

**Sim-Serv Working Group:  
Roadmap for Discrete Event Simulation in European Industry  
Meeting point: Frankfurt Airport Conference Center, April 8, 2004**

**Agenda**

9.30 Welcome  
9.45 Introduction of attendants  
12.30 Lunch  
13.30 Current developments (IMTI)  
14.30 Discussions  
16.00 Next steps  
17.30 End of meeting

**Participants**

Mr. Walczak, CAMT  
Prof. Bruzzone, University of Genoa  
Prof. Christova, University Sofia  
Dr. Chrobot, CAMT  
Prof. Kosturiak, IPA Slovakia  
Dr. Krauth, Sim-Serv, SDZ  
Prof. Noche, University Duisburg-Essen, SDZ  
Dr. Splanemann, Degussa

**Introduction of attendants**

Everybody presented himself and his activities in the field of simulation. At present the following assignments can be made:

Prof. Bruzzone: Retail and different special applications (military, terminals, etc.)  
Dr. Splanemann: Chemical industry (production, logistics, scheduling)  
Dr. Chrobot: Traffic systems and nodes, manufacturing, logistics, assembly  
Mr. Walczak: Traffic systems and nodes, manufacturing, logistics, assembly  
Prof. Christova: Smart adaptive systems (fuzzy logic, neural networks), chemical technology, forecasting  
Prof. Kosturiak: Layout planning, production, logistics  
Prof. Noche: Scheduling, production, logistics, test environment, flow of persons  
Dr Krauth: Scheduling, production, logistics, soft factors

Some key statements of the initial discussions have been:

- People should not know that they are using simulation
- The application of simulation must be easy and fast with no specific additional knowledge

There is a considerable knowledge of application and of simulation tools in the group: Arena, Witness, emplant, Quest, Automod, ProModel, Simulate, Modsim, Dosimis, Simpro

**Current developments elsewhere**

A short presentation of an interesting development in the US (IMTI) was discussed in the group.

Some remarks about the IMTI goals:

- Automatic modelling – how can the models be validated?

- Transparency of the model – do we trust the models?
- In which application field is simulation clearly needed?
- Do we really need just only simulation or is it more necessary to strengthen “computational methods”?

### **The situation in Europe**

We came to the conclusion that the task of the working group is to define a roadmap for the further development of European simulation technology. There is a clear difference to the US based IMTI activity:

- The application of simulation in Europe is driven by automotive industry
- It is difficult to bring together European industries for financing the funding of simulation developments
- In Europe simulation technology should be used more frequently in small and medium sized companies
- European simulation tools are more building block oriented instead of using a “queuing” oriented programming concept
- Big integrated simulation software concepts are not a current primary need

Where are the future trends for simulation?

- What about internet?
- Do we need 3D and scanning?
- How much software integration is needed?
- Do we need tool boxes (for what and how to use)?
- Is the Digital factory a vision for the future or a dead end?
- What about the fast ramp up – which influences has this demand on simulation?

However, it is clear that the situation in the application of simulation is absolutely unsatisfactory. The following arguments were mentioned:

- Simulation is often not applied even when the projects need the technology  
Reason: Simulation is too difficult, people use other technologies or procedures
- Simulation results come too late, we lost the effect of the help of simulation
- Missing integration aspect (e.g. data exchange)
- Soft factors are missing (modelling)
- Simulation is often a technology of universities and academia
- Credibility: Simulation can always produce the results you want

Besides, there are some developments in the applications fields which seem to make simulation application less attractive:

- The role of logistics in companies is changing (e.g. due to outsourcing)
- SAP is everywhere and discourages the further application (e.g. APO)
- Logistics doesn't seem to be complicated enough for justification of simulation efforts
- The cost / benefit situation is still unsatisfactory because benefits cannot be quantified beforehand.

### **The approach of the Working Group**

The IMTI vision is product oriented and emphasises large and complex products. Maybe Europe needs a more market oriented approach? Different markets may well need different simulation tools.

For the future development it is clear that the simulation has to be oriented to the application fields. Possible important application fields include:

- Car manufacturing
- Chemical plants
- Retail
- Flow of persons
- Piece production flow (all types of products in mechanical or electrical engineering)
- Single items and products (ships, planes, turbines)
- Distribution processes
- Document flow
- Health care

It seems to be clear that further advances in simulation technology in Europe are only possible by focussing on the application areas and by trying to adapt the tools to their specific needs. A first collection of application needs of simulation in chemical processes was done in the meeting:

- Investigation of buffer capacities
- Determination of the number of units
- Effects of changing one production step/ element on overall performance?
- Best maintenance strategy?
- Determination of the sequence of orders (product sequences)
- Lot sizes
- Routing rules through the system
- Optimization of productivity
  - maximum capacity
  - real plant capacity (according to the demand structure)
- Influence of order mix (lot size), daily scheduling (mix)
- Optimisation of personnel (shift models, allocation in repair, set up, maintenance, packaging, etc.)
- Determination of the number of intermediate boxes (empty boxes)
- Warehouse design (size, structure, locations)
- Investigation of production concepts
  - dedicated production lines versus flexible production capacities
  - push principles versus pull principles
  - silos and tanks versus packed products
  - batch oriented production versus continuous production
- How can capacities be increased?
- Where are the bottlenecks?
- How are production systems linked (changes in one unit might have impacts to the others)
- Definition of capacities for palletizing and packing
- Dimensioning of filling and delivery equipment (raw materials, finished goods)
- Distribution planning and routing (truck capacities and capabilities)
- Supply chain investigations: Which product in which plant for which customer (transport costs versus production costs)

The next steps are: structuring the questions, investigate the relevance for simulation or more general “computational methods”. Compare simulation and other, currently applied techniques.

Redesign simulation processes, derive hints for further (tool) developments. Characterize the directions of the developments.

Typical problems which have to be solved (not only) in chemical simulation applications:

- Model generation and production plans integration
- Repository of rules (routing, processing, etc.)
- Validation and verification (automation of the processes)
- Order sequencing as input for models
- Interpretation of results (we need conclusions – traffic lights)
- Documentation of results
- Design of experiments

In this context the following questions came up:

- Is it possible to have standard validation procedures?
- How can we come to generalized control strategies / decision rules in simulation models?
- Is it possible to define a standard set of simulation runs?
- Should we have a data generation tool for input data since data acquisition requires approx. 1/3 effort of a simulation study?

#### **Further activities**

- Questionnaires about some other application fields should be elaborated:
  - Retail and maintenance centres (Prof. Bruzzone, Prof. Noche)
  - Car manufacturing (Prof. Noche, Prof Kosturiak)
  - Traffic applications (Dr. Chrobot, colleague)
- Discuss and Investigate alternatives to simulation (Prof. Christova, Dr. Chrobot)

Bernd Noche, J. Krauth