Nowadays, simulating building performances is more and more commonly used by researchers and engineers. Researchers use simulation to better understand physical phenomena in order :

(i) to help industrials design higher performance components,
(ii) to help practitioners design more cost-effective systems and
(iii) to help energy managers decide and promote more efficient methods for rational use of energy.

To reach these goals, many conditions must be fulfilled :

1. Reliable and adapted models must be developed
2. Simulation technology must be improved to ease and accelerate computations
3. The use of simulation tools must be enlarged towards practitioners.

Papers presented in session 9 addresses these three goals.

Many papers deal with recent improvements in modelling, either specific components or physical phenomena. A wide range is covered : IAQ[1], Daylighting[2], Building Management Systems[3], Floor Heating Systems[4], and improvements in modelling conductive, convective and radiative transfers[5]. All these works contribute to enhancing the technical and scientific knowledge needed for the next step : simulating complex systems. But one question still remains : **how can the re-use of this knowledge be facilitated** ?

Two papers bring answers to this question. Wim Zeiler addresses modelling techniques and, more preciosely, the archiving of models in a re-usable format. Jean Lebrun addresses the same question in a paper entitled « *IEA Annex 30 : Bringing Simulation to Application* ». Both papers refer to the same basic technology : libraries of so-called « elementary » models. Models have to be well documented, parameters have to be clearly specified and must be as close as possible to the parameters used by engineers, and examples of use must be given. Wim Zeiler refers to a specific modelling language called OLMECO (developed in the framework of a EU-ESPRIT supported R&D program). At this stage, the fact is that some good concepts exist, partially supported by validated tools, but these concepts are not yet commonly shared by the research community and neither are the tools.

To convince practitioners to make a wider usage of models, adapted (-to-their-needs), simulation tools must be developed and convincing examples of practical uses must be given. Both Luc Tabary (*CA-SIS : an engineering tool for thermal studies with a gradual access*) and Wim Zeiler (*HVAC Process Design Improvement by Methodical Process Design*) bring solutions to these problems. Jean-Pascal Bourdouxhe (*Simulation used for the selection and sizing of a centralised cooling plant : methodology and limitations*) try to demonstrate to

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1 Including IAQ computation features in models for thermal simulation of residential buildings (S. Costanzo).

2 Quick Determination of Daylight and Irradiance in a Room with Lightshelf and its application to a hot humid climate (Eduardo Breviglieri Pereira de Castro)

3 Real time simulation of a building with electrical heating (H. Vaezi-Nejad)

4 Simulation of Transient Response of Floor-heating Systems for Middle eastern Construction Materials and Style (A. A. Al-Maaitah)

5 Effect of distribution percentage of radiant heat on loads in an upward displacement room (Zhi-Wei Lian)
Room Thermal Response Using Transfer Coefficients and the Rad-Air Model (M. G. Davis)

potential users, how simulation (in this case, TRNSYS), can be used in a concrete case. All the same, Patricia Briand (*Computer Aided Boiler Design*) demonstrates how simulation can be used to help designing innovative systems including control and management procedures (the case-study is a gas-fired boiler for DHW and the simulation tool is ALLAN.Simulation). But bringing simulation to practitioners is not only a question of making user-friendly and well adapted simulation software available to them, it is also a question of being able to provide them with various data bases which contain the data they need. Kenneth Lassila and Markku Jokela (*Data Management in Energy Simulations*) give guidelines for handling distributed data bases and gathering data for energy calculations. This paper could open a wide discussion upon new data base technologies and object oriented neutral formats for exchanging data (ie : IAI and STEP).

Beyond these generic questions, a couple of papers address up-stream problems as optimising the design process. A. Dunn (*Use of Genetic Algorithms for the Optimization of Parametric Design*) discuss the advantages of genetic algorithms. Genetic algorithms have been successfully used in a wide range of engineering applications and A. Dunn demonstrates that these algorithms have a potential in the field of HVAC design. In some ways, this should go together with error propagation and taking account of uncertainties when computing complex models. P. Aude and Patrick Depecker (*Building Thermal Modelling : an example of radiative exchange between system and envelope taking account of uncertainties*) propose a solution to take into account uncertainties when performing simulations. This opens the door to an interesting debate : one day, will any simulation environment embed error propagation modules ? And if yes, what kind ?

Whatever the technology is, it is often used to support a nationwide or a regionwide energy policy. This is the case of Australia : Angelo Delsante reports on « *The Development of an Hourly Thermal Simulation Program for Use in the Australian Nationwide House Energy Rating Scheme* », this new program is based on a multizone hourly thermal simulation code. At district level, Gordon Bloomquist reports on « *Modelling District Energy, Water, Gas, Sewerage and Electrical Utilities Systems* ». Gordon Bloomquist's paper also addresses economical issues. Often, simplified models are used in such general computation programs. Three papers deal with developing simplified models[6]. One of the big questions that arises at this point is the « competition » between simplified models and complex models embedded into simulation environments that make them as easy to use as simplified models. Fragments of answers are brought in the various papers of this session but it is for sure that this question will still be up-to-date at the next CLIMA 2000 conference.

Two other papers dealing with « simplified » models focus on Artificial Neural Networks (ANN). Both Soteris A. Kalogirou (*Building Heating Load Estimation Using Artificial Neural Networks*) and S. Kajl (*Evaluation of Building Energy Consumption Based on Fuzzy Logic and Neural Networks Applications*) emphasise improvements in calculation speed and simplicity of use. Nevertheless, obtaining good results with this technology assumes that ANN can be trained on large bases of known cases. If large project bases are available, the now traditional « Case Based Reasoning » approach may be successfully used. Pros and cons of both techniques are still to be compared.

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[6] Room cooling load calculations : a new proposal for the European standard (L. Agnoletto)
Calculation method of energy consumption for intermittent space heating (Jean-Christophe Visier, B. Sesolis)
Simple Modelling for energy consumption estimation in air conditioned buildings (Dominique Marchio)

As a conclusion, I would like to underline that the large number of papers submitted in this session allowed the Scientific Committee to build-up a program that covered the various aspects of modelling and simulating : from fundamental modelling to nationwide energy policy, going through model archiving and re-use, use of innovative techniques as Bond Graphs, Fuzzy Logic and Artificial Neural Networks, as well as methods for transferring simulation to practitioners. This shows that, nowadays, beyond the « traditional » modelling activities, still necessary, building performance simulation is also entering the age of Information Systems and we are, presumably, only at the beginning of a new era during which drastic improvements will occur in our design methods and in the component technology it-self as well.