Results from the Focus Group on Emerging Trends and Needs of Building Simulation

Held Tuesday, January 26, 2016
Organized by IBPSA-USA Emerging Simulation Technology Research Subcommittee
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The purpose of this focus group was to identify trends and shortcomings in the building performance simulation field. Needs identified through the focus group are expected to inform the writing of a white paper to guide the building industry and influence the priorities of research funding organizations.

The focus group was attended by nineteen participants in the 2016 ASHRAE Winter Conference representing five countries. They included practitioners, researchers, developers, and academics, with most attendees falling into multiple of these categories.

Based on themes that emerged during the focus group, the results are divided into two categories: recommendations for IBPSA and the IBPSA-USA Research Committee, and recommendations for research in building performance simulation. These recommendations are synthesized from the comments of focus group attendees.

Recommendations for IBPSA and the Research Committee

1. The Research Committee should ensure that IBPSA members benefit from the products of research. This recommendation has three components:

    a. *IBPSA should provide guidance to building modelers* by promoting best practices. These should include information about the level of detail required at each stage of design and the level of uncertainty to be expected at that stage. Exercises and benchmarks should be provided to building modelers to train them in best practices. The ability to communicate uncertainty levels will help clients build trust in simulation.

    b. *The Research Committee should develop a roadmap for simulation development* based on the needs of building modelers. To do this, a more detailed understanding of the building modeling community, including those not involved in IBPSA, is necessary. The Research Committee membership should include practitioners. The roadmap should be a living document, and practitioners must be given a voice in its development. IBPSA should use its influence to provide funding opportunities for researchers and to promote ideas for research to academics and PhD students.

c. *IBPSA should connect practitioners with the products of building simulation research*. In some cases, academic work should be refined to be understood by a broader audience. The goal of this connection is that practitioners with basic building physics knowledge can creatively design highly energy-efficient buildings through easy-to-use software.

2. IBPSA should expand its membership and audience.

    a. Within the mechanical engineering discipline, *IBPSA should provide guidance to the entire building simulation community*. Currently, the number of engineers engaging in building simulation work and the needs of the "average" building modeler are unknown. Attendees suspect that IBPSA reaches only the top 10% of building modelers.

    b. *IBPSA should extend to other simulation domains*. At ASHRAE, these domains are poorly represented. IBPSA should engage with other professional societies including those related to acoustic, seismic, and fire simulation.

3. The goal of the Research Committee should be to *produce an effect on the world's building stock*. The scope should not be limited to the United States or its climate. Research related to building energy simulation should seek to mitigate climate change.

Recommendations for Research in Building Performance Simulation

1. Research should *identify and produce demographics on the users of building performance simulation*. This includes identifying the needs of modelers and statistics such as the number of models they produce per year.

2. Research should *inform best practices for the level of complexity appropriate to each phase of design*. This includes identifying the uncertainty associated with various levels of model fidelity, including single-zone, core-and-perimeter, and detailed multi-zone models. Sensitivity of building energy simulation to geometric fidelity should be investigated. Uncertainty related to occupants should also be investigated.

3. Research and development should *enable consistent use of a single model throughout the evolution of a design* from preliminary to final stages. Simulations at multiple levels of fidelity should be possible from that model. Manufacturer-defined models for new products should be compatible with simulation engines without waiting for the development cycle to produce new software versions.

4. Research should *examine building physics in highly controlled test buildings that can be run in thermally guarded and natural climate modes*. Simulation engines should be developed to model older buildings and poorly insulated buildings.

5. Research should *account for existing operational problems in buildings*. Simulation engines should be developed that model older mechanical systems and systems that don't work perfectly.

6. Research should *examine buildings in an urban context*. This includes modeling the energy behavior of neighborhoods, modeling buildings' relationship to the power grid, and modeling transportation. Simulations should integrate demand response and intermittently available renewables on the grid.

7. Research should *speed up simulations to aid in decision-making*. The goal should be to produce results at the speed of thought. Reuse of previously calculated results within or between simulations should be investigated. Computer science research to improve simulation code, including non-timestep-based simulation methods should be investigated.

8. Research should *investigate the use of sensor data in simulations*. This includes autocalibration and simulations beyond calibration.