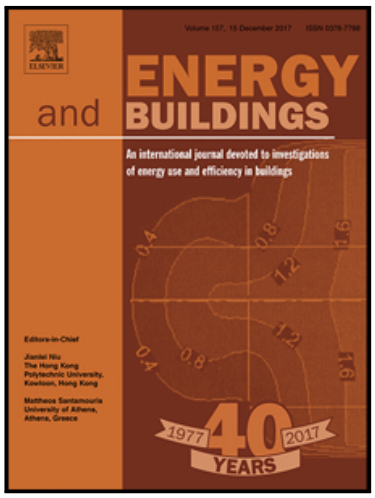

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A Simulation-Based Optimization Method for Designing Energy Efficient Buildings

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ABSTRACT

Buildings have a remarkable impact on the environment, therefore finding efficient design configurations satisfying conflicting criteria such as, economic and environmental performance has become an important task. The aim of this study is to propose a methodology to aid designers in satisfying the requirements of government regulations and green building certification programs, while optimizing the energy consumption and maintaining the thermal comfort. In this context, a software package combining a tailor-made thermal simulation software and Matlab Optimtool is developed to implement proposed methodology. The developed software package offers an effective method to perform large number of simulations to find optimal building configuration. The software package was tested on a reference building that represents a typical residential building in Turkey. The testing process is conducted on a five story building located in Istanbul and building information such as building size, location and occupation schedule were used within the developed software. Based on an extensive market search for building materials, cost functions for each parameter were developed as well as a database required for optimization process. A genetic algorithm optimization technique was utilized to minimize the objective function and find the optimal building configuration for the selected building. Development of a simulation-based optimization method fulfills the need for a tool that assists designers to find better design alternatives at the conceptual design stage. The software package requires least amount of data input for energy simulation process to improve usability. A tailor-made energy simulation module was developed to significantly reduce optimization time period. Besides, instead of coupling two separate software packages, performing the energy simulation and optimization processes on a single platform (MATLAB) reduces the time required to find optimal design and eliminates compatibility issues. Developing simulation-based optimization software on a single platform increased the flexibility and user-friendliness of the software. The effectiveness of the approach for finding optimal building configuration is demonstrated in the presented test cases.

Keywords: Energy Simulation, Optimization, Genetic Algorithm, Heat Balance Method.

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