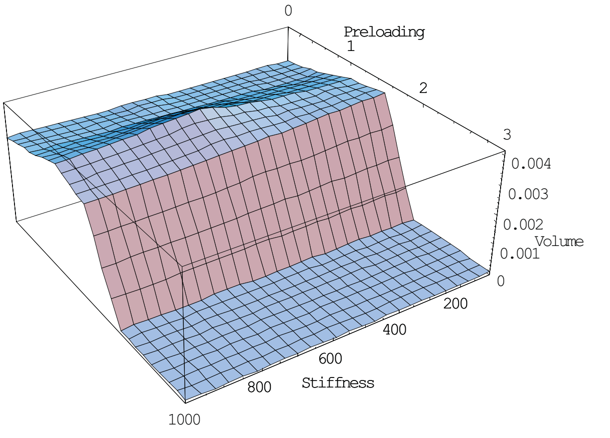

Fig.9: Cycle time as function of the spring stiffness and the preloading of the spring

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Comparing Pentium 4 and Athlon Execution Speeds in Simulation Tasks

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…. compares execution speeds of Pentium 4 and Athlon processors in simulation tasks,
…. makes use of the portable simulator DESIRE, using different implementations (Windows, Linux),
… and investigates classical benchmarks (Flight Simulation, PHYSBE) and new benchmarks (Monte-Carlo simulations, neural network)

Description of Benchmarks

Our table compares execution times obtained with Intel Pentium 4 and AMD Athlon processors and different compiler optimizations for 5 typical dynamic-system simulation tasks, viz.

- 3-dimensional flight simulation with bang-bang autopilot (Hidinger benchmark), [1] 16 differential equations
- Vectorized Monte Carlo simulation of 500 2-dimensional torpedo runs, [1,2] 6 differential equations replicated 500 times, effectively 3000 differential equtions
- Vectorized Monte Carlo simulation of 250 cannon-ball trajectories [1,3], 4 differential equations replicated 250 times, effectively 1000 differntial equations
- PHYSBE blood-circulation simulation,[1] 7 differential equations
- Neural-network simulation (backpropagation, 360 synapses) [4]

We used DESIRE simulation software under Linux and Windows 2000; relative execution times would be rather similar with Fortran-based simulation software such as ACSL except for the Monte Carlo simulations (DESIRE compiles vectorized Monte Carlo directly).

Discussion of Results

Our portable Linux program is written in standard ANSI C. We also show results for the Windows version, which uses Pentium-III-optimized assembly language.

This is, of course, faster than the c program, but true assembly-language optimization specifically for the Pentium 4 processor would be far too expensive, as it already is for RISC machines. The c-program comparisons are, therefore, the most significant.

Processor-specific C-compiler-optimization switches (**-march = Pentium 4**) are seen to speed simulation substantially. The GNU gcc 3.2 compiler did this very well, and the Intel Version 7 compiler (designed specifically to improve Pentium 4 performance) did even better. Even so, the 1-GHz AMD Athlon/DDR machine outran the 1.4 GHz Pentium 4 with its somewhat faster RDRAM memory. This is probably so because scientific computation naturally produces false branch predictions which repeatedly stall the Pentium 4's long processor pipelines.

As a minor point, c-compiler loop-unrolling (**-funroll-all-loops** for the gcc compiler, implicit in the Intel compiler) improved speed mainly for the neural-network problem, which does double-loop matrix computations. This is true because DESIRE always unrolls simple vector and dot-product loops without relying on the c compiler. [3]

Our comparisons used the standard Pentium versions of both operating systems. For truly optimal Pentium 4 performance one ought to recompile the operating system as well as the user program with **-march = Pentium 4**. While that is easy enough to do for Linux, it is not likely to happen for Windows.

More recent versions of the Pentium 4 and Athlon processors, with faster clock rates, faster front-side buses and memories, plus larger L2 caches, would roughly halve the execution times shown. The new 64-bit Athlon 64, which is already accommodated by the GNU gcc 3.2 c-compiler, will be even faster.

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BENCHMARK PERFORMANCE FOR 4 DYNAMIC-SYSTEM SIMULATION TASKS					
	Benchmarks with relative execution times smaller numbers are better				
CPU, memory, and gcc or icc COMPILER FLAGS	Flight Simulation	Torpedo Mt. Carlo	Ballistics Mt. Carlo	Blood Circulation	Neural Network
PROGRAM written in C					
1.4 GHz Pentium 4 (Willamette), 128 Mb RDRAM 800, gcc 3.2 (Red Hat Linux 8)					
-O3	3,4	2.0	1,5	1,5	37
-O3 -pipe -fomit-frame-pointer	3,2	2,0	1,5	1,5	35
… same with -funroll-all-loops	3,1	1,9	1,5	1,5	33
-march=pentium4 - O3	3,0	1,8	1,4	1,5	35
-march=pentium4 - O3					
-pipe -fomit-frame-pointer	2,8	1,7	1,3	1,5	35
… same with -funroll-all-loops	2,8	1,7	1,3	1,4	31
1.4 GHz Pentium 4 (Willamette), 128 Mb RDRAM 800, Intel compiler V7 (Red Hat Linux 8)					
- march=pentium4 -O2	2,6	1,5	1,3	1,3	28
1 GHz Athlon 4, 128 Mb DDR, gcc 2.95 (Red Hat Linux 7)					
-O3	2,8	1,7	1,4	1,4	37
1 GHz Athlon 4, 128 Mb DDR 2100 ((same results with 256 MB DDR), gcc 3.2.2 (Red Hat Linux 9)					
-march=athlon - O3					
-pipe -fomit-frame-pointer	2,5	1,6	1,3	1,2	28
… same with -funroll-all-loops	2,5	1,6	1,3	1,2	27
400 MHz 2001-dated Celeron, 64 Mb SDRAM, gcc 2.95 (Red Hat Linux 7)					
-O3	7.4	6.6	4.4	3.5	75
-O3 -pipe -fomit-frame-pointer	6,9	6,4	3,9	3,4	73
Program written in Pentium-III-optimized assembly language under Windows 2000					
1.4 GHz Pentium 4 (Willamette), 128 Mb RDRAM 800					
	1,6	0,7	0,3	1,4	17
1 GHz Athlon 4, 128 MB DDR	1,1	0,7	0,4	0,7	14
400 MHz 2001-dated Celeron, 64 Mb SDRAM					
	2,6	3,2	1,6	3,9	35

ARGESIM COMPARISONS

Restaurant Business Dynamics – Definition of a new ARGESIM Comparison - C16

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This comparison addresses modelling, simulation and optimisation of a discrete dynamic system. The business under examination is the restaurant business, although you can substitute this domain by any other domain dealing with branch offices in an unchanging market with a fixed number of people.

General Description: We are going to investigate a rectangular area with a fixed number of people and a (dynamically changing) number of restaurants. People are randomly distributed over the area with uneven density and do not move. The restaurants initially present in the model are distributed evenly. People go to restaurants from time to time with random intervals. Every time a person goes to a restaurant, he leaves there a fixed amount of money. People only go to restaurants that are located within a certain distance range from their home, and choose randomly in case there are many of those.

A restaurant accumulates its revenue during a week and at the end of the week summarizes the financial results and applies the running policies. A fixed running cost is subtracted from the gross weekly revenue, and then the tax (fixed percent) is applied. The remaining profit is analyzed. If the profit is greater than some fixed threshold value, the restaurant with some probability launches a new one at the location with the best ratio of people to restaurants density. Otherwise the restaurant closes down, again with some probability.

Multiple simulation runs will be used to identify the asymptotic behaviour of the system. In addition you should try to optimise the income of the government (accumulated tax payment) respectively the anticipated income of a restaurant.

There are no restrictions how to build the model and run simulations. You are invited to use high level simulators of different kind (object oriented, process oriented, agent based …) as well as low level coding and any mixture of it.

People: 3000 people live in a rectangular area with *Width* 600 and *Height* 400 (in a larger scale each person can be seen as aggregation of e.g. 1000 people). Every person belongs to one of the five cities, (see Fig. 1).

The coordinates of the city centers and the percentage of the whole population living in a city are given in Table 1. Person's location with respect to the city center is defined in polar coordinates (*angle*, *radius*) where angle is uniformly distributed, and radius is distributed triangularly from 0 to *MaxR* with mean at 0. If a randomly chosen location of a person is outside the area, a new location is calculated.

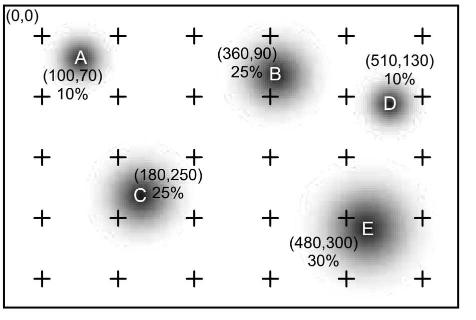

Fig. 1: Area with cities

	X	Y	MaxR	% of People
City A	100	70	100	10
City B	360	90	250	25
City C	180	250	250	25
City D	510	130	100	10
City E	480	300	300	30

Table 1: Location and largeness of the cities

People go to restaurants from time to time with intervals in between distributed discrete uniformly from 1 to *Maximum Dining Interval*. The restaurant to go to is chosen randomly from those located within *Range* from the person's home and with equal probabilities, no history is taken into account. A visit to a restaurant takes zero time and results in leaving there a *Dinner Cost* – flat for all restaurants.

Restaurants: Initially there are 30 restaurants evenly distributed (arranged) across the area in five rows, six restaurants in each; the horizontal distance between restaurants is 100, and the vertical is 80 (see Fig. 1). Restaurants are open every day. Do not model restaurant capacity and assume a restaurant can room any number of people.

The only source of revenue for a restaurant is what people pay when they visit it, so the weekly revenue is proportional to the number of visits during a week with coefficient Dinner Cost. At the end of each week a restaurant has to pay the weekly Running Cost (fixed) and the weekly Tax to the government – the fixed percent of what remains, zero if the revenue is smaller than the Running Cost. Whatever money remains after running cost and tax deduction is called Profit (can be negative).

When weekly profit is calculated, two rules (policies) are applied:

(a) if *Profit* is higher than fixed *Profit Threshold*, open a new restaurant at the best possible location (see below) with *Opening Probability*;

(b) if *Profit* is lower than *Profit Threshold*, close down with *Closing Probability*.

Finding location for a new restaurant: The best location to launch a new restaurant is found by partitioning the whole area into square cells of size 20x20 (there are 30 * 20 = 600 such cells) and calculating the ratio of *People Density* / *Restaurant Desity* for each cell. The *People Density* is simply the number of people living in the cell, whereas the *Restaurant Desity* is calculated as

$$\sum_i 1/D^k(cell\_center, rest_i)$$

While *D* is the distance between the cell center and the restaurant *i, k* is a weighting coefficient choosen appropriately (and investigated in one of the tasks). The cell with the maximum ratio of the densities is chosen and the new restaurant is placed randomly and uniformly within that cell.

Parameters: You are invited to experiment with all of the area settings, parameters and distributions but to compare different solutions of this problem you are asked to use the following parameter values:

parameter	value
Total Number of People	3000
Initial Number of Restaurants	30
Area Width and Height	600 x 400
Maximum Dining Interval	8
Dinner Cost	1
Range	100
Running Cost	150
Initial Tax Rate	20%
Profit Threshold	350
Opening Probability	10%
Closing Probability	20%
k in Restaurant Density	4

Table2: Model Parameters

Calculating results: Depending on the tasks, the focus is on the accumulated tax – income for the government respectively the capital of the restaurants.

Model approach: Give a short explanation of your model approach (process oriented, agent based, event approach, activity scanning approach, directly programmed, etc.) and the used simulation environment, development environment or software environment, resp.

Task a – Time Domain Analysis: Build the model and simulate the system for 1, 5 and 10 years and show the total number of restaurants over time. Perform 50 simulation runs and calculate the average limit value of number of restaurants after the 5th year.

Task b – Tax Income Maximisation. Maximise the tax income for the government and show the dependence of tax income from *Tax Rate*. The higher the tax rate is, the more tax will be paid by a single restaurant, but otherwise fewer restaurants will survive – and vice versa. Start with a parameter variation of the tax rate. There should be at least one maximum. Analyse and discuss, if this maximum reflects the best possible solution in view of the government. You can use other optimisation methods or arbitrary control strategy.

Task c – Restaurants' Revenue Analysis. Analyse the expected revenue of new restaurants depending on the strategy for opening new restaurants.. As the income of a restaurant depends only on the place where it will be located with respect to population and other restaurants, the evaluation of the existing situation is the important factor to control restaurants revenue. Therefore, vary the parameter *k* in the function for Restaurant Desity from 0 to 6 in steps of 0.5 and indicate the best value for k (max. revenue).

Comments and further information: This comparison is intended to be a very general one. On the one side, variable structures are needed, as found in object-oriented approaches. On the other side, time advance is relatively simple, so that event-scheduling mechanisms are not a must, and consequently any programming system can be used (time advance is given by the discrete distributed Dining Interval - 1 to MaximumDining Interval days -, and after 7 days profit is calculated).

Of course, there are well suited approaches for this comparison, e.g. agent-based modelling – with dynamically changing spatially structures, etc. But also very classical programming approaches, more or less directly programmed, can be used, with high efficiency (compared to simulation systems). Furthermore, also implementations with activity scanning may be advantageous; activity scanning is usually listed as third world view in discrete event simulation – but never used (the others views are event scheduling and process interaction). Or one may make use of a statistical environment, where time advance is programmed in the interpreter of the system, or one may use a computer algebra system, etc.

If questions or remarks coming up during modelling, simulation or interpretation of this comparison, feel free to contact the authors or have a look at www.argesim.org, where you can find extended information.

An Agent-based Approach to ARGESIM Comparison C16 'Restaurant Business Dynamics' with AnyLogic

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Simulator: AnyLogic (www.xjtek.com) is a multi-paradigm simulator supporting Agent Based modeling as well as Discrete Event (flowchart-based) and System Dynamics (stock-and-flow) approaches. Due to its very high flexibility AnyLogic is capable of capturing arbitrary complex logic, intelligent behavior, spatial awareness and dynamically changing structures.

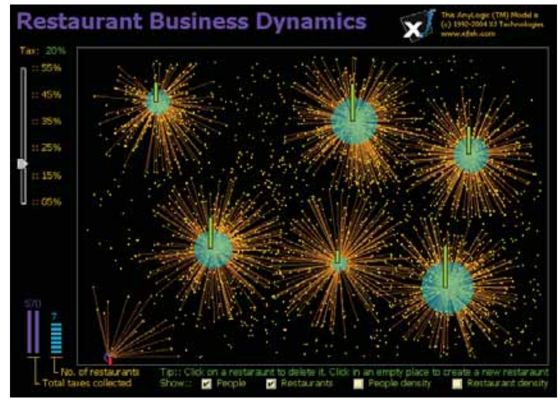
Model: The model was developed in a pure Agent Based "decentralized" style where the modeler defines the behavior of the individual agents (people or restaurants) and observes how the global behavior emerges from their interactions instead of defining a flowchart or other "centralized" view on the system. At top level there is a number of active objects of class Person and a number of objects of class Restaurant.

Space: Both people and restaurants have *(x,y)* coordinates in 2D continuous space, and their initial placement is done at model startup using various probability distributions. The *distance* function is also defined at this level. The people density is calculated once at startup and remembered in the array *pdensity* and the restaurant density *rdensity* is calculated each time a restaurant is opened or closed. *Time:* Restaurants act on weekly "ticks" generated by the *weeklyUpdateTimer* and people have their own events.

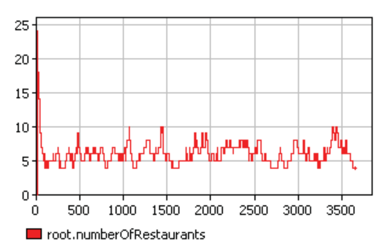
Person: Each person keeps a list of nearest restaurants *nearest* that is updated upon opening or closing down event, and a *diningTimer* that is setup to go off with the uniformly distributed inter-dining interval as required by definition (only when the current *nearest* list is nonempty). The function eat() of a randomly chosen restaurant is called in this case, which adds 1 to its *thisWeekRevenue* variable. *Restaurant:* Each restaurant has variables corresponding to its weekly financial results that are updated synchronously at the end of each week. After that the restaurant applies the strategies defined in Java:

```
//find cell with better people/restaurants ratio
  int k = bestCellForNewRestaurant();
  r.x = 20*(k%(int)(Model.width/20))+uniform(20);
  r.y = 20*(k/(int)(Model.width/20))+uniform(20);
  r.runningCost = runningCost;   r.tax = tax;
  m.setup_restaurants(r,uniform_discr(0,10000) );
```

The AnyLogic animation shows all individual objects in 2D space, their dynamic interactions (restaurant visits), current financial status of the restaurants and all aggregated characteristics such as weekly taxes collected or people and restaurant densities.



Task a – Time Domain Analysis. The model shows highly dynamic behavior with restaurants being started and going out of business quite a lot even with the fixed parameter values, given in the following chart of the number of restaurants (the model time unit is 1 day). It is well seen that the warm-up period for this model is about half year. The table shows the statistics on the number of restaurants at the end of the fifth year over 50 runs.



Mean	6.34
Min	4
Max	10
Variance	1.98
Deviation	1.41
Mean Confidence	0.40

Task b – Tax Income Maximisation. We have used OptQuest™ optimizer (modified genetic algorithms) built into AnyLogic. The objective function is the accumulated tax collected during the time from 180 days (end of warm-up) to two years from all restaurants. Searching in the range [5%,60%], after about 100 iterations, OptQuest has determined the best *Tax Rate* value at **39.85%** with objective function value is 17,727.

Task c – Restaurants' Revenue Analysis. *k=0* means we ignore other restaurants, starting restaurant where people live more densely. High values of *k* mean we open restaurants as far as possible from other restaurants paying less attention to people density. The criteria for choosing the best value for *k* is the accumulated revenue averaged for all restaurants over a period of 5 years. For simplicity, again optimisation was used, OptQuest™ found a value at 0.546 that corresponds to maximal revenue of 7838 – so that **0.5** is the best value for *k*.

C16 Classification: Agent-based Approach
Simulator: AnyLogic 5.0.2, 2004

An OO Process Flow Approach to ARGESIM Comparisons C2 'Flexible Assembly System' with AnyLogic

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Simulator: AnyLogic (www.xjtek.com) is an object – orientated, general-purpose simulator for discrete, continuous and hybrid applications. It supports modelling with UML – RT and the underlying modelling technology is based on Java. Since Version 4.5 AnyLogic provides different advanced libraries as the Enterprise Library which implements often used discrete model object classes like sources, conveyors, sinks …

Model: As the Comparison addresses the possibility to define and combine submodels, the object-oriented approach of AnyLogic, using the Enterprise Library, seems natural. The model consists of eight stations (see Fig. 1) connected by some conveyors (all predefined in the Enterprise Library).

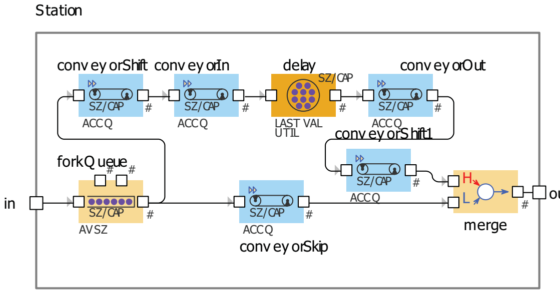

Fig. 1 Active Object Class Station

The instances of the station class and their connection as well as initialisation objects are defined in the Model class (see Fig. 2).

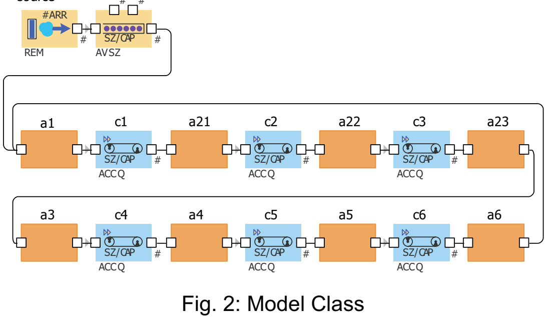

Fig. 2: Model Class

Model Analysis. Some results may be achieved by a brief analysis of the situation and can be used for validation of the model:

- Max. number of processed pieces: The fact, that machines of type two are the bottleneck of the system we gain a maximum number of 1440 processed pieces during an observation time of 480 minutes.
- Minimum throughput time: 16 m with speed 0.3 m/s plus complete shifting time of 20 s plus complete operation time of 135 results in a minimum throughput time of 208,33 s.

Task a - Control strategy, Method of Statistical Evaluation: Choosing local implementation of control strategy is a natural way for object-oriented modeling. Each station controls its flow of pallets. Statistics are collected within the model using the AnyLogic dataset class and can be observed using AnyLogic Viewer.

Task b - Simulation Results: A parameter loop with an increasing number of pallets was used to control multiple simulation runs. The focus of investigation was on throughput and average throughput time.

Throughput increases almost linear and reaches the threshold of ~ 1440 pallets/480 min. with usage of 17 pallets. There are minor oscillations about the threshold of 1440 pallets depending on the state of pallets at time 120 min (begin of inspection). Throughput time increases slightly in the range from one to 17 pallets and raises virtually linear afterwards. Evaluation was made from one to 30 pallets, 40 pallets and 60 pallets (see Fig. 3).

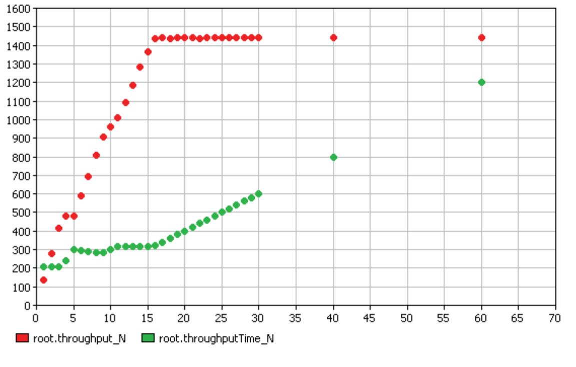

Fig. 3: throughput, average throughput time

Task c – Optimisation. Optimisation depends on the objective function. Optimal results with emphasis on maximal throughput can be extracted from results of task b (optimisation by parameter variation): Maximal throughput is reached for 17 or more. Since we get minimal throughput time (with max. throughput) with 17 pallets, the optimal solution is 17 pallets.

C2 Classification: OO Process Flow Approach

Simulator: AnyLogic 5.0.1, 2004

A Numerical Solution to ARGESIM Comparison C3 'Generalized Class-E Amplifier' using MATLAB - SIMULINK

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Simulator: MATLAB is an intuitive language and a technical computing environment. It provides core mathematics and advanced graphical tools for data analysis, visualization, and algorithm and application development. SIMULINK is a simulation and prototyping environment for modelling, simulating, and analyzing real-world dynamic systems.

Model: The solution of the problem is based on a pure SIMULINK model. A straight forward approach is used implementing the system of ordinary differential equations mainly using Integrators, Sum – blocks and Product – blocks. The time dependent resistor R(t) is realized using a Look-Up Table – block (Fig 1).

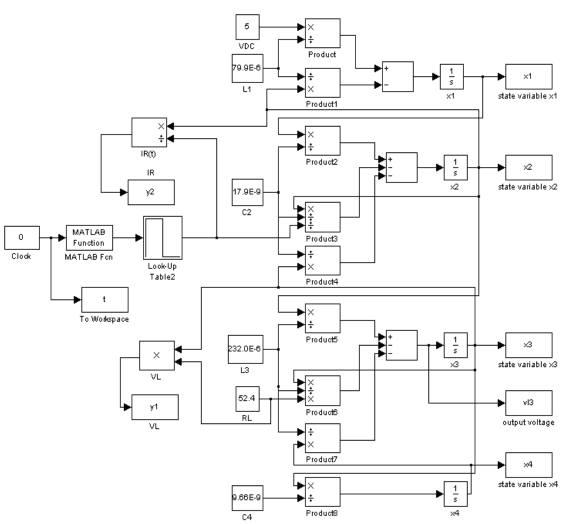

Figure 1: SIMULINK model of the amplifier

Task a – Calculation of Eigenvalues. The Eigenvalues in the ON – and OFF – period are calculated by means of the eig() – function introducing the 4-dimensional system dx/dt = A*x as m-file in MATLAB (since R(t) is constant in ON- and OFF – period, this approach is correct):

Eigenvalues on period	Eigenvalues off period
1.1173e+09	-5.4699e+04 + 1.0408e+06i
6.2578e+02	-5.4699e+04 - 1.0408e+06i
-1.1282e+05 + 6.5839e+05i	-5.8226e+04 + 5.3275e+05i
-1.1282e+05 - 6.5839e+05i	-5.8226e+04 - 5.3275e+05i

Task b: Simulation of the Stiff System. The simulation in the time interval [0, 100E-6] is performed with the MATLAB ode23 – solver, a Rosenbrock method for stiff differential equations. The results are shown in figures 2 and 3.

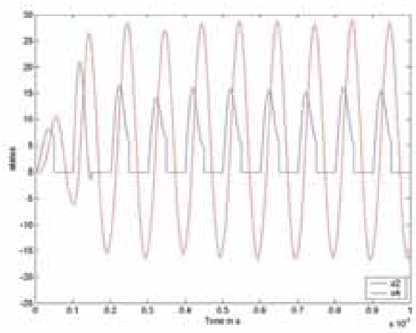

Figure 2: current in the switch resistor and output voltage

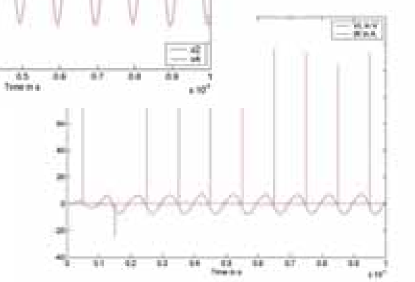

Figure 3: time curves of the state variables x_2 and x_4

Task c – Parameter Variation. The final solution of task b serves as initial state of this task. Therefore the init(i) values are set with the last entries of the state vectors x1 – x4. The different values of the rise- and fall-time TRF are also stored in a vector. The simulation is then started four times iterating these parameters. Figure 4 shows the resulting phase curves and one can notice, that only for a relatively slow toggle-time of 1E-7 the results differ slightly.

```
init(1) = x1(k);...init(4) = x4(k);
TRF_V = [1E-15 1E-11 1E-9 1E-7];
for i=1:4
    TRF = TRF_V(i); sim('comp3hh',[0 9E-6]);
    ph_x3{i} = x3;     ph_vl3{i} = vl3;
end
```

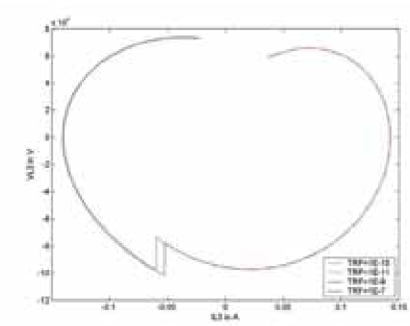

Figure 4: Phase curves for different TRF – values

C3 Classification: Numerical Approach

Simulator: MATLAB / Simulink Rel. 13, 2004

ARGESIM Comparison C3 'Class E Amplifier' Numerically Solved by MATRIXx

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Simulator: MATRIXx is a so-called CNS – a Computer Numeric System, as MATLAB is (and as CONTRL_C has been). The structure is very similar to MATLAB: it consists of an environment called XMath, and a graphical simulation tool called SystemBuild.

Model: SystemBuild was used to model this comparison. The graphical description is shown in Fig.1.

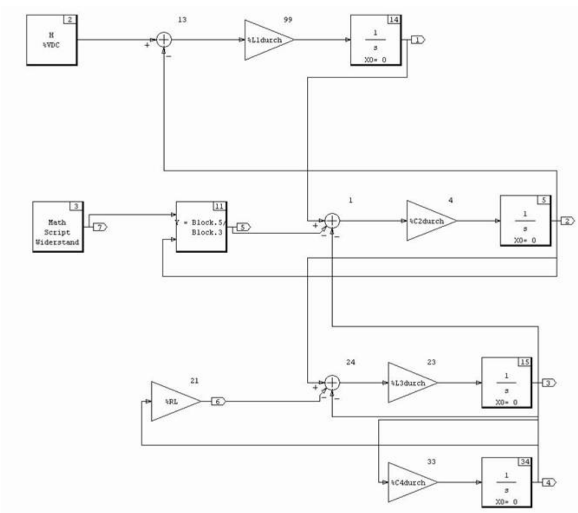

Figure 1: Sytembuild Model

The resistance *R(t)* is computed by an Xmath function which is embedded in the SystemBuild model by the use of a "MathScript"-block.

```
function R_out=Widerstandc(t,TRF)
k=((5e+6)-(5e-2))/TRF
[t_red,rmod]=mod(t,(10e-6))
if(0<=t_red)&(t_red<TRF)
   R_out=(5e-2)+k*t_red
elseif(TRF<=t_red)&(t_red<(5e-6))
   R_out=5e+6
elseif((5e-6)<=t_red)&(t_red<((5e-6)+TRF))
   R_out=(5e+6)-k*(t_red-(5e-6))
elseif((5e-6)+TRF<=t_red)&(t_red<(10e-6))
  R_out=5e-2
endIf
endFunction
```

Task a - Calculation of Eigenvalues. This task was computed as a whole in Xmath. The differential equations were therefore transformed into *dx/dt = A*x* and the Eigenvalues of *A* were computed (results below - the system is stiff as the eigenvalues prove).

OFF – Period	ON - Period
-5.8228E+4 + 5.3275E+5 j	-1.1173E+9
-5.8228E+4 - 5.3275E+5 j	6.2578E+2
-5.4708E+4 + 1.0407E+6j	1.1304E+5 + 6.5835E+5j
-5.4708E+4 - 1.0407E+6j	1.1304E+5 - 6.5835E+5j

Task b - Simulation of the Stiff System. The ODASSL (Over-determined Differential Algebraic System Solver) was used which is especially suitable for stiff systems. Figure 2 shows a plot of the current *IR=x2/r* und the output voltage *VL=x3*RL* over time.

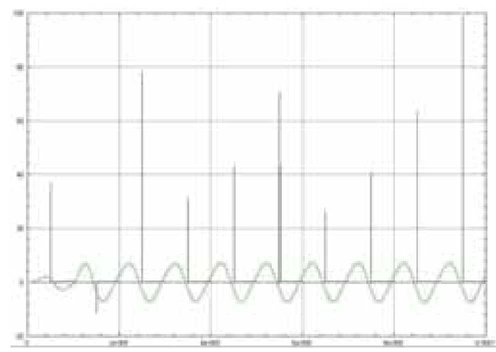

Figure 2: IR and VL over time, task 2
(Unfortunately the values of the peaks seem to be not exact.
fortunately no error – only missing output points).

Task c- Parameter Variation. TRF (rise/fall time) was varied for values of 1e-15, 1e-11, 1e-9 and 1e-7. In addition the initial solution should be equal to the final solution of task b. The following Fig. 3 shows phase plane curves of *dx3/dt = VL3* as a function of the current *x3 = IL3:*

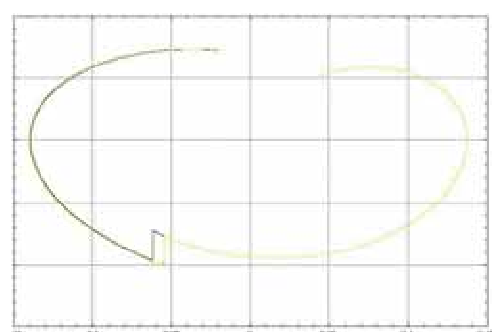

Figure 3: Phase diagram

The only differing result is given for TRF = 1e-7 because this value causes a very slow switching process (Frequency is 100 kHz).

C3 Classification: Numerical Approach

Simulator: MATRIXx Rel. 2004

ARGESIM Comparison C5 'Two State Model' Numerically Solved by MATRIXx

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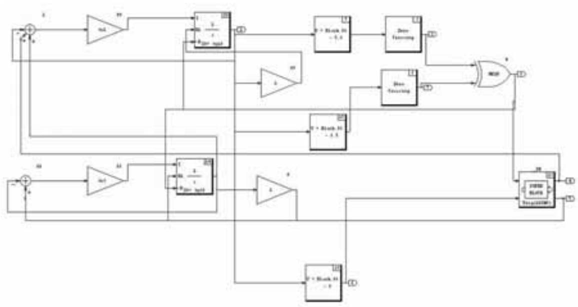
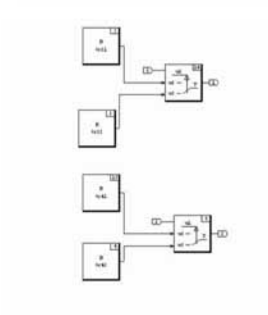
Simulator. MATRIXx is a so-called CNS – a Computer Numeric System, as MATLAB is (and as CONTRL_C has been). The structure is very similar to MATLAB: it consists of an environment called XMath, and a graphical simulation tool called SystemBuild.

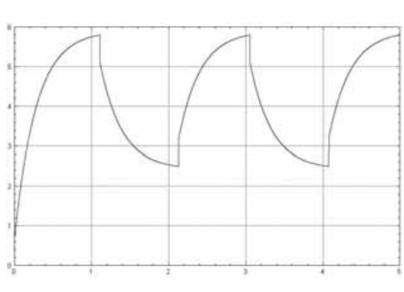
Model. SystemBuild was used to model this comparison. The graphical description is shown in the following two figures:





The detection of all state events is modelled by the use of two 'Zero-Crossing'-blocks. Their outputs were combined through an 'XOR'-operator which triggers the subsystem on the left side. There 'DataPathSwitch'-blocks are used to pass through the correct value of c2 and c4 (depending on y1).

Task a - Simulation of the System:



Using the 'extend' – keyword in the simulation call performs extended time calculations at every state event, giving sufficiently accurate results..

```
t = [0:0.001:5]' ; u = ones(t)
[t1, y1]=sim ("c5new",t,u,
        {ialg=9,extend,reltol = 1e-14});
```

The following table shows the results for every discontinuity and final value of y1.

Solver	DASSL	VKM
t0	0.000000	0.000000
t1	1.108306	1.108306
t2	2.129686	2.129686
t3	3.054153	3.054153
t4	4.075532	4.075532
t5	5.000000	5.000000
y1(5)	5.613722246632118	5.604149377519642

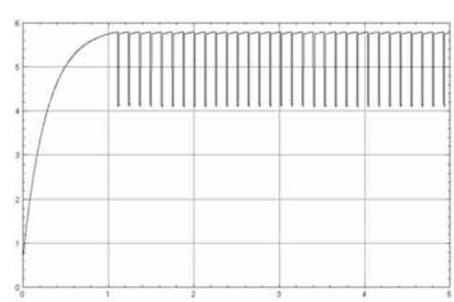
The results for these two solvers are nearly identical but VKM (variable-step Kutta-Merson method) is much slower then DASSL (suitable for stiff systems).

Task b - Time instants of discontinuities. This task consists of setting the relative accuracy to 1e-6, 1E-10 and 1E-14. Results are shown below:

solver	ODASSL	ODASSL	ODASSL
rel.	1E-06	1E-10	1E-14
t0	0.000000	0.000000	0.000000
t1	1.108307	1.108306	1.108306
t2	2.129682	2.129686	2.129686
t3	3.054150	3.054153	3.054153
t4	4.075530	4.075532	4.075532
t5	4.999994	5.000000	4.999999
y1(5)	5.800000	5.800000	5.8000000

Task c - Frequent events. The change of the parameters results in "oscillations" of the state y1. The number of discontinuities found is 62 or 63. This results in oscillation behaviour with 63 discontinuities (shown in the table and plot below).

solver	DASSL
t0	0.00000
t1	1.108306
…	
t62	4.936463
y1(5)	5.753453



C5 Classification : Fully Numerical Approach

Simulator : MATRIXx, Rel. 2004

An OO Programmed Approach to ARGESIM Comparison C6 'Emergency Department' 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 patients we have defined the class *Patient* with a set of attributes (such as *patient id*, *type of treatment*), and a set of operations that define the flow and behavior of the patient during the treatment. Each patient in our simulation model is an object of the class *Patient*. The behavior of the patient is defined as a CSIM *process*. In a CSIM model a *process* represents an active entity.

We have used CSIM *facilities* to model units of the emergency department, which consists of the registration, casualty wards (CW), X-ray room, and plastering room. CSIM supports single-server and multi-server facilities. Multi-server facilities are used to model casualty wards CW1 and CW2, and X-ray room, whereas single-server facilities model the registration and plastering room. The waiting of patients until doctors begin to work at 08:00h, is modeled with a CSIM *event*. When at 08:00h this event occurs, patients may proceed with the treatment.

The replacement of a doctor in a CW is modeled by changing the working time of one of the two doctors in CW during the period the condition for doctor exchange holds. In CSIM we have changed the service time for one the two servers of the multi-server facility that models CW.

The default service discipline is First Come, First Served (FCFS). The priority of the patient is changed by using the CSIM statement,

```
set_priority(new_priority).
```

The objects of the CSIM class table are used to collect explicit statistics on treatment times. Statistics of CSIM facilities are collected automatically.

Task a - Average Treatment Times. Table 1 shows the mean, maximum, and standard deviation for each type of patient.

The result for all 250 patients is shown in the last row of the table.

Patient type	Treatment time [minutes] mean	max.	s.d.
1	236	334	63
2	137	267	61
3	252	327	56
4	124	265	60
All	173	334	81
CW	queue length	doctor utilization	response T [min.]
1	57	0.92	96
2	31	0.84	83

Table 1. Simulation results for Task a.

Task b - Doctors' Exchange Strategy. This strategy increases the mean treatment time for all types of patients. The queue length, doctor utilization, and response time, are decreased for CW2, but the response time is increased for CW1 (see Table 2).

Patient type	Treatment time [minutes] mean	max.	s.d.
1	253	378	81
2	146	307	70
3	266	381	73
4	138	303	73
All	185	381	94
CW	queue length	doctor utilization	response T [min.]
1	64	0.92	127
2	21	0.64	61

Table 2. Simulation results for Task b.

Task c - Priority Ranking. The strategy to increase the priority of the patient that enters for the second time one of units of the emergency department results with a decrease of the mean treatment time for patients of type 1 and type 3. But, the treatment time for patients of type 2 and type 4 is increased. However, the overall treatment time and standard deviation are decreased (see Table 3).

Patient type	Treatment time [minutes] mean	max.	s.d.
1	165	334	76
2	167	329	76
3	179	323	75
4	157	326	75
All	163	334	76

Table 3. Simulation results for Task c.

Simulation is executed on Sun Blade 150 workstation (CPU 650MHz, memory 768MB). The CPU time used for one simulation run is 0.03 seconds. For each task we have executed 30 simulation runs.

C6 Classification: Object-Oriented Simulation

Simulator: CSIM 18.3 for SPARC Solaris

A Hybrid Numerical Solution to ARGESIM Comparison C11 'SCARA Robot' using Maple

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Simulator. Maple 9 is a Computer Algebra System which offers many routines for the exact solution of problems, although it's numerical capabilities are somewhat limited.

Task a - Modeling Method. This is the Task for which Maple is most suited. Transforming the implicit description of the system into an explicit one can be done at no time at all, as the commands for matrix and vector manipulation are intuitiv.

Task b - Simulation of the Controlled System. Adding another three ODEs is no problem in Maple. But implementing the restrictions for the armature voltages seemed to be impossible at first. Using the systematic approach

```
>kT3:=0.4:T3max:=0.6:
>I3max:=(sqrt(3)/2*kT3)^(-1)*T3max:
```

and replacing the -Imax<I<Imax condition by the term

```
>min(Imax,abs(I))*signum(I)
```

that, unlike a maple procedure, can be used for numerical integration, led to an error message:

```
Error, (in type/EvalfableProp) too many levels
of recursion".
```

Maple does not offer much help and / or support on error messages, so the user has to try to figure out what has gone wrong.

Manually calculating I3max – which yields sqrt(3) - and substituting this value instead of the variable worked. Apparently Maple was not able to get the correct value.

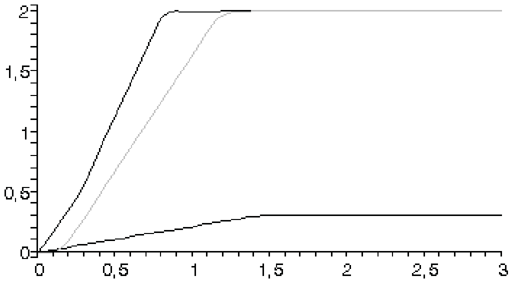

Fig. 1: movement without an obstacle

Once the system is properly set up, simulating the system is easy. As already described above, the term used as limiter is properly handled by the numerical IVP solver. Plotting the solution is a bit more difficult, because the result is a set of procedures - one for each independent variable - neither alphabetically ordered nor like the initial conditions, the order changing every time the worksheet is executed. Therefore an 'eval' command has to be used before the plot (Fig. 1) can be obtained.

Task c - Collision Avoidance. The best course of action is defining two new ODEs for the PD-Controller in emergency situations together with joining the now two sets of ODEs into a hybrid loop. At the time where either the collision is immanent or the tip is again in a save distance from the obstacle, the transition between the two states takes place. Maple needs the stopping conditions for the ODE solver in the classic form of a function with a zero crossing at the desired state. The trouble is, that the condition, according to Maples Help, "should vary smoothly with the solution". The x-coordinate for the tip,

```
>L1*cos(q1(t))+L2*cos(q1(t)+q2(t)),
```

is not smooth enough for maple in case of the emergency situation, so the it switches back to normal mode only at the point where q3 is greater then the height of the obstacle.

Plotting the results also gets much more difficult. Depending on the movement of the SCARA unit, you have to join several procedures into one for plotting.

It is much more convenient to compute arrays of [t,x] coordinates, transform them into list and join the lists and create output. Given the rate at which especially q1 can change, a step size of 10^(-3) is required for a diagram which contains all the qualitative information about the SCARA units movement (Figure 2).

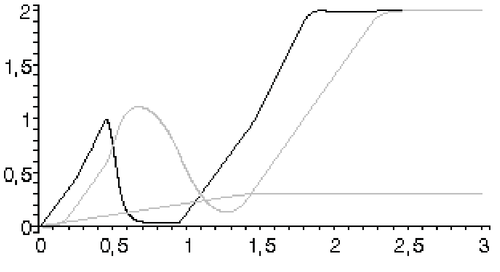

Fig. 2:movement with collision avoidance

C11 Classification: Hybrid Numerical Approach

Simulator: Maple 9, 2004

An OO Solution of ARGESIM Comparison C14 'Supply Chain Management' with eM-Plant

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Simulator. eM-Plant (www.emplant.com) is an object-oriented discrete event-driven simulation tool. It is a tool for all kinds of engineering tasks applied in industry, research and education. Features of eM-Plant are: object-oriented, easy-to-use, 2D and 3D modeling capabilities.

Model. The Supply Chain Management is modeled only by information flow without any material flow objects. Three class objects, the Factory, the Distributor and the Wholesaler, are build up in the class library and instantiated in the simulation model

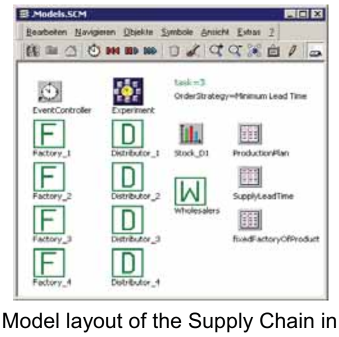

Figure 1: Model layout of the Supply Chain in eM-Plant

Each of the object instances has its own random number stream to avoid dependencies between the objects. Three tables store the input values and the variable "task" defines the task (a, b, c) to be executed. This allows to switch the task

```
inspect root.task
when 1,2 then
    result := ~.fixedFactoryOfProduct[current.name,part];

when 3 then -- collect all possible suppliers
    suppliers.create; pp := ~.ProductionPlan;
    pp.setCursor(1,1);
    while pp.find(part) loop
        suppliers.append(pp[pp.CursorX, 0]);-- add Factory
    end;
    supplier := suppliers.read(1);
    supplyTime := ~.SupplyLeadTime[supplier, current.name];
    for i:= 2 to suppliers.dim loop
        if ~.SupplyLeadTime[suppliers.read(i), current.name]<supplyTime then
            supplier := suppliers.read(i);
            supplyTime := ~.SupplyLeadTime[supplier, current.name];
        end;
    next;
    result := supplier;
end;
```

Figure 2: Section of the method getFactoryOfProduct

with the experiment manager and to reference the value in different methods representinbg different strategies. In figure 2 a section of method **getFactoryOfProduct** of the distributor object is shown, referencing the variable task. The eM-Plant experiment manager allows to define the three experiments and executes 100 simulation runs for each experiment.

The random number streams assigned to model components will also be controlled by the experiment manager. The values of interest are defined in the output value list of the experiment manager. For each value the statistical analysis is calculated.

Task a - Simple Order Strategy. This strategy leads to an incremental stock for each distributor as expected. The stock of Distributor_1 is shown in Fig. 3 employing the Chart-object of eM-Plant.

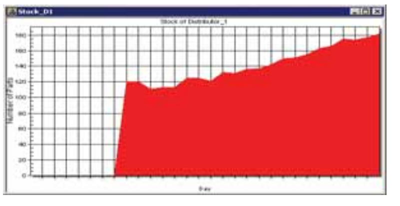

Fig. 3: Stock of Distributor D1 using the Simple Order Strategy

Task a	**min**	**max**	**mean**	**Dev**
C	30.782	37.875	34.609,53	1.397,24
N	192	249	216,97	12,569
R	142,65	176,68	159,79	6,94

Task b - On Demand Order Strategy. This strategy results in a nearly constant stock and therefore decreasing costs compared to task a.

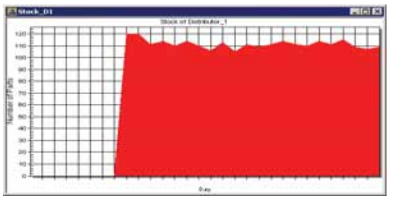

Fig. 4: Stock of Distributor D1 using Demand Order Strategy

Task b	min	max	mean	Dev
C	33.208	36.449	33.207,5	1.280,49
N	192	249	216,97	12,57
R	138,03	168,33	153,31	6,11

Task c - Minimal Supply Time Strategy. This strategy results in further lowering of costs as shown in the following table

Task c	min	max	Mean	Dev
C	26.526	31.761	29.200,58	1.063,69
N	192	249	216,97	12,57
R	122,08	144,67	134,83	5,41

Caused by the high starting order the stocks of the distributors never run out. Therefore the number of parts only depends on the number of orders.

C14 Classification: OO Process Flow Approach

Simulator: eM-Plant 7.0.5

A Programmed Solution to ARGE-SIM Comparison C15 Clearance Identification" with MATLAB

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Simulator: MATLAB is a widely used software tool based on numerical vector and matrix manipulation. Additionally it provides several toolboxes for various tasks. The computation of the following problem was done with the new MATLAB version 6.5 using also the Optimization Toolbox for task b.

Model: The model ODEs are directly programmed in MATLAB code. Simulation of the infusion was done with a simple if-else structure.

```
function inf=infusion(t)
D=2500; n=length(t);init
for i=1:n
    if t<tau; inf(i)=D/tau;
    else; inf(i)=0; end; end
function neu = nierenfuncti-
on(t,x,k01,k12,k21)
neu=[infusion(t)+k12*x(2)-
(k01+k21)*x(1);k21*x(1)-k12*x(2)];
```

Task a - Simulation of the System. The differential equations are numerically solved using MATLABs ODE solver ODE23 (Runge-Kutta solver).

```
tspan=[0:1:240];  x0=[0;0]; init
[t,x]=ode23(@nierenfunction,tspan,
x0,[],k01, k12, k21);
```

Figure 1 gives the results for different injections times. The appropriate numerical values for the different values t_1=0.5 min, t_2=3 min and t_3=240 min are $x_1(1.5)$=320.81, $x_1(4)$=299.2 and $x_1(240)$=144.8.

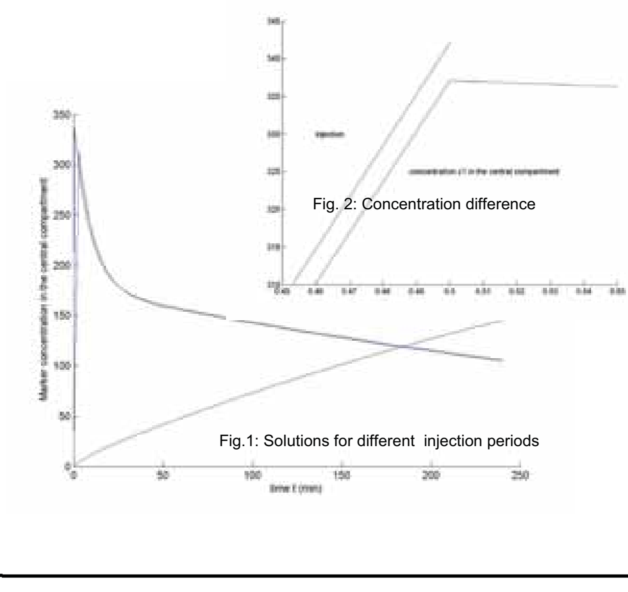

Fig. 2: Concentration difference

Fig.1: Solutions for different injection periods

In Fig. 2 the difference between the concentration of the injection and the real concentration due to the effect of the clearance can be seen.

Task b – Identification. Identification of this model was done using the Marquardt-Levenberg algoritm:

```
options=optimset('LargeScale','off',
'Dis-
play','iter','LevenbergMarquardt','on','To
lX',0.0001,'TolFun',0.0001);
[kopt, resnorm,residual] =
lsqnonlin(@error, kopt0, [], [], op-
tions,x1,x2,datashort,timeshort);
```

`Kopt0` contains all the initial parameter guesses (the closer to the optimal values these guesses are the faster the algorithm will terminate) while kopt returns the optimal parameter values that will minimize the objective function.

The function 'error' returns (the non squared) difference between the test data and the calculated values at the same time points. The resulting parameter values are: k01=0.0039, k12=0.0616, k21=0.0466, V1=7.884, V2=5.964, Clearence 31.111 and residdum 261.055. Fig. 3 shows the data points together with the identified function.

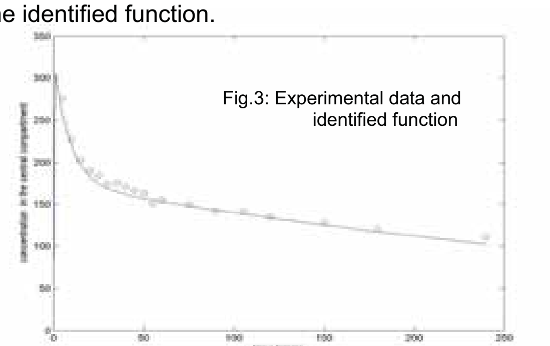

Fig.3: Experimental data and identified function

Task c - Error Estimation. Data are disturbed at MATLAB level by superposition of random numbers with mean 0 and standard deviation $s=(E/(n-n_p))^{1/2}$ on the given data. For each set of disturbed data the numerical identification is performed. The resulting mean value and standart deviation for the parameters are:

	k01	k12	k21	V1
mean	0.004	0.0625	0.0481	7.85
std	0.0003	0.0066	0.0078	0.3093

Table1: Mean and standard deviation (std) of identified parameters, based on 1000 samples

C15 Classification: Programmed Numerical Approach

Simulator: MATLAB Rel.12 with Optimization TB

BOOK REVIEWS

The Nature of Mathematical Modeling

N. Gershenfeld, Cambridge University Press, 1999, ISBN 0 521 57095 6

The basic attitude of Gershenfeld's book is not really to discuss the philosophical implications of mathematical modeling (in fact the book title is not well chosen) but rather to compile in one single book all the necessary methods and their interrelations that are important in model building and simulation.

As the author admits, this goal can never be reached in one volume. However, Gershenfeld makes the attempt to show the interrelations between methods from very different origin in order to present a general methodological framework without any disciplinary preferences.

He deals with

- analytical methods (ODFEs, PDEs, variational principles, stochastics),
- numerical methods (ODE and PDE solvers, cellular automata)
- and observational methods (parameter fitting, transforms, approximation, optimization, statistics).

In each case the very essentials of a method are sketched on a few pages to give the reader a birds perspective. Each chapter is closed with some well chosen annotated references.

This book can be very interesting in the current curricular discussions on academic courses or whole programs in modeling and simulation. Although some important simulation fields like discrete event simulation are completely left out (Gershenfeld is a physician) and the practice of simulation is not addressed most topics are well chosen.

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

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Cellular Automata Modelling of Physical Systems

by B. Chopard and M. Droz,
Cambridge University Press, 1998
ISBN 0 521 46168 5

Cellular automata (CAs) are a promising alternative method when spatially distributed processes with free boundaries, changing domain geometries or pattern formation phenomena must be simulated. The special charm of CAs is their simplicity and ease of implementation.

For a beginner it seems not to be necessary to learn any theory for setting up a CA. In fact most introductory textbooks just illustrate their rich and fascinating phenomenology or concentrate on implementation details. However, in order to understand the precise relation between CAs and classical PDE models an advanced theory is required. In particular, the influence and physical meaning of the simulation parameters (like the size, number, shape, and neighbourhood of cells) is not a trivial problem.

The present book discusses CAs in the context of statistical physics. It first deals with some classical automata like the game of life, or Wolframs automata. The majority of the book then concentrates on physical models like lattice gases and Lattice-Boltzman models. In the framework of statistical physics processes like diffusion, reaction diffusion, nonequilibrium phase transitions and wave propagation are discussed. In many cases a detailed mathematical analysis based on concepts from stochastic process theory (like the Chapman Enskog expansion) is undertaken.

Clearly, this mathematically demanding text cannot be recommended as a first introduction to CAs. However, if there is a first experience with CAs and a lot of questions arised then many of them will be certainly answered by this well written book.

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

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A Beginner's Guide to Finite Mathematics

For Business, Management, and the Social Sciences

W. D. Wallis, Boston, Basel, Berlin: Birkhäuser, 2004; ISBN 0-8176-4270-6, 350 pages

This book is designed for an elementary one-semester course in finite mathematics and applications. Finite mathematics here means applicable discrete mathematics used by students in business, management and social sciences.

More in details of the content of this book, the first chapter contains a brief survey of numbers, equations and elementary set theory, including Venn diagrams. There also are defined the different types of averages (mean, mode, median).

Counting is covered in chapter 2. Selections (combinations) and arrangements (permutations) are discussed, and the binomial theorem for positive integer index is prooved. In chapter 3 have included the main ideas of discrete probability, up to Bayes' theorem. Chapter 4 deals with the Graph Theory, including Euler and Hamilton cycles and coloring problems.

In chapter 5 Matrices and vectors are introduced, and systems of linear equations are solved.

The book finishes with a chapter about linear programming. The Geometric Method is presented and the Simplex Method is explained in detail, also the Two Phase Simplex method.

A number of worked examples, called Sample problems, are included in the body of each section. Every chapter is closed with a lot of exercises; complete solutions are provided at the end of the book.

In conclusion, the book is suitable for self-studying the topic "finite mathematics" without visiting a course because of requiring little mathematical background beyond high school algebra. I would recommend this book everyone who wants to have a first look at aplied discrete mathematics.

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

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Random Number Generation and Monte Carlo Methods

James E. Gentle, Springer 2003, ISBN 0-387-00178-6

The role of Monte Carlo methods and simulation in all of the sciences has increased in importance during the past several years. They play an especially important role in the rapidly developing subdisciplines of the computational sciences , computational life sciences and other computational sciences. At the kernel of Monte Carlo simulation is random number generation as it is also the heart of many statistical methods.

Various methods for generation of random numbers have been used. However, for Monte Carlo methods, which depend on millions of random numbers, a physical process as a source of random numbers is generally cumbersome.

So, the beginning of this book deals with simulating random numbers from a uniform distribution followed by a discussion about the quality of random number generators before it moves on the the field of quasirandom numbers. These quasirandom sequences are designed to be very regular in covering the support of the random process simulated.

Next, the book deals with the transformation of uniform deviates and the general methods involved in this (like the inverse CDF method or the ratio-of-uniforms method) and after this describes methods for some common specific distributions (Normal distribution, Gamma,…).

Chapter 6 continues the developments of the previous chapters to apply them to generation of samples and nonindependent sequences. Chapter 7 considers some applications of random numbers. Some of these applications are to solve deterministic problems. This type of method is called Monte Carlo.

The end of the book provides information on computer software for generation of random numbers concentrating on the S-Plus, R and IMSL software systems.

I think this is a very good and useful book on the generation of random numbers and the use of Monte Carlo methods. It can be used as both, a reference and a textbook. It covers basic principles as well as newer methods such as parallel random number gerneration and Markov chain Monte Carlo

Also this book includes exercises which I find very use- and helpful in understanding this not so trivial field in computer mathematics.

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

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Exploring, Investigating and Discovering in Mathematics

By Vasile Berinde; Birkhaeuser Verlag, Basel 2004, ISBN 3-7643-7019-X

Vasile Berinde, a romanian professor for mathematics, presents a collection of 24 different problems mostly of which already have been published in Gazeta Matematica or other mathematical journals. The emphasis is put on presenting different problem solving techniques.

Therefore the chapters are arranged similar containing subchapters as source problem, solutions, principles of generalization and possibilities of further investigation directions or related problems. Some space is given remarks explaining the essence of problems and given solution.

The themes presented are beginning quite simple treating elementary mathematics, covering arithmetic, algebra, geometry and analysis but increasing in sophistication and ranging till applied mathematics. But nevertheless the book is mainly addressed to those, starting their scientific research such as students, young mathematicians and teachers.

The book is structured well and can easily be read by any interested person having at least some ideas of mathematics but won't provide much new insights for advanced mathematicians.

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

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Evolution Equations: Applications to Physics, Industry, Live Sciences Economics

EVEQ2000 Conference in Levico Terme (Trento, Italy), October 30-November 4, 2000

Birkhäuser, 2003. 432 pages. Hardcover
ISBN 3-7643-0374-3

The international conference on which the book is based brought together many of the world's leading experts, with particular effort on the interaction between established scientists and emerging young promising researchers, as well as on the interaction of pure and applied mathematics. All material has been rigorously refereed.

The contributions contain much material developed after the conference, continuing research and incorporation additional new results and improvements. In addition, some up-to-date surveys are included.

Among the recent advances treated are new developments in

- moving boundary problems
- asymptotics in non-linear equations
- Poincaré equality on stratified sets
- behaviour of granular matter
- stochastic aspects of the Hamilton-Jacobi-Bellmann equation
- very general Paley-Wiener results applied to both classical and generalized functions
- Ornstein-Uhlenbeck operators
- semigroup approaches in economics (pricing theory)
- convolution-evolution equation in aeroelasticity

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

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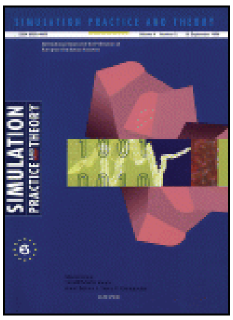
JOURNAL NEWS

SIMPRA - Simulation Modelling Practice and Theory

www.elsevier.nl/locate/simpra



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

It publishes high quality contributions on modelling and simulation. Instructions for authors and other information can be found on the journal's webpage.

Submissions of manuscripts, inquiries

Authors are kindly requested to send enquiries or to submit their papers to the Editor or Associate Editors:

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E. Gelenbe, Imperial College of Science, London, UK, e.gelenbe@imperial.ac.uk
P. Luker, Bournemouth University, Poole, Dorset, UK, luker@bournemouth.ac.uk

New SIMPRA Volume 12

In April 2004 volume 12 of SIMPRA started with the following contributions:

- RMPG: a realistic mobility pattern generator for the performance assessment of mobility functions; M. Kyriakakos, N. Frangiadakis, S. Hadjiefthymiades, L. Merakos
- Smart priority queue algorithms for self-optimizing event storage; H.A. Bahr, R.F. DeMara
- Incremental bond graph approach to the derivation of state equations for robustness study W. Borutzky, G. Dauphin-Tanguy
- Simulink and bond graph modeling of an air-conditioned room; B. Yu, A.H.C. van Paassen
- An age structured model for complications of diabetes mellitus in Morocco; A. Boutayeb, E.H. Twizell

SNE EDITORIAL BOARD

www.argesim.org

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, suggestions for contributions (technical notes, developments, comparison solutions), questions etc. please contact a member of the editorial board or the editor-in-chief.

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EUROSIM '04
5th EUROSIM Congress on Modelling and Simulation
6 – 10 September 2004

Cité Descartes, Marne la Vallée, France

Conference chair and contact:
Yskandar Hamam
y.hamam@esiee.fr

Conference themes

Adaptive simulation
Bondgraph simulation
Biomedical systems
Complex systems
Component based modelling
Continuous simulation
Control systems
Data mining
Decision support systems
Discrete event simulation
Distributed systems
Expert systems
Fuzzy simulation
Genetic algorithms
Graphical modelling
Heterogeneous systems
Hierarchical modelling
High complexity systems
High performance computing
Hybrid modelling
Integrated modelling
Intensive computation
Knowledge based systems
Large scale systems
Man-in-loop simulation
Mathematical methods in simulation
Mathematical modelling
Methodology of complex societal problems
Methodology of systems modelling
Multi-agent based systems
Neural networks Model validation
New inductive and deductive methods
Open systems
Operations research
Optimisation by simulation
Parallel modelling
Parallel processing
Petri nets
Real-time systems
Scientific computation
Self-organising systems
Statistic modelling
Statistical modelling
Stochastic systems
WEB based simulation

The EUROSIM 2004 Congress will be organised by the French Speaking Simulation Society (FRANCOSIM) on behalf of the Federation of European Simulation Societies (EUROSIM). It will take place in September 2004 at ESIEE in Marne la Vallée, France. It aims to address the impact of simulation science on the society in general. Contributions from natural and life sciences such as experimental and computational physics, mathematical engineering, applied chemistry, structural architecture, environmental management, economics and econometrics, operations research, social and behavioural sciences, such as experimental philosophy and applied psychology.

Besides submitting papers, interested persons may propose special sessions and invite contributors in the corresponding field. Selected papers on special issues may be published in the SIMPRA Journal.

Important dates:

January 9th, 2004:	proposal of special sessions
February 13th, 2004:	submission of abstracts
April 9th, 2004:	acceptance of abstracts
May 10th, 2004:	submission of full papers
May 28th, 2004:	final acceptance of papers
June 6th, 2004:	authors' and early registration

About Cité Descartes

The Descartes Science Centre, located at the heart of the Marne la Vallée New Town, officially created on March 22nd, 1983, has been given high priority in France's planning for regional development. It has a number of major advantages: proximity to PARIS, exceptional service both by public transport and by road and railroad networks (High Speed Train station of Marne la Vallée/Chessy) and it is close to the Roissy Charles de Gaulle and Orly Airports. Its environment and surroundings are of high quality and its development has always been guided by a strong consideration for the preservation and protection of the natural spaces. .

FrancoSim

EUROSIM SOCIETIES

EUROSIM

Federation of European Simulation Societies

www.eurosim.info

EUROSIM, the Federation of European Simulation Societies, was set up in 1989. The purpose of EUROSIM is to provide a European forum for regional and national simulation societies to promote the advancement of modelling and simulation in industry, research, and development. EUROSIM members may be regional and/or national simulation societies. At present **EUROSIM** has ten full members and three observer members:

- **ASIM** – Arbeitsgemeinschaft Simulation (Austria, Germany, Switzerland)
- **CROSSIM** – Croatian Society for Simulation Modelling (Croatia)
- **CSSS** – Czech & Slovak Simulation Society (Czech Republic, Slovak Republic)
- **DBSS** – Dutch Benelux Simulation Society (Belgium, The Netherlands)
- **FRANCOSIM** – Société Francophone de Simulation (Belgium, France)
- **HSS** – Hungarian Simulation Society (Hungary)
- **ISCS** – Italian Society for Computer Simulation (Italy)
- **SIMS** – Simulation Society of Scandinavia (Denmark, Finland, Norway, Sweden)
- **SLOSIM** – Slovenian Simulation Society (Slovenia),
- **UKSIM** – United Kingdom Simulation Society (UK, Ireland)
- **AES** – Asociación Española de Simulación (Spain; observer member)
- **PSCS** – Polish Society for Computer Simulation (Poland, observer member)
- **ROMSIM** - Romanian Society for Modelling and Simulation (Romania; observer member)

EUROSIM Board

EUROSIM is governed by a Board consisting of one representative of each member society, plus the organizer of the last and next EUROSIM Congress (past president and president), and of prepresentatives for the official EUROSIM publicatiosn (journals SIMPRA and SNE).

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

The EUROSIM boards met in December 2003 in Sicily in order to discuss daily affairs and options for the future. At this occasion details for the EUROSIM Congress **EUROSIM'04** in Paris, organised by FRANCOSIM were given. SLOSIM presented plans for the EUROSIM Congress **EUROSIM'07** (Sept. 2007 in Slovenia, in close co-operation with ASIM) Next meeting will take place on occasion of the EUROSIM Congress in Paris.

EUROSIM Publications SNE and SIMPRA

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

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

Conferences, EUROSIM Congress

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

The EUROSIM Congress is arranged every three years by a member society of EUROSIM. The next congress, **EUROSIM'04**, the 5th EUROSIM Congress, will take place in September 2004 in Paris (announcement see below). SLOSIM, in close co-operation with ASIM will organise the 6th EUROSIM Congress, **EUROSIM'07**, in Slovenia.

Congress Announcement

EUROSIM '04

5th EUROSIM Congress

Sept. 6 -10, 2004; Cite Descartes
Marne la Valle (near Paris), France

See Call for papers in this **SNE** issue

More information about EUROSIM and EUROSIM societies may be found at EUROSIM's WWW Server. For personal information about EUROSIM and about the congress EUROSIM'04 please contact the EUROSIM president, Mr. Y. Hamam.

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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

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ASIM / Dr. Ingrid Bausch-Gall, Wohlfahrtstrasse 21b, D-80939 München
Fax: +49-89-3231063, or online: info@asim-gi.org, www.asim-gi.org

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 the ASIM board meeting on the occasion of the ASIM 2003 conference in Magdeburg (September 2003) decisions about the structure of the 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 Hannover (February 2004) final decisions about the new Working Group structure were taken, and the first version of the new ASIM web page was presented. It was also decided, to reorganise the publication structure: concentration in printed publications, more publication via email and at the web – in a member area – see details later.

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.

Change of publication structure from 2004 on. Based on the results of a questionnaire to the members, the board discussed and decided some changes for the publications:

- First, from 2004 on, ASIM-Nachrichten will appear as electronically newsletter.
- Second, **SNE** should be extended. News and general information will be put as (German or English) addendum in SNE's news section.
- Third, 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.
  In 2004, the Working Group **"Simulation in Life Sciences"** will publish an issue.
- Fourth, the ASIM web pages will be redesigned totally, offering special areas for members, interactive information, mailing lists, etc, based on a content management system.

New ASIM Webpage

At present the ASIM webpage is newly designed. The webpage will be driven by content management system (TYPO3). The member data base will be 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 (last printed ASIM-Nachrichten) distributed with this SNE.

ASIM Working Groups

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

It was discussed either to combine small working groups, or to put them as subgroup into a big working group. The new structure for ASIM Working Groups decided at the last board meeting is as follows:

- The working group "Simulation and KI" will be become part of the working group "Methods of Modelling and Simulation",

- the working group "Simulation in Medicine, Biology, Biophysics" and the working group "Simulation in Environmental Systems will join to a Working Group "Simulation in Life Sciences"
- the Working Group "Simulation in OR" will co-operate with the working group "Simulation in Production and Logistics" and will be re-organised
- and the working group "Simulation of Transportation Systems" will co-operate either with "Simulation of Technical Systems" or with "Simulation in Production and Logistics", but will stay as stand-alone Working Group.

Special Sessions at EUROSIM'04

The ASIM Working Group **"Methods of Modeling and Simulation"** (GMMS) will organise two special sessions at the congress EUROSIM'04, entitled

"Alternative Methods in Modelling and Simulation"

"Education in Simulation"

The special session *Alternative Methods in Modelling and Simulation* will emphasize on non-classical modelling techniques, like cellular automata, neural nets, etc. – in comparison with classical approaches.

Also the aspect of identification will be discussed: it may happen that an alternative model approach can be identified easier. Furthermore, the session would like to bridge the gap between classical continuous modelling approaches and discrete distributed approaches. The session program will be co-ordinated with the program of the EUROSIM special session *"Modeling and Simulation - all problems solved !??"* organised by the working group "Simulation in Environmental Systems". For late contributions please contact the session organisers, F. Breitenecker (TU Vienna, Felix.Breitenecker@tuwien.ac.at) W. Wiechert (University Siegen, wiechert@simtec.mb.uni-siegen.de); the contributions to all four ASIM special sessions will be reviewed directly by the ASIM board, the sessions are open to everybody, not only to ASIM members.

The special session *Education in Simulation* will discuss various aspects of this theme, from simulation curricula via simulators for education purposes to interactive and web-based learning in modelling and simulation. The session will also deal with simulation as education tool in other disciplines, like medicine and physiology. For more details, please contact the session organisers W. Wiechert (University Siegen, wiechert@simtec.mb.uni-siegen.de) of F. Breitenecker (TU Vienna, Felix.Breitenecker@tuwien.ac.at).

The ASIM working group **"Simulation in Environmental Systems"** co-operates since many years with other working groups of GI which also deal with the environmental problems.

Based on experiences in the working group at the EUROSIM'04 congress a special section entitled

"Modeling and Simulation - all problems solved !??"

The motivation is as follows: during the last decade, modelling and simulation has become a popular and wide spread method for problem solving. This trend is documented by special tracks for modelling and simulation in almost every conference dedicated to the classical application areas for simulation such as production and logistics, but also biology, medicine, geology, ... On the other hand it is documented a decreasing interest in conferences about general simulation technologies and the concerning scientific problems. In this situation, the session asks, whether simulation methodology has reached its aim by spreading the basic concepts and methods over its application areas and by founding special-interest simulation groups within them.

Or, whether there are still some basic and/or methodological problems to work on even for a generally skilled simulation expert.

For the working group "Simulation in Environmental Systems" a promising first step has been done at the EnviroInfo 2003 in Cottbus. The process of specifying open problems and possible fields of research initiated there shall be continued and transferred by this EUROSIM workshop from the smaller focus of the application area "environmental systems" to general modelling and simulation problems and research objectives.

If you like to participate, feel free to contact the speaker of the working group, Jochen Wittmann (wittmann@informatik.uni-hamburg.de) or put -as a first contribution to the discussion - your opinion -on our virtual bill board under

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http://www.informatik.uni-hamburg.de/
TIS/index.php?channel=workshops

http://www.informatik.uni-hamburg.de/
TIS/index.php?content=EUROSIM/index.html
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The working group **"Simulation in Production and Logistics"** (SPL) and the working group **"Simulation of Traffic Systems"** will also organise a special session at the EUROSIM'04 congress, entitled

"Simulation and Optimisation"

This special session will discuss all aspects of the combination simulation – optimisation, from methods and algorithms to applications.

The motivation is: Simulation models have always been used for improving a certain system, without regarding of continuous or discrete-event type. Because of larger models and more powerful computing systems, optimisation tasks upon a simulation model reach a new level of complexity and dimension.

Everyone, who has been concerned with a problem of the complexity described above in connection with simulation, should feel encouraged to send in an abstract for a paper including a presentation. But also small and highly sophisticated solutions are of strong interest.

To give a full overview of the State-of-the-Art solutions to this topic, papers dealing with new methodologies or new ways of optimisation for certain fields of problems are highly appreciated. Please contact the organiser M. Klug, markus.klug@arcs.ac.at.

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". – report see below. 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, is prepared. The workshop will concentrate on modelling, control and diagnosis of processes in combustion engines. Further information can be found at the website www.mb.hs-wismar.de/cea/asimws/ .

Report Workshop "Spatially Distributed Systems and Simulation-Based Optimisation. The ASIM workshop of the special interest group 01 on foundations and methods of Modelling and Simulation took place on March 2nd and 3rd 2004 at the University of Siegen in Germany. The workshop was hosted by the department of simulation and the research institute of multidisciplinary analysis and applied systems optimization (FOMAAS). An important aim of the workshop was to bridge the gap between the simulation community and the computational science community. Both are heavily working on very similar problems in complex systems simulation but interestingly there is little personal information exchange.

The lectures on March 2nd concentrated on different aspects of specially distributed systems like the efficient management of spatial data by octrees (Prof. Bungartz, Stuttgart), PDAE systems (Prof. Betsch, Siegen and A. Bartel, Wuppertal), optoelectronic and thermoelectric couplings in chip design (Prof. Griese, Siegen and Dr. Schwarz, Dresden), alternative methods like the Lattice-Boltzman-Algorithm for the simulation of metal foams (Prof. Ruede, Erlangen) and a survey of current problems in automobile industry (Dr. Vietor, Ford-Werke AG).

The second day focused on simulation based optimization and was introduced with an introductional lecture of Prof. Grauer, Siegen. The next lectures dealt with algorithmic differentiation (Prof. S. Bischof, Aachen), control of running robots (Prof. von Stryk, Darmstadt), the multidisciplinary optimization of aircraft wings (Dr. Kobelev, Attendorn and T. Klimmek, Göttingen), typology optimization of light weight structures (Prof. Becker, Darmstadt) and optimal experimental design (Dr. Kostina, Heidelberg).

Due to the enthusiastic resonance on this workshop and the fruitful discussions between the members of different scientific communities the workshop concept will be continued in the next year and the duration will be extended to three days. In the future a poster session will be included where young researchers have can present their work to an expert audience. Currently, the conference proceedings are prepared in electronic form. They will be available on the ASIM web page.

The ASIM working group **"Simulation in Environmental Systems"** – now **"Simulation in Life Sciences"** co-operates since many years with other working groups of GI. This successful co-operation was continued at the workshop *"Simulation in Environmental Sciences and Geosciences"*, Müncheberg, Germany, April 17 – 19, 2004. A detailed report will be given in the next **SNE** issue.

The working group **„Simulation of Technical Systems"** met in Ingolstadt, for a workshop "Simulation of Technical Systems", on March 9 – 10, 2004. – detailed report in next **SNE**. The group is co-organising the 2nd ASIM WISMAR Workshop on *Modelling, Control and Simulation in Automotive*, September 16 – 17, 2004, Wismar.

The working group **"Simulation in Production and Logistics"** (SPL) had some successful one-day meetings and is preparing the bi-annual conference. The 11th conference *"Simulation in Production and Logistics"* organized by the working group will take place on 4th and 5th October 2004 (location: Berlin, Germany; organization and head of program committee: Dr. Markus Rabe, Fraunhofer IPK, email: markus.rabe@ipk.fhg.de). For detailed information please contact Markus Rabe by email.

The Working Group **"Simulation of Traffic Systems"** met on March, 5th 2004 for a half-day meeting in Magdeburg, embedded into the annual SimVis congress. With seven presentations and up to 27 listeners the participation exceeded all expectations. The presentations themselves are highly basing on practical work, done by the members and show a lot of demand for simulation based solutions in this field.

At the end of this meeting, elections of the speakers' team took place. By acclamation, Prof. Brannolte from Bauhaus Univerity in Weimar, Germany as speaker and Markus Klug, from ARC Seibersdorf research GmbH, Austria as vicespeaker of this working group have been confirmed by the present members.

ASIM Conferences

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 – details above, summary below. 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).

R. Hohmann (Univ. Magdeburg) organised the annual conference ASIM'2003 (September 2003, Univ. Magdeburg), see detailed report below. In 2004, the annual ASIM conference is skipped: ASIM members are invited to visit the EUROSIM Congress (Paris, September 2004), where special ASIM sessions are planned, or to attend the special conference "Simulation in Production and Logistics" (Berlin, Oct. 2004).

The annual conference ASIM 2005 will take place in Erlangen – organised by R. Rimane. 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 ASIM'2003

The "*17. Symposium Simulationstechnik*" i.e. **ASIM'03** took place from 16th to 19th September at the Magdeburg Otto-von-Guericke University. Co-organizers were SCS Europe (Society for Computer Simulation), IMACS (International Association for Mathematics and Computers in Simulation), EUROSIM (Federation of European Simulation Societies), GI (German Informatics Society) and IFF (Fraunhofer Institute for Factory Operation and Automation Magdeburg). The organisation committee was coordinated by HS-Doz. Dr. R. Hohmann.

The Magdeburg Otto-von-Guericke University celebrated its ten years' anniversary and 50 years' university location in 2003. With the installation of an electronic analog computer "endim 2000" the continuous simulation also has taken its beginning at the former Technical University 40 years ago. Therefore, it was particularly pleasant that the annual conference of ASIM, the 17th Symposium Simulation Technique, took place at Magdeburg university this year.

The submitted contributions have confirmed the attractiveness of the annual conferences despite an increasing interest in thematic workshops of the Working Groups.

The number of the contributions to the different areas corresponds to the size of the Working Groups. The Bases and Methods of Modeling and Simulation including the Optimization and the Simulation Tools, the Simulation in Production and Logistics as well as the Simulation of Technical Systems appear, therefore, with a series of sessions in the program.

Integral components of the program were the Practice Forum, this year with the Simulation of Mechatronical Systems as subject and the Simulation of Traffic Systems with an own workshop. The Education in Simulation Technique has proved to be a subject of the discussion. Topicality have Embedded Systems, the Distributed and Web-based Simulation. The Life Sciences were represented by the Simulation in Medicine, Biology and the Environmental Area. The Poster Session gave an introduction to the posters presented in the foyer of the conference building. Additional Work Talks took place about the European Project Sim-Serv and Model Libraries for Technical Systems. The symposium during the four days contained 29 sessions with up to four presentations in up to five parallel sessions altogether. Select sessions were opened with six invited plenary lectures. About 160 colleagues took part in the conference.

Scientific institutes of Magdeburg working in the field of the simulation presented research results. We also wanted to present the science landscape grown within the last years to our town. The session Virtual Reality for Development, Test and Training was arranged by the Fraunhofer Institute for Factory Operation and Automation IFF. The Max Planck Institute Dynamics of Complex Technical Systems opened with plenary lectures the Simulation in Mechatronics and Biology and has organized the session Simulation in Chemistry. Research results of the Ecological and Hydrological Modeling were introduced by the Department for Inland Water Research of the UFZ, Centre for Environmental Research Leipzig-Halle in the Helmholtz Association. Colleagues of the IFAK "Institut für Automation und Kommunikation e.V." reported about the Integrated Simulation of Sewage Systems in a plenary lecture.

The social program offered excursions to the ENERCON Company (wind power plants) and alternatively to the Waterway Cross Magdeburg (Traffic Project German Unity) as well as a historical town walk before the festive evening event. Just like the welcoming party it was musically arranged by students of the institute for music.

The ASIM conference 2003 gave many opportunities to exchange information and knowledge about modelling and simulation between participants from the industry, the universities, and research institutes. It also served the development of personal relations.

Monument to Otto von Guericke on the occasion of his 400th birthday 2002

The conference proceedings “Simulationstechnik, 17th Symposium in Magdeburg, September 2003” (ISBN 3-936150-27-3) were published by SCS- European Publishing House, Erlangen, Germany.

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ESM 2004
18th European Simulation Multiconference
June 13 – 16, 2004, Magdeburg, Germany

EUROSIM ’04
5th EUROSIM Congress
Sept. 6 -10, 2004; Cite Descartes (near Paris), France
ASIM Special Sessions:
Alternative Methods in Modelling and Simulation
Education in Simulation
Modeling and Simulation - all problems solved !??
Simulation and Optimisation

ASIM – GMMS / STS 2nd Wismar Workshop
Modelling, Control and Simulation in Automotive and Processautomation
September 16 – 17, 2004, Wismar, Germany

ASIM – SPL Conference
Simulation in Production and Logistics
October 4 – 5, 2004; Berlin, Germany

ESS 2004
18th European Simulation Symposium
October 17 – 20, 2004, Budapest, Hungary

ASIM 2005
18th Symposium Simulation Technique
September 2005, Erlangen, Germany

ASIM Info and Contact

GMMS *Methods in Modeling and Simulation, P. Schwarz, FhG Dresden,* http://www.gmms.asim-gi.org
SLS *Simulation of Life Sciences; J .Wittmann, Univ. Hamburg,* wittmann@informatik.uni-hamburg.de
*(**SUG** Simulation of Environmental Systems +*
SMBB *Simulation in Medicine, Biology, Biophysics)*
STS *Simulation of Technical Systems, A. Wohnhaas, debis Systemhaus GEI,* www.sts.asim-gi.org
SPL *Simulation in Production and Logistics, S.Wenzel, Fraunhofer Institute Dortmund,* www.spl.asim-gi.org/
AK SBW *Simulation in OR, C.Böhnlein, Univ. Würzburg* boehnlein@wiinf.uni-wuerzburg.de; www.asim-gi.org
SVS *Simulation of Transport Systems, U. Brannolte, Univ. Weimar / M. Klug, ARCS Seibersdorf* Ulrich.Brannolte@bauing.uni-weimar.de; www.asim-gi.org

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CSSS Czech and Slovak Simulation Society

General Information

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

Past Events

MOSIS'2003. The 37th International Conference on "Modelling and Simulation of Systems (MOSIS'2003) that took place on the 28th to 30th of April 2003 in Brno, Czech republic, was organised by the Department of Computer Science FEEI VŠB – Technical Univ. Ostrava and Faculty of Information Technology, Univ. of Technology Brno and sponsored by CSSS, ASU EUROSIM and SCS. Technical journal AUTOMATIZACE Praha was a medial sponsor. The Conference was connected with conference ISM'2003 - Information System Implementation and Modelling. Some 95 participants from Czech republic, Slovakia, and Poland attended the conference. The CSSS board meeting took place during conference.

ASIS'2003. The XXV International Colloquium on "Advanced Simulation of Systems" (ASIS 2003) that took place on the 9th to 113th September 2003 in St. Hostin, Czech Republic 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. Some of the interesting point in topic were "Simulation in Hydrodynamics", "Education of Modelling and Simulation in Education", Parallel and Distributed Simulation", New Modelling Paradigm", "Simulation Case Studies". Some 40 participants from Czech republic, Slovakia and Poland attended the workshop, which was connected with annual meeting of CSSS.

MOSMIC'2003. The 4th International Workshop "Modelling and Simulation in Management Informatics and Control" (MOSMIC'2003) that took place on October 8-9, 2003 in Zilina, Slovak republic, was organised by the Faculty of Management, Control and Informatics - University of Žilina, Slovak Society for Applied Cybernetics and Informatics, Bratislava and CSSS, sponsored by EUROSIM.

The chairman of the international program committee was prof. Dr. M. Alexik. Proceeding of the workshop has 20 reviewed papers. Over 20 attendants participated. The CSSS board meeting has taken place Wednesday October 8, 2003, during workshop.

Informatics'2003. The 7th International Conference „Informatics 2003 took place in Bratislava, Slovak republic on November 27-28, 2003. Conference was organised by the Slovak Society for Applied Cybernetics and Informatics- SSAKI, Alexander Dubcek University of Trencin, Institute of Informatics, Slovak Academy of Sciences, Bratislava and House of Technology of Association of Slovak Scientific and Technological Societies Bratislava Ltd, in cooperation with the Slovak Republic Government Office.

The chairman of the international organising committee is academician Prof. Dr. Ing. Ivan Plander. Some of the interesting presentation was: "The Strategy of Society Informatization within the Conditions of the Slovak Republic" by Dr. Papp from Ministry of Transport, Post and Telecommunications of the Slovak Republic, "Informatics –Science and Technology" by Magdolen P., Ministry of education of the Slovak Republic, "Intelligent Agents in Simulation" by Javor A., Budapest University of Technology and Economics, Hungary, "New Registry of Population by Dubcak A., Ministry of Interior of the Slovak Republic and Institutional, Legislative and "Methodical Framework of Public Administration Informatization" by Makara S., Telenor Slovakia spol. s.r.o. The major partners of the Conference was HP Slovakia, Oracle, Softip and Microcomp –Computersystem s.r.o, Bratislava.

Coming Events

MOSIS'2004

38th International Conference on
"Modelling and Simulation of Systems
April 19-22, 2004,
Roznov p. Radhostem, Czech republic

The 38th International Conference on "Modelling and Simulation of Systems" (MOSIS'2004) will take place on April 19-22, 2004, in Roznov p. Radhostem, Czech republic. The Conference will be connected with workshop ISM'2004 - Information System Implementation and Modelling. The chairman of the international program committee is Dr. Ing. Jan Stefan. For more information – jan.stefan@marq.cz.

ZE'2004

11th International Symposium
„Railways on the edge of third millennium"
May 27-28, 2004, Zilina, Slovak republic

The 11th International Symposium „Railways on the edge of third millennium – On the way towards the European Railway – Harmonisation and ITS“ (Zel ’2004) will take place on May 27-28, 2004 in Zilina, Slovak republic. One of the interesting points in topic is „Simulation of Railways Stations“. Accompanying Activities organised before Symposium (26 of May) is seminar „Established poles and platforms of Excellence in European Rail Research". Some of important sponsors of Zel 2004 are European Commission in Brussels, Siemens AG Österreich Wien, China TDJ Systems Research Centre Harbin, Scheit und Bachmann GmbH Mönchengladbach and ABB Schweiz AG, Wettingen. The chairman of the international program committee is Prof. Ing. L. Skyva, FRI-KTK, University of Zilina.

ASIS’2004

26th International Workshop
„Advanced of Simulation Systems“

September 22 – 24, 2004
St. Hostin, Czech republic

The 26th International Workshop „Advanced of Simulation Systems“ (ASIS’2004) will take place in the Moravian town St. Hostin, Czech republic on September 22-24, 2004. The chairman of the international organising committee is Dr. Ing. Jan Stefan.

6th International Scientific Conference on
"Electronic Computers and Informatics'2004"

September 22-24, 2004
Herlany, Slovak republic

The 6th International Scientific Conference on "Electronic Computers and Informatics'2004" will take place on September 22-24, 2004, in Herlany Slovak Republic. One of the topics is concentrating on Modelling and Simulation of the Systems. The general chair of the conference is prof. Jelšina, Technical university of Košice.

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CROSSIM - Croatian Society for Simulation Modelling

General Information. CROSSIM - CROatian Society for SIMulation Modelling was founded in 1992 as a non-profit society with the goal to promote knowledge and use of simulation methods and techniques, dissemination of information and development of education and training in simulation particularly through organization of meetings, courses and workshops. The Society is an affiliate of SCS since 1994 and a full member of EUROSIM since 1997. The majority of 70 CROSSIM members belong to the academic community but there are also members from institutes, governmental institutions, industry, private enterprises and a few international members as well.

Past Events. The General Assembly of the Society meets once a year and the last was held on March 29, 2004 when prof. Jadranka Bozikov was elected for her second three-year mandate as a president.

ITI 2004 – BIOSTAT 2004

26th International Conference
Information Technology Interfaces
11th Meeting of Researchers in Biometrics/Statistics

June 7-10, 2004
Cavtat near Dubrovnik, Croatia

ITI 2004
26th Internacional Conference on
INFORMATION TECHNOLOGY INTERFACES

CROSSIM together with ARGESIM, TU Vienna, co-operates with the Zagreb University Computing Centre in organisation of the International Conference *Information Technology Interfaces ITI 2004* that will be held this year on June 7-10 in Cavtat near Dubrovnik. The special session entitled "*ITI in the Century of the Gene: Challenges and Opportunities*" will be the leading one among thirteen topics of interest. The Conference traditionally has the strong section on modelling, simulation and optimisation. *BIOSTAT 2004*, *Meeting of Researchers in Biometrics/Statistics* together with the *School of Biometrics* will be organised in cooperation with the Croatian Biometric Society and held in parallel with the Conference for the eleventh time.

All the information is available at Conference web site iti.srce.hr

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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.

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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DBSS Steering Committee

A.W. Heemink (TU Delft): Chairman
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Past Events

Seminar: “Simulation in Economics”, Erasmus University Rotterdam, September 17th 2003.

The Faculty of Economics of Erasmus University Rotterdam, where the late Prof. Jan Tinbergen and Nobel price laureate once lectured, organized this seminar. This one-day seminar covered many interesting topics. In SNE news 38/39 the progamme has already been published. In this SNE news we present a more detailed report of the workshop.

In the morning session four lectures were presented in which predominantly attention was given to the state-of-the-art in the field and some new developments were discussed on simulation in Economics. In the afternoon session four cases were discussed from different application fields.

The morning session started with an overview delivered by Prof. Jack Kleijnen of Tilburg University. He emphasized that, especially in Economics, simulation deals with the following three issues: 1) sensitivity analysis (for answering “what-if” questions), 2) uncertainty analysis (for answering questions on all kinds of risks), and 3) optimization with and/or without constraints (for answering questions of what is the “best” solution). Kleijnen clearly demonstrated via many examples that in Economics simulation is developing more and more as a “module” in decision support systems, including ERP and MRP systems. In his eyes important work on modern software developments has been delivered in the last years by Law and Kelton (2000), and Swain (2001).

Relevant information of the activities of Prof. Kleijnen and his group is available on the following website: center.kub.nl/staff/kleijnen/papers.html.

Prof. Rommert Dekker of Erasmus University Rotterdam (EUR) was the second speaker and he addressed the topic of simulation in logistics. With the aid of a number of applications from different fields, like container stacking, elevator and inventory control, he demonstrated that the indirect value of simulations is often more important than the direct results.

Most logistics systems are so complex that validation is not possible and can become very costly, so he proposed not to do it at all.

In logistics it is very important to use the technique of "decoupling", because it can make the problems more transparent and can simplify the problem solving process. An interesting finding was that he could conclude from a comparative study, that if three groups independently developed programs for the same logistics problem, the outcomes of the programs may differ by more than 20%!

Dekker further observed that the used software in most container handling problems has too much overhead and the great detail needed to solve special problems caused the creation of huge programs, which are bug-ridden.

These programs can hardly be checked and many software developers are confronted with the statement: "The devil is in the detail". His general advice was to choose those programs, which fit with the aims of the simulation, and not to fight on or with methods but seek to combine.

In his eyes, elevator programs are the most complex control systems in logistics; he illustrated that with a study performed on a system at the EUR. Interesting is that Otis uses programming systems that are able to create automatically embedded software codes, and so they can make quickly reliable and tailor-made elevator systems without too much delays and bugs.

He concluded his talk with some "wise" statements, which we will repeat here: 1) develop models which can be re-used; 2) make a clear spec of the model; 3) during the model building one gains the most insight into the problem on-hand; 4) always combine simulation with analysis; 5) use the simulation model as an operational tool; and 6) give attention to the new areas as AI, Embedded Systems, etc., because they will play a dominant role in logistics in some years from now!

The third speaker was Dr. Vladimir Karamychev from the Erasmus University Rotterdam on theoretical and computational models in Insurance Markets, which handle asymmetric information. The model he presented was rather simple, but showed in the simulations very surprising results, which looked like the results from chaotic systems with a simple bifurcation point. Karamychev showed that equilibriums do not exist in certain situations, and most likely this knowledge is used by insurance companies to generate the many insurance products available nowadays.

Sometimes, the simulationist feels that he or she tries to solve the unsolvable; in this field it is certainly valid that models are built on the edge of the known. A very challenging contribution, which created more questions than answers.

The fourth and last speaker of the morning session was Prof. Cees van Halem, also from the Erasmus University Rotterdam. Moreover, he runs Oasis BV., a consulting company in Nieuwegein in The Netherlands. The title of his talk was: Simulation in Management. This talk was very informative, because it gave a very good overview of the value of simulation in management, if the work is done in the right way.

Van Halem basically sees simulation as a tool, which can lead to better decisions of the management, but always must be understood that the customer always stays the problem-owner, and the simulationist should never forget that. It means that the simulationist must translate the 'mental model' of the customer into a simulation model, and not build the model on his own mental model!

Important steps in his approach are: 1) starting with 'issue raising' via mental mapping, mind mapping and clustering techniques; 2) the creation of cause and effect diagrams which is considered as the most critical step; 3) making the computer model, and 4) play with this computer model and simulate the company and learn the dynamics of the company to learn to make sensible decisions.

As the aims of these causal models for management, he mentioned a.o. the following subjects: catching of the appropriate mental models, the synchronization of insights, the execution of "what-if" scenarios, the development of a feeling for the company dynamics, and lastly the seeing of the coherence in the diverse activities of the company. Van Halem concluded with the statement, that in his area "people are needed who understand the business, and speak the language, and do not loose the problem-owner!" Oasis BV. can be reached via the Internet site: www.oasis.nl.

The afternoon session was devoted to a number of case studies, presented by senior consultants in simulation as well as by university researchers. The first case was presented by Eelco van Asperen from Erasmus University Rotterdam. He discussed how to model the arrival processes of vessels in ports. In port simulation models, the impact of the arrival process of ships on the model outcomes tends to be underestimated. Arrival processes are commonly modeled by Poisson processes.

In his presentation Van Asperen demonstrated that other arrival process models may be more valid such as stock-controlled or equidistant processes. In the case study the uncontrolled arrival processes actually performed worst in terms of both ship delays and required storage capacity. Stock-controlled arrivals perform best with regard to large vessel delays and storage capacity.

Additional control of the arrival process through the application of a priority scheme in processing ships further impacts efficiency in all three cases.

The second case study was presented by Rienk Bijlsma from Systems Navigator. He may certainly be considered as a senior consultant in simulation. He worked for Systems Modeling for many years (Systems Modeling is the origin of the well-known Arena simulation package) and he continued to do so for Incontrol and Rockwell Automation. As a senior consultant he guided many trainees in simulation and his talk concerned a number of master theses in discrete-event simulation, which was actually the title of his talk. In a clear presentation he described the type of research in which his trainees were involved in various industries, such as banking, energy, logistics and telecom.

The third case study was presented by Mrs. Leanneke Loeve from Incontrol Enterprise Dynamics. She demonstrated Simone, a large-scale train network simulation. This simulation model was developed for Railned (ProRail) and is meant to assess the robustness of timetables and analyze cause-effect relationships of delay in the network. The model was implemented in Enterprise Dynamics and shows how trains proceed on the Dutch railway network also showing relevant information such as whether or not delayed and if so how much the delay is. It was considered a weakness that thus far the model did not take the effect of stations and personnel management into account.

The last speaker of the day was Csaba Boer, a PhD student from Erasmus University Rotterdam who conducts his research in close cooperation with the Simulation group of Alexander Verbraeck from Delft University of Technology. There are many simulation languages around (Arena and Enterprise Dynamics are two of these) and then it can easily happen that one submodel has been implemented in one simulation package and another in a different language. Would it be possible to have these submodels communicate? Could a simulation task be distributed over a number of simulation languages? This question is the core of Csaba Boer's research and in his presentation entitled 'Distributed e-Services for Road Container Transport Simulation' he demonstrated the relevance of his research in a logistic application.

The sheets of the presentations are available in pdf-format on the web page: http://www.few.eur.nl/few/research/eurfew21/m&s/seminar/program.htm

Wim Smit
DBSS/HAN University Arnhem en Nijmegen
Henk de Swaan Arons,
DBSS/Erasmus University Rotterdam

StratMap Seminar, HAN University in Arnhem, March 24th, 2004.

StratMap is a rather simple software-programming tool, which is special developed for SME's [Small and Medium-Sized Enterprises], to construct in an interactive way strategy plans. The software is marketed and sold under the name "StratAchieve Software". Besides, the tool allows to perform "what-if" analyses. Keith Sawyer, who markets this program via his company, has developed the program. Information on the software and company can be requested via e-mail address: keithsawyer@blueyonder.co.uk.

More than 30 persons attended this one-day seminar; 14 persons came from different SME's, non-profit organizations and local government agencies; the other participants were consultants, professors, tutors and students. The day was sponsored by Syntens Gelderland and Overijssel, a government agency for enforcing SME's on innovation, DBSS (Dutch Benelux Simulation Society), and the Knowledge Centre of HAN University. The organizers had planned sufficient breaks in the programme, so that participants could communicate intensively with each other.

The day started with a welcome by the chairman of the technical faculty, Mr. Harry Ankone, who addressed the importance of strategy in general, but also the teaching of strategic thinking in an educational setting, and he hoped that this initiative might lead to a further strengthening of the contacts between SME's and the HAN University.

The next speaker was Hans Broekhuis, professor in Strategic Entrepreneuring at the Hanze University in Groningen, whose topic was dedicated to the sense and nonsense of strategic plans. Between strategy and knowledge he saw something, which characterizes the entrepreneur, viz. "smartness", because with this human attribute the entrepreneur can get the optimum from knowledge. Further he related strategy with the present innovation policy in The Netherlands, and in his view subsidizing R&D activities will not increase productivity or the profit power on the short term, but will only increase the number of scientific papers and patents. Most subsidies presently go to the universities and big companies for R&D programs. SME's develop and survive via their "smartness", and only by this they are able to increase their productivity and profits. More than 80% of all working Dutch are working in SME's, but SME's only receive about 15% of the national and European R&D subsidy budgets. In his eyes innovation means the constant re-invention and adaptation of the company's business design to internal and external changes. Broekhuis concluded his lecture with an overview of some distinctions between entrepreneurs and managers.

One main distinction is that entrepreneurs put their own money at risk; managers don't do that.

The last speaker of the morning session was Keith Sawyer, who started with some theory on strategy. In his eyes a strategy is the organisation's plan to achieve its goals. In his presentation he used some power point sheets, which are distributed on request through: Charlotte.Lamers@ft.han.nl. In formulating a strategy Sawyer finds the discourse between his StratAchieve Software and the user(s) essential, and he prefers to start with the "what" questions, which are followed by the "how" and "why" questions. Especially with teams this approach is able to create a consensus, which accelerates the formation of a common opinion and mission among the team members. Via some examples the audience was trained for the afternoon sessions, which consisted of the design of an own strategy by teams.

In the afternoon sessions the participants created in small groups their own strategy plans, and Sawyer went around to help the groups with advice and explaining the various options of the programming tool. At the end the groups were asked to present their work in a plenary session, so that everybody could benefit from each other work. Impressive was that most groups were able to create a reasonably detailed strategy plan in a rather short time. Sawyer offered to help the groups further in refining and upgrading the strategy plans by e-mail correspondence. In the mean time for seven participants an upgraded strategy plan has been made.

At the end of the day most participants valued this day, and look out to further initiatives from our side in offering workshops which programming tools which might be of value for SME's.

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AES Spanish Simulation Society

Spanish Simulation Society

No news received.

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FRANCOSIM - Société Francophone de Simulation

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

Pole "Modelling & simulation of discrete events systems"

To improve the necessary synergy between industry and academia workers in the area of system modelling, the pole co-organises the series of conferences "MOSIM" (Modelling and Simulation). The 4th conference took place April 2003, the 5th MOSIM will take place in Nantes, September 2004 (see below).

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Pole "Modelling & simulation of continuous systems"

This pole has launched in 1999 a series of conferences on modelling and simulation in medicine and biology (BioMedSim). The pole organised the 3rd BioMedSim Conference on the 27th-30th of May 2003 at the University of Balamand, Lebanon

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Coming Events

MOSIM'04

5th French-Speaking Conference in Modelling and Simulation

Modeling and simulation to analyze and to optimize industrials and logistics systems

Sept. 1 - 3, 2004; Ecole des Mines de Nantes

Nantes, France

The main theme of the 5th French-Speaking Conference in Modelling and Simulation, MOSIM'04, is "*Modelling and Simulation for the Analysis and Optimisation of Industrial and Logistic Systems.*".

MOSIM'04 aims at being a place of communication and exchange between researchers and industrials on this topic.

The selected themes and the main application areas cover a large range, but are not intended to be restrictive. Because the MOSIM conferences aspire at bridging the gap between theory and practice, MOSIM'04 will combine theoretical and/or methodological presentations with presentations describing applications.

Selected articles presented at MOSIM'04 will be published in national and international journals (European Journal of Operational Research, Engineering Applications of Artificial Intelligence, Journal of Intelligent Manufacturing, International Journal of Production Research, Journal of Decision Systems).

The conference will be held at the Ecole des Mines de Nantes, France, which is located close to the beautiful Erdre river, on September 1-3, 2004. Nantes, the 6th largest town in France, is located 400km from Paris (2 hours by TGV), and 50 km from the Atlantic coast. It is considered to be the economic and cultural capital of the west of France.

More information can be found at the website www.emn.fr/mosim04/ or via email: mosim04@emn.fr

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EUROSIM'04

5th EUROSIM Congress on Modelling and Simulation

Sept. 6 -10, 2004

Cite Descartes

Marne la Valle / Paris, France

FRANCOSIM organises the 5th EUROSIM Congress on Modelling and Simulation, the main simulation conference in 2004. Detailed information can be found at the begin of **SNE**'s news section.

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 exchang 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 postrgraduate 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. At present there is a volume to be published containing papers in various fields of simulation revealing R&D simulation results achieved.

With regard to the development of regions – that is of great importance in the EU of which Hungary will become member from the 1st of May – simulation studies within a national project are undertaken in cooperation with the Regional Scientific Transdanubian Center of the Hungarian Academy of Sciences. Our members have been and are successfully participating in national and EU simulation projects.

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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), and Osiekik/ Koszalina (2002).

The annual PSCS Workshop on Simulation in Research and Development took place on September 9-12, 2003 in Zakopane, Poland. The 52 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 9th PSCS Workshop on „Simulation in Research and Development", T. Krzyzynski and A. Tylikowski (Eds.), Koszalin, 2003 were published (in Polish). The price is 20,- PLN.

Coming Events

11th PSCS Workshop

„Simulation in Research and Development "

September 1 - 4, 2004

Bialystok & Augustow, Poland

Prof. L. Bobrowski will organize the 11th PSCS Workshop on „Simulation in Research and Development" on September1-4, 2004 in Bialystok & Augustow, Poland. Further information via E-mail: ptsk2004@ii.pb.bialystok.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 (Tresurer).

2003 Annual Conference

ISCS - Annual Conference Cefalù, November 28-29, 2003. The event, which has been held together with the annual meeting of the ISCS members has gathered international experts in the simulation area operating in the research area, in the industrial context, in the Public Administration and in the field of formation and training. Fields of interest of the Conference concerned all the aspects of the continuous and discrete simulation and of the artificial intelligence techniques applied to it.

The conference location has been Cefalù in Sicily (Italy). Member of the Scientific Committee were Alfredo Anglani (Univ. Lecce), Felice Cennamo (Univ. Napoli), Antonio Grieco (Univ. Lecce), Giuseppe Iazeolla and Franco Maceri (Univ. Roma "Tor Vergata"), Mario Savastano (IBB-CNR, Napoli).

The next Annual Conference ISCS will be held in December 2004.

ISCS Information

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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 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. ROMSIM members presented communications at CSCS-13th International Conference on Control Systems and Computer Science, held in Bucharest in May 2001. Some members of ROMSIM attended ECC-European Control Conference, held in Porto, Portugal, in September 2001. A ROMSIM member has participated at MATHMOD Conference 2003 at TU Vienna. At the demand of Prof. Yskandar Hamam, EUROSIM President, a ROMSIM member was proposed for the IPC of BioMedSim03 conference.

Present and Coming Events

ROMSIM is involved in organization of the Eurosim Congress 2004 to be hold in Paris. The Call for Papers of Congress has been sent to members of ROMSIM. Two members of ROMSIM are members of Scientific Committee of the Congress. At the same time ROMSIM encouraged members to submit papers at this Congress. As a result a numbers of papers have been submitted and we expect to have a representative participation to Eurosim Congress 2004.

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

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

The Seminar on "Fuzzy sets, theory andapplications" started working in 1996. Since then the activity of the seminar has taken place at th Instutute of Informatics in Bucarest. The main fields of interest are :fuzzy set theory, fuzzy logic and various applications in model ing, optimization and fuzzy systems. The seminar is in fact an interdisciplinary one; there are mathematicians, computer science engineers, economists and logicians trying to apply fuzzy technics. Many other subjects were considered: modal logic,causality, machine learning neural nets, large systemsetc. The activity of the seminar was reported in "Studies in information and control" (in 1997, 1998,1999 ,2000). In this very moment (the spring 2003) the seminaris concentrated on dynamic logic and representationsof fuzzy structures. The leader of the Seminary is Paul Fflondor.

Seminar on Chaos and Fractals. Starting with october 2002 , at the Faculty of Automatics and Computer Science of the Politehnica University of Bucarest, a monthly seminar about chaos , fractals and applications takes place. About 30 members (professors, researchers, graduate and undergraduate students) from various fields like engineering, medicine, mathematics, physics ,chemistry and biology are involved . The main organizer is prof. Radu Dobrescu from Politehnica University.

The group already organized the First South-East European Symposium on “Interdisciplinary Approaches in Fractal Analysis-IAFA 2003. This Symposium was a succes due to the large cooperation between romanian researchers and researchers from many other countries.

In the present, the seminar is dedicated to chaos theory with application in medical imaging, especially the analysis of tumours. The problem is to find good methods for understanding the morphology of tumours ,tissue homogeneity and growing phenomena. Some PH.D thesis ,elaborated on these subjects by some members of the seminar, are in progress.

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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 93 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

Executive board of SLOSIM had two meetings in the last period. The first one was in december last year, and besides some reports about current status and actions of society, it ended with the decision that SLOSIM proposes prof. dr. Borut Zupančič for the future president of EUROSIM. The society was asked for the proposition from the side of EUROSIM Executive Board due to the practice that the society organizing the next EUROSIM congress delegates also the president for the three year period. As we reported in the previous issue (december, 2003) SLOSIM was chosen to be the organizer of EUROSIM 2007 congress.

The second SLOSIM Executive Board meeting took place at the Faculty of Electrical Engineering on april 4th, 2004. The members decided to organize a visit to the Environmental Agency of Slovenia, the group of air and climate changes where also the weather forecast is made, using modelling and simulation approach as well. Intensive activities concerning the EUROSIM 2007 congress were started covering different aspects of organization. Main ideas and data will be presented to the EUROSIM Executive Board and will be disscussed on meeting following the congress this september in Paris. The Leaflet with the first information about the congress will be prepared to be spread among the EUROSIM 2004 attendees.

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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 seminar **Automaatio, Safety and Simulation on Nuclear Power Stations** were held on a cruising on the Baltic Sea between Helsinki and Riga 13 – 15 April 2004. The Finnish Simulation Forum (FinSim) organised this seminar together with the FSA Energy and the Automation Safety Forum (ASAF). The topics were on safety, critical control, regulatory guides, simulation aided automation design, reactor simulation, transient and accident analyses, and engineering, testing and training simulators.

Future Events

Conference Announcement

45^{th} SIMS Conference

September 23 – 24, 2004
Lungby, Denmark

The **45th Scandinavian Conference on Simulation and Modeling**, will be organized at Technical University of Denmark (DTU) in Lungby, Denmark, September 23-24, 2004. Around 80 abstracts have been accepted. Further information is available from www.scansims.org

Conference Announcement

4th Modelica International Conference

March 2005, Hamburg, Germany

The International Modelica Conference is organized each one-and-half year. Location of Modelica'2005: Technical University of Hamburg-Harburg, Germany. Local organizer is Prof. Schmitz. Further information is available from 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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Past Events

The UK Simulation Society held its 2004 conference, **UKSim 2004**, in St. Catherine's College, Oxford, March 29-31. For the first time the location of the conference was chosen to be Oxford, after three Cambridge conferences. As a result of a decision made during the previous meeting in Cambridge, this was also the first annual conference rather than biennial. As expected, there was a drop in the total number of papers selected for presentation, but the quality and distribution in terms of regional representation remained high from both universities and industry.

The conference included a plenary session with an invited speaker, Dr Simon Tomlinson from the games industry where simulation technology has found new fertile application grounds. A total of 30 papers were presented within 7 sessions in the areas of Man-Machine Systems, Industry & Defence, Analytical & Stochastic Models, Networks & Distributed Simulation, and Health & Human Models. In particular the Analytical and Stochastic Models theme, started with last year's conference in Cambridge, continued to generate interest and attract high quality papers. Similarly, the Networks & Distributed Simulation theme, established during the second Cambridge conference, continued its success with contributions in the areas of Network and Tools, Distributed Systems, and Fast Networks and Applications. Papers presented within these sessions generated a great deal of interest and discussion, and provided an opportunity for the instigation of future collaboration amongst participants.

The social activities for the conference participants included an afternoon of punting activities, museum visits, and a conference banquet at the St Catherine's college dining hall.

At the meeting of the UKSim committee, held during the second day of the conference, it was agreed to continue with the annual frequency and hold the 2005 conference in the period right after Easter. It was also agreed to maintain Oxford as a conference location for the next year, with the option of choosing one of the older colleges.

A plan for the next 3-4 issues of the IJSSST was also discussed. A first issue on "Complex System and Processes", including selected papers from the latest UKSim conference, is expected to be ready in late May/June. Another issue on "Applied Modelling and Simulation" is planned for the end of the year. Other possible issues for 2004 include "Mobile Networks" and "Medical Development & Applications".

Alessandra Orsoni, UKSIM Secretary
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INTERNATIONAL SOCIETIES AND RESEARCH GROUPS

CISM - International Centre for Mechanical Sciences

www.cism.it

CISM is a non-profit organization, founded in 1968 to favour the exchange and application of the most advanced knowledge in the mechanical sciences and in other fields (mathematics, information and system theory, operations research, computer science, artificial intelligence). Located in the Palazzo del Torso in the centre of Udine, the Centre's facilities include two lecture halls, several smaller lecture and meeting rooms, the Centre's library, secretariat, administrative and technical offices and, on separate premises, the Centre's printing press. CISM is international in both scope and structure: the Scientific Council, rectors, lecturers are selected from among the acknowledged authorities in their respective fields the world over.

The principal activity of the Centre is the organization of courses, seminars, work shops, symposia, and conferences to present the state of the art of these sciences to researchers. It also provides advanced training for engineers operating in industry.

The Centre has produced over 350 texts, the collected lectures of CISM courses, together with the proceedings of symposia hosted by CISM, and selected monographs, for publication by Springer-Verlag of Vienna and New York. The journal *Mechanics Research Communications* was founded by CISM in collaboration with Pergamon Press, Oxford in 1973.

CISM is funded by the Friuli Venezia Giulia Region, the Province and the city of Udine, and local public institutions. Further financial support comes from the National Research Council of Italy (CNR), and from UNESCO.

The typical course or seminar is brief, but intense: a week of 35/40 lectures, more or less the equivalent of a university course of one semester. Participants pay a registration fee, but young researchers who cannot be supported by their own institutions may apply for scholarships.

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INDUSTRY NEWS

Enterprise Dynamics Academic Program

Discrete-event simulation is more and more part of the academic curriculum. Enterprise Dynamics is one of the most commonly used simulation platforms to be used in these courses. Not only is it easy-to-learn, but it also comes complete with many simulation objects (called atoms) that assist the student in building a well-constructed simulation model for virtually any type of training subject.

But, it gets even better; there are many materials available to assist universities and other academic institutes in their efforts to teach simulation:

- The **Educational Suite** is the same software that is normally available for the industry but with additional cases and training materials.
- A **Free Student Version** for institutes with a valid license of the Educational Suite.
- **Free Student Tutorials** in English, German, French and Dutch.
- A special **Teachers' Training** to assist the teacher in getting started with a simulation course using Enterprise Dynamics.

Traffic Planning for Shiphol Train Tunnel by SIMONE

The train tunnel running under Amsterdam Airport Schiphol is about to become a transportation bottleneck in the densily populated west part of The Netherlands. Since April 2003 potential solutions are invented by a joint project team of Prorail and Dutch Railways. To quantify the effects of each alternative, the project team uses SIMONE+. This simulation application has been developed by Incontrol Enterprise Dynamics and is based on SIMONE - **SI**mulation **MO**del for **Ne**tworks.

SIMONE+ simulates the flow of trains in the tunnel at a highly detailed level. Trains enter the simulation model according to a fixed timetable, but may be randomly delayed when they approach the tracks that are being studied. Based on the settings of signals along the tracks, a train decides whether it should pull up, maintain its current speed or slow down. In this way the simulator can determine exactly how long a train remains on the studied track.

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Scientific Computers distributes Maple 9.5

Scientific Computers, distributor for the German speaking area, starts distributing Maple 9.5, the newest version of the widely adopted Maple mathematical computation product line. Continuing the tradition of providing standards-compliant algorithms that deliver maximum accuracy and powerful solvers, Maple 9.5 significantly expands the type and complexity of problems you can solve.

- The Optimization package is a powerful tool that extends Maple's numeric problem-solving capabilities.
- Differential-algebraic equation (DAEs) solvers support advanced modeling applications.
- Improved ODE and PDE solvers extend Maple 9.5's lead in the technical software industry.
- Numerical performance improvements appear throughout the system. Using the latest technical advancements, Maple 9.5 is significantly faster than before.

Maple 9.5 contains new tools and an improved working environment to allow you to truly manage, manipulate and convey your knowledge, not just your calculation results.

- With the inclusion of a dictionary of mathematical and engineering terms and concepts, Maple 9.5 provides convenient access to important technical reference information.
- Enhancements to plots improve interactive manipulation through sliders, scaling, panning, and an enhanced plot builder.
- New dockable palettes make expression entry easier.
- Easy-to-access interactive task assistants help with common tasks, such as unit conversion and solving ODEs.
- Improved command completion for easy navigation of the Maple command set.
- Mathematica® Notebook conversion and command translation saves time when migrating your work to Maple.
- OpenMaple™ allows access to Maple using C and now Java™ and Visual Basic® programs.

Maple 9.5 offers more tools to help educators effectively deliver course material, and to facilitate and increase students' understanding of mathematical and engineering concepts.

- The Student[MultivariateCalculus] package assists with the teaching and learning of multivariate calculus.
- The Student[Precalculus] package now includes more functions for visual explorations of topics in greater depth.

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MathWorks Releases Genetic Algorithm TB

The Genetic Algorithm and Direct Search Toolbox extends the optimization capabilities in MATLAB® and the Optimization Toolbox with tools for using the genetic and direct search algorithms. You can use these algorithms for problems that are difficult to solve with traditional optimization techniques, including problems that are not well defined or are difficult to model mathematically. You can also use them when computation of the objective function is discontinuous, highly nonlinear, stochastic, or has unreliable or undefined derivatives

The Genetic Algorithm and Direct Search Toolbox can complement other optimization methods to help you find good starting points. You can then use traditional optimization techniques to refine your solution.

Toolbox functions, which can be accessed through a graphical interface or the MATLAB command line, are written in the open MATLAB language. This means that you can inspect the algorithms, modify the source code, and create your own custom functions.

Key Features are

- Graphical user interfaces and command-line functions for quickly setting up problems, setting algorithms options, and monitoring progress
- Genetic algorithm tools with numerous options for creation, fitness scaling, selection, crossover, and mutation
- Direct search tools that implement a pattern search method, with options for defining mesh size, polling technique, and search method
- Functions for integrating Optimization Toolbox and MATLAB routines with the genetic or direct search algorithm
- Support for automatic M-code generation

The **genetic algorithm** solves optimization problems by mimicking the principles of biological evolution, repeatedly modifying a population of individual points using rules modeled on gene combinations in biological reproduction.

The toolbox also lets you specify population size, number of elite children, crossover fraction, migration among subpopulations (using ring topology), etc.

Direct Search Algorithm Tools. The direct search algorithm implements a pattern search method. Instead of eg. Gradients the pattern search method implements a minimal and maximal positive basis pattern. It handles bound constraints, linear equalities, and linear inequalities, and does not require functions to be differentiable or continuous.

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FEMLAB 3.0 – much faster

For years COMSOL has been known as an industry innovator of software that solves large, complex sets of partial differential equations (PDEs) in engineering and scientific contexts, especially in the field known as multiphysics.

Now the firm announces a dramatic leap in performance with FEMLAB 3.0. Now available as a standalone program while still being able to tightly integrate into MATLAB from The MathWorks, the firm's designers wrote optimized code from the ground-up in C++ and Java.

Compared to its predecessor, this new product can compute some models as much as 20 times faster while using as much as 20 times less memory. Thus in today's standard PCs it can accommodate extremely large problems, and its accelerated Java graphics perform visualizations 30 times as fast.

In addition, a sophisticated user interface that allows scientists and engineers to define complex models in minutes combines with a wide range of optimized solvers to make it the fastest, most efficient modeling software of its type on the market.

FEMLAB 3.0 uses the proven finite-element analysis (FEA) method to efficiently solve models of physical phenomena so engineers and scientists can better understand their underlying properties. They can thereby predict how a given system will function without building an expensive prototype, and they can make a process more efficient so it takes less time or makes the best use of expensive raw materials.

The software can model virtually any physical phenomena someone can describe with PDEs including heat transfer, fluid flow, electromagnetics and structural mechanics.

Further, FEMLAB 3.0 is interdisciplinary; within one easy-to-use graphical interface a researcher can investigate the interactions of these various effects. For instance, the analysis of a fuel cell might involve not only chemical reactions and electrical currents but also fluid dynamics and heat transfer. FEMLAB 3.0 couples these various transport processes and reactions faster and simpler than any other software.

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