

Optimum Thermal Design of Air-Conditioned Residential Buildings

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Building design is a decision making process, in which decisions are made on the selection of certain design variables in order to achieve certain objectives (i.e. economy, thermal comfort, visual comfort, aesthetics, etc.). Information on the relationships between the variables and the desired objectives is necessary for proper decision making. Architects have traditionally reached their design decisions based on past experience. However, total reliance upon individual experience may lead to incomplete and inaccurate results. Therefore, given today's complexities in building design, as well as advances in computer technology, systematic approaches can be used as an aid to, not a replacement for, building designers in the decision making process.

This paper presents the results of implementing an optimization model to the design of energy conserving air-conditioned residential buildings in different climatic regions. Optimum sets of building design variables for typical U.S. and Saudi residences are presented, with the objective of minimizing annual energy consumption for those buildings. Optimization results showed that significant energy savings can be achieved by using optimization in the thermal design of buildings. Valuable design information on the selection and arrangement of various building components can be obtained in the early stages of the building design process by the implementation of optimization techniques, as in the model implemented in this paper. © 1997 Elsevier Science Ltd.
