A Knowledge-Based System for Automated Evaluation of Energy Standards Compliance

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Introduction

It has been estimated that as much as 60% of the energy used to heat, cool, and illuminate buildings could be saved through better design. Consequently, many states have incorporated an energy standard (such as ASHRAE/IES Standard 90.1-1989) into their building codes, compelling architects and engineers to consider building energy use during the design process. Although energy standards provide a benchmark against which designers may measure their designs, compliance evaluation often requires tedious calculation. In addition, energy standards fail to provide project-specific recommendations for improving energy-inefficient designs.

Research Methodology

We have built a computer program, the *Energy Standards Intelligent Design Tool* (ES-IDT), that addresses both of these issues. The ES-IDT is one component of the Advanced Energy Design and Operation Technologies (AEDOT) project's first prototype. This prototype is a computer-based environment for integrating CAD and building energy software. The ES-IDT automatically and continually evaluates a building design as it is being developed using a CAD tool. If the emerging design begins to deviate from compliance with selected sections of the ASHRAE/IES Standard 90.1-1989, the ES-IDT notifies the architect, indicating which section of the standard was violated and what design decision(s) caused the violation. The ES-IDT also will suggest some design options to improve the energy efficiency of the building. Based on these suggestions, the architect can either modify the design manually or ask the computer to implement one of the options automatically.

Research Results

The operation of the ES-IDT within the AEDOT prototype demonstrates how energy tools can be linked to the drawing/designing activity. Providing an automatic data link saves time required by the designer to prepare separate input data for energy tools, and allows the analysis to proceed concurrently with the design process. Users of the ES-IDT need not interrupt their design (creative) thinking to activate the tool. The computer program operates whenever sufficient information is available, and presents its evaluation and feedback only when the designer asks for it. The close connection between the two activities encourages the use of energy efficiency as an integral part of the conceptualization and development of the building design.

Acknowledgements