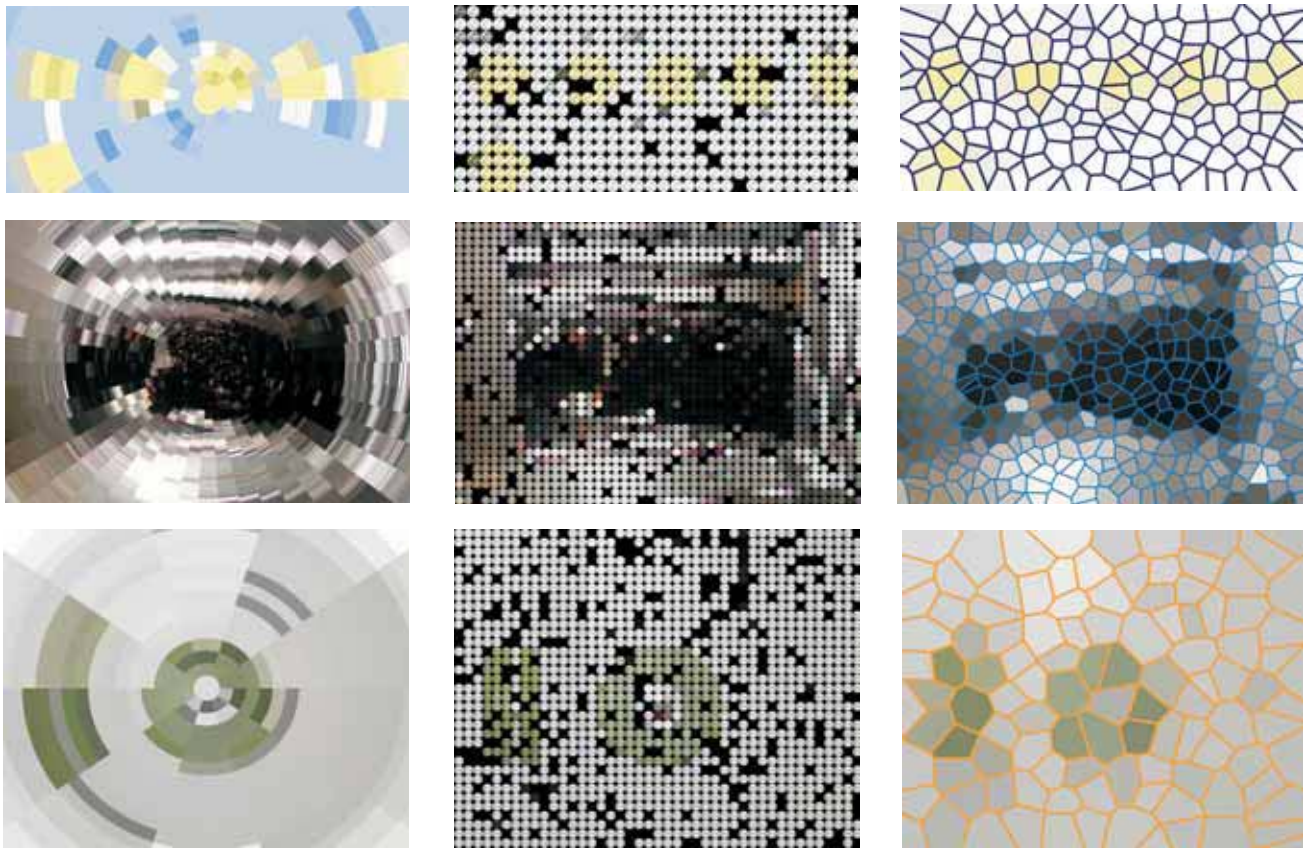
SNE SIMULATION NEWS EUROPE



Volume 16 Number 1 (SNE 46) August 2006, ISSN 0929-2268

Journal on Developments and Trends in Modelling and Simulation

Membership Journal for Simulation Societies in EUROSIM

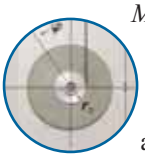
ARGESIM

Dear readers,
This is the second SNE issue with new layout, and we are glad, that we got positive reactions for changes in SNE layout and for opening the publication strategy of SNE. Together with this issue, we are proud to announce the first SNE Special Issue 'Parallel and Distributed Simulation Methods and Environments'. First born as idea in ASIM - ASIM Working Groups intend to publish alternately a Special Issue each year, the SNE Special Issues are open for all societies and conference organisers. The Special Issues cause a change in numbering the SNE issues: this regular SNE issue, SNE 46, is now identified as SNE 16/1 (Volume 16, Number 1), the first Special Issue as SNE 16/2; the next regular SNE double issue (SNE 47/48) will be numbered SNE 16/3-4. This remembers, that we are running SNE since 16 years, and we thank our faithful readers.
Together with the new layout, both editorial boards are being reorganised and will be enlarged for the future. We are also working on a new infrastructure for running an editorial office, together with tasks for SNE on the web.
We hope, the readers enjoy this issue, and the contributors appreciate the new editorial structure (more strict, but hopefully more efficient). Three Technical Notes and three Short Notes in this issue show the broad variety of modelling and simulation. The Technical Notes are special ones: based on a post-conference review procedure via Internet for contributions to MATHMOD 2006 Vienna, papers were selected for publication in SNE (to appear also in the next SNE issues). Furthermore, as first reaction on the ARGESIM / MATHMOD Yo-yo Challenge, the Techncial Note by Leon Zlajpah introduces into mechanical mysteries of Yo-yo control. The Comparison Section publishes an updated version of Comparison C13 'Crane and Embedded Control', reflecting the developments in this area of modelling and simulation; furthermore, seven comparison solutions concentrate on modelling issues and alternative approaches.
The News Section reports about progress in new structures for EUROSIM, and about activities in EUROSIM member societies and in Societes related to Modelling and Simulation. We thank all contributors, members of the editorial boards, and people of our ARGESIM staff for co-operation in producing this SNE issue.

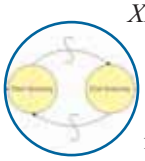
Felix Breitenecker, editor-in-chief; Felix.Breitenecker@tuwien.ac.at

SNE 16-1 / SNE 46 in Five Minutes

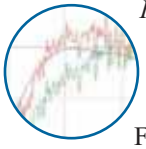
Process Modelling in a Sterilisation Tunnel (TN) - presents modelling and simulation for temperature profiles in an industrial production process – ***page 3***



Modelling and Control of Yoyo (TN) – deals with the classical Yoyo toy: mathmatical models for control and for haptic interfaces, control strategies, and verification by a robot – ***page 9***

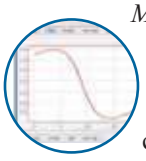


XML in DEVS (TN) – introduces XML as model basis for discrete event models for simulation via WWW and presents a prototype implementation – ***page 16***

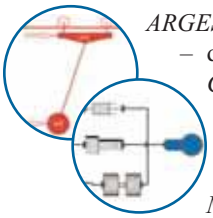


Real-time Simulation with DSPs (SN) - reports about a connection of two DSPs, one identifying the plant, the other performing Kalman Filter and LQ control – ***page 21***

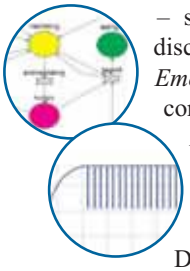
Simulation of Blood Glucose Regulation (SN) – presents MATLAB models glucose status together with a graphical interface for educational use – ***page 23***



Modelling and Control of a 2DOF - Robot (SN) – outlines modelling and simulation of a simple robot for E-learning of simulation and control via WWW – ***page 25***



ARGESIM Comparison Section – defines a revised benchmark C13 *Crane and Embedded Control* (implicit modelling, digital control, sensor action), followed by a sample solution with *Modelica/Dymola* – ***page 27***



– seven *Comparison Solutions* for discrete comparisons (*Dining Philosophers*, *Emergency Department*), continuous comparisons (*Switching States*, *SCARA Robot*) and general comparisons (*Cellular Automata*, *Identification*) show efficient implementations using MATLAB/Simulink, Dymola, DSOL/Java, Maxima and special Petri Net tools – ***page 31 - 38***

Book Reviews and *Journal News* – Eleven book reviews and one book news

Introduction of the SNE Special Issue *Parallel and Distributed Simulation Methods and Environments*

Call for next SNE Special Issue *Validation and Verification*
– ***page 39 - 47***

Young Simulationists – introduction of simulationists from Germany and Austria – ***page 48***

EUROSIM Society Reports – 20 pages reports from EUROSIM societies, followed by 8 pages from International Societies and Groups (ECMS/SCS, MATHMOD, Modelica, etc.) and 2 pages *Industry News* in the *News Section*

Content

SNE Editorial Boards

SNE - Simulation News Europe – is advised by two Editorial Boards. The *SNE Editorial Board* is taking care on reviewing and handling of Technical Notes, Shortnotes, Software Notes, Book and Journal Review, and of Comparison and Benchmark Notes. The *SNE News Editorial Board* (News Section) is responsible for reports from EUROSIM, EUROSIM societies, International Societies, and for Industry News.

Editorial board

Contact

SNE - Editors /ARGESIM
c/o Inst. f. Analysis and Scientific Computation
Vienna University of Technology
Wiedner Hauptstrasse 8-10, 1040 Vienna, AUSTRIA
Tel + 43 - 1- 58801-10115 or 11455, Fax - 42098
sne@argesim.org; WWW.ARGESIM.ORG

Editorial Info - Impressum

SNE Simulation News Europe ISSN 1015-8685 (0929-2268).
Scope: Information on development in modelling and simulation, comparisons and bechmarks on modelling and simulation, membership information for EUROSIM and Simulation Societies.
Editor-in-Chief: Felix Breitenecker, Mathematical Modelling and Simulation, Inst. f. Analysis and Scientific Computing, Vienna University of Technology, Wiedner Hauptstrasse 8-10, 1040 Vienna, Austria; *Felix.Breitenecker@tuwien.ac.at*
Layout: A. Breitenecker, ARGESIM TU Vienna / Linz; Anna.Breitenecker@liwest.at
Printed by: Grafisches Zentrum, TU Wien, Wiedner Hauptstrasse 8-10, A-1040, Wien
Publisher: ARGESIM and ASIM
ARGESIM, c/o Inst. for Scientific Computation, TU Vienna, Wiedner Hauptstrasse 8-10, A-1040 Vienna, Austria, and ASIM (German Simulation Society), c/o Wohlfartstr. 21b, D-80939München

A Matrix-oriented Approach to CA Modelling in ARGESIM Comparison C17 'SIR-type Epidemic' with MATLAB

Magda Moczydlowska, Lukas Lapinski, Gdanks Univ. of Technology, Poland; *magdamoczydlowska@gmx.net*
Daniel Leitner, Vienna University of Technology; *dleitner@osiris.tuwien.ac.at*

Simulator: MATLAB (version 6.05) is a powerful programming language and very suitable for CA modelling and analysing cellular automata (CA).

Model. For implementing the different cellular automata models, similar matrix structures are used. For *LGCAs* we are using a matrix with elements 0, 1, 2, 3, (0 - no element there, 1 - susceptible, 2 - infected and 3- recovered individual).
In the *HPP* model every cell includes four positions (up, down, left, right), characterised by a 2 x 2 matrix per cell. Thus, the *HPP CA* is modelled by a $2m$ x $2n$ matrix (m, n grid size). In the *FHP* model every cell includes six positions (up-left, up, up-right, down-left, down, down-right,), represented by a 2x3 matrix for each cell of the grid. The following main model shows a very dense MATLAB code: spatial update, random changes, spread of infection in the CA update.

```
for k=1:time
   A = HPP_Step(A);
   if deflrdn A = HPP_Deflrdn(A); end;
   [A,nS,nI,nR] = HPP_Infection(A,r,a);
end;
```

A - Task: CA and ODE solutions. For the ODE solution, MATLAB's standard algorithm ode45 was used. The CA grids were updated in single time steps. The results are qualitative similar, but have different time constants. In the ODE model, the desease spreads at fastest - 7000 infected (maximun) after 10 days, while the CA models show more smooth behaviour (FHP: 4000/14 days, HPP: max 3000/16 days). If in the CA models additionally random motion takes place, the system again slows down (HPP motion: max 2500/25 days) - the more spatial movement, the slower the model (Figure 1).

B - Task: Vaccination strategies in CA models. Vaccination is implemented complex additional update rule when performing a step with the CA.

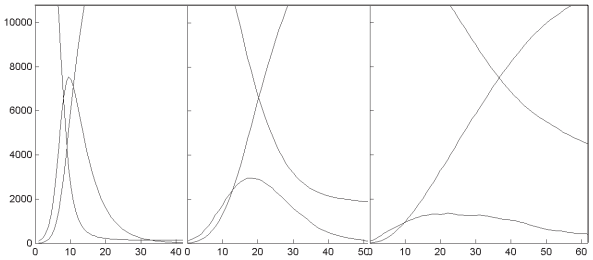


Figure 1: ODE model, HPP model, FHP random deflection.

Three experiments work with 100 infected individuals in the upper half domain, and with 16.000 susceptible individuals uniformly distributes in the whole domain:
- Experiment 1: vaccination of every fourth (eigth, etc) in the whole domain
- Experiment 2: vaccination of every second (fourth, sixth, ...) in the 'infected' halfdomain
- Experiment 3: vaccination of 4.000 individuals nearest to the border of the infected area.

Experiment 1 and 2 show similar results, vaccination clearly smoothes down the infection. In principle, in both experiments the same number of individuals is vaccinated, but the denser vaccination in the infected halfdomain works faster. The third vaccination strategy is the best, because the desease is primarily attacked there, where most infected people stay. Although only one fourth of individuals is vaccinated, less people are infected; but the overall recvery process takes more time (Figure 2).

C - Task: Convergence of CA solutions to ODE solution. Rearrangement of indiviuals in each update step is implemented by simple random distribution at the grid after the update. As result, the FHP CA solution (Figure 3) is very similar to the ODE solution as well as the DE solution.

Classification: Matrix-based directly programmed approach

Corresponding author: Daniel Leitner,
M. Moczydlowska, L. Lapinski, Gdansk University of Technology, ul. Narutowicza 11/12, 80-952 Gdansk, Poland
D. Leitner, ARGESIM, Viena Univ. of Technology, Wiedner Hauptstr. 8-10, 1040 Vienna, Austria;
dleitner@osiris.tuwien.ac.at

Received: May 10, 2006
Revised: June 15, 2006; July 13, 2006
Accepted: July 30, 2006

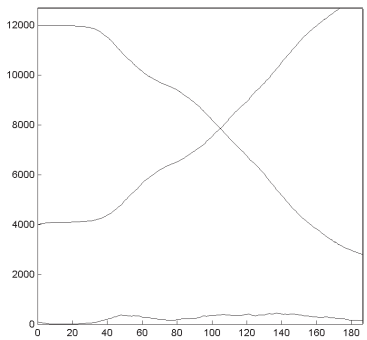


Figure 2: Best vaccination on border to infected region.

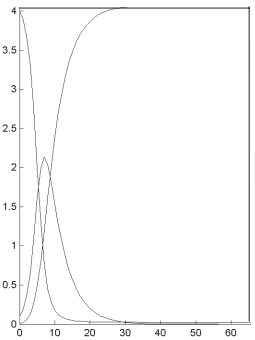


Figure 3: FHP solution with random reordering.