ABSTRACT

This paper describes how to set up courses in (advanced) simulation techniques based on ARGESIM/EUROSIM Comparisons. SNE has defined 13 Software Comparisons, of which 6 concern discrete models, and collected solutions over the last 8 years. These solutions have now been evaluated and made accessible via the world wide web. This evaluation may be used as basis for a course on modeling and simulation. Finally, there is a brief introduction of ETCA and it is shown how it uses the ARGESIM/EUROSIM Comparisons for giving advice which simulators to use in the field of environmental technologies.

1 MOTIVATION

In teaching simulation, it is preferable to use examples to demonstrate what we are talking about. This is best done through the use of executable examples. Since there are several different types of simulation software and modeling approaches, it is not always easy to find suitable examples.

ARGESIM/EUROSIM features a series on comparisons of simulation software. Based on easily comprehensible models, special features of modeling and experimentation within simulation languages, also with respect to an application area, are compared. Since 1990, thirteen comparisons have been defined and about 190 different solutions collected.

Each of the defined ARGESIM/EUROSIM Comparisons presents a central model and up to three additional tasks to be carried out. Each of these tasks focuses on a particular feature, for instance modeling technique, event handling, numerical integration, steady-state calculation, parameter sweep, output analysis, animation, sub models, macros, complex strategies, optimization of parameters, etc.
2 EVALUATION AND CLASSIFICATION OF SOLUTIONS

The collected solutions of the ARGESIM/EUROSIM Comparisons are continually being evaluated and classified according to a set of criteria. There are general criteria (basically judging the methodology) and further criteria for the additional tasks (judging the individual performance needed for that task).

The criteria are individually chosen for each comparison but taken from a standardized set. This allows finding similarities in solutions of different comparisons! Given the great variety of models that is dealt with in the comparisons, it is interesting and instructive to see how the solutions for these comparisons sometimes use quite similar simulation techniques.

The ARGESIM/EUROSIM pages provide lists of the criteria for each comparison and a classification of the available solutions on a further page.

3 USAGE OF ARGESIM COMPARISONS IN COURSES ON SIMULATION

It is suggested to use ARGESIM/EUROSIM Comparisons for advanced courses and it is also fruitful to include the central models in introductory courses. We suggest the following categories of courses:

- Introductory courses
  - on simulation software
  - on simulation techniques
- Advanced courses
  - on simulation software
  - on simulation techniques
  - on modeling methodology

The ARGESIM/EUROSIM Comparison web pages provide not only a list of the definitions and solutions but also allow searching for solutions that contain specific features. For example, one has access to a list of those solutions which use Petri-nets or as a second example those concentrating on state-events (comp. previous section).

For an introductory course on a particular simulation software, for example, one would search for solutions which use that software. These solutions can then be discussed in class and even downloaded and executed (if the simulator is installed locally).

3.1 What Does Such a Course Look Like?

The main objective of the ARGESIM/EUROSIM pages is to provide well documented examples for any kind of courses on simulation. Experience shows that it is a good idea to first present a method, a simulator and a problem, then let the students try and work out solutions. Advanced students may choose or even develop the method they use themselves.

This sequence of steps has its advantages:

- The course is more than a simple programming course and students dig deeper into the problems of modeling and simulation than they would do if presented with a sample solution at the beginning and just redoing it.
- Sometimes new, not yet published approaches are chosen for a particular comparison, thereby widening the view of the problem.
- Students who have made their own models before and experienced the difficulties will draw more and more useful information out of the ARGESIM/EUROSIM pages.
An important feature of a course should also be a discussion about the advantages and disadvantages of the different approaches, which is made possible by the large amount of published, classified and commented solutions.

4 EXAMPLES

4.1 Introductory Course on Petri-Nets

When planning a course on Petri-nets, one can visit the ARGESIM/EUROSIM Comparison web pages and search for examples that are suitable for demonstrating them. Today he or she would find comparison 4 and comparison 10 (Dining Philosophers).

4.2 Advanced Course on State Events

For a course on State-Events, it is suggested to use Comparison 7 (Constrained Pendulum). Again, there is a detailed definition and a collection of solutions.

There are four sections for each of the comparisons: Definition, Solution, Evaluation and comments.

Definition provides a detailed definition of the comparison that does not only give the tasks to be performed, but also highlights the role Petri-nets play.

Solution gives a list of all received solutions, stating the used software and the date of publishing; Evaluation gives a classification of the solutions according to certain criteria. This is the point to visit when looking for solutions with certain properties.

The available solutions are compared with each other and commented in detail at Comments.

Finally the source-code of the solution can even be downloaded and executed on a local computer.
Using the ARGESIM/EUROSIM Comparisons does help designing excellent lectures on simulation.

5 ARGESIM COMPARISONS IN ETCA

ETCA (Environmental Technology Concerted Action) is an informational infrastructure for research, industry and authorities.

ETCA provides

- an organizational background for projects in the European Commission workshops of the environmental program, and for the relations with national programs
- a communication network in the field of environmental technologies
- a scientific secretariat for research in the field of environmental technologies.

ETCA is aimed at

- promoting research and bringing Research, User/Producers and Authorities together
- reducing costs of research and promoting inter-operation of national and EU programs
- allowing the application of the results of research
- improving competitiveness of European industry and SME

To meet these aims ETCA will act as a clearing house (information concerning experiences with methods, equipment, facilities, etc.) and a discussion forum (technical aspects, regulations) considering their implications on e.g. measurement techniques, social climate. It has also established several work groups that will concentrate on isolated aspects of environmental technologies. The topics of work group one and two are

- Available tools for the development and the assessment of benefit of environmental technologies.
- Design of a practical toolbox on the basis of existing methodologies, measuring techniques and integration procedures.

Clearly simulation is a powerful tool for development! ETCA will use ARGESIM's knowledge of simulation languages and its collection of solutions to the comparisons. Whenever ETCA suggests to use simulation for the developing of environmental technologies it will also indicate which simulators are appropriate for the given problem. For that ETCA will use the ARGESIM/EUROSIM Comparison pages which do indeed give this information.

The typical modeling approach in environmental applications of simulation will be *compartments or system dynamics*. So ETCA will look up the ARGESIM/EUROSIM Comparison web pages and search for solution based on the desired features. Since complex problems need an individual solution, the set of desired features will always be different. There is no standard answer so the AGESIM/EUROSIM Comparison pages will be helpful in providing suitable advice.

The web-address of ETCA is <http://etca.arcs.ac.at>.

REFERENCES


AUTHOR BIOGRAPHIES

FELIX BREITENECKER is professor for simulation technique at the Vienna University of Technology (VUT). He received M.Sc. and Ph.D. of VUT. He got the *venia legendi* (prerequisite for professorship in Austria) for "Simulation and Mathematics of Control". Felix Breitenecker deals with continuous and discrete simulation in teaching, in research and in industry projects. He is member of SCS, EUROSIM, and IMACS, and he is past president of EUROSIM, the Federation of European Simulation Societies, and at present President of ASIM, the German Simulation Society. His main interests include modern simulation methods, comparison and evaluation of simulators, and simulation applications in any area. Within ARGESIM, the ARGE Simulation News he is editor-in-chief of the journal Simulation News Europe. His email address is <Felix.Breitenecker@tuwien.ac.at>

MARTIN LINGL is a Ph.D. student at the Dept of Simulation Technique at the Vienna University of Technology. His interests include fuzzy logic and combined simulation. He is a member of ARGESIM and ASIM. His email address is <mlingl@argesim.tuwien.ac.at>.

ERWIN RYBIN is responsible for industrial and economic simulations in the Austrian Research Center Seibersdorf. He received his Ph.D. from the Vienna University of Technology, Austria, and works in the field of applied simulation since 1993. His email and web addresses are <erwin.rybin@arcs.ac.at> and <www.arcs.ac.at>.

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