Hensen, J. (2006).
About the current state of building performance simulation and IBPSA.
Proceedings of the 4th national IBPSA-CZ conference Simulace Budov a Techniky Prostredi, 7 November, pp.2.
Prague: International Building Performance Simulation Association - Czech Republic.

IBPSA-CZ

ABOUT THE CURRENT STATE OF BUILDING PERFORMANCE SIMULATION AND IBPSA

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CURRENT STATE OF BUILDING PERFORMANCE SIMULATION

In his editorial "Building performance simulation: the now and the not yet" [1] Spitler states that "simulation of building thermal performance using digital computers has been an active area of investigation since the 1960s, with much of the early work (see e.g. [2]) focusing on load calculations and energy analysis. Over time, the simulation domain has grown richer and more integrated, with available tools integrating simulation of heat and mass transfer in the building fabric, airflow in and through the building, daylighting, and a vast array of system types and components. At the same time, graphical user interfaces that facilitate use of these complex tools have become more and more powerful and more and more widely used."

As stated earlier [3], over the past two decades the building simulation discipline has matured into a field that offers unique expertise, methods and tools for building performance evaluation. When used appropriately it has the potential to improve competitiveness, productivity, quality and efficiency in buildings and in the construction industry as well as facilitating future innovation and technological progress.

This is recognized in government programs such as LEED (Leadership in Energy and Environmental Design) and Epact in the USA, EPBD (Energy Performance of Buildings Directive) in Europe, and others.

Building performance simulation draws its underlying theories from diverse disciplines, mainly from physics, mathematics, material science, biophysics, human behavioral, environmental and computational sciences. The theoretical challenges are bountiful when one recognizes that the physical state of a building is the result of the complex interaction of a very large set of physical components. The integration of these interactions in one behavioral simulation poses major modeling and computational challenges. Its ability to deal with the resulting complexity of scale and diversity of component interactions has gained building simulation a uniquely recognized role in the prediction, assessment and verification of building performance. The building simulation discipline is continuously evolving and maturing and improvements are continuously taking place in model robustness and fidelity. As a result the discussion has shifted from the old agenda that focused on software features to a new agenda.

The new agenda focuses on the effectiveness of building performance simulation in building life cycle processes, including the following.

- First and foremost quality assurance, both in terms of the software itself and in how it is used for solving real world problems. The development, evaluation, use in practice, and standardization, of the models and programs is therefore of growing importance. For building design, construction, operation, maintenance and management activities, there is also an urgent need for the integration of "generally applicable" and "generally accepted" methods and tools, for various applications, each having various levels of complexity and/or various types of end-users. In this context, also important is the technology transfer issue within the building simulation field.
- The uptake of building performance simulation in current building design projects is limited. Although there is a large number of building simulation tools available (e.g. [4]), the actual application of these tools is mostly restricted to the final building design. Mainly for code compliance testing and for thermal load calculations for sizing of heating and air-conditioning systems. In other words: analysis (of a single solution) rather than (multiple variant) design optimization oriented.
- Increasing the scope of simulation further towards early design phases or post construction applications for operation and management.
- Multi-scale methods that can deal with large ranges of time and special scales and link various types of physics.
- Sharing of distributed developments by run-time coupling of software.

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IBPSA – A GLOBAL NETWORK & COMMUNITY OF PRACTICE

The International Building Performance Simulation Association (IBPSA – www.ibpsa.org) was established now almost 20 years ago in 1986 as a non-profit society of building performance simulation researchers, developers and practitioners dedicated to improving the built environment.

IBPSA is in the lucky situation that it has many very active individuals amongst its several thousand members worldwide. The society is based on regional affiliate organizations (currently 16, with proposals being discussed in another 10 regions) around the world. It is managed by a central Board of Directors, consisting of officers, members at large, and a representative of each regional affiliate organization. Since quadrupled, so IBPSA is rapidly expanding.

To maintain its leading role in the promotion and development of building simulation technology, IBPSA provides a forum for researchers, developers and practitioners to review building model developments, facilitate evaluation, encourage the use of software programs, address standardization, accelerate integration and technology transfer. So that:

- members all over the Globe find membership in IBPSA worthwhile and profitable in their area of interest;
- governments, industry, utilities and academic institutions look to IBPSA for guidance in determining policies, areas of research, and application development in building simulation;
- local chapters around the Globe benefit from the body of knowledge and experience available through IBPSA;
- IBPSA acts as a clearing house for publications on building simulation; members network with other members and societies through electronic means;
- IBPSA provides a framework for strategic alliances for information and cooperation in R&D and technology transfer.

IBPSA covers broad areas of building environmental and building services engineering. Typical topics include building physics (including heat, air and moisture flow, electric and day lighting, acoustics, smoke transport); heating, ventilation and air-conditioning systems; energy supply systems (including renewable energy systems, thermal storage systems, district heating and cooling, combined heating and power systems); human factors (including health, productivity, thermal comfort, visual comfort, acoustical comfort, indoor air quality); building services; and advancements and developments in modeling and simulation such as coupling with CAD, product modeling, software interoperability, user interface issues, validation and calibration techniques.

All these topics may be addressed at different levels of resolution (from microscopic to the urban scale), and for different stages in the building life cycle (from early sketch design, via detailed design to construction, commissioning, operation, control and maintenance) of new and existing buildings worldwide.

One of IBPSA's main activities is the organization of a series of bi-annual international conferences: Vancouver, Canada (1989), Nice, France (1991), Adelaide, Australia (1993), Madison, USA (1995), Prague, Czech Republic (1997), Kyoto, Japan (1999), Rio de Janeiro, Brazil (2001), Eindhoven, Netherlands (2003), Montreal, Canada (2005), Beijing, China (2007) and Glasgow, Scotland (2009).

IBPSA produces twice per year an international newsletter. IBPSA is well under way in establishing an international archival journal.

IBPSA has also recognized the difficulties surrounding the development of products and services that are appropriate to the day-to-day needs of its members. The underlying causes of these difficulties are twofold. Firstly, the geographical spread of IBPSA members is wide and gives rise to a requirement to cover disparate work practices, technologies and professional needs. Secondly, IBPSA's organizational structure is such that the coordination of activities at the local (regional) level is problematic. That is why IBPSA is organized in regional organizations which are making significant progress at the local level through seminar, workshop, publications, training and software development activities. IBPSA – Czech Republic is a prime example.

IN CONCLUSION

Building performance simulation has the potential to deliver, direct or indirect, substantial benefits to all building stakeholders and to the environment.

It is the mission of IBPSA and its regional organizations to promote correct application and further development of building performance simulation.

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