

KEYNOTE: ON THE ORIGIN OF OCCUPANT BEHAVIOR: THE EVOLUTION OF SIMULATING EFFECTS OF PEOPLE IN THE BUILDING PERFORMANCE



Abstract

The use of computers in the design of buildings predates the invention of the electronic computer with civil engineer Konrad Zuse designing the Z3 electromechanical computer for a number of uses including structural engineering calculations. As all electronic computers replaced electromechanicals, the use of computers in building simulation grew. Starting with BRIS in Sweden in 1963 and the “Post Office Program” in the U.S. in 1971, building performance simulation, the simulation of thermodynamics, airflow, lighting, and acoustics, has grown enormously, with hundreds of programs now available for designers ranging from simple spreadsheets to software that can do full 3D heat transfer and computational fluid dynamics simulation. While the thermodynamics and airflow are now simulated with surprisingly high fidelity, the effects of people are usually not. Whereas people are diverse, unpredictable, and reactive, the actions of people are usually simulated as homogenous, predictable, and non-reactive. This talk will focus on the evolution of including the effects of people on building performance and how the use of big data, agent-based modeling and artificial intelligence (AI) might finally start to get it right.

Author

Ralph T. Muehleisen, PhD
Argonne National Laboratory

Ralph T. Muehleisen, PhD, is the Chief Building Scientist, the Building Energy Decision and Technology Section leader, and the Urban Science and Engineering Program lead for Argonne's Energy Systems division. At Argonne, Dr. Muehleisen leads research to increase the energy efficiency and resiliency of the built environment while improving the quality of life and return on investment for citizens. His projects include urban science and engineering, stochastic building energy modeling, reduced order building energy modeling, risk analysis of building energy retrofits, Bayesian Calibration methods for building energy models, agent-based models for understanding adoption of retrofit technologies, smart building/smart grid integration, and the development of new energy-efficient and diagnostic technologies buildings. Dr. Muehleisen is the author of more than 200 publications and presentations, and is a frequent invited speaker in the areas of urban science and engineering, building energy modeling, and architectural acoustics and noise control.