Building Simulation Brisbane 2025

ID: 277

A) Research Paper

Energy Efficiency and Sustainability

Oral presentation and full paper

Keywords: carbon footprint, energy efficiency, single-zone model

Simplified energetic assessment of complex properties through single-zone modeling

Normen Langner, David Voellner, Nicolas März, Justus Medgenberg,

Technical University of Applied Sciences Würzburg-Schweinfurt, Germany

Cities, municipalities, as well as universities, airports, and industrial and commercial enterprises often possess complex property structures. Evaluating their carbon footprint concerning their CO2 emissions is challenging and resource-intensive, especially when considering the diverse existing structures with significant variations in construction age, design, building materials, technical equipment, and usage. This complexity is exacerbated by inadequate documentation and insufficient availability of plans and information regarding technical facilities in existing buildings.

This ongoing research project addresses the development of a method for straightforward energetic modeling of complex property structures. The focus is on both the energetic inventory of existing conditions and the prediction of the energetic performance of buildings after retrofitting measures (or assessing and weighing these measures before their implementation).

The energetic modeling can be accomplished using various numerical simulation programs. While modeling entire buildings is often intricate and complex, single-zone models (or single-room models) are generally quick to generate. The concept of developing a simple method for the energetic modeling of complex properties is based on forming representative single-zone models for different uses within a property and simulating their energetic characteristics. Multiplying the result of the single-zone model by the actual number of rooms with the same use and then adding the results of all different uses (also determined through single-zone modeling) allows for a simplified representation of the overall building's energetic behavior. Since existing buildings are considered, the simulation results can be compared with the actual consumption data of the building. Corrections, guided by expected larger discrepancies, can be determined, such as corrections based on average differences in floor area or other parameters. A statistical analysis of the building's room structure is conducted for this purpose. Following validation with correction factors, if necessary, the simulation, potentially calibrated against actual

consumption data, can then forecast the performance of energetic retrofitting measures through single-zone modeling.

The application of the simplified energetic assessment through single-zone modeling is demonstrated using the example of a University city campus with a highly heterogeneous building structure (ranging from heritage-listed buildings to new constructions). Upon successful implementation of the developed method, energy managers of complex properties can utilize the single-zone model for a straightforward and rapid energetic assessment of their building structure, including an estimation of the potential success of specific energetic retrofitting measures.