Integrating Passive Solar Energy to the Climate Control Scheme of a Typical Building Zone to Improve Energy Efficiency

Final Report

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Abstract

In order to reduce the consumption of nonrenewable energy sources in buildings, there is a challenge to better utilize renewable energy sources to improve overall building energy efficiency. To meet this challenge, it is proposed in this project to analyze the effects that passive solar energy has on the climate control system of a typical building zone. The objective of this project is to design a local controller for a typical building zone that integrates the use of solar energy (passive solar building zone), to achieve an ideal comfort range based on a predetermined setpoint. The control strategies of interest include classical PID (spell), Optimal Control methods, and Artificial Neural Networks. A Matlab/Simulink model of the building zone is developed and the control algorithms are implemented to maintain the comfort range. An additional H∞ adaptive bilinear controller was developed beyond the proposed controllers that successfully met the proposed performance index. Controller performances were analyzed to determine which strategy results in the best performance in a passive solar building. The objectives of this project were met within the budget constraints and within the scheduled time.

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