BUILDING SIMULATION '91

CONFERENCE PROCEEDINGS

Edited by
J. A. Clarke
J. W. Mitchell
R. C. Van De Perre

AUGUST 20-22, 1991
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PREFACE

The Building Industry is one of the major industrial sectors worldwide. In Europe it is the second largest industry, accounting for around 12% of the Gross Domestic Product. The capital value of new buildings is of the same order of magnitude as their recurring costs — with heat energy alone representing in excess of 40% of the European delivered energy. Energy Conservation and the Environmental Quality of the built indoor and outdoor environment are becoming critical factors in the life cycle of buildings. Increasingly, computer-based models (programs) are being employed to aid in the design, operation, or management decision-making process. The development, verification, use in practice, and standardization, of these models and programs is therefore of growing importance.

Previous 'Building Energy Modelling' research projects placed stress upon the need to ". . . *increase the fundamental understanding of, and develop the tools for, the prediction of the dynamic thermal behaviour of buildings . . .*" As a result of this R&D effort, several building modelling systems have emerged throughout the 80s, which can address a certain range of cost and performance issues of interests to building designers; from realistic visualisations, to a detailed appraisal of the operational performance of the energy, lighting, and control systems.

Several attempts to *transfer this technology* into practice have been undertaken. Firstly, because buildings are complex mechanisms, involving phenomena such as transient conduction and air movement, and there is growing realisation that traditional design tools cannot cope with this complexity in a multi-climate and multi-building type context. Secondly, because of a need for rapid feedback on the cost and performance of alternative design scenarios, particularly at the earlier stages of the design process (when the present system of specialist consultants, while adequate for the detailed design and final specification phases, fails to provide this immediate 'ad hoc' advice). However, there are still four principle barriers to the effective use of computer-based design tools in practice. Firstly, there are attitudinal and *technology transfer* problems, (which are best overcome by a concerted educational effort and the involvement of the end-user in the model development process). Secondly, there is the lack of *commonality* between the various research groups who conduct the fundamental research and develop the design tools. Thirdly, there is a lack of *(standard) methodology and (standard) quality assurance procedures* for addressing building performance assessment questions (in a modelling context). And finally, a general framework for Building Simulation and Environmental Building Performance assessment has received up to now only *minor attention* (compared to their economical and ecological impact) from Governmental Bodies, Building Authorities, and Building Industry.

The current generation or research projects, being supported in this field at the international, as well as at the various national levels, is aiming more at " . . . *the creation of a truly collaborative framework for model development and validation, integration aspects in software-development, the use of the latest Information Technologies available, and the appropriate use of performance analysis methods, . . .*", and is hence addressing the above mentioned barriers of the second and third type.

The underlying subject matter is, primarily, the role of computer modelling and simulation in the design and management of (energy conscious) buildings. As a result of those initiatives, there is now a community-wide understanding of the nature of the problem and the role a modelling approach might play. It also becomes clear that the issue of Environmental Building Modelling and Simulation is not the exclusive domain of one single (energy research) sector, but that it should be placed in, and tackled from, a more global context/perspective,-including the endusers, i.e. building manufacturers, designers, managers, as well as building 'regulators'.

Various Building CAD-systems are already for some time available to the design profession. Computer Integrated Manufacturing (CIM) Techniques start to find their way to the Building Industry. The (pre-)normative work undertaken on both sides of the Atlantic, leading to specifications for harmonized calculation methods in fields as various as Mechanical Resistance and Stability, Safety in case of Fire,

Hygiene Health and the Environment, Safety in Use, Protection Against Noise, or Energy Economy and Heat Retention, can take benefit from the present Knowledge and Information Technology on offer.

A basic question however, is how to fulfill efficiently the obvious needs for information exchange, training and coordination, for all above identified developments and end-users.

The recent formation of professional organisations which represent the notion of building performance modelling (the International Building Performance Simulation Association (IBPSA), the Building Environmental Performance Analysis Club in the UK (BEPAC), the Building Analysis Group in Belgium (BAG), . . .) should be considered as signal events in this respect.

In January 1987, after two years of preparatory work, the International Building Performance Simulation Association (IBPSA), was established by North American and European researchers active in building simulation. The International Building Performance Simulation Association (IBPSA) was founded to advance and promote the science of building performance simulation in order to improve the design, construction, operation and maintenance of new and existing buildings worldwide.

Along with building designers, owners, operators and developers, IBPSA identifies problems within the built environment that maybe solved by improved simulation tools and techniques, and highlights the performance characteristics of buildings on which simulation should be focussed. Building performance simulation R&D needs are regularly updated and listed, while new developments are transferred to the user. Standardization of the building simulation industry is promoted, while the public is informed and educated, regarding the value and the state-of-the-art of building performance simulation. As such, IBPSA created a permanent international platform for researchers and practitioners of building simulation, broadening the horizons of the many national and local groups such as ALMETH-France, BAG-Belgium and BEPAC-UK, amongst others.

In Europe and North America, various successful international workshops in the field of Building Simulation have already been organized: Leesburg-US (Spring, 1983), Seattle-US (Summer, 1985), Ispra-I (November, 1987) and Ostend-B (September, 1988.) At the first Building Simulation world conference (BUILDING SIMULATION '89, Vancouver, B. C., June 1989), organized by IBPSA, a Two-year Conference Goal, with international venue, was established. A broad consultation process with various European Groups, and the substantial logistic support offered by the French Energy Agency (AFME), led to the decision to organize the BUILDING SIMULATION '91 Conference in Nice, Sophia Antipolis, late August 1991.

IBPSA gratefully acknowledges the financial support from the Electric Power Research Institute (EPRI), the Gas Research Institute (GRI), the US department of Energy (DOE), the Bonneville Power Administration (BPA), the Building Environmental Performance Analysis Club (BEPAC), the Agence Française pour la Maîtrise de l'Energie (AFME), the Centre Scientifique et Technique du Bâtiment (CSTB), Electricité de France (EDF), Gaz de France (GDF), the Ecole Nationale Supérieure des Mines de Paris (ENSMP), and the Commission of the European Communities (CEC).

The Building Simulation '91 Conference, of which you find here the Conference Proceedings, aimed at linking up various local initiatives, and to put them in a worldwide context. With 85 papers presented in 10 sessions, by approximately 200 authors and 100 institutions worldwide, an excellent opportunity was created for corporations and researchers, to be informed of the latest developments, and to explore new possibilities for co-operation and joint ventures.

Therefore, the BUILDING SIMULATION '91 Conference is expected to be, in its field, another milestone in the European and trans-continental integration process.

<table>
<tr><td>Edward F. Sowell</td><td>Rik Van de Perre</td></tr>
<tr><td>*President, IBPSA*</td><td>*Conference Programme Chairman*</td></tr>
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