

Simplified 3R2C Building Thermal Network Model: A Case Study

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Abstract : Whole building energy simulation models are widely used for predicting future energy consumption, performance diagnosis and optimum control. Black box building energy modeling approach has been heavily studied in the past decade. The thermal response of a building can also be modeled using a network of interconnected resistors (R) and capacitors (C) at each node called R-C network. In this study, a model building, Case 600, as described in the "Standard Method of Test for the Evaluation of Building Energy Analysis Computer Program", ASHRAE standard 140, is studied along with a 3R2C thermal network model and the ASHRAE clear sky solar radiation model. Although building an energy model involves two important parts of building component i.e., the envelope and internal mass, the effect of building internal mass is not considered in this study. All the characteristic parameters of the building envelope are evaluated as on Case 600. Finally, monthly building energy consumption from the thermal network model is compared with a simple-box energy model within reasonable accuracy. From the results, 0.6-9.4% variation of monthly energy consumption is observed because of the south-facing windows.

Keywords : ASHRAE case study, clear sky solar radiation model, energy modeling, thermal network model

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